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MATHER AFB CALIFORNIA

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AIR FORCE
INSTALLATION RESTORATION PROGRAM

FINAL COMPREHENSIVE ENVIRONMENTAL
RESPONSE, COMPENSATION, AND LIABILITY ACT OF 1980
RECORD OF DECISION

BASEWIDE OPERABLE UNIT SITES

MATHER AIR FORCE BASE, CALIFORNIA

AIR FORCE CENTER FOR ENVIRONMENTAL EXCELLENCE

BROOKS AIR FORCE BASE, TEXAS

AUGUST 24, 1998

Comprehensive Environmental Response, Compensation, and Liability Act of 1980

Record of Decision

Final

Basewide Operable Unit Sites

Mather Air Force Base

Sacramento County, California

August 24, 1998

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List of Acronyms

AC&W	Aircraft Control and Warning
AFB	Air Force Base
ARAR	applicable or relevant and appropriate requirement
bls	below land surface
BTEX	benzene, toluene, ethylbenzene, and xylenes
CBRA	Comprehensive Baseline Risk Assessment
CCR	California Code of Regulations
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act of 1980
COC	contaminant of concern
COPC	contaminant of potential concern
CVRWQCB	Central Valley Regional Water Quality Control Board
DCE	dichloroethene
DTSC	Department of Toxic Substances Control
DWR	Department of Water Resources
ESD	Explanation of Significant Difference
FFS	Focused Feasibility Study
FS	feasibility study
HWCL	Hazardous Waste Control Law
ILCR	incremental lifetime cancer risk
IRP	Installation Restoration Program
JP-4	jet propellant fuel
MCL	maximum contaminant level
mg/kg	milligrams per kilogram
mg/L	milligrams per liter
NCP	National Contingency Plan
ng/DSCM	nanograms per dry square cubic meter
NPL	National Priorities List
OU	operable unit
PAH	polycyclic aromatic hydrocarbon
POTW	publicly owned treatment works
ppm	parts per million

List of Acronyms (Continued)

PQL	practical quantification limit
RCRA	Resource Conservation and Recovery Act
RI	remedial investigation
ROD	Record of Decision
RWQCB	Regional Water Quality Control Board
SAC	Strategic Air Command
SARA	Superfund Amendments and Reauthorization Act of 1986
SIP	State Implementation Plan
SMAQMD	Sacramento Metropolitan Air Quality Management District
SVE	soil vapor extraction
SWRCB	State Water Resources Control Board
TBC	to-be-considered
TCDD	tetrachlorodibenzo-p-dioxin isomer
TCE	trichloroethene
TDL	total designated level
TEQ	toxicity equivalent
TPH	total petroleum hydrocarbons
USEPA	United States Environmental Protection Agency
UST	underground storage tank
VOC	volatile organic compound
WDR	Waste Discharge Requirement
WQG	water quality goal

Executive Summary

This Record of Decision (ROD) presents the selected remedial actions for the Basewide Operable Unit (OU) sites, at the formerly active Mather Air Force Base (AFB), Sacramento County, California. Mather AFB is located in the Central Valley region of northern California in Sacramento County, approximately ten miles east of downtown Sacramento, California, and due south of unincorporated Rancho Cordova, California. The base is due south of U.S. Highway 50, a major highway connecting Sacramento and South Lake Tahoe, and encompassed approximately 5,845 acres at the time of closure (including 129 acres of easements) in an unsurveyed part of Township 8 North, Ranges 6 East and 7 East. Mather AFB was constructed in 1918 and its primary mission was as a flight training school. The base was decommissioned under the Base Realignment and Closure Act on September 30, 1993.

The selected remedial actions were developed in accordance with the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA), as amended by the Superfund Amendments and Reauthorization Act of 1986 and, to the extent practicable, in accordance with the National Oil and Hazardous Substances Pollution Contingency Plan. The decisions, documented herein, are based on information contained in the Administrative Record for the subject sites. The Administrative Record Index identifies documents that were considered or relied upon to make these decisions.

The purpose of this ROD is to document the selection of the appropriate level of remediation necessary to protect human health, the environment, and groundwater beneficial uses and define which legal requirements are applicable or relevant and appropriate based on the site-specific conditions. In addition, this ROD incorporates an assessment of the comprehensive risk from all the previous operable units.

The Basewide OU was established to facilitate remedial activities associated with Installation Restoration Program (IRP) sites at Mather AFB that had not been included as part of other Mather AFB RODs: the Disposal and Reuse ROD [USAF 1993], the Soil OU ROD [IT 1996a], the Groundwater OU ROD [IT 1996a], the Aircraft Control and Warning OU ROD [IT 1993a], or the Landfill OU ROD [USAF 1995]. Sites 80, 85, and 88 were included in the Basewide OU; however, they have been removed from this ROD and will be included in a future ROD, since proposed cleanup standards were not agreed upon.

The Basewide OU Focused Feasibility Study (FFS) included a screening-level review of the cleanup standards established in previous Mather AFB RODs, as well as the Basewide OU cleanup standards, to determine whether possible cumulative effects from multiple contaminants exceed acceptable health risk levels (a hazard quotient of 1 or an excess cancer risk of 1 in 10,000). The screening-level review indicated that all but one soil site and the Groundwater OU had cleanup standards that were not of concern. The cleanup standards from Site 69 (the one soil site) and the Groundwater OU required more detailed assessment.

The cleanup standards for surface soils at Site 69 could result in an unacceptable risk if each of the nine categories of dioxins and furans were cleaned up just to the cleanup standard, and concentrations of all of these chemicals remained at the site at the cleanup level. In fact, the soils at Site 69 containing dioxins and furans were removed and placed in Mather landfill Site 4 in 1996. Confirmation sampling for dioxins and furans resulted in only one detection, of octachlorodibenzo-p-dioxin, in ten samples [MW 1998], indicating that there are no longer concentrations of chemicals remaining in surface soils at Site 69 that pose an unacceptable risk.

The groundwater cleanup standards for the Groundwater OU were acceptable except for the fact that the cleanup standard for 1,1-dichloroethene (DCE), which is the same as the California drinking water standard, exceeded the acceptable health risk levels based upon the best estimate of cancer risk published by U.S. Environmental Protection Agency (USEPA) [USEPA 1994]. However, this estimate contains a great deal of uncertainty and conservatism, and the Remedial Project Managers agree that the drinking water standard is an appropriate cleanup standard. In addition, in order to achieve the cleanup standard of the other volatile contaminants in the groundwater, 1,1-DCE concentrations will be reduced well below the cleanup standard.

The cleanup standard for lead in the groundwater, which is set at the tap-water standard, also represents a hazard index above one, but lead has only been detected at concentrations above the cleanup standard in a few locations in the groundwater. As water from many extraction wells is blended in the groundwater treatment system, any elevated lead concentrations are expected to be reduced because of the mixing process.

This Basewide OU is comprised of the following IRP sites:

- Site 2 - "8150" Area Landfill;
- Site 8 - Fire Department Training Area No. 1;
- Site 10C - Fire Department Training Area No. 3;

- Site 17 - Weapons Storage Septic Tank;
- Site 18 - Old Burial Site;
- Expanded Site 19 - Jet Propellant Fuel (JP-4) Tanks;
- Site 20 - Sewage Treatment Facility (Digester Tanks Area)
- Site 23 - Sanitary Sewer System (Main Base Area)
- Site 67 - Sanitary Sewer System (Strategic Air Command Area);
- Site 68 - Underground Storage Tanks at Fuel Transfer Station;
- Site 81 - Sewage Oxidation Ponds;
- Site 82 - Golf Course Maintenance Area Yard;
- Site 83 - Helicopter Washrack;
- Site 84 - Sanitary Sewer Line (Runway Area);
- Site 86 - Military Firing Range; and
- Site 87 - Skeet Range/Trap Range.

Results of the human health and ecological risk assessments and remedial investigations were evaluated using applicable screening criteria to determine the potential existence of chemicals of potential concern (COPCs) at each Basewide OU site. The sites with COPCs identified were evaluated under one of three land-use scenarios, in accordance with the Disposal and Reuse ROD as amended [USAF 1993], which are dependent upon anticipated future site use or access as follows:

- Occupational - Sites 10C/68 and 20;
- Recreational - Site 87; and
- Residential - Sites 18, 23, and 86.

In addition, those sites that do not have an anticipated residential land-use (per the Disposal and Reuse ROD [USAF 1993]) were re-evaluated under the more stringent residential scenario in order to facilitate risk management decisions. Chemicals of concern and cleanup goals have been developed for all sites to be at levels suitable for residential land-use, except for Site 87 which will be remediated to levels suitable for recreational land-use. Since cleanup is to non-residential standards at Site 87, institutional controls would be implemented to restrict activities that may endanger public health.

Contamination exists at Basewide OU sites as a result of past United States Air Force (Air Force) operations conducted between 1918 and 1993. The Basewide OU is comprised of contaminated soils associated with waste disposal pits, underground storage tanks, fire training areas, sewage treatment facility/systems, a gun range, and a skeet/trap range. Sources of contamination at the Basewide OU sites include equipment maintenance, industrial activities, fire suppression training, sewage treatment, spent ammunition, and fuels storage and delivery.

Installation Restoration Program activities (i.e., environmental studies) were initiated at Mather AFB by the Air Force in 1982 to investigate the extent of soil and groundwater contamination resulting from past base operations. These previous investigations have confirmed the presence of volatile organic compounds and other hydrocarbons at several of the IRP sites. Based on this, the entire base was proposed for listing on the Superfund (CERCLA) National Priorities List (NPL) in July 1989, and was placed on the NPL on November 21, 1989. In July 1989, the Air Force, the USEPA, and the State of California signed a Federal Facility Agreement, under CERCLA Section 120, to ensure that environmental impacts from past and present operations are thoroughly investigated and appropriate cleanup actions are taken to protect human health, welfare, and the environment. The Federal Facility Agreement sets enforceable deadlines for documents, defines roles and responsibilities of each signatory party, and provides a vehicle for dispute resolution. The Air Force is the owner of the site, the principal responsible party, and lead agency for conducting investigative and cleanup activities. There have been no CERCLA enforcement actions at the Basewide OU sites.

The Final Basewide OU FFS Report [IT 1997a] and Proposed Plan [IT 1997b] became available to the public in 1997. The FFS identified, screened, and compared alternatives applicable for site cleanup. The Proposed Plan summarized the cleanup alternatives presented in the FFS, presented the recommended cleanup actions, explained the reasons for recommending the actions, and solicited comments from the community on the actions. The Administrative Record for Mather AFB, which includes copies of the FFS report and supporting site-related documents, is available for review at the Air Force Base Conversion Agency office at Mather AFB. In addition, selected major documents are available for review at the Rancho Cordova Community Library and the Sacramento Central Library.

Formal request for public comment on the Proposed Plan [IT 1997b] and FFS Report [IT 1997a] was published in the Sacramento Bee on May 22, 1997. The public comment period extended from May 23, 1997 through June 23, 1997, to allow the public a chance to comment on the Proposed Plan and the supporting remedial investigation and FFS reports. A public meeting was held at Mather AFB (Denker Hall) on May 29, 1997. Representatives from the Air Force, the USEPA Region IX, the California Central Valley Regional Water Quality Control Board (CVRWQCB), and the California Department of Toxic Substances Control were present at the meeting. Representatives from the Air Force and regulatory agencies answered questions about the Basewide OU sites and the remedial alternatives under consideration.

The Air Force, the USEPA Region IX, and the State of California concur with the selected remedial actions. Cleanup options have been selected for Sites 10C/68, 18, 20, 23, 86, and 87.

Cleanup options were not developed for sites at which no chemicals were identified that would require the need for remedial action (i.e., no contaminants of concern were identified). Based on the calculations in the human health risk assessment, excess lifetime cancer risks fall within or below the range of one-in-one million to one-in-ten thousand and non-cancer risks were less than a hazard index of 1.0 under both the current and future land uses examined for each site. Additionally, site-specific information was evaluated which determined that cleanup or further investigative activities are not warranted for these sites. The Basewide OU no further action sites are: Sites 2, 8, 17, expanded 19, 67, 81, and 84.

The remedial alternatives for Site 2 were presented in the Landfill OU FFS [IT 1993b] and Proposed Plan [IT 1993c]. Capping was the remedial action proposed in the Proposed Plan and selected in the ROD [USAF 1995]. However, once cap construction was initiated, it was apparent that there was less refuse at Site 2 and that there was an opportunity to consolidate the refuse from Site 2 into Site 4 prior to Site 4 being capped. This was judged more cost-effective based upon the revised estimate of refuse volume, and additionally would be less restrictive to future airport development. A Removal Action Memorandum [USAF 1996a] was approved on September 1996, to document this fundamental change to the Landfill OU ROD [USAF 1995]. All the refuse at Site 2 was excavated and consolidated into Site 4 in 1996, as documented in the Final Closure Certification Report for Landfill Sites [MW 1997a]. Therefore, this ROD confirms that the excavation and consolidation of refuse from Site 2 into Site 4 constitutes the final remedy for Site 2.

No further action under CERCLA is requried for the "petroleum only" sites based on the lack of statutory authority under CERCLA. The "petroleum only" sites are: Sites 82 and 83. Based on the calculations in the human health risk assessment, excess lifetime cancer risks fall within or below the range of one-in-one million to one-in-ten thousand and non-cancer risks are less than a hazard index of 1.0. However, these sites do not meet criteria for closure under Subtitle I of the Resource Conservation and Recovery Act or other applicable State of California regulations. Regulatory oversight will be provided by the CVRWQCB.

There are differences between information presented in the Basewide OU FFS [IT 1997a] and Proposed Plan [IT 1997b] and this ROD. The main changes effect Sites 10C/68, 80, 81, 85, and 88. For Site 10C, debris existed in an apparent buried disposal pit, with associated lead contamination detected in a soil sample. The size of the pit was approximately 20 by 30 feet with debris found to a depth of six feet below ground surface. A Time-Critical Removal Action Memorandum for Site 10C was prepared [USAF 1996b] to document the decision to excavate this waste and consolidate the waste into Site 4. The excavated material was disposed at Landfill Site 4 after it was determined to meet the acceptance criteria. Confirmation sampling indicated that lead concentrations remaining in the soil were below the cleanup standard. Based on recent excavation and confirmation samples at Sites 10C/68, surface soil with lead contamination above the cleanup standard has been removed. Other contaminants of concern at Site 10C/68 will still be remediated. This ROD confirms that the removal action at Site 10C constitutes the final remedy for lead contamination at this site. Therefore, additional excavation is no longer needed, and the selected remedy no longer includes excavation, stabilization, and disposal of the contaminated surface soils. Additionally, Sites 80, 85, and 88, all of which are ditch sites, are not included in this ROD and will be documented in a future Mather ROD since the extent of contamination is not fully defined to detection limits consequently consensus has not been reached on cleanup levels. Site 81 was selected for no further action after reconsideration of conservative risk assessment assumptions indicated there is not a significant risk to human health at this site.

TAB

Section 1

1.0 Introduction

This decision document presents the selected remedial actions for the Basewide Operable Unit (OU) sites, at the formerly active Mather Air Force Base (AFB), Sacramento County, California. The selected remedial actions were developed in accordance with the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA), as amended by the Superfund Amendments and Reauthorization Act of 1986 (SARA) and, to the extent practicable, in accordance with the National Oil and Hazardous Substances Pollution Contingency Plan (NCP). The decisions, documented herein, are based on information contained in the Administrative Record for the subject sites. The Administrative Record Index (Appendix A) identifies documents that were considered or relied upon to make these decisions.

The purpose of this Record of Decision (ROD) is to document the selection of the appropriate level of remediation necessary to protect human health, the environment, and groundwater/surface water beneficial uses, and define which legal requirements are applicable or relevant and appropriate requirements (ARARs) based on site-specific conditions.

This ROD has been divided into six sections which specifically address the selected remedial actions for the Basewide OU sites. These six sections are:

- Section 1.0 - Introduction
  - This section presents a summary of the selected remedial alternatives, as well as signatures of concurrence by the United States Air Force (Air Force), United States Environmental Protection Agency (USEPA), and the State of California.
- Section 2.0 - Basewide OU Sites Selected for Remedial Action
  - This section documents the remedial actions selected for soil sites where cleanup is warranted.
- Section 3.0 - Basewide OU Sites Selected for No Further Action
  - This section documents the decision that no action is warranted at specified soil sites because conditions pose no current or potential future threat to human health or the environment.
- Section 4.0 - Basewide OU "Petroleum Only" Sites Selected for No Action Under CERCLA (but which remain to be closed under other regulations)
  - This section documents the decision that no action is warranted under CERCLA. Comprehensive Environmental Response, Compensation, and

Liability Act of 1980 does not provide the appropriate legal authority to undertake a remedial action at petroleum only soil sites. The no action decision does not constitute a finding that adequate protection has been achieved at the sites. Cleanup alternatives have been developed and will be implemented under the Resource Conservation and Recovery Act (RCRA) Subtitle I, other appropriate State of California regulations, and the Defense Environmental Restoration Program.

- Section 5.0 - Listing of ARARs and Performance Standards
  - This section describes all federal and state ARARs and performance standards that must be addressed under this ROD.

- Section 6.0 - Responsiveness Summary
  - This section contains comments received during the public comment period and public meeting and responses to those comments.

The Basewide OU sites selected for remedial action (Section 2.0) are the main focus of this ROD.

1.1 Basewide Operable Unit Background

The formerly active Mather AFB is located in the Central Valley region of northern California in Sacramento County, approximately ten miles east of downtown Sacramento, California, and due south of unincorporated Rancho Cordova, California, as shown on Figure 1-1. Mather AFB is due south of U.S. Highway 50, a major highway connecting Sacramento and South Lake Tahoe and encompassed approximately 5,845 acres at time of closure (including 129 acres of easements) in an unsurveyed part of Township 8 North, Ranges 6 East and 7 East. Mather AFB was constructed in 1918 and its primary mission was as a flight training school. The base was decommissioned under the Base Realignment and Closure Act on September 30, 1993.

The Basewide OU addresses sites which had not been included as part of the Soil OU [IT 1996a], the Groundwater OU [IT 1996a], the Aircraft Control and Warning (AC&W) OU [IT 1993a], or the Landfill OU [USAF 1995]. Sites 80, 85, and 88 were included in the Basewide OU; however, they have been removed from this ROD and will be included in a future ROD.

Contamination exists at Basewide OU sites as a result of past Air Force operations conducted between 1918 and 1993. The Basewide OU is comprised of contaminated soils associated with waste disposal pits, underground storage tanks (USTs), fire training areas, sewage treatment facility/systems, a gun range, and a skeet/trap range. Sources of contamination at the

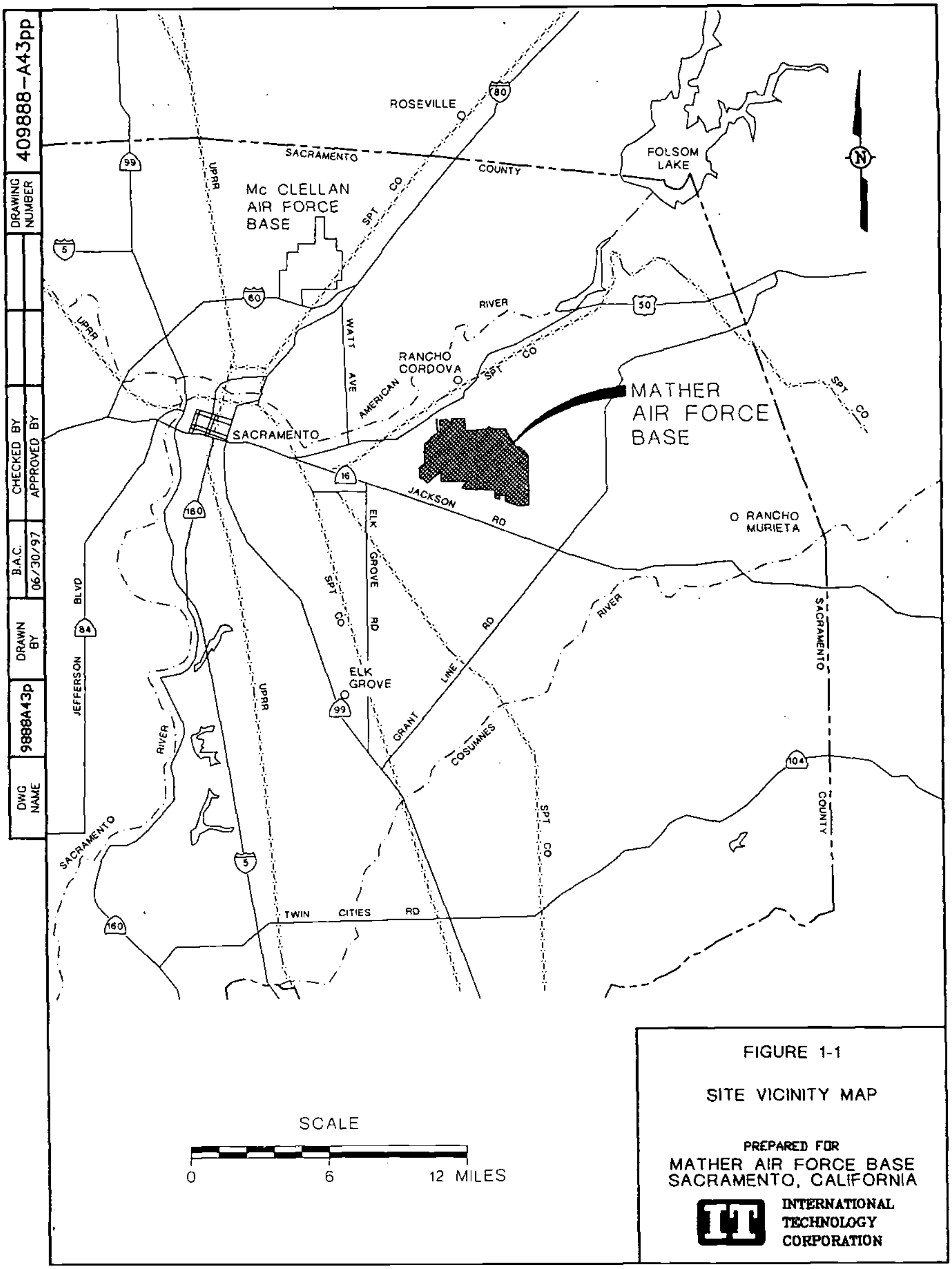


FIGURE 1-1

SITE VICINITY MAP

PREPARED FOR
MATHER AIR FORCE BASE
SACRAMENTO, CALIFORNIA

INTERNATIONAL
TECHNOLOGY
CORPORATION

Basewide OU sites include equipment maintenance, industrial activities, fire suppression training, sewage treatment, spent ammunition, and fuels storage and delivery. Table 1-1 presents a list of the Installation Restoration Program (IRP) sites and the corresponding ROD in which they are documented.

Installation Restoration Program activities (i.e., environmental studies) were initiated at Mather AFB by the Air Force in 1982 to investigate the extent of soil and groundwater contamination resulting from past base operations. These previous investigations have confirmed the presence of volatile organic compounds (VOCs) and other hydrocarbons at several of the IRP sites. Based on this, the entire base was proposed for listing on the Superfund (CERCLA) National Priorities List (NPL) in July 1989, and was placed on the NPL on November 21, 1989. In July 1989, the Air Force, the USEPA, and the State of California signed a Federal Facility Agreement, under CERCLA Section 120, to ensure that environmental impacts from past and present operations are thoroughly investigated and appropriate cleanup actions are taken to protect human health, welfare, and the environment. The Federal Facility Agreement sets enforceable deadlines for documents, defines roles and responsibilities of each signatory party, and provides a vehicle for dispute resolution. The Air Force is the owner of the site, the principal responsible party, and lead agency for conducting investigative and cleanup activities. There have been no CERCLA enforcement actions at the Basewide OU sites.

The Final Basewide OU FFS Report [IT 1997a] and Proposed Plan [IT 1997b] became available to the public in 1997. The FFS identified, screened, and compared alternatives applicable for site cleanup. The Proposed Plan summarized the cleanup alternatives presented in the FFS, presented the recommended cleanup actions, explained the reasons for recommending the actions, and solicited comments from the community on the actions. The Administrative Record for Mather AFB, which includes copies of the FFS report and supporting site-related documents, is available for review at the Air Force Base Conversion Agency office at Mather AFB. In addition, selected major documents are available for review at the Rancho Cordova Community Library and the Sacramento Central Library.

Formal request for public comment on the Proposed Plan [IT 1997b] and FFS Report [IT 1997a] was published in the *Sacramento Bee* on May 22, 1997.

Table 1-1. Installation Restoration Program Sites and their Corresponding Records of Decision

IRP Site Number	AC&W OU	Landfill OU	GW OU/Soil OU	Basewide OU
1		X		
2 (a)		X		X
3		X		
4		X		
5		X		
6		X		
7/11			X	
8				X
9			X	
10			X	
10C				X
12	X			
13			X	
14			X	
15			X	
16			X	
17				X
18				X
19			X	
expanded 19				X
20 (b)			X	X
21			X	
22			X	

Table 1-1. Installation Restoration Program Sites and their Corresponding Records of Decision (Continued)

IRP Site Number	AC&W OU	Landfill OU	GW OU/Soil OU	Basewide OU
23				X
24			X	
25	X			
26			X	
27			X	
28			X	
29			X	
30	X			
31			X	
32			X	
33			X	
34			X	
35			X	
36			X	
37			X	
39			X	
40			X	
41			X	
42			X	
43			X	
44			X	
45			X	
46			X	

Table 1-1. Installation Restoration Program Sites and their Corresponding Records of Decision (Continued)

IRP Site Number	AC&W OU	Landfill OU	GW OU/Soil OU	Basewide OU
47	X			
48			X	
49			X	
51			X	
52			X	
53			X	
54			X	
55			X	
56			X	
57			X	
58			X	
59			X	
60			X	
61			X	
62			X	
63			X	
64			X	
65			X	
66			X	
67				X
68				X
69			X	
70 (formerly Site A)			X	

Table 1-1. Installation Restoration Program Sites and their Corresponding Records of Decision (Continued)

IRP Site Number	AC&W OU	Landfill OU	GW OU/Soil OU	Basewide OU
71 (formerly Site B)			X	
72 (formerly Site C)			X	
73 (formerly Site E)			X	
74 (formerly Site F)			X	
75 (formerly Site G)			X	
76 (formerly Site H)			X	
77 (formerly Site I)			X	
78 (c)				
79 (c)				
81				X
82				X
83				X
84				X
86				X
87				X

Note: Sites 80, 85, 88, and 89 were removed from the Basewide Operable Unit and will be addressed in a future ROD.
(a) Site 2 was originally a Landfill Operable Unit site and was remediated under a Removal Action Memorandum [USAF 1996a]. (b) The site has been documented in the Soil OU and Groundwater OU ROD [IT 1996a]; however, the digester tank area associated with the site was investigated further during the Additional Site Characterization Investigation [IT 1996b] and Final Comprehensive Baseline Risk Assessment [IT 1996c] and was referenced as the Sewage Treatment Facility.
(c) This site was not included in any operable unit; however, it is designated as a non-Comprehensive Environmental Response, Compensation, and Liability Act petroleum site.

OU = operable unit
AC&W = Aircraft Control and Warning
GW = Groundwater
IRP = Installation Restoration Program
ROD = Record of Decision

The public comment period extended from May 23, 1997 through June 23, 1997, to allow the public a chance to comment on the Proposed Plan and the supporting remedial investigation (RI) and FFS reports. A public meeting was held at Mather AFB (Denker Hall) on May 29, 1997. Representatives from the Air Force, the USEPA Region IX, the California Central Valley Regional Water Quality Control Board (CVRWQCB), and the California Department of Toxic Substances Control (DTSC) were present at the meeting. Representatives from the Air Force and regulatory agencies answered questions about the Basewide OU sites and the remedial alternatives under consideration. The Responsiveness Summary (Section 6.0) contains comments received during the public meeting and public comment period and the Air Force responses to these comments.

The Air Force, the USEPA Region IX, and the State of California concur with the selected remedial actions (which are presented in Table 1-2) and statutory determinations for each of the separate sections of this ROD. Concurrence by the parties is indicated by the signatures in Section 1.3.

1.1.1 Basewide Operable Unit Sites Selected for No Further Action

Cleanup options were not developed for sites at which no chemicals were identified that would require the need for remedial action (i.e., no contaminants of concern [COCs] were identified). Based on the calculations in the human health risk assessment, excess lifetime cancer risks fall within or below the range of one-in-one million to one-in-ten thousand and non-cancer risks are less than a hazard index of 1.0 under both the current and future land uses examined for each site. Additionally, site-specific information was evaluated which determined that cleanup or further investigative activities are not warranted for these sites. These no further action sites are: Sites 2, 8, 17, expanded 19, 67, 81, and 84.

The remedial alternatives for Site 2 were presented in the Landfill OU FFS [IT 1993b] and Proposed Plan [IT 1993c]. Capping was the remedial action proposed in the Proposed Plan [IT 1993c] and selected in the Landfill OU ROD [USAF 1995]. However, once cap construction was initiated, it was apparent that there was less refuse at Site 2 and that there was an opportunity to consolidate the refuse from Site 2 into Site 4 prior to Site 4 being capped. This was judged more cost-effective based upon the revised estimate of refuse volume, and additionally would be less restrictive to future airport development. A Removal Action Memorandum [USAF 1996a] was approved on September 1996, to document this change. All the refuse at Site 2 was excavated and consolidated into Site 4 in 1996, as documented in the Final Closure Certification

Table 1-2. Preferred Remedial Alternatives for the Basewide Operable Unit Sites Selected for Remedial Action

Selected Remedial Alternative	Description
10C/68.4	*In situ* treatment (i.e., soil vapor extraction and/or bioremediation) of fuel-contaminated subsurface soils.
18.2	Soil vapor extraction of the contaminated shallow and deep subsurface soils, as appropriate.
20.4	Excavation, stabilization (if needed for disposal), and transportation and placement of those soils at Site 7 for onbase treatment and use as foundation material in the construction of a cap (assuming Site 7 acceptance criteria are met) or to an appropriate off-base disposal facility. *Ex situ* bioremediation of the excavated soils until treatment standards are achieved. In addition, a groundwater monitoring well will be installed and monitored.
23.2	Soil vapor extraction of the contaminated shallow and deep subsurface soils, as appropriate.
86.2	Excavation, stabilization (if needed for disposal), and transportation of the contaminated surface soils to either Site 7 for use as foundation material in the construction of a cap if the soils meet Site 7 acceptance criteria or to an appropriate off-base disposal facility.
87.2	Excavation, stabilization (if needed for disposal), and transportation of the contaminated surface soils and sediments to either Site 7 for use as foundation material in the construction of a cap if the materials meet Site 7 acceptance criteria or to an appropriate off-base disposal facility. In addition, since cleanup at this site is to non-residential standards, institutional controls will be implemented to restrict activities that may endanger public health.

Note: At Sites 10C/68 installation and pilot testing of a soil vapor extraction system was conducted in August 1997. However, following consistently low influent concentrations the system was shut down in December 1997. The system is currently shut down to evaluate the rebound of contaminant concentrations in the vadose zone and to determine if *in situ* bioremediation is more appropriate for this site. As part of a removal action performed by Montgomery Watson in 1996 [USAF 1996b], the debris identified in the surface soils at the Site 10C burn pit was excavated, transported to, and disposed into Site 4 under authority of a Removal Action Memorandum [USAF 1996b]. The disposal pit was then backfilled with clean soil.

Report for Landfill Sites [MW 1997a]. Therefore, this ROD confirms that the removal action at Site 2 constitutes the final remedy for Site 2.

1.1.2 Petroleum Only Sites Selected for No Further Action Under Comprehensive Environmental Response, Compensation, and Liability Act (which remain to be closed under other regulations)

A "no action" decision is the selected remedy for the "petroleum only" sites based on the lack of statutory authority under CERCLA. The "petroleum only" sites are Sites 82 and 83. Based on the calculations in the human health risk assessment, excess lifetime cancer risks fall within or below the range of one-in-one million to one-in-ten thousand and non-cancer risks are less than a hazard index of 1.0. However, these sites do not meet criteria for closure under RCRA Subtitle I or other applicable State of California regulations. Regulatory oversight will be provided by the CVRWQCB.

1.2 *Significant Changes from the Focused Feasibility Study and Proposed Plan*

There have been a number of differences between the FFS [IT 1997a], Proposed Plan [IT 1997b], and this document. The following subsections briefly describe the changes and reasons for the changes.

1.2.1 *Sites 10C/68*

The FFS [IT 1997a] identified COCs at Sites 10C/68 as lead, oil and grease, total petroleum hydrocarbons (TPH) measured as diesel, TPH measured as gasoline, and volatile organic compounds (benzene, toluene, ethylbenzene, and xylene [BTEX] and carbon tetrachloride) all of which were identified based on protection of groundwater quality.

The preferred alternative as presented in the Proposed Plan [IT 1997b] consisted of the following components:

- excavate the lead-contaminated surface soils, stabilize the soils (if appropriate), and dispose onbase at Site 7; and
- treat remaining in-place soils using a combination of soil vapor extraction (SVE) and/or bioremediation.

Since these documents have been issued, Montgomery Watson has performed activities at the site which include soil excavation activities and installation and testing of an SVE pilot system. Debris existed in an apparent buried disposal pit at Site 10C, with associated lead contamination detected in a soil sample. The size of the pit was approximately 20 by 30 feet with debris found to a depth of six feet below ground surface. A Time-Critical Removal Action Memorandum for Site 10C was prepared [USAF 1996b] to document the decision to excavate this material and consolidate the material into Site 4. The excavated material was disposed at Landfill Site 4 after it was determined to meet the acceptance criteria. Confirmation sampling indicated that concentrations remaining in the surface soil were below the cleanup standard and were deleted as COCs. Therefore, since excavation activities abated the problem with the surface soils, the only remaining component of the preferred alternative is *in situ* treatment of the subsurface soils (i.e., for TPH and VOCs).

1.2.2 *Sites 80, 85, and 88*

Sites 80, 85, and 88, all of which are ditch sites, were initially evaluated and proposed for remedial action. However, based on recent conversations with the regulators it was noted that the extent of contamination is not well defined, toxicity tests are not conclusive, and consensus has not been reached on cleanup levels. Therefore, it is premature to include these sites in this Basewide OU ROD; however, the sites will be addressed in a future Mather ROD.

1.2.3 Site 2

The Site 2 landfill was documented in the Landfill OU ROD [USAF 1995]. Subsequent to the ROD, a Removal Action Memorandum [USAF 1996a] documented a change in remedy from capping (selected in the ROD) to excavation of the refuse and consolidation in the Site 4 landfill. This Basewide OU ROD confirms that the removal action at Site 2 constitutes the final remedy for Site 2.

1.2.4 Site 81

The FFS [IT 1997a] and Proposed Plan [IT 1997b] identified the need for remediation based on TPH measured as diesel in the soils/sediments and an unacceptable human health risk from inhalation of dust (i.e., cadmium). However, additional sampling was conducted by Montgomery Watson to measure soluble levels for TPH [MW 1998]. Based on the TPH results and subsequent conversations with the RWQCB, it was determined that the TPH does not pose a threat to groundwater quality; therefore, TPH is not a COC. The only COC identified in the sediments/surface soils (e.g., maximum of three feet deep) was cadmium which was based on protection of human health (i.e., inhalation of dust). The estimate of total residential ILCR at the Sewage Oxidation Ponds was 1.6×10^{-5}, with cadmium contributing all of the risk through the inhalation of dust pathway. This ILCR is below the USEPA upper bound limit of 1×10^{-4} (therefore the site as a whole does not pose significant carcinogenic risk, but is still within the range of concern of 1×10^{-6} to 1×10^{-4}. However, there were numerous conservative assumptions built into the calculation of risk at the Sewage Oxidation Pond. The following is a brief description of these assumptions and a more realistic inhalation of dust risk calculation for the Sewage Oxidation Ponds.

The initial ILCR estimate presented in the CBRA [IT 1996c] for dust inhalation included the following assumptions;

- the cadmium was present at the 95 percent upper confidence limit over the entire site (1.5×10^5 square meters);
- there was no vegetation at the site;

- the California Environmental Protection Agency slope factor ([15 mg/kg-day]$^{-1}$) was used in the calculation of risk instead of the less conservative USEPA value found in Integrated Risk Information System ([6.3 mg/kg-day]$^{-1}$);
- the wind was assumed to prevail in the direction of the receptor 100 percent of the time; and
- the wind speed was assumed to be strong enough to carry dust 100 percent of the time.

Upon further examination the majority of the cadmium above background is limited to the western portion of the northern most oxidation pond (pond No. 4) and is a small fraction of the site area (approximately one quarter). When this new area (approximately 30,000 square meters) was used in the ILCR calculation and using a 50 percent vegetative cover assumption, the site falls near the 1×10^{-6} threshold (i.e., 1.3×10^{-6}). Under these conditions and without examining the remaining conservative assumptions above, this site does not pose a significant threat to human health. Therefore, this site was selected for no further action.

1.3 Assessment of Comprehensive Risk

In addition, this ROD incorporates an assessment of the comprehensive risk from all the previous operable units. The Basewide OU Focused Feasibility Study (FFS) included a screening-level review of the cleanup standards established in previous Mather AFB RODs, as well as the Basewide OU cleanup standards, to determine whether possible cumulative effects from multiple contaminants exceed acceptable health risk levels (a hazard quotient of 1 or an excess cancer risk of 1 in 10,000). The screening-level review indicated that all but one soil site and the Groundwater OU had cleanup standards that were not of concern. The cleanup standards from Site 69 (the one soil site) and the Groundwater OU required more detailed assessment.

The cleanup standards for surface soils at Site 69 could result in an unacceptable risk if each of the nine categories of dioxins and furans were cleaned up just to the cleanup standard, and concentrations of all of these chemicals remained at the site at the cleanup level. In fact, the soils at Site 69 containing dioxins and furans were removed and placed in Mather landfill Site 4 in 1996. Confirmation sampling for dioxins and furans resulted in only one detection, of octachlorodibenzo-p-dioxin (OCCD), in ten samples [MW 1998], indicating that there are no longer concentrations of chemicals remaining in surface soils at Site 69 that pose an unacceptable risk.

The groundwater cleanup standards for the Groundwater OU were acceptable except for the fact that the cleanup standard for 1,1-dichloroethene (DCE), which is the same as the California drinking water standard, exceeded the acceptable health risk levels based upon the best estimate of cancer risk published by USEPA [USEPA 1994]. However, this estimate contains a great deal of uncertainty and conservatism, and the Remedial Project Managers agree that the drinking water standard is an appropriate cleanup standard. In addition, in order to achieve the cleanup standard of the other volatile contaminant in the groundwater, 1,1-DCE concentrations will be reduced well below the cleanup standard.

The cleanup standard for lead in the groundwater, which is set at the tap-water standard, also represents a hazard index above one, but lead has only been detected at concentrations above the cleanup standard in a few locations in the groundwater. As water from many extraction wells is blended in the groundwater treatment system, any elevated lead concentrations are expected to be reduced because of the mixing process.

1.4 Signatures

Sep 23 '98

Albert F. Lowas, Jr.
Director, Air Force Base Conversion Agency
U.S. Air Force

Date

9/28/98

Daniel D. Opalski
Chief, Federal Facilities Cleanup Branch
U.S. Environmental Protection Agency Region IX

Date

9-29-98

Anthony J. Landis, P.E.
Chief, Northern California Operations
Office of Military Facilities
Department of Toxic Substances Control
California Environmental Protection Agency

Date

TAB

Section 2

2.0 Basewide Operable Unit Sites Selected for Remedial Action

2.1 Declaration for the Basewide Operable Unit Sites Selected for Remedial Action

Statutory Preference for Treatment as a
Principal Element is Met
and a Five-Year Review is Required at those Basewide OU
Sites Selected for Remedial Action Under CERCLA

2.1.1 Site Name and Location

Basewide OU Sites (IRP Sites) Selected for Remedial Action

Mather AFB (a NPL Site)

Sacramento County, California

2.1.2 Statement of Basis and Purpose

The Basewide OU sites were investigated under the Mather AFB IRP and are described and evaluated in the remedial investigation/feasibility study (RI/FS) documents [IT 1996b and IT 1997a]. This ROD has the following purposes:

- certify that the remedy selection process was carried out in accordance with the requirements of CERCLA;
- outline the engineering components and cleanup goals of the selected remedies;
- provide the public with a consolidated source of information for the site, as well as a summary of cleanup alternatives considered, evaluated, and reason(s) selected; and
- assess risk from all previously documented operable units.

This section presents the selected remedial actions for Basewide OU sites at which remedial action is warranted. These sites include:

- Sites 10C/68 - Former Fire Department Training Area No. 3/Two 2,000 Gallon and Sixteen 50,000 Gallon USTs at Fuel Transfer Station;
- Site 18 - Old Burial Site;

- Site 20 - Sewage Treatment Facility;
- Site 23 - Sanitary Sewer Line (Main Base Area);
- Site 86 - Military Firing Range; and
- Site 87 - Skeet/Trap Range.

Remedial actions were chosen in accordance with CERCLA, as amended by SARA, and, to the extent practicable, in accordance with the NCP. All remedial decisions are based on the Administrative Record for these sites.

The USEPA Region IX and the State of California concur with the selection of remedial alternatives for each of the Basewide OU sites.

2.1.3 Assessment of the Basewide Operable Unit Sites

Contamination exists at these Basewide OU sites as a result of past Air Force operations conducted between 1918 and 1993. The main sources of contamination include industrial activities, fire suppression training, sewage treatment, spent ammunition, and fuels storage and delivery. Results of the human health and ecological risk assessments and RIs were evaluated using applicable screening criteria to determine the potential existence of COCs at each Basewide OU site. A formal Comprehensive Baseline Risk Assessment (CBRA) was conducted at all Basewide OU sites, except Sites 86 and 87, with results documented in the CBRA Report [IT 1996c]. However, a screening level risk assessment for Sites 86 and 87 was conducted with details presented in Appendices B and C, respectively. The screening level risk assessment consisted of evaluating the ecological and human health risks posed by the identified COCs. Table 2-1 presents a summary of site risks for the Basewide OU sites.

Based on the human health risk assessment, all cancer risks are within or below the acceptable range of 1×10^{-4} to 1×10^{-6} and all non-cancer risks have a hazard index of less than 1.0 in their current state, except for Site 87, which has an estimated future total non-carcinogenic risk greater than 1.0 (however, no individual risk is greater than 1.0).

Table 2-1. Summary of Site Risks for Basewide Operable Unit Sites Where Remedial Action is Warranted

Installation Restoration Site Number	Maximum Carcinogenic Risk (ILCR)	Non-Carcinogenic Risk (HQ)	Lead Blood Level (μg/dL) (a)	Ecological Risk (b)
10C/68 (c)	3.0×10^{-6} (f)	<1.0	61.8 (d)(f)	None
18 (c)	None	<1.0	NA	None
20 (c)	1.2×10^{-5}	<1.0	26	None
23 (c)	None	None	NA	None
86 (c)	2.5×10^{-5}	<1.0	27.2	Low
87 (e)	4.9×10^{-5}	1.3	139.5	Medium

NA = not applicable
ILCR = incremental lifetime cancer risk
μg/dL = micrograms per deciliter
HQ = hazard quotient

(a) Represents the maximum concentration in blood based on results of the LEADSPREAD model. LEADSPREAD was only applied at sites with lead concentrations greater than 130 parts per million. A concentration of 10 micrograms per deciliter or greater is a threshold which indicates potential learning disabilities in a young child.
(b) Ecological risk assessed by weight-of-evidence approach using exposure models, comparison with benchmark toxicity values, field surveys, toxicity testing, residue analysis, and a weighted average home-range evaluation
(c) Site evaluated under a residential land-use scenario.
(d) The concentration of lead in the soil which resulted in the elevated blood level results (i.e., LEADSPREAD results) has been reduced to acceptable levels through excavation of surface soils.
(e) Site evaluated under a recreational land-use scenario.
(f) This is the risk calculated in the original risk assessment; however, since then excavation activities have been conducted by Montgomery Watson which removed lead contaminated soils to acceptable levels that are protective of groundwater quality.

California DTSC's LEADSPREAD model was used to predict the concentrations of lead in human blood that would result from ingestion of lead-contaminated soil. LEADSPREAD modeling was performed for Mather AFB sites at which lead concentrations in soil were greater than 130 parts per million (ppm). The sites with elevated lead levels include Sites 10C/68, 20, 86, and 87.

Uncertainties associated with estimates of ecological risk using non-site-specific data were reduced through the further sampling of Mather AFB surface waters, sediments, and soils and the collection of small mammals and plants. Surface-water, sediment, and soil samples from selected sites were tested for ecological toxicity in the laboratory. In addition, small mammals and plants were analyzed for chemical concentrations. This information, in addition to field observations and professional judgement, was used to validate earlier screening assessment results obtained from the use of literature obtained values, model parameter values, and conservative exposure concentrations. Based on this information, an ecological risk exists only (medium or higher) at Site 87. The selected remedies at the Basewide OU sites will be instituted to reduce risk to human health, and/or reduce the risk to ecological receptors, and/or for the protection of groundwater and surface water quality.

Chemicals were classified as COCs if assessment efforts determined that they could adversely impact groundwater/surface water or pose unacceptable ecological or human health risks. In accordance with the Disposal and Reuse ROD as amended [USAF 1993] issued by the Air Force, the Basewide OU sites (where COCs were identified) were evaluated in the FFS Report [IT 1997a] under one of three land-use scenarios which were dependent upon anticipated future site use or access:

- Occupational - Sites 10C/68 and 20;
- Recreational - Site 87; and
- Residential - Sites 18, 23, and 86.

However, implementation of the selected remedy for sites evaluated under occupational and recreational land-use scenarios would achieve cleanup compatible with residential development with a minimal increase in cost, except for Site 87. The minimal cost increase is due to the fact that cleanup to residential-use levels versus occupational- or recreational-use does not significantly increase the volume of soil to be remediated. Therefore, due to minimal cost increases, all sites will be remediated to levels suitable for residential land-use, excluding Site 87 which will be remediated to levels suitable for recreational land-use.

Actual or threatened releases of hazardous substances from these sites, if not addressed by implementing the response actions selected in this section of the ROD, may present an imminent and substantial endangerment to human health, welfare, and/or the environment.

A summary of site characteristics for each of the Basewide OU sites is provided in Section 2.2.5.

2.1.4 Description of the Selected Remedy

This section summarizes the major components of the preferred remedies for contamination at Sites 10C/68, 18, 20, 23, 86, and 87. Table 2-2 provides the major components of the selected remedy for each of the Basewide OU sites selected for remedial action.

Table 2-2. Preferred Remedial Alternatives for the Basewide Operable Unit Sites Selected for Remedial Action

Selected Remedial Alternative	Description
10C/68.4	*In situ* treatment (i.e., soil vapor extraction and/or bioremediation) of fuel-contaminated subsurface soils.
18.2	Soil vapor extraction of the contaminated shallow and deep subsurface soils, as appropriate.
20.4	Excavation, stabilization (if needed for disposal), and transportation and placement of those surface soils at Site 7 for onbase treatment and use as foundation material in the construction of a cap (assuming Site 7 acceptance criteria are met) or to an appropriate off-base disposal facility. *Ex situ* bioremediation of the excavated surface soils until treatment standards are achieved. In addition, a groundwater monitoring well will be installed and monitored.
23.2	Soil vapor extraction of the contaminated shallow and deep subsurface soils, as appropriate.
86.2	Excavation, stabilization (if needed for disposal), and transportation of the contaminated surface soils to either Site 7 for use as foundation material in the construction of a cap if the soils meet Site 7 acceptance criteria or to an appropriate off-base disposal facility.
87.2	Excavation, stabilization (if needed for disposal), and transportation of the contaminated surface soils and sediments to either Site 7 for use as foundation material in the construction of a cap if the materials meet Site 7 acceptance criteria or to an appropriate off-base disposal facility. In addition, since cleanup at this site is to non-residential standards, institutional controls will be implemented to restrict activities that may endanger public health.

Note: At Sites 10C/68 installation and pilot testing of a soil vapor extraction system was conducted in August 1997. However, following consistently low influent concentrations the system was shut down in December 1997. The system is currently shut down to evaluate the rebound of contaminant concentrations in the vadose zone and to determine if *in situ* bioremediation is more appropriate for this site. As part of a removal action performed by Montgomery Watson in 1996 [USAF 1996b], the debris identified in the surface soils at the Site 10C burn pit was excavated, transported to, and disposed into Site 4 under authority of a Removal Action Memorandum [USAF 1996b]. The disposal pit was then backfilled with clean soil.

2.1.5 Statutory Determinations

The selected remedies satisfy the statutory requirements of Section 121(b) of CERCLA, as amended by SARA, in that the following mandates are attained:

- selected remedies are protective of human health, the environment, and/or groundwater/surface water quality;

- selected remedies comply with federal and state requirements that are legally applicable or relevant and appropriate to the remedial actions;

- selected remedies are cost-effective; and
- selected remedies use permanent solutions and alternative treatment technologies, or resource recovery technologies, to the maximum extent practicable.

A review will be conducted within five years after commencement of the remedial actions to ensure that the remedies continue to provide adequate protection of human health and the environment, and protect water quality for its beneficial uses.

2.2 Decision Summary for Basewide Operable Unit Sites Selected for Remedial Action

The Decision Summary provides an overview of the site characteristics, the alternatives evaluated, and the analysis of those options. The Decision Summary also identifies the selected remedy and explains how the remedy fulfills statutory requirements.

2.2.1 Site Names, Locations, and Descriptions

The Basewide OU sites selected for remedial action at Mather AFB are presented in Figure 2-1 and include: Sites 10C/68 - Former Fire Department Training Area No. 3/Two 2,000 Gallon and Sixteen 50,000 Gallon USTs at Fuel Transfer Station, Site 18 - Old Burial Site, Site 20 - Sewage Treatment Facility, Site 23 - Sanitary Sewer Line Main Base Area, Site 86 - Military Firing Range, and Site 87 - Skeet/Trap Range. More detailed site maps are presented in the Basewide OU FFS Report [IT 1997a] and in Section 2.2.5 below.

2.2.2 Site History and Enforcement Activities

Previous investigations have been conducted at the sites listed in Section 2.2.1 as part of the Air Force IRP. No enforcement activities have been conducted for the Basewide OU sites. A listing of the investigations conducted at each of these sites is summarized in Table 2-3.

2.2.3 Highlights of Community Participation

The public participation requirements of CERCLA Sections 113(k)(2)(B)(i-v) and 117 were met through a public comment period (held May 23 through June 23, 1997) and public meeting (held May 29, 1997) to address the Proposed Plan [IT 1997b] and content of supporting RI/FS documents.

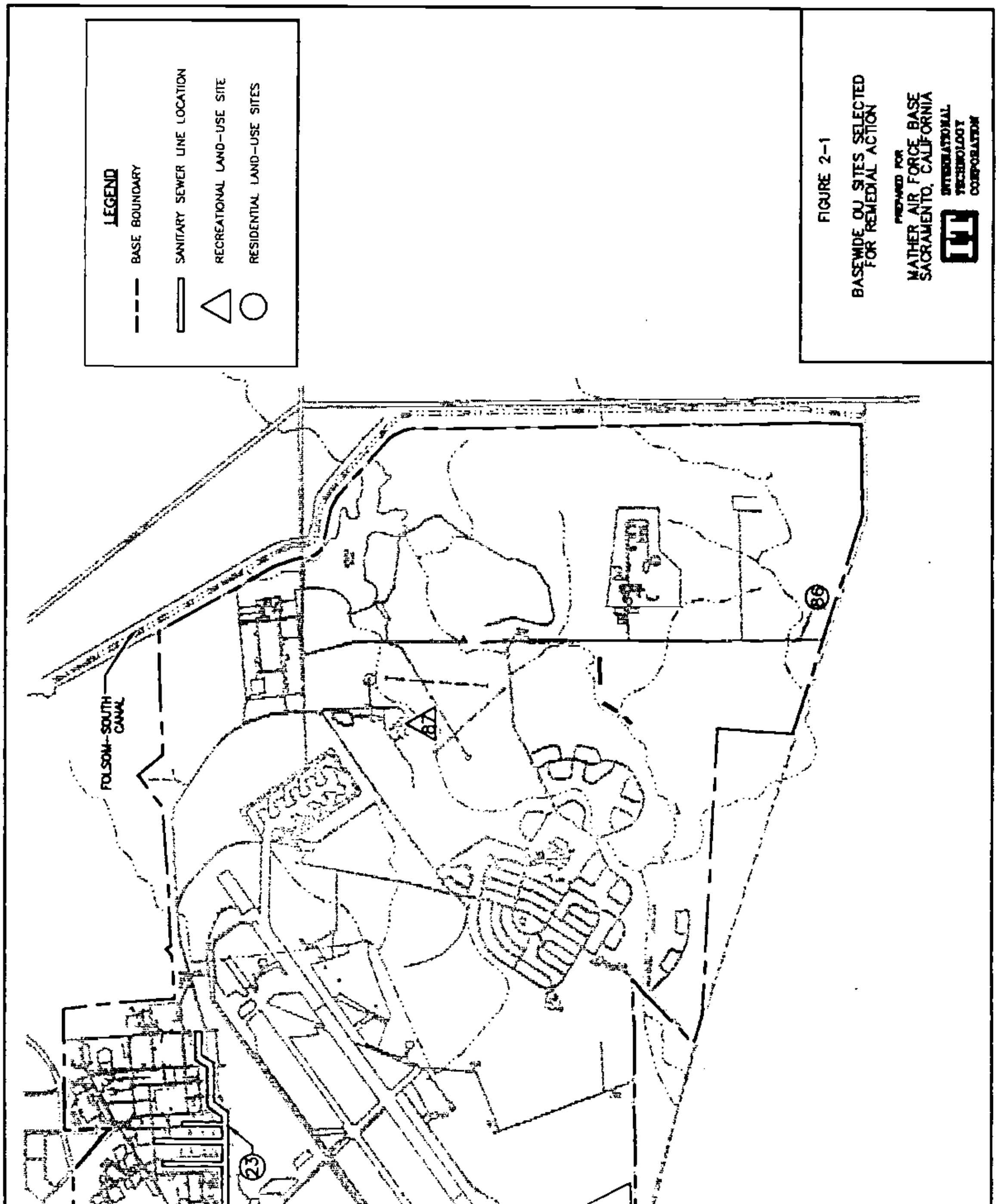


FIGURE 2-1
BASEWIDE OU SITES SELECTED FOR REMEDIAL ACTION

Table 2-3. Previous Investigations at the Basewide Operable Unit Sites Selected for Remedial Action

Site Number	Applicable Investigation
10C/68	6, 10, 14, 15, 17
18	1, 2, 3, 4, 5, 6, 7, 8, 9, 11, 12, 14, 15, 17
20	1, 2, 4, 6, 8, 9, 11, 12, 13, 14, 15, 17
23	1, 6, 9, 14, 15, 17
86	16, 17
87	16, 17

1. Installation Restoration Program (IRP) Records Search for Mather Air Force Base, Phase I [CH2M-Hill, Inc. 1982];
2. IRP Phase II, Stage 2 Investigation [AeroVironment 1987];
3. IRP Phase II, Stage 3 Investigation [AeroVironment 1988];
4. Well Redevelopment and Sampling Plan [IT 1988a];
5. Solid Waste Assessment Test Report [IT 1993d];
6. Quarterly Routine Groundwater Sampling [IT 1995a] and [EA 1990a-c];
7. Landfill Gas Testing Report [IT 1988b];
8. Site Inspection Report [IT 1990a];
9. Group 2 Sites Remedial Investigation Report [IT 1992];
10. Group 3 Sites Technical Memorandum [IT 1993e];
11. Final Soils and Groundwater Operable Unit (OU) Additional Field Investigation Report [IT 1994a];
12. Groundwater OU and Soil OU Focused Feasibility Study (FFS) Report [IT 1995b];
13. Mather Baseline Risk Assessment Report [IT 1995c];
14. Additional Site Characterization Remedial Investigation Report [IT 1996b];
15. Comprehensive Baseline Risk Assessment Report [IT 1996c];
16. Site Characterization for IRP Sites 86 and 87 [IT 1997c]; and
17. Basewide OU FFS Report [IT 1997a].

2.2.4 Scope and Role of Response Action

Environmental studies were initiated by the Air Force in 1982 to investigate contamination resulting from past operations at the base. The USEPA placed Mather AFB on the NPL (or "Superfund" list) in 1989. To administer cleanup efforts, sites at Mather AFB were organized into five operable units, such that sites with similar sources of contamination and site conditions could be grouped together. Previous RODs presented cleanup options for the AC&W OU [IT 1993a] (where contaminated groundwater is currently being extracted and treated by air stripping), the Landfill OU [USAF 1995] (where landfill caps are in-place or where refuse and debris have been removed), the Soil OU [IT 1996a], and the Groundwater OU [IT 1996a]. The Basewide OU addresses sites not included as part of the previous RODs and assesses the comprehensive risk from all operable units. The Basewide OU FFS conducted a screening-level review of the cleanup standards established in previous Mather AFB RODs, as well as the

Basewide OU cleanup standards, to determine whether or not cumulative effects from multiple contaminants exceed acceptable levels. The results indicated that all sites had appropriate cleanup standards which provide adequate protection of human health and the environment, with the exception of the surface soils at Site 69 and 1,1-DCE in the groundwater. The risk of exposure to 1,1-DCE is uncertain. The federal drinking water standard (maximum contaminant level or MCL) of 7 micrograms per liter, is the cleanup standard, but is estimated to represent an incremental lifetime cancer risk of 1×10^{-6}. Additionally, the majority of surface soils at Site 69, which posed the unacceptable risk, have been removed from the site. The remaining soils are planned for remediation (i.e., excavation) in 1999.

2.2.5 Summary of Site Characteristics

Contamination exists at the Basewide OU sites as a result of past Air Force operations conducted between 1918 and 1993. The Basewide OU is comprised of contaminated soils and sediments associated with site drainages, disposal pits, USTs, a gun range, a skeet/trap range, fire training areas, a waste burial site, a golf course maintenance area, a sewage treatment facility, and sewage treatment systems.

Previous RIs have been conducted at Basewide OU sites as part of the Air Force IRP. A brief description of each of the Basewide OU sites recommended for remedial action, including summaries of hazardous material releases and the nature and extent of contamination, is provided in the following sections.

2.2.5.1 Site 10C/68 - Former Fire Department Training Area No. 3/Two 2,000 Gallon and Sixteen 50,000 Gallon Underground Storage Tanks at Fuel Transfer Station

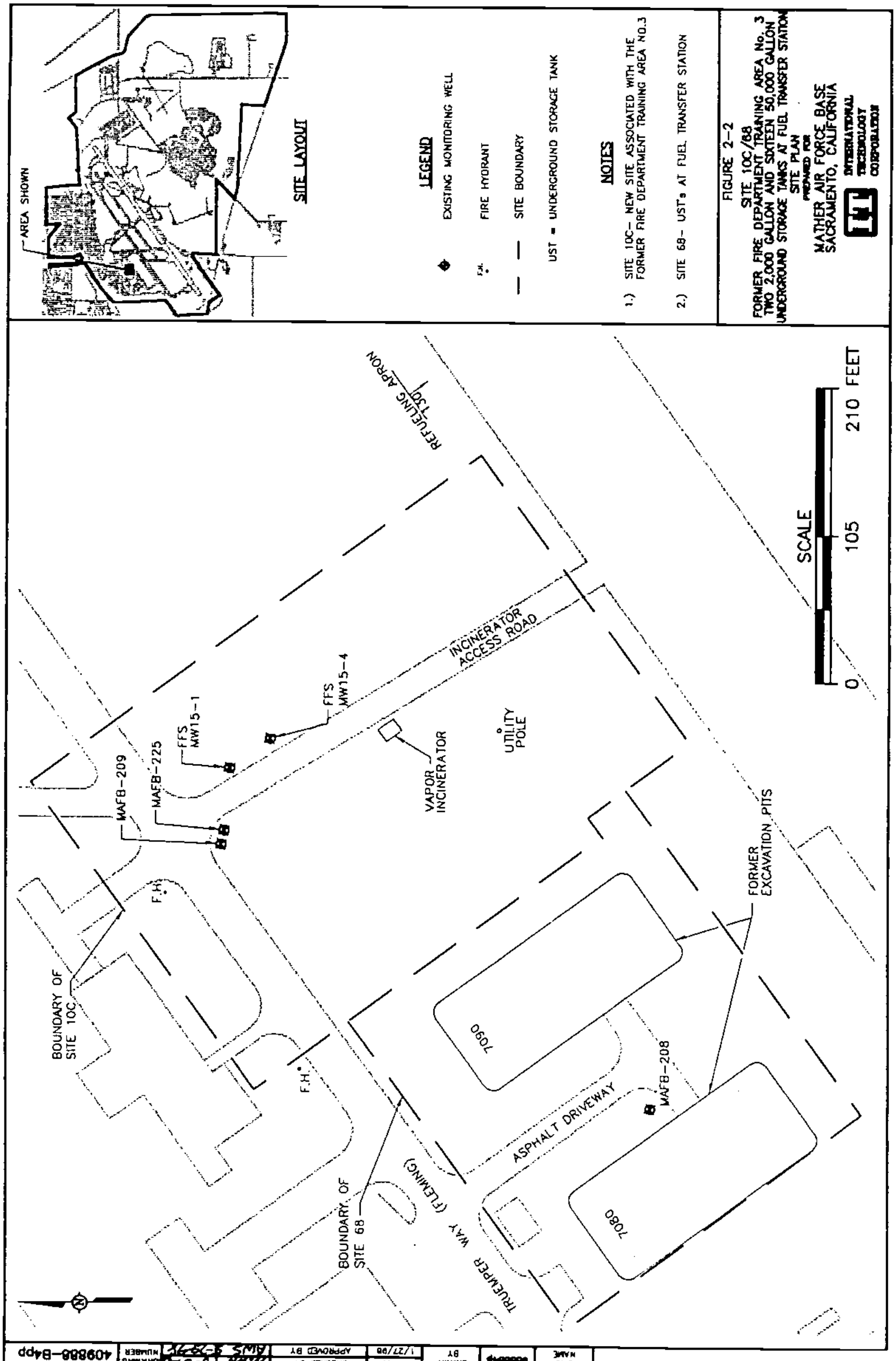
For purposes of remediation, Sites 10C and 68 were grouped together based on proximity and common contaminants. A pilot treatment system was installed in 1997 by the Air Force to evaluate the effectiveness of *in situ* remediation technologies at these combined sites.

Sites 10C/68 (Figure 2-2) is located adjacent to the northwestern border of the "Charlie" Ramp (Strategic Air Command [SAC] Refueling Apron). Petroleum, oil, and lubricant waste were ignited and extinguished during training exercises conducted at the site. The combined site also included two 2,000 gallon waste fuel USTs and sixteen 50,000 gallon USTs as part of the Fuel Transfer Station, to the area of the former SAC refueling apron. The Fuel Transfer Station consisted of pumps, filters, USTs, and valving which integrated the jet propellant fuel (JP-4) pipeline delivery and storage system with individual fuel lines located beneath the SAC refueling apron. In 1994, all USTs and ancillary valves and piping were removed. A summary of the results of previous investigations conducted at Sites 10C/68 are presented in Tables 2-4 and 2-5, respectively.

Additionally, the Air Force conducted a pilot SVE test in 1997 at Sites 10C/68 to determine the extent of subsurface VOC and petroleum hydrocarbon contamination and evaluate the effectiveness of using *in situ* treatment technologies. The data on contaminant distribution acquired during the pilot test is reported in the Site Investigation and SVE System Installation Report for Site 10C/68 [EA 1997]. Approximately 33 borings were drilled at the sites for use as remediation SVE or bioventing wells, or soil gas monitoring wells. Most of the borings were drilled to depths of about 40 feet, although several extended to near the water table at about 85 feet below ground surface. The data from this report indicates that gasoline contamination extends no further than 30 feet below ground surface, leaving a separation of about 50 feet between the deepest detection and groundwater. The system was installed in August 1997, and an initial compliance source test of the SVE system was conducted on August 15, 1997. After the compliance source test was conducted, the system was shut down while awaiting analytical results. The analytical results indicated that the unit was operating in accordance with the Sacramento Metropolitan Air Quality Management District (SMAQMD) requirements, and the SVE system was restarted and became fully operational on August 21, 1997. The system was operating at approximately 400 cubic feet per minute and was treating an influent vapor stream with contaminant concentrations at approximately 50 parts per million volume. The SVE system was shut down December 3, 1997, following consistently low influent concentrations. The system is currently shut down to examine the rebound of contaminant concentration in the vadose zone, and to determine if *in situ* bioremediation is more appropriate for this site.

Debris identified in an apparent buried disposal pit at Site 10C (along with lead-impacted surface soil) was excavated, transported to, and disposed into Site 4 [MW 1998] by Montgomery Watson under authority of a Removal Action Memorandum [USAF 1996b]. A Time-Critical Removal Action Memorandum was prepared [USAF 1996b] to document the decision to excavate this waste and consolidate the waste into Site 4. The size of the pit was approximately 20 feet by 30 feet, with debris found to a depth of six feet below ground surface. Eight confirmation samples were collected and analyzed. Lead, motor oil, and oil and grease were detected in the samples. Lead detections ranged from 4.7 to 99 milligrams per kilogram (mg/kg) and oil and grease was detected at levels from 11 to 150 mg/kg, both of which were below the soil cleanup standard. Motor oils were detected at levels ranging from 30 to 200 mg/kg (no cleanup level has been established). The excavation was then backfilled with clean soil. Through these excavation activities, the impacted surface soils (previously identified in the FFS [IT 1997a] and Proposed Plan [IT 1997b]) are no longer a concern at this site.

Contamination therefore only exists in the subsurface soils at both Site 10C and Site 68. The COCs identified at Sites 10C/68 under a residential future land-use scenario include: petroleum hydrocarbons (measured as diesel and gasoline) and VOCs. The basis for cleanup is protection of groundwater quality. The impacted volumes are estimated at 24,000 cubic yards of subsurface soils at Site 10C and 4,100 cubic yards of subsurface soils at Site 68.



RI/8-98/FS/3920001.AWS

Table 2-4. Site 10C - Results of Previous Investigations

Investigation and Investigator	Air Investigation and Significant Analytical Results	Soil Investigation and Significant Analytical Results	Groundwater Investigation and Significant Analytical Results	Other Activities	References
ASC Investigation - IT Corporation	None	Five surface soil samples collected and analyzed. Maximum concentrations detected were: TPH-D (660 ppm), oil and grease (4,400 ppm), barium (1,150 ppm), chromium (143 ppm), copper (611 ppm), manganese (1,730 ppm), zinc (1,980 ppm), lead (2,600 ppm), arsenic (10.5 ppm), cadmium (66.4 ppm), mercury (0.36 ppm), silver (6.3 ppm), and Aroclor-1260 (0.045 ppm). Collected and analyzed twenty-two soil vapor samples. Maximum concentrations detected were: TPH-G (390 mg/L), benzene (3,300 µg/L), toluene (150 µg/L), ethylbenzene (130 µg/L), and total xylenes (360 µg/L). Six borings were drilled and sampled. Maximum concentrations detected were: TPH-D (3,200 ppm), oil and grease (970 ppm), TPH-G (310 ppm), cadmium (1.6 ppm), thallium (0.55 ppm), and total xylenes (880 ppb). Benzene, toluene, ethylbenzene, and xylenes otherwise detected (18 ppb). Forty-two trench soil samples were collected and analyzed. Maximum concentrations detected were: oil and grease (10,600 ppm), TPH-D (3,500 ppm), TPH-G (2,700 ppm), copper (3,030 ppm), lead (1,830 ppm), benzene (37,000 ppb), ethylbenzene (37,000 ppb), toluene (23,000 ppb), total xylenes (66,000 ppb), naphthalene (1,000 ppb), and dioxins and furans (40 pg/g).	None	NA	[IT 1996b]

Table 2-4. Site 10C - Results of Previous Investigations (Continued)

Investigation and Investigator	Air Investigation and Significant Analytical Results	Soil Investigation and Significant Analytical Results	Groundwater Investigation and Significant Analytical Results	Other Activities	References
Sites 10C/68 SVE Bioventing System Design - Montgomery Watson	None	Collected and analyzed 49 soil vapor samples from 25 soil borings at Site 10C in October, 1996. Maximum concentrations detected were: TPH-G (15,000 ppm), benzene (39 ppm), toluene (28 ppm), ethylbenzene (40 ppm), xylenes (46 ppm), and carbon tetrachloride (6.8 ppm). Collected and analyzed 109 soil samples from 33 soil borings at Sites 10C/68 in January, 1997. Maximum concentrations detected were: TPH-D (720 ppm), TPH-G (31 ppm), benzene (22 ppb), toluene (12 ppb), ethylbenzene (180 ppb), and xylenes (210 ppb).	None	Excavated and removed approximately 570 CY of refuse from the refuse pit at Site 10C. Excavation pits 7080 and 7090 were dewatered, lined with 20 mil polyethylene sheeting and backfilled.	[MW 1997b]
Draft Project Definition - Montgomery Watson	None	Collected and analyzed eight soil samples for lead, motor oil, and oil and grease following excavation activities. Maximum concentrations detected were: lead (99 ppm), motor oil (200 ppm), and oil and grease (150 ppm).	None	NA	[MW 1998]

ASC = Additional Site Characterization
TPH-D = total petroleum hydrocarbons as diesel
ppm = parts per million
TPH-G = total petroleum hydrocarbons as gasoline
mg/L = milligrams per liter
µg/L = micrograms per liter
ppb = parts per billion
pg/g = picograms per gram
SVE = soil vapor extraction
CY = cubic yard
NA = not applicable

Table 2-5. Site 68 - Results of Previous Investigations

Investigation and Investigator	Air Investigation and Significant Analytical Results	Soil Investigation and Significant Analytical Results	Groundwater Investigation and Significant Analytical Results	Other Activities	References
Quarterly Routine Groundwater Sampling - IT Corporation	None	None	Data for selected constituents were summarized most recently in the 3rd Quarter, Quarterly Groundwater Monitoring Report [IT, 1993f].	NA	[IT 1993f] [IT 1993g] [IT 1993h]
Group 3 Sites RI - IT Corporation	None	Drilled and sampled four soil borings. Maximum concentrations detected were: oil and grease (833 ppm); TPH-G (1,300 ppm); TPH-D (67 ppm); ethylbenzene (1.5 ppm); toluene (0.002(J) ppm); total xylenes (0.43 ppm); lead (0.57 ppm); 4,4'-DDD (0.0031(J) ppm); 4,4'-DDE (0.011(J) ppm); and benzo(g,h,i)perylene (0.05(J) ppm).	Installed and sampled Well MAFB-208. No significant levels of contaminants were detected.	NA	[IT 1993e]
Final Comprehensive Baseline Risk Assessment - IT Corporation	None	None	None	No ILCR $>10^{-6}$ No HQ >1	[IT 1996c]
Sites 10C/68 SVE Bioventing System Design - Montgomery Watson	None	Collected and analyzed 109 soil samples from 33 soil borings at Sites 10C/68 in January, 1997. Maximum concentrations detected were: TPH-D (720 ppm); TPH-G (31 ppm), benzene (22 ppm), toluene (12 ppm), ethylbenzene (180 ppm), and xylenes (210 ppm).	None	NA	[MW 1997b]

TPH-D = total petroleum hydrocarbons as diesel
TPH-G = total petroleum hydrocarbons as gasoline
RI = remedial investigation
DDD = dichlorodiphenyldichloroethane
ILCR = incremental lifetime cancer risk

ppm = parts per million
NA = not applicable
HQ = hazard quotient
DDE = dichlorodiphenyldichloroethylene
SVE = soil vapor extraction

2.2.5.2 *Site 18 - Old Burial Site*

Site 18 (Figure 2-3) is located in the northwest portion of Mather AFB and is currently covered by the paved fuel tanker yard north of Building 4120 and a smaller parking lot west of the building. The site was reportedly used in the late 1940s for disposal of general refuse and various stock items, however, drilling in this area has not revealed any debris. A summary of the results of previous investigations conducted at Site 18 is presented in Table 2-6.

Contamination has been identified in soil vapor samples collected from the subsurface soils. Volatile organic compounds have been identified as COCs based on VLEACH modeling. The basis for cleanup is protection of groundwater quality.

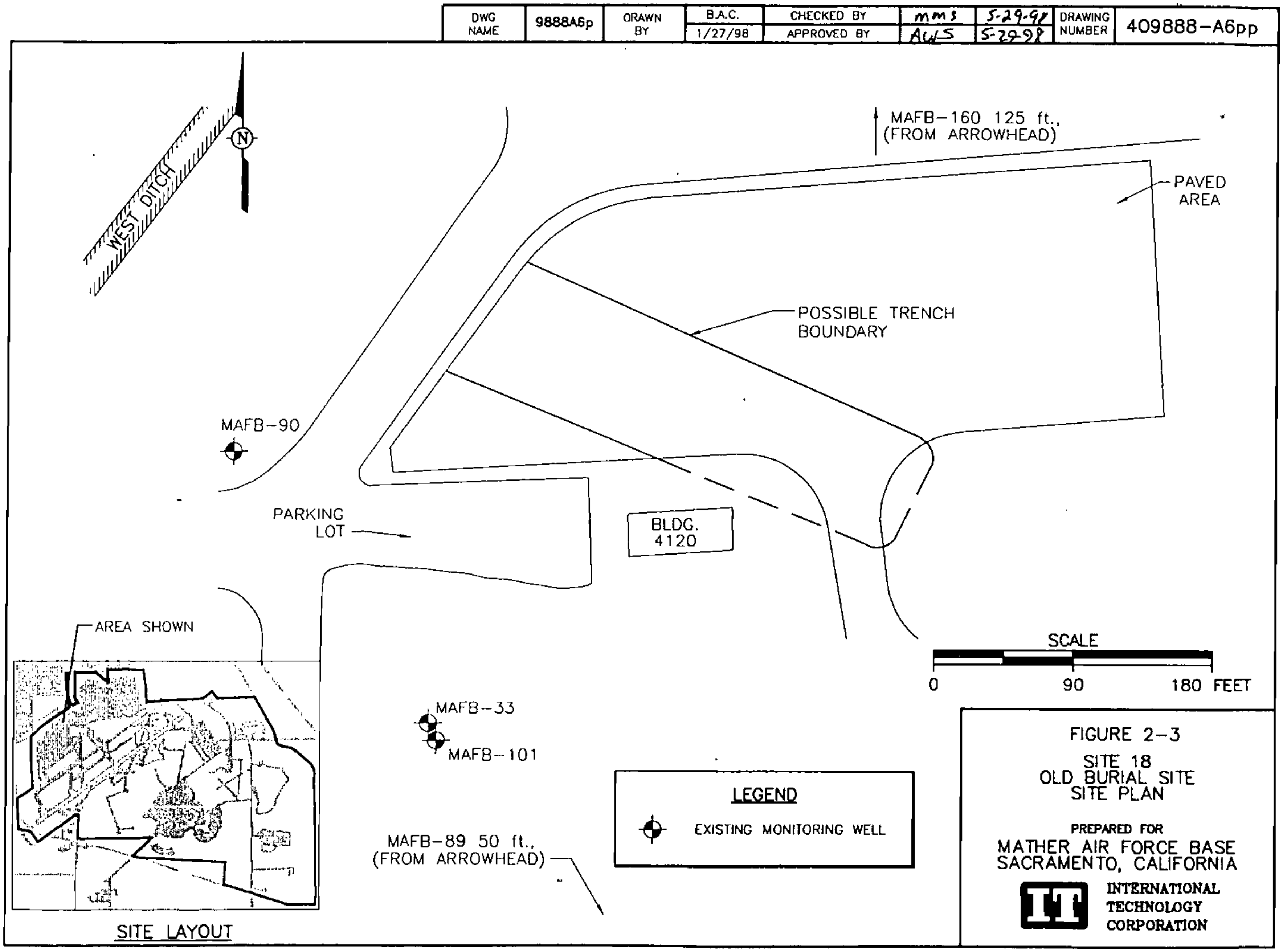


FIGURE 2-3
SITE 18
OLD BURIAL SITE
SITE PLAN

Table 2-6. Site 18 - Results of Previous Investigations

Investigation and Investigator	Air Investigation and Significant Analytical Results	Soil Investigation and Significant Analytical Results	Groundwater Investigation and Significant Analytical Results	Other Activities	References
IRP Phase I, Records Search - CH2M Hill	None	None	None	Base Records Search	[CH2M Hill, Inc. 1982]
IRP Phase II, Stage 2 Investigation - AeroVironment, Inc	None	None	Installed and sampled Wells MAFB-33, 34, and 35. Maximum concentrations detected were: TCE (67 ppb), PCE (2.1 ppb).	NA	[AeroVironment 1987]
IRP Phase II, Stage 3 Investigation - AeroVironment, Inc	None	None	Sampled three wells (MAFB-33 through 35). Maximum concentrations detected were: TCE (67 ppb) and PCE (2.1 ppb).	NA	[AeroVironment 1988]
Well Redevelopment and Sampling - IT Corporation	None	None	Sampled Wells MAFB-33,34, and 35. Maximum concentrations detected were: TCE (24 ppb) and lead (11 ppb).	NA	[IT 1990b]
Quarterly Routine Groundwater Sampling - IT Corporation and EA Engineering, Science and Technology, Inc.	None	None	Data for selected constituents were summarized most recently in the 3rd Quarter 1993, Quarterly Groundwater Monitoring Report [IT 1993f].	NA	[IT 1989] [IT 1990c] [IT 1990d] [EA 1990a] [EA 1990b] [EA 1990c] [IT 1993f] [IT 1993g] [IT 1993h]
Landfill Gas Testing - IT Corporation	None	Installed and sampled three wells (CW-46, MW-47 and MW-48). Maximum concentrations detected in the CW were: TCE (2,000 ppb); PCE (380 ppb); trichloromethane (71 ppb); tetrachloromethane (100 ppb) and methane (<2 percent).	None	NA	[IT 1988b]

Table 2-6. Site 18 - Results of Previous Investigations (Continued)

Investigation and Investigator	Air Investigation and Significant Analytical Results	Soil Investigation and Significant Analytical Results	Groundwater Investigation and Significant Analytical Results	Other Activities	References
IRP Site Inspection - IT Corporation	None	Evaluated all geologic and chemical data relating to environmental contamination at Mather AFB. No sampling or analysis conducted.	Evaluated all geologic and chemical data relating to environmental contamination at Mather AFB. Data from 1988 groundwater sampling included. Two rounds of water level measurements conducted for all on-base monitoring wells. No sampling or analysis conducted.	NA	[IT 1990a]
Group 2 Sites RI - IT Corporation	Collected integrated surface air samples. Maximum concentrations detected were: methylene chloride (0.64 ppb); 1,1,1-TCA (0.65 ppb); benzene (1.2 ppb) and PCE (0.5 ppb).	A SOV survey was conducted to screen potential contaminant sources. Maximum concentrations detected were: total petroleum hydrocarbon compounds (40,000 ppm); TCE (>1,000 ppm); PCE (<50 ppm); DCE (<25 ppm); TCA (760 ppm) and benzene (22.3 ppm). Sampled three landfill gas wells (CW-46, MW-47 and MW-48). Maximum concentrations detected were: TCE (3,200 ppb) and PCE (1,000 ppb). Eleven soil borings, including three redrills, (DSB-18A through DSB-18F) were drilled and sampled. Maximum concentrations found were: TCE (50 ppb); oil and grease (6,600 ppm); 1,2-DCE (13 ppb); PCE (15 ppb); TPH-D (50 ppm); TPH-G (19 ppm); and alpha-benzene hexachloride (10 ppb). All detected inorganics were below established background concentrations, except cadmium, silver, and thallium.	Installed and sampled four new wells (MAFB-89, 90, 101, and 160). Maximum concentrations detected were: TCE (21 ppb); PCE (170 ppb); lead (5,740 ppb); and carbon tetrachloride (3.3 ppb).	NA	[IT 1993i]

Table 2-6. Site 18 - Results of Previous Investigations (Continued)

Investigation and Investigator	Air Investigation and Significant Analytical Results	Soil Investigation and Significant Analytical Results	Groundwater Investigation and Significant Analytical Results	Other Activities	References
Solid Waste Assessment Report - IT Corporation	None	None	Sampled and analyzed four existing wells (MAFB-33,90,101, and 160). Maximum concentrations detected were: TCE (15 ppb); PCE (180 ppb); and carbon tetrachloride (7.9 ppb).	NA	[IT 1993d]
Soils and Groundwater OU AFI Report - IT Corporation	None	Drilled and sampled two soil borings (SB-18-01 and SB-18-02). The only contaminant detected was TCE (0.005(J) ppm).	Drilled and logged five stratigraphic borings to evaluate site subsurface stratigraphy. A groundwater sample was collected at the bottom of each boring and analyzed. One sample was analyzed at the field screening lab while the other was analyzed at a contract laboratory. Detectable concentrations were not found in either sample. Installed and sampled seven groundwater monitoring wells (MAFB-251, 264, 265, 272, 273, 291, and 292). Maximum concentrations detected were: carbon tetrachloride (2.3 ppb); chloroform (0.88 ppb); PCE (4.0 ppb); and TCE (26 ppb). Slug tests were conducted in each well to evaluate aquifer characteristics.	NA	[IT 1994a]

1135 54

Table 2-6. Site 18 - Results of Previous Investigations (Continued)

Investigation and Investigator	Air Investigation and Significant Analytical Results	Soil Investigation and Significant Analytical Results	Groundwater Investigation and Significant Analytical Results	Other Activities	References
Groundwater OU and Soil OU FFS - IT Corporation	None	Installed and sampled two soil vapor extraction wells (SVE-18S and SVE-18D). Maximum vapor concentrations detected were: total petroleum hydrocarbon (270 ppm); TCE (250 ppm); PCE (32 ppm); and total lead (0.24 $\mu g/m^3$). Additionally, soil samples were collected during drilling and were analyzed for geotechnical and biological parameters.	None	NA	[IT 1995b]
Comprehensive Baseline Risk Assessment - IT Corporation	None	None	None	ILCR $> 10^{-6}$ for Benzene No HQ > 1	[IT 1996c]
ASC Investigation - IT Corporation	None	Sampled existing soil vapor extraction well SVE-18S. Maximum vapor concentrations detected were: TCE (310 ppmv), PCE (180 ppmv), TPH-G (280 ppmv), cis-1,2-DCE (220 ppmv), methylene chloride (2.7 ppmv), and toluene (2.2 ppmv).	None	NA	[IT 1996b]

2.2.5.3 *Site 20 - Sewage Treatment Facility*

Site 20 (Figure 2-4) is located in the southwest portion of Mather AFB, near the southwest end of the main runway. Site 20 was originally defined to consist of sludge drying beds and a diesel spill associated with the facility's 150-gallon UST. The original Site 20 was included in a Non-Time Critical Removal Action Memorandum [IT 1994b], to document the decision to remove sludge and soil associated with the sludge drying beds and digester tanks at the former sewage treatment facility. The material was excavated between September 1996 and January 1997, with most of the excavated material being disposed onbase at Site 4 (which was closed in 1997). Some of the material exceeded hazardous waste criteria and was transported to the Class I Hazardous Waste Disposal Facility at Kettleman Hills. The removal action was successful in achieving performance standards found in the final Soil OU and Groundwater OU ROD [IT 1996a]. The Sewage Treatment Facility was further investigated in the area of the sedimentation and digester tanks during the Additional Site Characterization Investigation to determine whether the facility had contributed contaminants, particularly chlorinated VOCs and metals, to groundwater. These additional portions were investigated as part of the Basewide OU and are addressed in this ROD. A summary of the results of previous investigations conducted at Site 20 is presented in Table 2-7.

Contamination has been identified in the surface soils and subsurface soils. Risks due to contamination associated with this site were evaluated and presented under an occupational future land-use scenario in the FFS [IT 1997a] and Proposed Plan [IT 1997b] documents. However, due to the fact that cleanup compatible with residential development can be achieved at this site with a minimal increase in cost, it was decided to set cleanup standards commensurate with residential land use for this ROD. Contaminants of concern identified at the site are lead and polycyclic aromatic hydrocarbons (PAH). The basis for cleanup is protection of human health and groundwater quality. The impacted volume to be excavated is estimated to be 500 cubic yards of surface soils. Even though sporadic detections of phthalates and diesel were detected in the subsurface soils no remediation is planned. One groundwater well will be installed and monitored for phthalates and diesel.

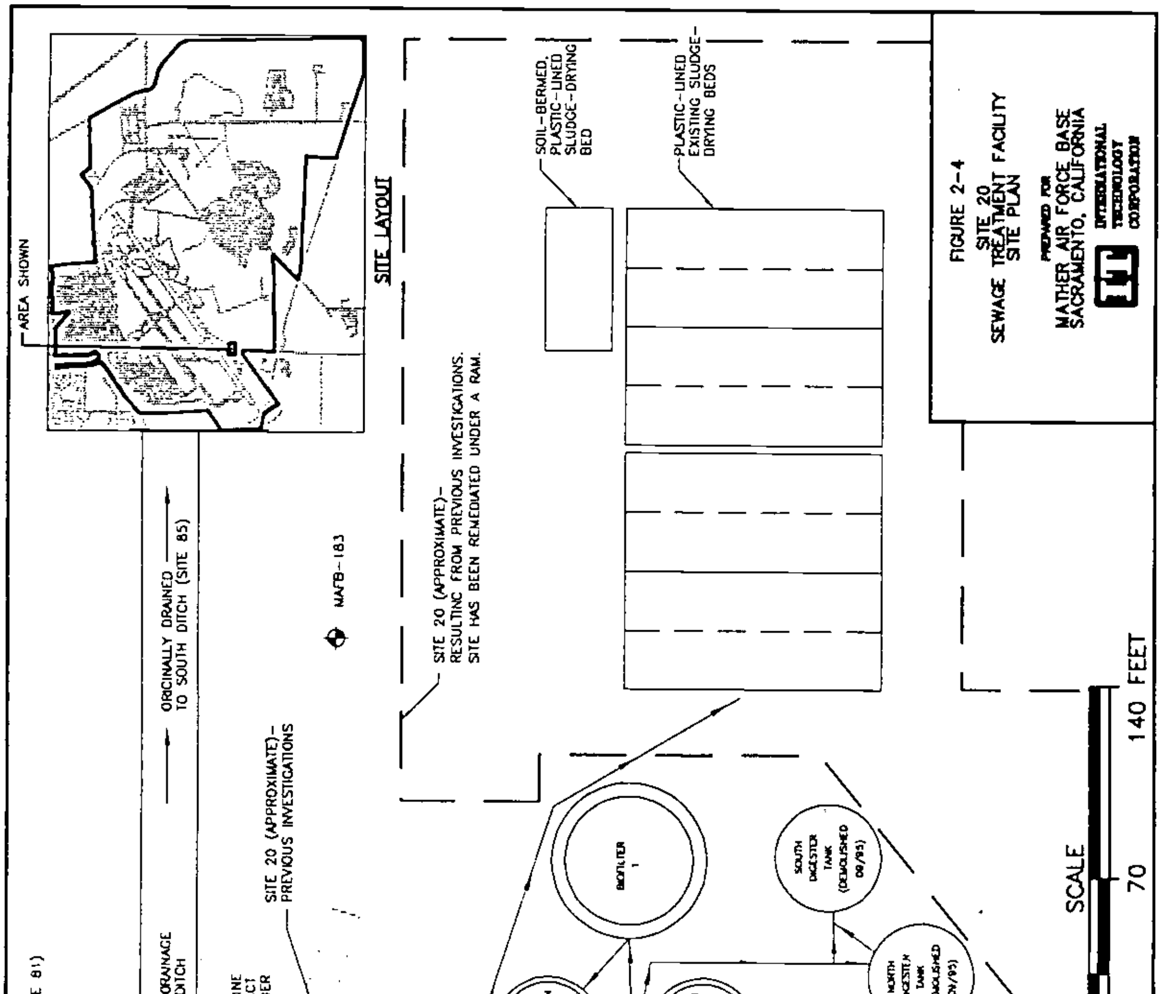


FIGURE 2-4
SITE 20
SEWAGE TREATMENT FACILITY
SITE PLAN
PREPARED FOR
MATHER AIR FORCE BASE
SACRAMENTO, CALIFORNIA
INTERNATIONAL TECHNOLOGY CORPORATION
SITE LAYOUT
AREA SHOWN
SOIL-BERMED, PLASTIC-LINED SLUDGE-DRYING BED
PLASTIC-LINED EXISTING SLUDGE-DRYING BEDS
SITE 20 (APPROXIMATE)-RESULTING FROM PREVIOUS INVESTIGATIONS. SITE HAS BEEN REMEDIATED UNDER A RAM.
ORIGINALLY DRAINED TO SOUTH DITCH (SITE 85)
MAFB-183
SITE 20 (APPROXIMATE)-PREVIOUS INVESTIGATIONS
DRAINAGE DITCH
TO SEWAGE OXIDATION PONDS (SITE 81)
CHLORINE CONTACT CHAMBER
SHOP
SUMP
PUMP STATION
BIOFILTER 1
BIOFILTER 2
SOUTH DIGESTER TANK (DEMOLISHED 09/95)
NORTH DIGESTER TANK (DEMOLISHED 09/95)
PRIMARY SEDIMENTATION TANK 1
PRIMARY SEDIMENTATION TANK 2
SPLITTER STRUCTURE
MAFB-38 (DEST)
MAFB-182
18" (ABANDONED)
ALEXANDER WAY
SCALE
0
70
140 FEET
LEGEND
EXISTING MONITORING WELL
SEWER LINE SHOWING MANHOLE AND FLOW DIRECTION
(DEST) ABANDONED MONITORING WELL
DWG NAME
DRAWN BY
CHECKED BY
APPROVED BY
DRAWING NUMBER
409888-B8pp

Table 2-7. Site 20 - Results of Previous Investigations

Investigation and Investigator	Air Investigation and Significant Analytical Results	Soil Investigation and Significant Analytical Results	Groundwater Investigation and Significant Analytical Results	Other Activities	References
IRP Phase I, Records Search - CH2M Hill	None	None	None	Base Records Search	[CH2M Hill 1982]
IRP Phase II, Stage 2 Investigation - AeroVironment, Inc	None	None	Installed and sampled one well (MAFB-38). No significant contamination was detected.	Conducted a terrain conductivity and GPR geophysical survey.	[AeroVironment 1987]
Well Redevelopment and Sampling - IT Corporation	None	None	Sampled Well MAFB-38. No significant contamination was detected.	None	[IT 1990b]
Quarterly Routine Groundwater Sampling - IT Corporation and EA Engineering, Science and Technology, Inc.	None	None	Data for selected constituents were summarized most recently in the 3rd Quarter 1993, Quarterly Groundwater Monitoring Report [IT 1993f].	NA	[IT 1989] [IT 1990c] [IT 1990d] [EA 1990a] [EA 1990b] [EA 1990c] [IT 1993f] [IT 1993g] [IT 1993h]
IRP Site Inspection - IT Corporation	None	Evaluated all geologic and chemical data relating to environmental contamination at Mather AFB. No sampling or analysis conducted.	Evaluated all geologic and chemical data relating to environmental contamination at Mather AFB. Data from 1988 groundwater sampling was included. Conducted two rounds of water level measurements for all on-base monitoring wells.	NA	[IT 1990a]

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Table 2-7. Site 20 - Results of Previous Investigations (Continued)

Investigation and Investigator	Air Investigation and Significant Analytical Results	Soil Investigation and Significant Analytical Results	Groundwater Investigation and Significant Analytical Results	Other Activities	References
Group 2 Sites RI - IT Corporation	None	Conducted a SOV survey to screen potential source areas. Maximum concentrations detected were: TPHC (2,049 ppm); TCE (20 ppm); benzene (41 ppm); toluene (2.2 ppm); and ethylbenzene (2.8 ppm). One shallow (SSB-20A) and four deep (DSB-A-20A through DSB-A-20D) soil borings were drilled and sampled. Maximum concentrations found were: diesel (1,400 ppm); gasoline (<10 ppm); xylenes (<5 ppb); 2-butanone (18(J) ppb) and oil and grease (24,000 ppm). Collected and analyzed 26 surface soil and sludge samples (SS-20-A through SS-20-W). Analyzed for metals and pH. All detected inorganics were below established background concentrations, except barium, cadmium, calcium, chromium, copper, lead, nickel, selenium, silver, and zinc. pH ranged from 4.6 to 7.2	Installed and sampled two wells (MAFB-182 and 183). Sampled existing Well MAFB-38. Maximum contaminants detected were: methylene chloride (3.1 ppb) and lead (3.1 ppb). No other organics or inorganics were detected.	NA	[IT 1993i]
Comprehensive Baseline Risk Assessment - IT Corporation	None	None	None	No ILCR $>10^{-6}$ No HQ >1	[IT 1996c]

1135 59

Table 2-7. Site 20 - Results of Previous Investigations (Continued)

Investigation and Investigator	Air Investigation and Significant Analytical Results	Soil Investigation and Significant Analytical Results	Groundwater Investigation and Significant Analytical Results	Other Activities	References
ASC Investigation - IT Corporation	None	Three surface soil samples were collected and analyzed. Contaminants detected include: metals, PAHs, pesticides, and petroleum hydrocarbons. Analytical results may be found in the ASC RI Report [IT 1996c]. Six soil borings were drilled and sampled. Maximum concentrations detected were: lead (186 mg/kg), 1,1,2,2-tetrachloroethane (1 μg/kg), acetone (13 μg/kg), bis(2-ethylhexyl)phthalate (1,200 μg/kg), butyl benzyl phthalate (35 μg/kg), diethyl phthalate (42 μg/kg), pyrene (20 μg/kg), and TPH-D (360 mg/kg). One surface soil and four subsurface soil samples were analyzed with a waste extraction test. Analytical results may be found in the ASC RI Report [IT 1996b].	Groundwater sampling was conducted from two existing wells. Maximum concentrations detected were: calcium (10,500 μg/L), magnesium (5,810 μg/L), sodium (8,860 μg/L), and vanadium (15.4 μg/L).	Five sludge samples were collected from the Digester Tanks. The only contaminant to exceed California Total Threshold Limit Concentration standard was mercury (20 mg/kg) Two surface water samples were collected from the Digester Tanks. No detections exceeded standards.	[IT 1996b]

IRP = Installation Restoration Program
AFB = Air Force Base
GPR = ground penetrating radar
NA = not applicable
RI = remedial investigation
SOV = soil organic vapor
TPHC = total petroleum hydrocarbon compounds
ppm = parts per million
TCE = trichloroethene
ppb = parts per billion
ILCR = incremental lifetime cancer risk
HQ = hazard quotient
ASC = Additional Site Characterization
PAH = polycyclic aromatic hydrocarbons
TPH-D = total petroleum hydrocarbon as diesel
mg/kg = milligrams per kilogram
μg/kg = micrograms per kilogram
μg/L = micrograms per liter

2.2.5.4 *Site 23 - Sanitary Sewer Line Main Base Area*

Site 23 (Figure 2-5) consists of portions of the Main Base sanitary sewer line totaling approximately 13,000 feet in length. The primary section is in the Main Base area and extends eastward along the entire length of Superfortress Avenue with several north-trending laterals. A summary of the results of the previous investigations conducted at Site 23 is presented in Table 2-8. As a result of previous investigations, four main areas of concern (23A, 23B, 23C, and 23D) have been identified. These areas of concern are where significant contamination was identified in the immediate vicinity of the sanitary sewer line. However, this contamination may or may not be attributed to contamination from other known IRP sites (e.g., Site 18 or 39).

Volatile organic compounds have been identified as COCs based on VLEACH modeling. The basis for cleanup is protection of groundwater quality.

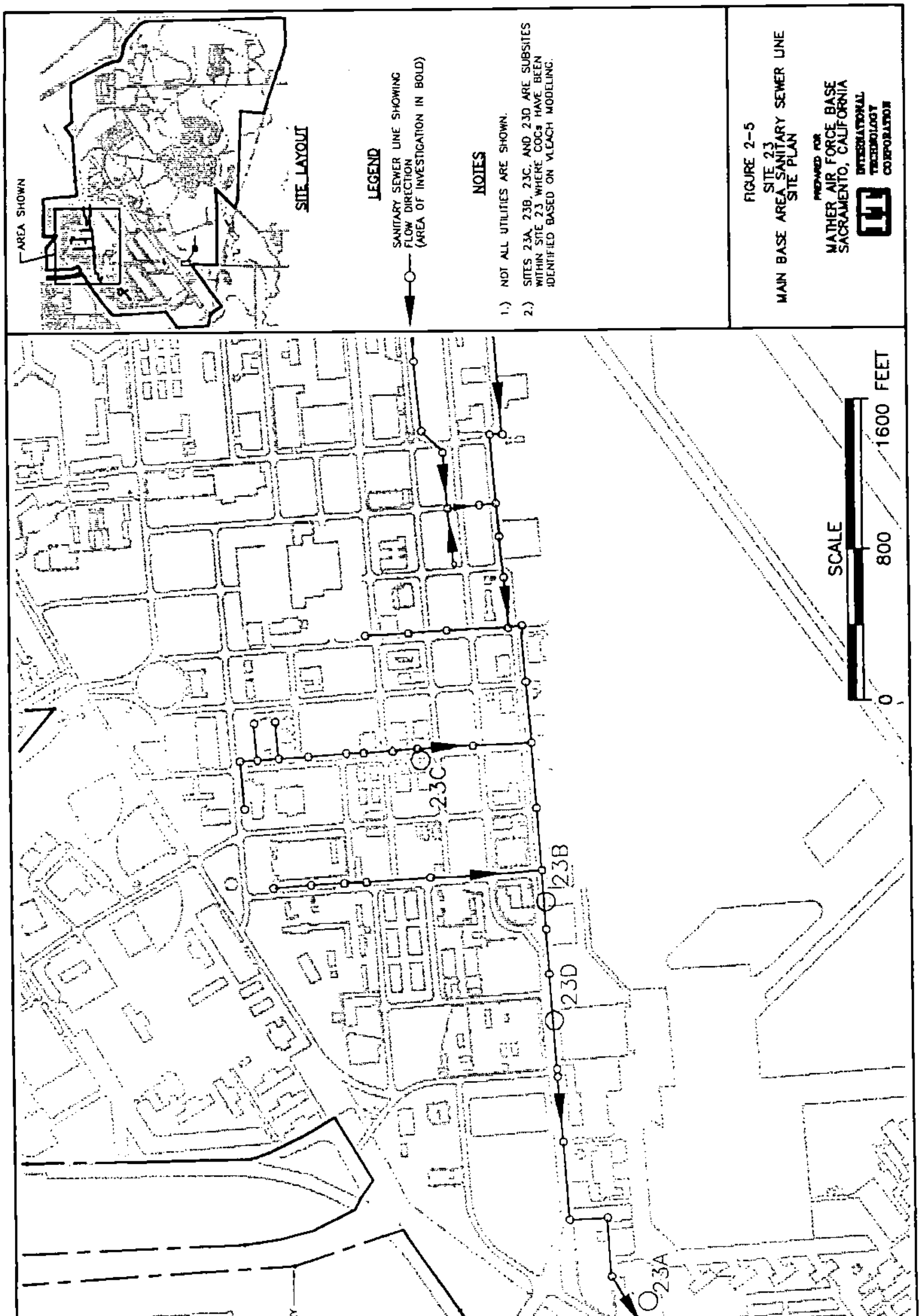

FIGURE 2-5
SITE 23
MAIN BASE AREA SANITARY SEWER LINE
SITE PLAN

Table 2-8. Site 23 - Results of Previous Investigations

Investigation and Investigator	Air Investigation and Significant Analytical Results	Soil Investigation and Significant Analytical Results	Groundwater Investigation and Significant Analytical Results	Other Activities	References
IRP Phase I, Records Search - CH2M Hill	None	None	None	Base Records Search	[CH2M Hill 1982]
Quarterly Routine Groundwater Sampling - IT Corporation and EA Engineering, Science and Technology, Inc.	None	None	Data for selected constituents were summarized most recently in the 3rd Quarter 1993, Quarterly Groundwater Monitoring Report [IT 1993f].	NA	[IT 1989] [IT 1990c] [IT 1990d] [EA 1990a] [EA 1990b] [EA 1990c] [IT 1993f] [IT 1993g] [IT 1993h]
Group 2 Sites RI - IT Corporation	None	Ten shallow (SSB-23A through SSB-23J) soil borings were drilled and sampled. Maximum concentrations found were: diesel (10 ppm); gasoline (12 ppm); total xylenes (<5 ppb); 2-butanone (12 ppb); toluene (<5 ppb); ethylbenzene (<5 ppb); lead (0.5 ppb) and oil and grease (59 ppm).	Installed and sampled seven wells (MAFB-94 through 99, and MAFB-105). Maximum concentrations detected were: TCE (19 ppb); PCE (60 ppb) and carbon tetrachloride (1.6 ppb).	NA	[IT 1993i]
Comprehensive Baseline Risk Assessment - IT Corporation	None	None	None	No ILCR $>10^{-6}$ No HQ >1	[IT 1996c]

Table 2-8. Site 23 - Results of Previous Investigations (Continued)

Investigation and Investigator	Air Investigation and Significant Analytical Results	Soil Investigation and Significant Analytical Results	Groundwater Investigation and Significant Analytical Results	Other Activities	References
ASC Investigation - IT Corporation	None	Eight deep soil borings were drilled and sampled. Maximum concentrations detected were: 1,2-dichloroethene (3 µg/kg), 2-butanone (28 µg/kg), acetone (190 µg/kg), ethylbenzene (56 µg/kg), toluene (3 µg/kg), trichloroethene (25 µg/kg), and total xylenes (8 µg/kg). Forty-four locations were sampled for SOVs. Shallow SOV screening detections of less than 10 µg/L occurred in 43 of the samples. One sample detected PCE at 32 µg/L. Eight deep soil boring locations were sampled for SOVs. Up to approximately 130,000 ppb of TCE was detected.	None	One hundred twenty grab samples of flush water from the sanitary sewer line were collected and analyzed. The flush samples confirmed that chlorinated VOCs are not present in significant amounts within the sewer lines.	[IT 1996b]

IRP = Installation Restoration Program
RI = remedial investigation
ppm = parts per million
ppb = parts per billion
TCE = trichloroethene
PCE = tetrachloroethene
NA = not applicable
ILCR = incremental lifetime cancer risk
HQ = hazard quotient
ASC = Additional Site Characterization
µg/kg = micrograms per kilogram
SOV = soil organic vapor
µg/L = micrograms per liter
VOC = volatile organic compound

2.2.5.5 Site 86 - Military Firing Range

Site 86 (Figure 2-6) is located in the southeastern portion of Mather AFB. The site was operated by the military as a small arms firing range. A summary of the results of previous investigations conducted at Site 86 is presented in Table 2-9.

Contamination has been identified in the surface soils. The only COC identified at the site under a residential future land-use scenario is lead. The bases for this cleanup is protection of human health, groundwater quality, and ecological receptors. The volume of impacted soils associated with Site 86 is estimated at 6,100 cubic yards (1,900 cubic yards to excavate from the bullet flight path and 4,200 cubic yards stockpiled at the site).

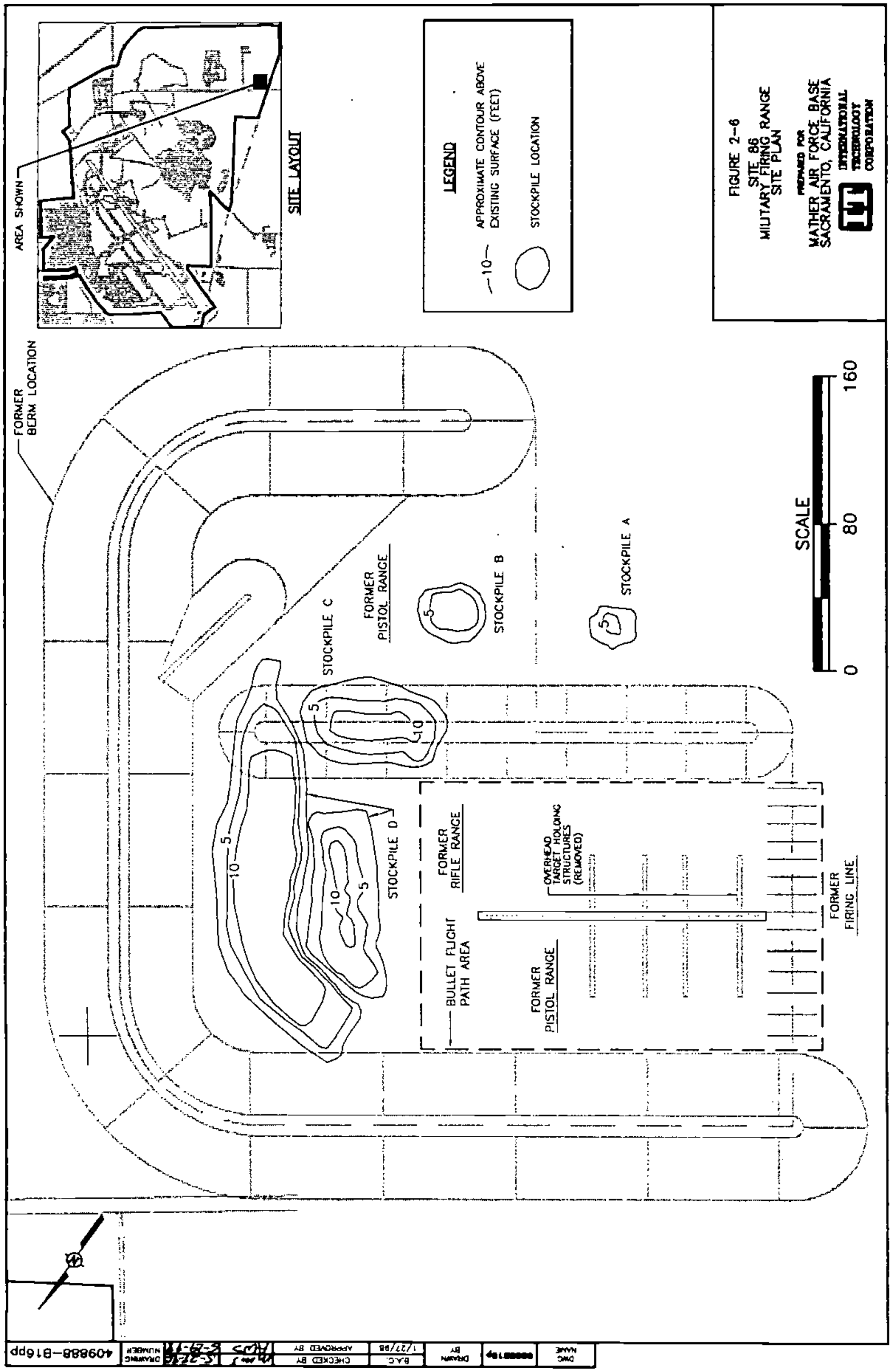
AREA SHOWN
SITE LAYOUT
LEGEND
—10— APPROXIMATE CONTOUR ABOVE EXISTING SURFACE (FEET)
STOCKPILE LOCATION
FIGURE 2-6
SITE 86
MILITARY FIRING RANGE
SITE PLAN
PREPARED FOR
MATHER AIR FORCE BASE
SACRAMENTO, CALIFORNIA
INTERNATIONAL TECHNOLOGY CORPORATION
FORMER BERM LOCATION
SCALE
0
80
160
STOCKPILE A
STOCKPILE B
STOCKPILE C
STOCKPILE D
FORMER PISTOL RANGE
FORMER RIFLE RANGE
OVERHEAD TARGET HOLDING STRUCTURES (REMOVED)
BULLET FLIGHT PATH AREA
FORMER PISTOL RANGE
FORMER FIRING LINE
5
10
409888-B16pp

Table 2-9. Site 86 - Results of Previous Investigations

Investigation and Investigator	Air Investigation and Significant Analytical Results	Soil Investigation and Significant Analytical Results	Groundwater Investigation and Significant Analytical Results	Other Activities	References
Site Characterization for IRP Sites 86 and 87-IT Corporation	None	Forty-three soil samples were collected from the bullet flight line area and four discrete soil stockpiles and analyzed for bullet fragment counts. A total of 113 lead bullets and five brass casings were found in the soil samples. Of the samples, five were analyzed at a laboratory with the maximum concentration of lead found in the soil being 1,660 mg/kg. This sample was also analyzed by waste extraction test methodology, and lead was detected at 16 mg/L.	None	NA	[IT 1997c]

IRP = Installation Restoration Program
mg/kg = milligrams per kilogram
mg/L = milligrams per liter
NA = not applicable

2.2.5.6 Site 87 - Skeet/Trap Range

Site 87 (Figure 2-7) is located in the eastern portion of Mather AFB. The site was operated by a local shooting club as a skeet/trap shooting range. Morrison Creek traverses the site in front of the firing positions. A summary of the results of previous investigations conducted at Site 87 is presented in Table 2-10.

Contamination has been identified in the surface soils and sediments. If water is encountered during excavation of the sediments, it will be diverted around the impacted area (only during remediation) or discharged to the publicly owned treatment works (POTW) (if acceptable to Sacramento County). The COCs identified at the site under a recreational future land-use scenario are arsenic, lead, and PAHs. The bases for cleanup are protection of human health, groundwater and surface water quality, and ecological receptors. The volume of impacted sediments and surface soils associated with Site 87 is estimated at 28,000 cubic yards.

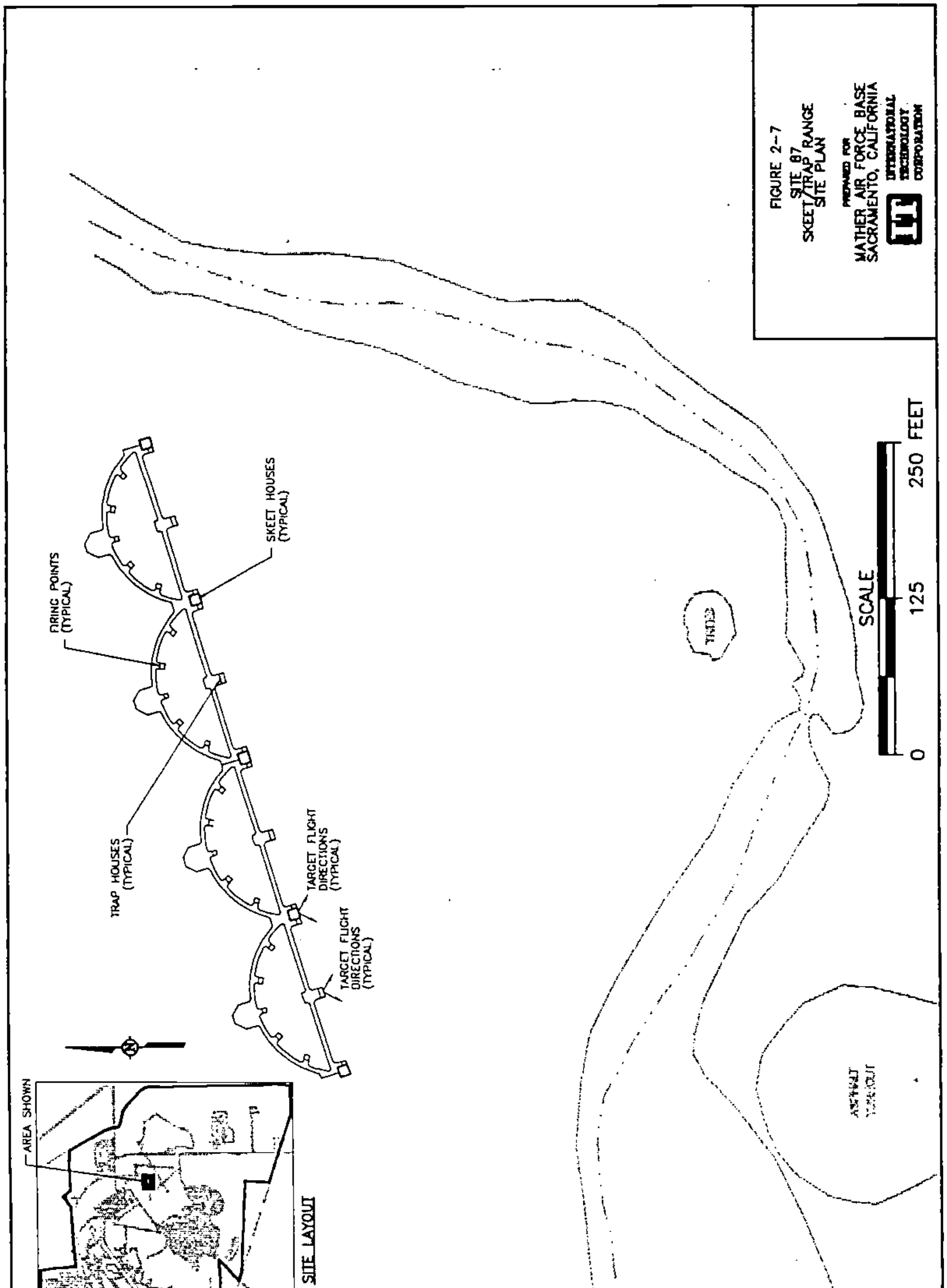

FIGURE 2-7
SITE 87
SKEET/TRAP RANGE
SITE PLAN

PREPARED FOR
MATHER AIR FORCE BASE
SACRAMENTO, CALIFORNIA

INTERNATIONAL TECHNOLOGY CORPORATION

Table 2-10. Site 87 - Results of Previous Investigations

Investigation and Investigator	Air Investigation and Significant Analytical Results	Soil Investigation and Significant Analytical Results	Groundwater Investigation and Significant Analytical Results	Other Activities	References
Site Characterization for IRP Sites 86 and 87 - IT Corporation	None	A total of 137 surface soil and sediment samples were collected for fragment count. Of these samples, 24 were chemically analyzed. Surface soil samples detected a maximum lead concentration of 1,330 mg/kg along with nine different PAHs. Waste extraction test analysis on six of the soil samples detected lead concentrations ranging from 0.5 mg/L to 1.7 mg/L. Waste extraction test analysis on four surface soil samples did not detect any PAHs above the method detection limit. Sediment samples detected a maximum lead concentration of 6,800 mg/kg along with eight different PAHs. Waste extraction test analysis on two samples did not detect any PAHs above the method detection limit.	None	One surface water sample and one duplicate were collected from the pond located on the range. The only parameter detected was barium at 87 and 89 µg/L.	[IT 1997c]

IRP = Installation Restoration Program
PAH = polycyclic aromatic hydrocarbons
mg/kg = milligrams per kilogram
mg/L = milligrams per liter
µg/L = micrograms per liter

1135 70

2.2.6 Summary of Site Risks

Remedial investigation activities at Mather AFB have included detailed assessments of potential human health and ecological risks, and assessments of potential impacts to groundwater and/or surface water quality, associated with the subject sites (Section 2.1.3). Results of the human health and ecological risk assessments for all subject sites at Mather AFB, with the exception of Sites 86 and 87, are presented in the Final CBRA [IT 1996c]. A screening level risk assessment was conducted for Sites 86 and 87 as part of this ROD with results presented in Appendices B and C of this document. Results of the assessments of potential threat to groundwater and/or surface water quality, and other details of the COC selection process, are documented in the Basewide OU FFS Report [IT 1997a]. The data collected and used in the RIs and the FFSs were of USEPA Level III, IV, V, or equivalent [USEPA 1987]. Formal data validation of the RI- and FFS-generated data was performed to ensure that data were of quality commensurate with their intended use. The potential human health and ecological risks, and potential threats to groundwater and/or surface water associated with the subject sites are summarized below.

Estimates of potential risks/hazards to human and ecological receptors were obtained from the CBRA [IT 1996c]. Revisions from the previous risk assessment [IT 1995c] included the use of surrogate toxicity values, an updated dermal exposure model, revised dermal absorption values, additional ecological risk assessment activities, and an aggregate mining scenario. The initial list of contaminants of potential concern (COPCs) (presented in the FFS Report [IT 1995b]) which were identified on the basis of potential ecological risk/hazard have not changed appreciably due to these additional activities.

From an ecological perspective, COPCs for which concentrations exceed background screening values, or for which associated estimates of potential ecological hazard index exceed 1.0, were also identified as COCs. Site 87 was rated as medium for ecological risk. Therefore, the selected remedies at this site will be instituted for the protection of ecological receptors.

From a human health perspective, COPCs with estimated incremental lifetime cancer risk (ILCR) exceeding 1×10^{-6}, or the hazard quotient exceeding 1.0 (on an individual pathway basis), were identified as COCs.

Based on the calculations in the human health risk assessment, excess lifetime cancer risks were within or below the range of one-in-one million to one-in-ten thousand. However, the non-cancer risk at Site 87 exceeded the hazard quotient of 1.0. The selected remedies at Sites 20, 86, and 87 will be implemented to reduce potential human health risks.

Contaminants of concern have been identified on the basis of potential impact to groundwater quality at Sites 10C/68, 18, 20, 23, 86, and 87. Potential impacts to surface water quality have also been identified at Site 87. Accordingly, the selected remedies for these sites will also be initiated to ensure protection of groundwater and/or surface water quality, as applicable.

Actual or threatened releases of hazardous substances, if not addressed by implementing the response actions selected in this ROD, may present an imminent and substantial endangerment to public health, welfare, or the environment.

2.2.7 Description of Alternatives

Remedial alternatives (including the no action alternative) were developed for each of the sites for detailed analysis in the FFS Report [IT 1997a]. These remedial alternatives address contaminants in soil, soil vapor, surface water, and sediments as appropriate. Groundwater contamination beneath these sites, if present, was previously addressed in the Soil OU and Groundwater OU ROD [IT 1996a].

In developing the alternatives, it was assumed that the sediments (maximum two feet deep based on sediment sampling procedures), surface soils (a maximum of three feet below land surface [bls] depending upon contamination extent and site physical characteristics), and shallow soils (base of the surface soils to 30 feet bls) are capable of being excavated without specialized equipment. Excavation of the deep soils (30 feet bls to the water table) is not considered feasible or appropriate. The no action alternative, as required by CERCLA, has been included for each site to provide a baseline for comparison purposes.

2.2.7.1 Sites 10C/68 Remedial Alternative

Table 2-11 summarizes four remedial alternatives that were developed for possible application at Sites 10C/68 and presented in the FFS [IT 1997a]. The selected remedy is shown in bold, italic text.

Table 2-11. Sites 10C/68 Remedial Alternatives

ALTERNATIVE	*DESCRIPTION*
10C/68.1	No Action
10C/68.2	Excavation (lead-contaminated surface soils) with off-base disposal; and *in situ* treatment (consisting of bioremediation and soil vapor extraction) of the remaining contaminated surface soils and shallow and deep subsurface soils.
10C/68.3	Excavation (lead-contaminated surface soils) with off-base disposal; excavation (remaining contaminated surface soils) with *ex situ* bioremediation and on-base disposal at Site 7; and *in situ* treatment (consisting of bioremediation and soil vapor extraction) of the contaminated shallow and deep subsurface soils.
10C/68.4*	***In situ treatment (consisting of bioremediation and soil vapor extraction) of the remaining contaminated surface soils and shallow and deep subsurface soils.***

* The surface soils at the Site 10C Burn Pit have been removed and transported to Site 4 under authority of a Removal Action Memorandum [USAF 1996b]. Eight confirmation samples were collected and analyzed. Risks from the lead-contaminated soils have been reduced to acceptable levels and are protective of groundwater quality as a result of the excavation activities. Therefore, *in situ* treatment (i.e., shallow and deep subsurface soils) is the only portion of the remedy that would remain. Installation and pilot testing of a soil vapor extraction system was conducted in August 1997. However, following consistently low influent concentrations the system was shut down in December 1997 to evaluate the rebound of contaminant concentrations in the vadose zone and to determine if *in situ* bioremediation is more appropriate for this site.

2.2.7.2 Site 18 Remedial Alternatives

Table 2-12 summarizes two remedial alternatives that were developed and evaluated for possible application at Site 18 in the FFS [IT 1997a]. The selected remedy is shown in bold, italic text.

Table 2-12. Site 18 Remedial Alternatives

ALTERNATIVE	*DESCRIPTION*
18.1	No Action
18.2	***In situ soil vapor extraction (shallow and deep subsurface soils).***

2.2.7.3 Site 20 Remedial Alternatives

Table 2-13 summarizes four alternatives that were developed and evaluated for possible application at Site 20 in the FFS [IT 1997a]. The selected remedy is shown in bold, italic text.

Table 2-13. Site 20 Remedial Alternatives

ALTERNATIVE	*DESCRIPTION*
20.1	No Action
20.2	Excavation (surface soils) with off-base disposal; and groundwater well installation and monitoring. Institutional controls will be implemented to restrict activities that may endanger public health.
20.3	Excavation (surface soils) with stabilization, *ex situ* bioremediation, and on-base disposal at Site 7 (however, if lead levels are below acceptance criteria for Site 7, the soils will not be stabilized prior to on base disposal at Site 7); and *in situ* bioremediation (shallow and deep subsurface soils). Institutional controls will be implemented to restrict activities that may endanger public health.
20.4	***Excavation (surface soils) with stabilization, ex situ bioremediation (as necessary), and on-base disposal at Site 7; and groundwater well installation and monitoring.***

2.2.7.4 Site 23 Remedial Alternatives

Table 2-14 summarizes two alternatives that were developed and evaluated for possible application at Site 23 in the FFS [IT 1997a]. The selected remedy is shown in bold, italic text.

Table 2-14. Site 23 Remedial Alternatives

ALTERNATIVE	*DESCRIPTION*
23.1	No Action
23.2	***In situ soil vapor extraction (shallow and deep subsurface soils).***

2.2.7.5 Site 86 Remedial Alternatives

Table 2-15 summarizes three remedial alternatives that were developed and evaluated for possible application at Site 86 in the FFS [IT 1997a]. The selected remedy is shown in bold, italic text.

Table 2-15. Site 86 Remedial Alternatives

ALTERNATIVE	*DESCRIPTION*
86.1	No Action
86.2	***Excavation (surfuce soils) with treatment (i.e., stabilization) and on-base disposal at Site 7 (however, if lead levels are below acceptance criteria for Site 7, the soils will not be stabilized prior to onbase disposal at Site 7) or off-base disposal if the excavated material exceeds Site 7 acceptance criteria.***
86.3	Excavation (surface soils) with on-base disposal at Site 7 (or off-base disposal if the excavated material exceeds Site 7 acceptance criteria).

2.2.7.6 Site 87 Remedial Alternatives

Table 2-16 summarizes three remedial alternatives that were developed and evaluated for possible application at Site 87 in the FFS [IT 1997a]. The selected remedy is shown in bold, italic text.

Table 2-16. Site 87 Remedial Alternatives

ALTERNATIVE	*DESCRIPTION*
87.1	No Action
87.2	***Excavation (sediments and surface soils) with treatment (i.e., stabilization) and on-base disposal at Site 7 (or off-base disposal if the excavated material exceeds Site 7 acceptance criteria). Institutional controls will be implemented to restrict activities that may endanger human health. Institutional controls will be implemented to restrict activities that may endanger public health, unless cleanup does reduce risk to a level compatible with unrestricted land use.***
87.3	Excavation (sediments and surface soils) with on-base disposal at Site 7 (or off-base disposal if the excavated material exceeds Site 7 acceptance criteria). Institutional controls will be implemented to restrict activities that may endanger human health. Since cleanup at this site is to non-residential standards. Institutional controls will be implemented to restrict activities that may endanger public health, since cleanup at this site is to non-residential standards.

2.2.8 Summary of Comparison Analysis of Alternatives

The remedial alternatives developed in the FFS Report [IT 1997a] were analyzed in detail using the first seven evaluation criteria required by the NCP (Section 300.430(e)(7)). These criteria are classified as either threshold or primary balancing criteria.

Threshold criteria must be met for a remedial alternative to be selected and include:

- overall protection of human health and the environment; and
- compliance with ARARs.

Primary balancing criteria are designed to identify trade-offs between those alternatives which meet the threshold criteria and include:

- long-term effectiveness and permanence;
- reduction of toxicity, mobility, or volume through treatment;
- short-term effectiveness;
- implementability; and
- cost.

Two additional criteria, referred to as modifying criteria, are evaluated during the public comment period and development of this document. The modifying criteria include:

- state/support agency acceptance; and
- community acceptance.

The relative ability of each alternative to meet each of the nine criteria (Figure 2-8) were weighed to identify the alternative providing the best tradeoffs for each site. The following sections summarize the nine criteria. Table 2-17 summarizes the results of the comparative analysis.

2.2.8.1 State/Support Agency Acceptance

This indicates whether, based on review of the RI Report [IT 1996c], FFS Report [IT 1997a], and Proposed Plan [IT 1997b], the state concurs with, opposes, or has no comment on the preferred cleanup options. The State of California is represented by the California Environmental Protection Agency, DTSC as a support agency under the Federal Facility Agreement for Mather AFB; DTSC coordinates review comments from other state agencies, such as the CVRWQCB and the Integrated Waste Management Board. Section 1.3 of this ROD presents signature of state acceptance of the selected remedies.

THRESHOLD CRITERIA

Overall Protection of Human Health and the Environment. Addresses whether or not a cleanup option provides adequate protection and describes how risks, posed through each pathway, are eliminated, reduced, or controlled through treatment, engineering controls, or institutional controls.

Compliance with Applicable or Relevant and Appropriate Requirements. Addresses whether a cleanup option will meet all applicable or relevant and appropriate requirements or federal and state environmental statutes and/or provide grounds for invoking a waiver. Applicable or relevant and appropriate requirements include cleanup and protection of groundwater/surface water quality for its beneficial uses.

BALANCING CRITERIA

Long-Term Effectiveness of Permanence. Refers to the ability of a cleanup option to maintain reliable protection of human health and the environment over time, once cleanup goals (i.e., cleanup standards) have been met.

Reduction of Toxicity, Mobility, and Volume through Treatment. Refers to the anticipated ability of a cleanup option to reduce the toxicity, mobility, and volume of the hazardous components present at the site.

Short-Term Effectiveness. Addresses the period of time needed to complete the cleanup option, and any adverse impacts on human health and the environment that may be posed during the construction and implementation period, until the cleanup goals (i.e., cleanup standards) are achieved.

Implementability. Refers to the technical and administrative feasibility of a cleanup option, including the availability of materials and services needed to carry out a particular option.

Cost. Refers to the estimated capital and operation and maintenance costs of each cleanup option. For comparison purposes, a present worth value was calculated using a 5 percent discount factor so that each option could be equally compared in 1996 dollars.

MODIFYING CRITERIA

State Acceptance. Indicates whether, based on its review of the information, the state concurs with, opposes, or has no comment on the preferred cleanup options.

Community Acceptance. Indicates whether community concerns are addressed by the cleanup option and whether or not the community has a preference for a cleanup option.

Figure 2-8. Selecting a Cleanup Remedy

Table 2-17. Comparative Analysis of Remedial Alternatives for the Basewide Operable Unit Sites Selected for Remedial Action

Evaluation Criteria	Site Number	10C/68				18		20				23		86			87		
	Alternative	10C/ 68.1	10C/ 68.2	10C/ 68.3	10C/ 68.4	18.1	18.2	20.1	20.2	20.3	20.4	23.1	23.2	86.1	86.2	86.3	87.1	87.2	87.3
Long-Term Effectiveness and Permanence		P	B	B	B	F	B	F	G	B	G	G	B	P	B	G	P	B	G
Reduction of Toxicity, Mobility, and Volume		P	F	G	B	P	B	P	G	B	G	P	B	P	B	B	P	B	B
Short-Term Effectiveness		P	F	G	B	F	B	F	G	B	G	G	B	P	B	G	P	B	G
Implementability		B	G	G	G	B	G	B	G	G	G	B	G	B	G	G	B	G	G
Community Acceptance		No	No	No	Yes	No	Yes	No	No	No	Yes	No	Yes	No	Yes	No	No	Yes	No
State Acceptance		No	No	No	Yes	No	Yes	No	No	No	Yes	No	Yes	No	Yes	No	No	Yes	No
Present Worth Cost ($ millions)		0.030	0.608	0.693	0.597	0.017	1.039/ acre	0.040	0.191	0.731	0.108	0	1.041/ acre	0	0.5464 - 2.073	0.147 - 5.223	0	2.800 - 9.026	1.078 - 22.022

* ARARs do not have to be met unless a remedial action is taken.
P = Poor
F = Fair
G = Good
B = Best
Shaded columns indicate preferred alternative

2.2.8.2 *Community Acceptance*

This is an assessment of the general public's response to the Proposed Plan [IT 1997b] following review of the public comments received during the public comment period (from May 23 through June 23, 1997) and open community meeting (held on May 29, 1997). It indicates whether community concerns are addressed by the cleanup option and whether or not the community has a preference for a cleanup option. Section 6.0 of this ROD documents the community acceptance of the selected remedies, as presented in the Responsiveness Summary.

2.2.9 *The Selected Remedies*

This section presents the remedies selected by the Air Force, with concurrence by the USEPA and the State of California, for each of the Basewide OU sites which warrant cleanup. The selected remedies were chosen based on the results of the comparative analysis of the alternatives presented in Table 2-17 and are optimized in terms of the nine evaluation criteria. Design and construction of the selected remedial actions will be conducted by certified professionals or under the supervision of certified professionals, as appropriate.

2.2.9.1 *Sites 10C/68 - Former Fire Department Training Area No. 3/Two 2,000 Gallon and Sixteen 50,000 Gallon Underground Storage Tanks at Fuel Transfer Station*

Alternative 10C/68.4 was selected by the Air Force, with concurrence by the USEPA and the State of California, as the remedy for Sites 10C/68. The major components of this remedy include:

- *in situ* treatment of the fuel contaminated subsurface soils at Sites 10C and 68; and
- treatment of the offgas (if applicable) will be conducted using granular activated carbon or more cost-effective means of best available control technology as necessary to comply with ARARs.

The *in situ* treatment system could be used as a bioremediation system or converted to an SVE system, depending on the contaminants measured. Compliance with cleanup standards will be demonstrated before system operation is terminated. Thermal destruction of chlorinated hydrocarbons may generate dioxins. Therefore, if thermal destruction technology is used as part of the *in situ* remediation selected for this Basewide Operable Unit site and the influent gas contains chlorinated chemicals the emissions from the thermal treatment unit will be monitored (which will consist of at least three sampling events) for dioxin/furans during the first month of operation, and again if significant changes are made to the influent vapor or the operation of the thermal treatment unit that could reasonably be expected to result in increased dioxin/furan emissions. If the emissions exceed the value of 0.2 nanograms per dry square cubic meter (ng/DSCM), calculated as the sum of toxicity equivalent (TEQ) (values to the 2,3,7,8-tetrachlorodibenzo-p-dioxin [TCDD] isomer) currently proposed as an emissions standard for RCRA incinerators, then a risk calculation will be performed. Risks exceeding the 10^{-6} to 10^{-4} threshold range will require mitigation; risks within the threshold range will be subject to further consideration by the Air Force, USEPA, and the State of California under the Federal Facility Agreement.

The Air Force will conduct further soil gas sampling at this site to define the extent of VOC contamination, as part of the remedial design work. Interim actions have been initiated at Sites 10C/68 which involved the installation and pilot testing of an SVE system. Details of the pilot test are described in Section 2.2.5.1. The feasibility of SVE will be evaluated when it is demonstrated that soil contaminants may cause concentrations in the leachate to exceed the aquifer cleanup levels, based on an interpretation of soil gas data using VLEACH or another appropriate vadose zone model.

The actual decision on whether to build and operate an SVE system will depend on the degree to which the contamination presents a threat to groundwater and whether site characteristics are suitable for the SVE technology. It is generally preferable from a technical and cost perspective to clean up contamination in the vadose zone before it reaches the groundwater. The feasibility analysis will be prepared by the Air Force as a primary document. The decision will be made by the signatory parties to the Federal Facility Agreement and will be based, at a minimum, on the following factors:

- the cost and time associated with the predicted additional groundwater remediation if no SVE is implemented;
- the cost of implementing the SVE system to meet the SVE soil cleanup standard;
- the incremental cost over time of vadose zone remediation compared to the incremental cost of groundwater remediation, on the basis of a common unit (e.g., cost to remove a pound of trichloroethene [TCE]), provided that the underlying groundwater has not reached aquifer cleanup levels;
- the results of VLEACH or another appropriate vadose zone model, in conjunction with a groundwater fate and transport model to predict the resulting concentration from the vadose zone contamination in the nearest groundwater wells monitoring the site; and

- the results of VLEACH or another appropriate vadose zone model, that interprets soil gas data, to predict the mass and concentration of discharges from the vadose zone to the groundwater.

This demonstration is to be made prior to operation of the bioventing system in areas considered for SVE (to prevent interference from bioventing). Once SVE is initiated, it will be terminated in accordance with the demonstration described in the following paragraphs. The need to implement the bioventing remedy will be reevaluated when SVE is terminated.

The goal of cleaning up the vadose zone is to minimize further degradation of the groundwater by the contaminants in the soil. It is generally preferable from a technical and cost perspective to clean up contamination in the vadose zone before it reaches the groundwater. The soil cleanup standard will be achieved when the residual vadose zone contaminants will not cause the groundwater cleanup standard, as measured in groundwater wells monitoring the plume, to be exceeded after the cessation of the groundwater remediation. The Air Force will make the demonstration that the standard has been met through contaminant fate and transport modeling, trend analysis, mass balance, and/or other means. This demonstration will include examination of the effects of the residual vadose zone contamination in the groundwater using VLEACH or another appropriate vadose zone model, in conjunction with a groundwater fate and transport model, to predict the resulting concentration from this residual vadose zone contamination in the nearest groundwater wells monitoring the site. This demonstration can be made prior to the cessation of groundwater remediation. The Air Force shall provide verification, through actual data, that the above standard has been met. The signatory parties to this ROD will jointly make the decision that the soil cleanup standard has been met.

The Air Force shall operate the SVE system until it makes the demonstration that the cleanup standard, set forth above, has been met. The Air Force shall continue to operate the SVE system if appropriate, after considering the following factors:

- whether the mass removal rate is approaching asymptotic levels after temporary shutdown periods and appropriate optimization of the SVE system;
- the additional cost of continuing to operate SVE system at concentrations approaching asymptotic mass levels;
- whether the predicted concentration of the leachate from the vadose zone using VLEACH or another appropriate vadose zone model that interprets soil gas data will exceed the groundwater cleanup standard;

- the predicted effectiveness and cost of further enhancements to the SVE system (e.g., additional vapor extraction wells);
- whether the cost of groundwater remediation will be significantly more if the residual vadose zone contamination is not addressed;
- whether the residual mass in the vadose zone will significantly prolong the time to attain the groundwater cleanup standard; and
- the incremental cost over time of vadose zone remediation compared to the incremental cost over time for groundwater remediation on the basis of a common unit (e.g., cost of a pound of TCE removed) provided that the underlying groundwater has not reached aquifer cleanup levels.

The signatory parties agree that the Air Force may cycle the SVE system on and off in order to optimize the SVE operation and/or evaluate the factors listed above.

The signatory parties to this ROD will jointly make the decision that the SVE system may be shut off. If the parties cannot reach a joint resolution, any party may invoke dispute resolution. This ROD does not resolve the ARAR status of state requirements regarding the establishment of soil cleanup levels. The parties agree that in the event of a dispute regarding SVE shutoff, the state may argue its authority to require soil cleanup (including soil cleanup standards) as the basis for continuing operation of the SVE system, based on the above factors.

Alternative 10C/68.4 was chosen as the preferred alternative since *in situ* SVE/bioremediation reduces the toxicity and mobility associated with the fuel-contaminated subsurface soils.

Capital cost estimates for this remedy are estimated at approximately $155,000, operation and maintenance costs are estimated at $506,000. Total cost, represented as a net present worth using a five percent discount rate, is estimated at $597,000.

This site was evaluated using a residential land-use scenario. The risk assessment concluded that acceptable human health risks exist at this site. The basis for cleanup at Sites 10C/68 is protection of groundwater quality. Therefore, this site will be cleaned up to levels commensurate with residential land-use.

A cleanup level of 1 milligram per liter (mg/L) for gasoline in the subsurface soil at Site 68 was identified in the Basewide OU FFS [IT 1997a]. The cleanup level is the practical quantitation limit (PQL) for the available analytical method. The FFS calculated a Total Designated Level

(TDL) of 0.05 ppm based on a water quality goal (WQG) of 0.005 mg/L, an attenuation factor of 1.0, and a leachability factor of 10 (0.005 ppm x 1 x 10 = 0.05 ppm). An attenuation factor of 1.0 is typically used when the distance from the deepest contaminant detection to groundwater is equal to or less than ten feet. Since information on the distance from the deepest contaminant detection to groundwater was not available when the FFS was prepared, an attenuation factor of 1.0 was apparently chosen to be conservative. The TDL in the FFS [IT 1997a] is less than the PQL, so the preliminary remediation goal and hence the cleanup level was proposed at the PQL. Regional Water Quality Control Board (RWQCB) guidance suggests an attenuation factor of 100 is suitable for the case when the distance from the deepest contaminant detection to groundwater is greater than 30 feet, as is now understood to be the case at Site 68. Therefore, an attenuation factor of 100 has been used to re-calculate the TDL for Site 68, resulting in a cleanup level of 5 ppm for TPH measured as gasoline. This is also the cleanup level for Site 10C which has distribution of contaminants very similar to Site 68.

Oil and grease was apparently selected as a COC in the subsurface soil at Site 10C because of its potential to impact groundwater quality. A TDL was calculated at 100 ppm using a WQG of 1 ppm, an attenuation factor of 10, and a leachability factor of 10 (1 ppm x 10 x 10 = 100 ppm). This level is less than the established background level of 430 ppm, so the background level was selected as a cleanup level in the draft version of this ROD. However, data from the Site Investigation and SVE System Installation Report for Site 10C/68 [EA 1997] indicates that an attenuation factor of 100 is appropriate based on the distance from the deepest contaminant detection to groundwater. Use of a higher attenuation factor is also supported by the relative immobility of oil and grease in most soil types. With an attenuation factor of 100 the TDL for oil and grease is 1,000 ppm. Only one sample obtained during drilling of the pilot test wells had a detection of oil and grease above 1,000 ppm (MATHER-SO-10C-SB30-15 at 3,340 ppm). One other sample had a detection at 530 ppm (same boring as MATHER-SO-10C-SB30-15 but at a depth of 25 feet), but all other samples were less than the background level. The Air Force, the USEPA, and the State of California decided not to require cleanup for oil and grease since the site data indicates that it is not widely distributed above the revised cleanup level. Only an alternate remedy such as excavation could ensure cleanup that will meet the oil and grease cleanup standard. This alternative was not considered when the FFS was prepared, but would be considerably more costly than the selected remedy, and the benefit of removing such a limited amount of oil and grease is not considered to warrant the additional cost to remove it. Therefore, it is thereby determined that oil and grease is <u>not</u> a COC at this site. Table 2-18 presents the Sites 10C/68 cleanup levels.

Table 2-18. Sites 10C/68 Cleanup Levels

Contaminant of Concern	COC Basis	Cleanup Level		Cleanup Basis
Subsurface Soils - Site 10C				
		Total (ppm)	Soluble (mg/L)	
Benzene	VLEACH	See text in Section 2.2.9.1	NA	(a)
Toluene	VLEACH	See text in Section 2.2.9.1	NA	(a)
Ethylbenzene	VLEACH	See text in Section 2.2.9.1	NA	(a)
Xylenes	VLEACH	See text in Section 2.2.9.1	NA	(a)
Carbon Tetrachloride	VLEACH	See text in Section 2.2.9.1	NA	(a)
TPH measured as Diesel	DLM	100	10	TDL/SDL
TPH measured as Gasoline	DLM	5	NA	TDL/NA
Subsurface Soils - Site 68				
		Total	Soluble	
TPH measured as Gasoline	DLM	5	NA	TDL/NA

(a) Potential threat to groundwater quality
ppm = parts per million
VLEACH = VLEACH model results
mg/L = milligrams per liter
COC = chemical of concern
DLM = Designated Level Methodology (i.e., protection of groundwater quality)
TPH = total petroleum hydrocarbon
TDL = total designated level
SDL = soluble designated level
NA = not applicable

2.2.9.2 Site 18 - Old Burial Site

Alternative 18.2 was selected by the Air Force, with concurrence by the USEPA and State of California as the remedy for Site 18. The major components of this remedy include:

- installing an *in situ* SVE system comprised of extraction wells and possibly passive injection wells; and

- treatment of offgas by granular activated carbon or more cost-effective means of best available control technology as necessary to comply with ARARs.

Thermal destruction of chlorinated hydrocarbons may generate dioxins. Therefore, if thermal destruction technology is used as part of the *in situ* remediation selected for this Basewide

Operable Unit site and the influent gas contains chlorinated chemicals the emissions from the thermal treatment unit will be monitored (which will consist of at least three sampling events) for dioxin/furans during the first month of operation, and again if significant changes are made to the influent vapor or the operation of the thermal treatment unit that could reasonably be expected to result in increased dioxin/furan emissions. If the emissions exceed the value of 0.2 ng/DSCM, calculated as the sum of TEQ (values to the 2,3,7,8-TCDD isomer) currently proposed as an emissions standard for RCRA incinerators, then a risk calculation will be performed. Risks exceeding the 10^{-6} to 10^{-4} threshold range will require mitigation; risks within the threshold range will be subject to further consideration by the Air Force, USEPA, and the State of California under the Federal Facility Agreement. Once SVE is initiated, it will be terminated in accordance with the demonstration described in the following paragraphs.

The goal of cleaning up the vadose zone is to minimize further degradation of the groundwater by the contaminants in the soil. It is generally preferable from a technical and cost perspective to clean up contamination in the vadose zone before it reaches the groundwater. The soil cleanup standard will be achieved when the residual vadose zone contaminants will not cause the groundwater cleanup standard, as measured in groundwater wells monitoring the plume, to be exceeded after the cessation of the groundwater remediation. The Air Force will make the demonstration that the standard has been met through contaminant fate and transport modeling, trend analysis, mass balance, and/or other means. This demonstration will include examination of the effects of the residual vadose zone contamination in the groundwater using VLEACH or another appropriate vadose zone model, in conjunction with a groundwater fate and transport model, to predict the resulting concentration from this residual vadose zone contamination in the nearest groundwater remediation. The Air Force shall provide verification, through actual data, that the above standard has been met. The signatory parties to this ROD will jointly make the decision that the soil cleanup standard has been met.

The Air Force shall operate the SVE system until it makes the demonstration that the cleanup standard, set forth above, has been met. The Air Force shall continue to operate the SVE system if appropriate, after considering the following factors:

- whether the mass removal rate is approaching asymptotic levels after temporary shutdown periods and appropriate optimization of the SVE system;
- the additional cost of continuing to operate SVE system at concentrations approaching asymptotic mass levels;

- whether the predicted concentration of the leachate from the vadose zone (using VLEACH or another appropriate vadose zone model that interprets soil gas data) will exceed the groundwater cleanup standard;

- the predicted effectiveness and cost of further enhancements to the SVE system (e.g., additional vapor extraction wells);

- whether the cost of groundwater remediation will be significantly more if the residual vadose zone contamination is not addressed;

- whether residual mass in the vadose zone will significantly prolong the time to attain the groundwater cleanup standard; and
- the incremental cost over time of the vadose zone remediation compared to the incremental cost over time for groundwater remediation on the basis of a common unit (e.g., cost of a pound of TCE removed) provided that the underlying groundwater has not reached aquifer cleanup levels.

The signatory parties agree that the Air Force may cycle the SVE system on and off in order to optimize the SVE operation and/or evaluate the factors listed above.

The signatory parties to this ROD will jointly make the decision that the SVE system may be shut off. If the parties cannot reach a joint resolution, any party may invoke dispute resolution. This ROD does not resolve the ARAR status of state requirements regarding the establishment of soil cleanup levels. The parties agree that in the event of a dispute regarding SVE shutoff, the state may argue its authority to require soil cleanup (including soil cleanup standards) as the basis for continuing operation of the SVE system, based on the above factors.

Alternative 18.2 was chosen as the preferred alternative for the following reasons:

- significant mass of VOCs removed during the 1993 and 1995 pilot tests demonstrates technical feasibility;

- potential to expand system to mitigate contamination at Site 23A; and

- the site would be actively remediated through SVE thereby reducing mass and potentially reducing the duration of groundwater remediation.

It is anticipated that the system would be installed in a phased approach in conjunction with additional sampling during the Remedial Design/Remedial Action phase to delineate the extent of contamination. Therefore, this alternative is conceptual in nature with costs presented in a unit (per acre) basis. Capital cost estimates for this remedy are estimated to be approximately

$736,000 per acre, operation and maintenance costs are estimated at $319,000 per acre. Total cost, represented as a net present worth using a five percent discount rate, is estimated to be $1,039,000 per acre.

This site was evaluated using a residential land-use scenario. The risk assessment concluded that human health and ecological risks at this site are acceptable. The basis for cleanup at Site 18 is protection of groundwater quality. Therefore, this site will be cleaned up to levels commensurate with residential land-use. Table 2-19 presents the Site 18 cleanup levels.

Table 2-19. Site 18 Cleanup Levels

Contaminant of Concern	COC Basis	Cleanup Level	Cleanup Basis
Soil Vapor			
TCE	VLEACH	see text in Section 2.2.9.2	(a)
1,2-DCE	VLEACH	see text in Section 2.2.9.2	(a)

(a) Potential threat to groundwater quality
TCE = trichloroethene
DCE = dichloroethene
COC = chemical of concern
VLEACH = VLEACH model results

2.2.9.3 Site 20 - Sewage Treatment Facility

Alternative 20.4 was selected by the Air Force, with concurrence by the USEPA and State of California as the remedy for Site 20. The major components of this remedy include:

- Excavating and transporting approximately 500 cubic yards of contaminated surface soils to the Mather Soil Bioremediation Facility.
- *Ex situ* bioremediation of excavated surface soils if necessary until Site 7 acceptance criteria for PAHs are achieved. Compliance with the acceptance criteria will be verified with post treatment confirmation soil sampling and analysis.
- Transporting the treated Site 20 soils from the Mather Soil Bioremediation Facility to Site 7 for use as foundation material in construction of a cap if the soils meet Site 7 acceptance criteria or to an appropriate off-base disposal facility.

- Installing one additional groundwater monitoring well at the site. Compliance with cleanup standards will be verified with groundwater monitoring.
- Groundwater monitoring for phthalates and diesel would be conducted for four quarters, if non-detect, monitoring would be discontinued.

Alternative 20.4 was chosen as the preferred alternative for the following reasons:

- Excavation provides an immediate reduction of the toxicity and mobility associated with the lead contaminated surface soils.
- Stabilization will be done if it can allow the lead-contaminated soils to be suitable for disposal at Site 7 which results in a cost savings over off-base disposal.
- The TPH measured as diesel analytical results were all (J) qualified (estimated) and at relatively low concentrations in the subsurface soils; therefore, groundwater monitoring is appropriate to evaluate future potential impacts.

Capital cost estimates for this remedy are estimated to be approximately $73,000, operation and maintenance costs are estimated at $38,000. Total cost, represented as a net present worth using a five percent discount rate, is estimated to be $108,000.

This site was evaluated using a residential land-use scenario. The risk assessment concluded an unacceptable human health risk exists at this site. The bases for cleanup is protection of human health and groundwater quality. Therefore, this site will be cleaned up to levels commensurate with residential land-use. Table 2-20 presents the Site 20 cleanup levels.

Table 2-20. Site 20 Cleanup Levels

Contaminant of Concern	COC Basis	Cleanup Level (ppm)	Cleanup Basis
Surface Soils			
Lead	DLM, HH	130	CAL EPA
Benzo(b)fluoranthene	DLM, HH	0.33	PQL
Benzo(k)flouranthene	DLM	0.33	PQL
Benzo(a)pyrene	HH	0.33	PQL
Phenanthrene	DLM	0.33	PQL
Benzo(a)anthracene	DLM	0.33	PQL

ppm = parts per million
COC = chemical of concern
PQL = practical quantitation limit
HH = human health risk
DLM = Designated Level Methodology (i.e., protection of groundwater quality)
CAL EPA = California Environmental Protection Agency screening level (i.e., LEADSPREAD model)

2.2.9.4 *Site 23 - Sanitary Sewer Line Main Base Area*

Alternative 23.2 was selected by the Air Force, with concurrence by the USEPA and the State of California as the remedy for Site 23. The major components of this remedy include:

- installing an *in situ* SVE system comprised of extraction wells and passive injection wells; and
- treatment of offgas by granular activated carbon or more cost-effective means of best available control technology.

Thermal destruction of chlorinated hydrocarbons may generate dioxins. Therefore, if thermal destruction technology is used as part of the *in situ* remediation selected for this Basewide Operable Unit site and the influent gas contains chlorinated chemicals the emissions from the thermal treatment unit will be monitored (which will consist of at least three sampling events) for dioxin/furans during the first month of operation, and again if significant changes are made to the influent vapor or the operation of the thermal treatment unit that could reasonably be expected to result in increased dioxin/furan emissions. If the emissions exceed the value of 0.2 ng/DSCM, calculated as the sum of TEQ (values to the 2,3,7,8-TCDD isomer) currently proposed as an emissions standard for RCRA incinerators, then a risk calculation will be performed. Risks exceeding the 10^{-6} to 10^{-4} threshold range will require mitigation; risks within the threshold range will be subject to further consideration by the Air Force, USEPA, and the State of California under the Federal Facility Agreement. Once SVE is initiated, it will be terminated in accordance with the demonstration described in the following paragraphs.

The goal of cleaning up the vadose zone is to minimize further degradation of the groundwater by the contaminants in the soil. It is generally preferable from a technical and cost perspective to clean up contamination in the vadose zone before it reaches the groundwater. The soil cleanup standard will be achieved when the residual vadose zone contaminants will not cause the groundwater cleanup standard, as measured in groundwater wells monitoring the plume, to be exceeded after the cessation of the groundwater remediation. The Air Force will make the demonstration that the standard has been met through contaminant fate and transport modeling, trend analysis, mass balance, and/or other means. This demonstration will include examination of the effects of the residual vadose zone contamination in the groundwater using VLEACH or another appropriate vadose zone model, in conjunction with a groundwater fate and transport model, to predict the resulting concentration from this residual vadose zone contamination in the nearest groundwater remediation. The Air Force shall provide verification, through actual data, that the above standard has been met. The signatory parties to this ROD will jointly make the decision that the soil cleanup standard has been met.

The Air Force shall operate the SVE system until it makes the demonstration that the cleanup standard, set forth above, has been met. The Air Force shall continue to operate the SVE system if appropriate, after considering the following factors:

- whether the mass removal rate is approaching asymptotic levels after temporary shutdown periods and appropriate optimization of the SVE system;
- the additional cost of continuing to operate SVE system at concentrations approaching asymptotic mass levels;
- whether the predicted concentration of the leachate from the vadose zone (using VLEACH or another appropriate vadose zone model that interprets soil gas data) will exceed the groundwater cleanup standard;
- the predicted effectiveness and cost of further enhancements to the SVE system (e.g., additional vapor extraction wells);
- whether the cost of groundwater remediation will be significantly more if the residual vadose zone contamination is not addressed;
- whether residual mass in the vadose zone will significantly prolong the time to attain the groundwater cleanup standard; and

- the incremental cost over time of the vadose zone remediation compared to the incremental cost over time for groundwater remediation on the basis of a common unit (e.g., cost of pound of TCE removed) provided that the underlying groundwater has not reached aquifer cleanup levels.

The signatory parties agree that the Air Force may cycle the SVE system on and off in order to optimize the SVE operation and/or evaluate the factors listed above.

The signatory parties to this ROD will jointly make the decision that the SVE system may be shut off. If the parties cannot reach a joint resolution, any party may invoke dispute resolution. This ROD does not resolve the ARAR status of state requirements regarding the establishment of soil cleanup levels. The parties agree that in the event of a dispute regarding SVE shutoff, the state may argue its authority to require soil cleanup (including soil cleanup standards) as the basis for continuing operation of the SVE system, based on the above factors.

Alternative 23.2 was chosen as the preferred alternative for the following reasons:

- SVE has been successfully applied at other on-base sites with similar contaminants; and
- potential to expand remedial action from other sites (i.e., Sites 18, 39, and 59) to encompass Site 23 areas of concern (e.g., 23A, 23B, 23C, and/or 23D).

It is anticipated that the system would be installed in a phased approach in conjunction with additional sampling during the Remedial Design/Remedial Action phase to delineate the extent of contamination. Therefore, this alternative is conceptual in nature with costs presented in a unit (per acre) basis. Capital cost estimates for this remedy are estimated to be approximately $738,000 per acre, operation and maintenance costs are estimated at $319,000 per acre. Total cost, represented as a net present worth using a five percent discount rate, is estimated to be $1,041,000 per acre.

This site was evaluated using a residential land-use scenario. The risk assessment concluded that the human health and ecological risks were acceptable. The basis for cleanup is protection of groundwater quality. Therefore, the site will be cleaned up to levels commensurate with residential land use. Table 2-21 presents the Site 23 cleanup levels.

Table 2-21. Site 23 Cleanup Levels

Contaminant of Concern	COC Basis	Cleanup Level	Cleanup Basis
Soil Vapor - Site 23A			
TCE	VLEACH	see text in Section 2.2.9.4	(a)
Soil Vapor - Site 23B			
TCE	VLEACH	see text in Section 2.2.9.4	(a)
1,2-DCE	VLEACH	see text in Section 2.2.9.4	(a)
Soil Vapor - Site 23C			
PCE	VLEACH	see text in Section 2.2.9.4	(a)
Soil Vapor - Site 23D			
Xylenes	VLEACH	see text in Section 2.2.9.4	(a)

(a) Potential threat to groundwater quality
TCE = trichloroethene
DCE = dichloroethene
COC = contaminant of concern
PCE = tetrachloroethene (perchloroethene)
VLEACH = VLEACH model results

2.2.9.5 *Site 86 - Military Firing Range*

Alternative 86.2 was selected by the Air Force, with concurrence by the USEPA and the State of California as the remedy for Site 86. The major components of this remedy include:

- excavating approximately 1,900 cubic yards of lead-contaminated surface soils from the bullet flight path;
- stabilizing (if needed for disposal) approximately 6,100 cubic yards of contaminated surface soil (e.g., the excavated soils and lead-contaminated soils stockpiled at the site);
- transporting the soils stabilized as needed, to Site 7 for use as foundation material in construction of a cap, or to an off-base facility if sample screening (Figure 2-9) indicates that Site 7 acceptance criteria are not met; and

- backfilling the excavated areas with uncontaminated soils and/or recontouring to create effective drainage.

Alternative 86.2 was chosen as the preferred alternative for the following reasons:

- treatment of soil reduces the mobility of the contaminants; and
- stabilization results in the soils to be potentially disposed on-base.

Capital costs, assuming disposal at Site 7, for this remedy are estimated to be approximately $564,000, while no operation and maintenance costs are anticipated. Total cost, as net present worth using a five percent discount rate, is estimated to be $564,000. Should the soils not meet Site 7 acceptance criteria, off-base disposal will be required.

Capital costs assuming all soils are disposed off-site are estimated to be $2,073,000. No operation and maintenance costs are associated with this alternative. Total cost, represented as a net present worth using a five percent discount rate, is estimated to be $2,073,000.

This site was evaluated using a residential land-use scenario. The risk assessment concluded that an unacceptable human health and ecological risk exists at the site. The bases for cleanup is protection of human health, groundwater quality, and ecological receptors. Therefore, this site will be cleaned up to levels commensurate with residential land use. Table 2-22 presents the Site 86 cleanup levels.

Table 2-22. Site 86 Cleanup Levels

Contaminant of Concern	COC Basic	Cleanup Level (ppm)	Cleanup Basis
Surface Soil			
Lead	DLM, ECO Risk, HH	130	CAL EPA

ppm = parts per million
CAL EPA = California Environmental Protection Agency screening level (i.e., LEADSPREAD model)
COC = chemical of concern
HH = human health risk
DLM = Designated Level Methodology (i.e., protection of groundwater quality)
ECO Risk = ecological risk

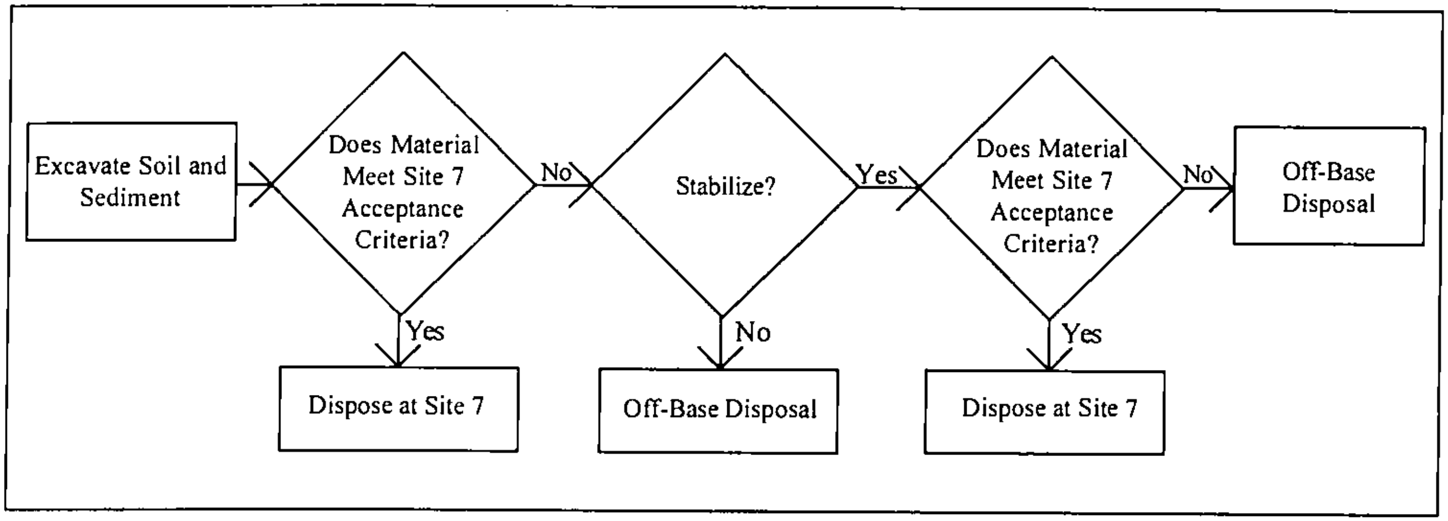

Figure 2-9. Disposition of Sites 86 and 87 Surface Soils and/or Sediments

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2.2.9.6 *Site 87 - Skeet/Trap Range*

Alternative 87.2 was selected by the Air Force, with concurrence by the USEPA and the State of California as the remedy for Site 87. The major components of this remedy include:

- excavating approximately 28,000 cubic yards of contaminated sediments and surface soils to a 6 inch depth through the fall zone of the lead shot;
- stabilizing (if needed for disposal) approximately 28,000 cubic yards of contaminated sediments and surface soils;
- if surface water is present, constructing diversion dams to channel the water flow away from the areas to be excavated. These dams would be removed following completion of the excavation activities. If diversion dams are not appropriate, the water will be discharged to the POTW, if approved by Sacramento County;
- transporting the soil, stabilized as necessary, to Site 7 for use as foundation material in construction of a cap, or an off-base facility if sample screening (see Figure 2-9) indicates that Site 7 acceptance criteria are not met;
- backfilling the excavated areas with uncontaminated soils and/or recontouring to create effective drainage; and
- institutional controls will be implemented with the goal of protecting human health.

Alternative 87.2 was chosen as the preferred alternative for the following reasons:

- treatment of soil reduces the mobility of the contaminants;
- stabilization results in the soils to be potentially disposed on-base; and
- institutional controls provide further protection of human health and the environment.

Capital costs, assuming disposal at Site 7, for this remedy are estimated to be approximately \$2,800,000, while no operation and maintenance costs are anticipated. Total cost, as net present worth using a five percent discount rate, is estimated to be \$2,800,000. Should the soils not meet Site 7 acceptance criteria, off-base disposal will be required.

Capital costs, assuming all soils are disposed off-site, are estimated to be \$9,026,000. No operation and maintenance costs are associated with this alternative. Total cost, represented as a net present worth using a five percent discount rate, is estimated to be \$9,026,000.

This site was evaluated using a recreational land-use scenario. The risk assessment concluded unacceptable human health and ecological risks exist at the site. The basis for cleanup is protection of human health, groundwater and surface water quality, and ecological receptors. This site will be cleaned up to levels commensurate with recreational land use. Table 2-23 presents the Site 87 cleanup levels. However, since cleanup is not planned to achieve residential standards, institutional controls will be implemented to restrict activities that could endanger public health unless the cleanup does reduce risk to a level compatible with unrestricted land use.

Table 2-23. Site 87 Cleanup Levels

Contaminant of Concern	COC Basis	Cleanup Level (ppm)	Cleanup Basis
Sediments			
Arsenic	DLM, ECO Risk, HH	9.6	BKGRD
Lead	DLM, ECO Risk, HH	15.5 (a)	DLM
Surface Soil			
Lead	ECO Risk, HH	700	ECO
Benzo(a)pyrene	HH	0.33	PQL
Dibenz(a,h)anthracene	DLM, HH	0.33	PQL
Benzo(g,h,i)perylene	DLM	0.33	PQL
Fluoranthene	DLM	0.33	PQL
Phenanthrene	DLM	0.33	PQL

(a) Additionally, lead pellets in the stream bed will be removed to the extent practicable in order to reduce the risk of ingestion by water fowl and prevent further leaching from the sediments.

ppm = parts per million
COC = chemical of concern
PQL = practical quantitation limit
HH = human health risk
ECO Risk = ecological risk
ECO = ecological risk-based cleanup
BKGRD = Inorganic Background (Aerojet and Mather Air Force Base [see Appendix F])
DLM = Designated Level Methodology (protection of groundwater/surface water quality)

Institutional controls are warranted under the CERCLA remedial action at Site 87 in order to assure the protection of human health when contaminants posing a significant health threat remain in the environment. The cleanup standard for lead in the soil at Site 87 is 700 ppm (Table 2-23); this is a higher concentration than that acceptable for unrestricted or residential use. Institutional controls are necessary to prevent humans from significant exposure to contaminated soil at Site 87. Therefore, institutional controls will be implemented with the goal of limiting unacceptable exposure where contamination remains in place during or after cleanup such that the site is not compatible with residential (or unrestricted) use. Such institutional controls could consist of lease restrictions and/or "deed restrictions" or other controls mutually agreed to by the Air Force, the USEPA, and the State of California. These institutional controls will be implemented in accordance with relevant Air Force, DOD, USEPA, and state guidance with respect to such implementation. The restrictions will prohibit land use that presents unacceptable risk to human health due to the residual contamination.

In addition to these controls, the terms and conditions of property leases or transfers include the right of the Air Force, the USEPA, and the State of California to access the property as necessary to accomplish and oversee required remediation.

The proposed ecological cleanup goal for lead in terrestrial habitats at Site 87 is 700 mg/kg. This was based on site-specific data from another terrestrial site at Mather. In the Phase II Detailed Ecological Risk Assessment for Mather AFB, IRP Site 20 and a reference location were selected to represent grassland habitats associated with the base [IT 1996c - Appendix L]. As part of this effort, soil, plants, and small mammals were collected and analyzed for a suite of metals which included lead. In addition, toxicity tests were performed using rye grass to assay for potential phytotoxic effects associated with metals in the soil. Statistical analysis of data from Site 20 and Reference Site 2 did not indicate significant differences in lead concentrations in plant tissues from the two sites. Lead concentrations in small mammals were, however, significantly different as were concentrations of lead in surface soils from the two sites. With regard to the lead concentrations measured in the small mammals from Site 20, they are not believed to be hazardous to small mammals as supported by Eisler [1998] who reported whole body lead concentrations in small mammals collected from uncontaminated sites to range from 1 to 7 mg/kg (dry weight). The maximum lead concentration in animals collected from Site 20 was 5.1 mg/kg (dry weight) and the mean was 2.2 mg/kg (dry weight).

A 28-day rye grass shoot length and biomass assay (a modification of the early seedling growth test) was conducted to assess toxicological impacts on vegetation at Site 20. (Biomass was selected as the toxicological endpoint as recommended by Clarence Callahan, USEPA Region 9.) Rye grass was used as a test species in the bioassay study because it is common to the grasslands of Mather AFB and is found at both Site 20 and Reference Site 2. Statistically significant differences in biomass and shoot length were not found between the two test groups.

Development of ecological cleanup goals for terrestrial sites at Mather AFB incorporated information on special status species within the area and data from the Phase II investigation. No special status or protected species are associated with Site 87. Because the Phase II investigation at Site 20 did not indicate ecological risks to terrestrial receptors when compared to a reference site, the 95 percent upper confidence limit of the mean concentration of lead in surface soil at Site 20 (700 mg/kg) was used as an ecological cleanup goal for lead in Mather AFB surface soils. As a final note, surface soil lead concentrations for Site 20 (Phase II investigation) ranged from 151 to 703 mg/kg with a 95 percent upper confidence limit of the mean concentration of 700 mg/kg. Site 87 had a 95 percent upper confidence limit of the mean concentration of 718 mg/kg for lead. This indicates that lead exposure concentrations at the two sites are similar on a site-wide basis.

The Air Force will perform monitoring to insure that the residual levels of lead left in place at Site 87 do not represent a hazard to small mammals and waterfowl. To accomplish this, monitoring of lead levels in small mammal tissue will be required on an annual basis for three years, with the results evaluated in an annual monitoring report to the regulatory agencies. In addition, any dead waterfowl found in the area of Site 87 must be reported to the regulatory agencies, and necropsied by a certified laboratory for signs of lead toxicity. The details of the monitoring program will be worked out cooperatively between the Air Force and the regulatory agencies.

If small mammal tissue lead levels are lower than those reported to cause adverse effects [Eisler 1998] after a minimum of two years of monitoring, then monitoring will be discontinued upon agreement by the regulatory agencies. If small mammal tissue lead levels are higher than those reported to cause adverse effects [Eisler 1998] after a minimum of two years of monitoring, then further ecological investigation and re-evaluation of the lead cleanup level will be conducted. The Air Force may have to undertake additional remedial action to reduce lead levels at Site 87.

If necropsied waterfowl show evidence of adverse effects due to ingestion of lead, then further ecological investigation and re-evaluation of the lead cleanup level will be conducted. The Air Force may have to undertake additional remedial action to reduce lead levels at Site 87.

2.2.10 Remedial Action Operation and Maintenance

The CERCLA program at Mather AFB has identified 88 sites organized into six operable units. As of this ROD, 83 of those sites have been selected either for remedial action or no further action under CERCLA. Each of the sites selected for remedial action has or will have remedial action plans describing in detail the design and the operation, maintenance, and monitoring of the remedial action, as required by the federal facility agreement for Mather AFB.

In order to assist the Air Force, the USEPA, the State of California, and the public to understand how the CERCLA program is implemented and documented, the BRAC Cleanup Plan will be periodically updated to summarize the current status of environmental restoration at Mather, and present a comprehensive strategy for implementing the response actions necessary to protect human health and the environment. The Air Force and regulatory agencies will determine the appropriate level of detail in this plan.

The BRAC Cleanup Plan will address both engineered remedial actions (i.e., groundwater treatment systems and landfill caps), as well as non-engineered remedial actions (i.e., institutional controls). The Air Force will revise the BRAC Cleanup Plan to describe the operation and maintenance of each remedial action, briefly explaining each remedial action, provide a list of all pertinent documents used to complete each remedial action, including the remedial action work plans (operation and maintenance plans, health and safety plans, and the performance and environmental monitoring requirements), and any institutional controls required to accomplish the remedies.

The objectives of this plan are to:

- provide a comprehensive guide to the management of each long-term remedial action;
- provide a single reference point for all ROD cleanup goals;
- provide text and tables graphing the status and schedule of completion for each remedial action;
- reference and briefly describe the purpose of each document developed for a particular remedial action;
- evaluate project progress; and
- streamline the management of all long-term remedial actions at Mather.

The plan should be reviewed annually and be revised as necessary.

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TAB

Section 3

3.0 Basewide Operable Unit Sites Selected for No Further Action

3.1 Declaration for the Basewide Operable Unit Sites Selected for No Further Action

No Further Action is Necessary to Ensure
Protection of Human Health and the Environment

3.1.1 Site Name and Location

Basewide OU Sites (IRP Sites) Selected for No Further Action

Mather AFB (a NPL Site),

Sacramento County, California.

3.1.2 Statement of Basis and Purpose

The Basewide OU sites for which no further action was chosen at the formerly active Mather AFB were investigated under the Mather AFB IRP and are described and evaluated in the RI/FS documents. These sites include:

- Site 2 - "8150" Area Landfill;
- Site 8 - Fire Training Area No. 1;
- Site 17 - Weapons Storage Septic Tank Leach Field;
- Site 19 (Expanded) - Bulk Fuel Storage Facility;
- Site 67 - SAC Area Shop Drainage Systems;
- Site 81 - Sewage Oxidation Ponds; and
- Site 84 - Sanitary Sewer Line Runway Investigation.

These decisions are based on the Administrative Record for these sites.

The USEPA Region IX and the State of California concur that no action is appropriate at these sites and that no action ensures protection of human health and the environment.

3.1.3 Description of the No Further Action Decision

Cleanup options were not developed for sites which no COCs were identified. Based on the calculations in the human health risk assessment, excess lifetime cancer risks fall within or below the range of one-in-one million to one-in-ten thousand, or do not exist at all, and all non-cancer risks have a hazard index of less than 1.0 . Therefore, the Air Force is not proposing cleanup or further investigative activities. Additionally, no threats to water quality or ecological risks are associated with these sites.

3.1.4 Summary of Site Risks

Remedial investigation activities at Mather AFB have included a CBRA which consisted of a baseline risk assessment which evaluated the potential human health and ecological risks associated with exposures to contaminated soils that would result if no cleanup actions are taken at a site [IT 1996c], and assessments of potential impacts to groundwater and/or surface water quality [IT 1997a]. The data collected and used in the RIs and FFS were of USEPA quality Level III, IV or V, or equivalent [USEPA 1987]. Formal data validation of the RI- and FFS-generated data was performed to ensure that data were of the quality commensurate with their intended use.

Based on the calculations in the human health risk assessment, excess lifetime cancer risks for the sites described in this section fall within or below the range of one-in-one million to one-in-ten thousand, and non-cancer risks had a hazard index less than 1.0 in their current state. The sites selected for no further action do not present a threat to groundwater or surface water quality and do not present an ecological risk.

3.2 Decision Summary for Basewide Operable Unit Sites Selected for No Further Action

The Decision Summary provides a brief overview of the site characteristics, the alternatives evaluated, and the analysis of those options.

3.2.1 Site Name, Location, and Description

The Basewide OU sites selected for no further action at the formerly active base are presented in Figure 3-1 and in Section 3.1.2.

3.2.2 Site History and Enforcement Activities

Previous investigations have been conducted at the Basewide OU sites selected for no further action as part of the Air Force IRP. A listing of the investigations conducted at each of these sites is summarized in Table 3-1.

Table 3-1. Previous Investigations at the No Further Action Sites

SITE NUMBER	APPLICABLE INVESTIGATION
2	1, 5, 6, 7, 8
8	1, 3, 4, 5, 9, 10, 11
17	1, 2, 4, 5, 10, 11
19 (expanded)	1, 2, 3, 4, 5, 6, 8, 9, 10, 11
67	4, 7, 8, 9, 10, 11
81	9, 10, 11
84	9, 11

1. Installation Restoration Program (IRP) Records Search for Mather Air Force Base, Phase I [CH2M-Hill, Inc. 1982];
2. IRP Phase II, Stage 1 Investigation [Weston 1986];
3. IRP Phase II, Stage 3 Investigation [AeroVironment 1988];
4. Well Redevelopment and Sampling Plan [IT 1988a];
5. Solid Waste Assessment Test Report [IT 1993d];
6. Quarterly Routine Groundwater Sampling [IT 1995a] and [EA 1990a-c];
7. Landfill Gas Testing Report [IT 1988b];
8. Group 2 Sites Remedial Investigation Report [IT 1992];
9. Additional Site Characterization Remedial Investigation Report [IT 1996b];
10. Comprehensive Baseline Risk Assessment Report [IT 1996c];
11. Basewide Operable Unit Focused Feasibility Study Report [IT 1997a].

3.2.3 Highlights of Community Participation

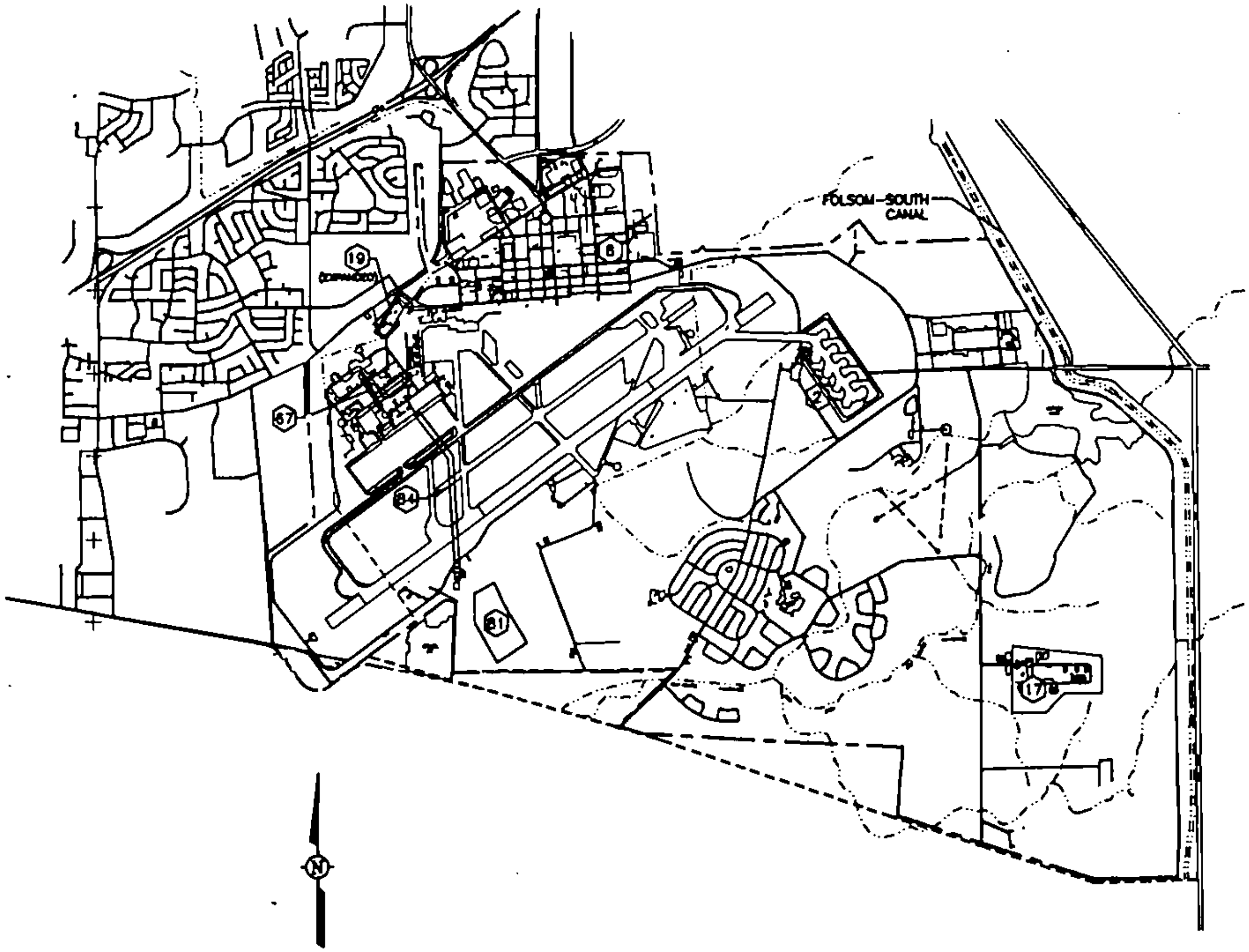
The public participation requirement of CERCLA Sections 113(k)(2)(B)(i-v) and 117 were met through a public comment period (held May 23 through June 23, 1997) and a public meeting (held on May 29, 1997) to address the Proposed Plan [IT 1997b] and content of supporting RI/FS documents in the selection of the no further action sites.

3.2.4 Scope and Role of Response Action

Because no COCs were identified at these sites, the no further action alternative is chosen as the planned response action. No unacceptable risk to human health or the environment exists at these sites.

3.2.5 Summary of Site Characteristics

A brief description of each of the no further action sites is provided in the following sections.



LEGEND

- BASE BOUNDARY
- DITCH OR SANITARY SEWER LINE LOCATION
- NO ACTION SITE

FIGURE 3-1

BASEWIDE OU SITES SELECTED FOR NO FURTHER ACTION

PREPARED FOR
MATHER AIR FORCE BASE
SACRAMENTO, CALIFORNIA

INTERNATIONAL TECHNOLOGY CORPORATION

DWG NAME	9888C3p	DRAWN BY	B.A.C. 1/27/98	CHECKED BY / APPROVED BY		DRAWING NUMBER	409888-C3p

3.2.5.1 Site 2 - "8150" Area Landfill

The remedial alternatives for Site 2 were presented in the Landfill OU FFS [IT 1993b] and Proposed Plan [IT 1993c]. Capping was the remedial action proposed in the Proposed Plan and selected in the ROD [USAF 1995]. However, once cap construction was initiated, it was apparent that there was less refuse at Site 2 and that there was an opportunity to consolidate the refuse from Site 2 into Site 4 prior to Site 4 being capped. This was judged more cost-effective based upon the revised estimate of refuse volume, and additionally would be less restrictive to future airport development. A Removal Action Memorandum [USAF 1996a] was approved on September 1996, to document this change. All the refuse at Site 2 was excavated and consolidated into Site 4 in 1996, as documented in the Final Closure Certification Report for Landfill Sites [MW 1997a]. Therefore, this ROD confirms that the removal action at Site 2 constitutes the final remedy for Site 2.

3.2.5.2 Site 8 - Fire Training Area Number 1

Fire Training Area No. 1 was the original fire-training area at Mather AFB and was in use until 1945. The site was located by historical aerial photographs; however, the Air Force found no evidence of a burn pit during the RI. Petroleum, oil, and lubricant wastes were used during weekly training exercises. Cleaning solvents such as TCE and carbon tetrachloride were possibly commingled with the wastes. Investigations at Site 8 found no evidence to suggest that the Former Fire Training Area No. 1 has been a source for contamination. Investigations have revealed no COCs; therefore, no threat to human health or the environment exists.

3.2.5.3 Site 17 - Weapons Storage Septic Tank Leach Field

The Weapons Storage Septic Tank Leach Field is located in the SAC Weapons Storage Area and was used for sewage disposal until 1978. In addition, solvents and petroleum hydrocarbons may have been disposed in small amounts. Investigations at Site 17 have revealed no COCs; therefore, no threat to human health or the environment exists.

3.2.5.4 Site 19 (Expanded) - Bulk Fuel Storage Facility

The Bulk Fuel Storage Facility is located in the northwest portion of the base, inside a bermed area containing two main aboveground JP-4 storage tanks. Expanded site work took place outside the bermed area. Contamination at Site 19 (inside the bermed areas) has been addressed in the Groundwater OU and Soil OU FFS [IT 1995b] and Soil OU and Groundwater OU ROD [IT 1996a]. In these documents, the selected remedy has been identified as *in situ* bioremediation of the shallow subsurface soils. Since the time these decisions were made, expanded investigations have been conducted in the immediate vicinity of the site (i.e., expanded

Site 19). These investigations were focused in an area northwest of the bulk storage tanks near the excavated tank site, pumphouses, and truck fill stands. Investigations of the expanded area have revealed no COCs; therefore, no threat to human health or the environment exists.

3.2.5.5 Site 67 - Strategic Air Command Area Shop Drainage Systems

The SAC Area Shop Drainage System consists of storm drains, sanitary sewers (approximately 14,200 feet of sewer line), and an open ditch (approximately 1,200 feet in length) near Building 7008. Waste solvents (tetrachloroethene, trichloroethane, and TCE), fuels, and oils were generated in the SAC Area facilities and may have been disposed into the sewer system. Leaks in the drainage system might have provided possible pathways for migration of solvents or hydrocarbon wastes produced in the SAC Area shops. Investigations at Site 67 found no evidence to suggest that the SAC Area Shop Drainage System has been a source for soil or groundwater contamination. Investigations have revealed no COCs; therefore, no threat to human health or the environment exists.

3.2.5.6 Site 81 - Sewage Oxidation Ponds

Site 81, the sewage oxidation ponds, is located in the southwestern portion of the Mather AFB, south of the Sewage Treatment Facility (Site 20) and east of the "7100" Area Disposal (Site 7). The sewage oxidation ponds were constructed to indirectly increase the capacity of the sewage treatment facility by providing additional retention time. The base sewage system was connected to the municipal system approximately one year prior to its deactivation in 1983.

However, during heavy periods of rainfall, the conveyance system overloads and the southern most ponds (1 and 2) serve as emergency retention until such time as the water can be metered back through the base system and into the municipal system.

It is not feasible to distinguish between the sediments and surface soils; therefore, COCs of one medium were considered as likely for the other medium. Risks due to contamination associated with this site were evaluated and presented under an occupational future land-use scenario in the FFS [IT 1997a] and Proposed Plan [IT 1997b] documents. Additional sampling was conducted by Montgomery Watson to measure soluble levels for TPH [MW 1998]. Based on the TPH results and subsequent conversations with the RWQCB, it was determined that the TPH does not pose a threat to groundwater quality; therefore, TPH is not a COC. The only COC identified in the sediments/surface soils (e.g., maximum of three feet deep) was cadmium which was based on protection of human health (i.e., inhalation of dust). The estimate of total residential ILCR at the

Sewage Oxidation Ponds was 1.6×10^{-5}, with cadmium contributing all of the risk through the inhalation of dust pathway. This ILCR is below the USEPA upper bound limit of 1×10^{-4} (therefore the site as a whole does not pose significant carcinogenic risk, but is still within the range of concern of 1×10^{-6} to 1×10^{-4}. However, there where numerous conservative assumptions built into the calculation of risk at the Sewage Oxidation Pond. The following is a brief description of these assumptions and a more realistic inhalation of dust risk calculation for the Sewage Oxidation Ponds.

The initial ILCR estimate presented in the CBRA [IT 1996c] for dust inhalation included the following assumptions;

- the cadmium was present at the 95 percent upper confidence limit over the entire site (1.5×10^{5} square meters);
- there was no vegetation at the site;
- the California Environmental Protection Agency slope factor ([15 mg/kg-day]$^{-1}$) was used in the calculation of risk instead of the less conservative USEPA value found in Integrated Risk Information System ([6.3 mg/kg-day]$^{-1}$);
- the wind was assumed to prevail in the direction of the receptor 100 percent of the time; and
- the wind speed was assumed to be strong enough to carry dust 100 percent of the time.

Upon further examination the majority of the cadmium above background is limited to the western portion of the northern most oxidation pond (pond No. 4) and is a small fraction of the site area (approximately one quarter). When this new area (approximately 30,000 square meters) was used in the ILCR calculation and using a 50 percent vegetative cover assumption, the site falls near the 1×10^{-6} threshold (i.e., 1.3×10^{-6}). Under these conditions and without examining the remaining conservative assumptions above, this site does not pose a significant threat to human health. Therefore, this site was selected for no further action.

3.2.5.7 Site 84 - Sanitary Sewer Line Runway Investigation

The Sanitary Sewer Line Runway Investigation was conducted from the SAC Area to the Sewage Treatment Facility, approximately 4,200 feet of sewer line. The sewer line was identified as a possible source of various potential COCs to the vadose zone and a potential threat to groundwater. Investigations at Site 84 found no evidence to suggest that the sanitary sewer line in the runway area has been a source for soil or groundwater contamination. Investigations have revealed no COCs; therefore, no threat to human health or the environment exists.

TAB

Section 4

4.0 Basewide Operable Unit "Petroleum Only" Sites Selected for No Action Under Comprehensive Environmental Response, Compensation, and Liability Act (but which remain to be closed under other regulations)

4.1 Declaration for the Basewide Operable Unit Petroleum Only Sites Selected for No Action

No Action is Necessary Based
on the Lack of Statutory Authority under CERCLA

4.1.1 Site Name and Location

Site 82 - Golf Course Maintenance Yard and Site 83 - Helicopter Wash Rack
Mather AFB (a NPL Site),
Sacramento County, California

4.1.2 Statement of Basis and Purpose

The "petroleum only" sites were investigated under the Mather AFB IRP and are described and evaluated in previous RI/FS documents. However, there is no CERCLA authority to take action at these sites; therefore, they will be cleaned up under RCRA Subtitle I and other applicable State of California regulations. Regulatory oversight will be provided by the CVRWQCB, and Sacramento County as appropriate. These decisions are based on the Administrative Record File for these sites.

The USEPA Region IX and the State of California concur on the lack of statutory authority under CERCLA to examine remedial actions for the "petroleum only" sites; therefore, those sites will be addressed further under the Defense Environmental Restoration Program, RCRA Subtitle I, and other applicable State of California regulations.

4.1.3 Description of the Selected Remedy

The COCs at the "petroleum only" sites are exempt from remedial action under CERCLA. Therefore, no further action is required under CERCLA for the "petroleum only" sites based on the lack of statutory authority under CERCLA. The "petroleum only" sites include: Sites 82 and 83.

4.1.4 Declaration Statement

The USEPA does not have authority under CERCLA Section 104 to address the "petroleum only" sites. However, the "no action" decision does not constitute a finding that adequate protection has been achieved at the sites. Cleanup alternatives have been developed and documented in the FFS Report [IT 1997a] and these sites will be addressed under RCRA Subtitle I and other applicable State of California regulations, with regulatory oversight by the CVRWQCB and Sacramento County as appropriate. Cleanup activities at the "petroleum only" sites are not subject to the same requirements as the CERCLA sites, i.e., "petroleum only" sites, do not require a CERCLA five-year review and are not subject to the 15 month requirement to begin remedial activities.

4.2 Decision Summary for Basewide Operable Unit "Petroleum Only" Sites Selected for No Action Under Comprehensive Environmental Response, Compensation, and Liability Act (but which remain to be closed under other regulations)

The Decision Summary provides an overview of the site characteristics, the alternatives evaluated, and the analysis of those options. The Decision Summary also identifies the selected remedy and explains how the remedy fulfills statutory requirements.

4.2.1 Site Name, Location, and Description

Locations of the Basewide OU "petroleum only" sites at the formerly active Mather AFB are presented in Figure 4-1 and include: Site 82 - Golf Course Maintenance Yard and Site 83 Helicopter Wash Rack.

4.2.2 Site History and Enforcement Activities

Cleanup options were developed for the "petroleum only" sites and are presented in the FFS Report [IT 1997a]; however, the USEPA does not have authority under CERCLA to address these sites. Therefore, the no action decision is documented as the selected remedy.

Previous investigations have been conducted at the Basewide OU "petroleum only" sites as part of the Air Force IRP. A listing of the investigations conducted at each of these sites is summarized in Table 4-1.

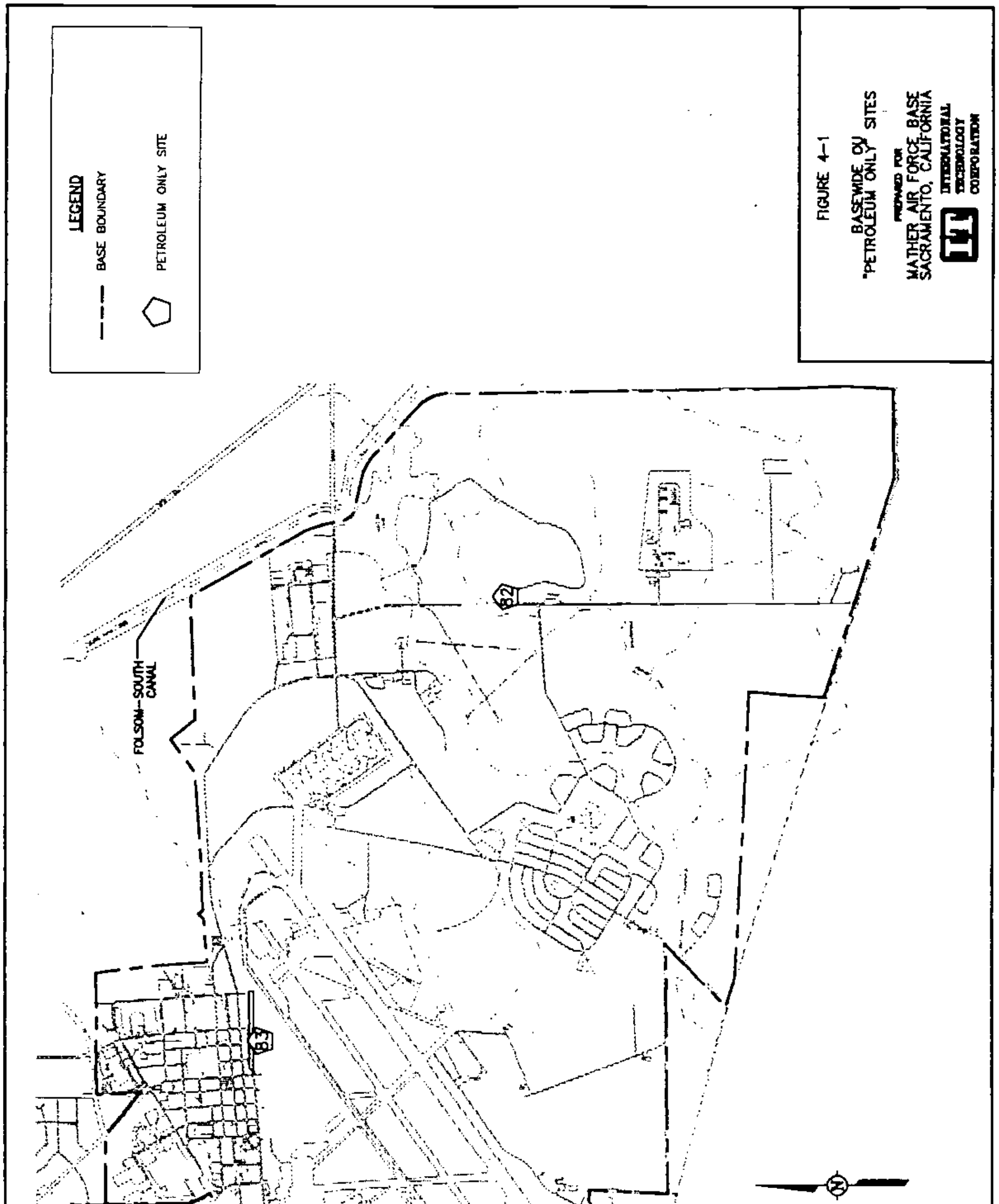


FIGURE 4-1
BASEWIDE OU "PETROLEUM ONLY" SITES

Table 4-1. Previous Investigations at the Soil Operable Unit "Petroleum Only" Sites

Site Number	Applicable Investigation
82	1, 2, 3
83	1, 2, 3

1. Additional Site Characterization Remedial Investigation Report [IT 1996b];
2. Final Comprehensive Baseline Risk Assessment Report [IT 1996c];
3. Basewide Operable Unit Focused Feasibility Study Report [IT 1997a].

4.2.3 Highlights of Community Participation

The public participation requirement of CERCLA Sections 113(k)(2)(B)(i-v) and 117 do not apply to these sites; however, these sites were included in the Proposed Plan [IT 1997b], and the public comment period (held from May 23 through June 23, 1997) and public meeting (held May 29, 1997) to address the Proposed Plan and content of supporting RI/FS documents.

4.2.4 Scope and Role of Response Action

Because there is no CERCLA authority to take action at these sites, the no action alternative was selected as the planned response action. No risk to human health or the environment exist at these sites from CERCLA (i.e., non-petroleum) constituents. Petroleum-only COCs were identified based on protection of groundwater quality.

4.2.5 Summary of Site Characteristics

The Basewide OU "petroleum only" sites are comprised of contaminated soils associated with a fuel washrack and a golf course maintenance area. The sources of contamination are equipment maintenance and fuels storage and delivery. The objective of this section of the ROD is to address the primary concerns at the Basewide OU "petroleum only" sites posed by soil contamination.

Environmental studies were initiated by the Air Force in 1982 to investigate soil contamination resulting from past base operations. Previous RIs have been conducted at the Basewide OU "petroleum only" sites as part of the Air Force IRP. A brief description of the nature and extent of contamination at each of the Basewide OU "petroleum only" sites is provided in the following sections.

4.2.5.1 Site 82 - Golf Course Maintenance Yard

Site 82 is located in the eastern portion of Mather AFB, along Eagles Nest Road. Activities at the site, include equipment washing, pesticide mixing and storage, and fuel and oil refilling and storage. Contamination was identified in the subsurface soils. Petroleum only hydrocarbons measured as diesel have been identified as a COC based on protection of groundwater quality.

4.2.5.2 Site 83 - Helicopter Washrack

Site 83 is located in the southeastern portion of the Main Base Area. During repair of the storm drain near the washrack, fuel contamination was detected in the shallow soils. Contamination was identified in the subsurface soils. Petroleum only hydrocarbons measured as diesel have been identified as a COC based on protection of groundwater quality.

4.2.6 Summary of Site Risks

Remedial investigation activities at Mather AFB included a CBRA [IT 1996c] (which include an ecological and human health assessment) and assessments of potential impacts to groundwater and surface water quality [IT 1996c]. The data collected and used in the RIs and FFS were of USEPA quality Level III, IV, or V, or equivalent [USEPA 1987]. Formal data validation of the RI- and FFS-generated data was performed to ensure that data were of the quality commensurate with their intended use.

Based on the calculations in the human health risk assessment, excess lifetime cancer risks fall within or below the range of one-in-one million to one-in-ten thousand or no cancer risk existed. Additionally, all non-cancer risks had a hazard index of less than 1.0. However, petroleum hydrocarbons in soils at Sites 82 and 83 may pose a threat to groundwater quality. Accordingly, although the sites have been designated for no further action under CERCLA, corrective actions pursuant to RCRA Subtitle I and applicable State of California regulations will be performed to ensure protection of groundwater quality.

4.2.7 Statutory Authority Finding

The no action finding is selected based on the petroleum exclusion in CERCLA. However, the "no action" decision does not constitute a finding that adequate protection has been achieved at the sites. Cleanup alternatives have been developed and documented in the FFS Report [IT 1997a] and these sites will be addressed under RCRA Subtitle I and other applicable State of California regulations, with regulatory oversight by the CVRWQCB and Sacramento County as appropriate.

TAB

Section 5

5.0 List of Applicable or Relevant and Appropriate Requirements and Performance Standards

Pursuant to Section 121(d)(1) of CERCLA, remedial actions must attain a degree of cleanup which assures protection of human health and the environment. Additionally, remedial actions that leave hazardous substances, pollutants, or contaminants onsite must meet standards, requirements, limitations, or criteria that are applicable or relevant and appropriate requirements. Federal ARARs include requirements under federal environmental laws, while state ARARs include promulgated requirements under state environmental or facility-siting laws that are more stringent than federal ARARs, and have been identified to USEPA by the State of California in a timely manner.

Applicable requirements are those cleanup standards, control standards, and other substantive environmental protection requirements, criteria, or limitations promulgated under federal or state law that specifically address a hazardous substance, pollutant, contaminant, remedial action, location, or other circumstance at a CERCLA site. Under CERCLA regulation, onsite actions need comply only with the substantive aspects of ARARs, not with corresponding administrative requirements (such as, but not limited to, permits, recordkeeping, and reporting). However, substantive components of apparently administrative requirements, such as recordkeeping, are potential ARARs. For example, a regulation that describes required reports can include specific measures of remediation performance that must be made. The report is not a potential ARAR but the specific measures needed to document remediation performance are substantive requirements and may be ARARs.

Relevant and appropriate requirements include those that, while not "applicable" to a hazardous substance, pollutant, contaminant, remedial action, location, or other circumstance at a CERCLA site, nevertheless address problems or situations sufficiently similar to those encountered at the CERCLA site to indicate their use. A requirement must be both relevant and appropriate to be designated an ARAR. If no ARAR addresses a particular situation, or if an ARAR is insufficient to protect human health or the environment, then nonpromulgated standards, criteria, guidance, and to-be-considered (TBC) advisories may be used to develop a protective remedy. Where a TBC was used to develop a remedy or cleanup goal, it becomes a performance standard that must be met for the remediation project.

Applicable or relevant and appropriate requirements are identified on a site-specific basis from information about site-specific chemicals, specific actions that are being considered, and specific features of the site location. There are three categories of ARARs:

- Chemical-specific ARARs are numerical values or methods which, when applied to site-specific conditions, result in numerical values. They are used to determine acceptable concentrations of specific hazardous substances, pollutants, and contaminants in the environment.

- Location-specific ARARs are restrictions placed on the concentration of hazardous substances or the conduct of activities solely because the site occurs in, or may affect, a special location, such as a wetland or floodplain.

- Action-specific ARARs are technology- or activity-based requirements or limitations on actions taken with respect to hazardous waste.

The ARARs and performance standards were developed using the following guidelines and documents:

- CERCLA Compliance with Other Laws Manual, Part I: Interim Final [USEPA 1988];

- "CERCLA Compliance with Other Laws Manual, Part II: Clean Water Act and Other Environmental Statutes and State Requirements" [USEPA 1989]; and

- "California State Water Resources Control Board ARARs Under CERCLA" [SWRCB 1992].

The following sections outline the ARARs and other information considered for the Basewide OU sites where remedial actions will be initiated (see Section 2.0). These sections present the federal and state regulations and guidance under each appropriate ARAR category (i.e., chemical-, location-, and action-specific). Chemical-specific ARARs and performance standards are listed in Section 5.1, location-specific ARARs and performance standards are listed in Section 5.2, and action-specific ARARs and performance standards are listed in Section 5.3.

It should be noted that the California State Water Resources Control Board (SWRCB) regulations governing disposal to land, Title 23 California Code of Regulations (CCR), Chapter 15, were recodified in Title 27. Due to the timing of these events, the Chapter 15 regulations have been retained in this ROD, however, any enforcement actions of Chapter 15 regulations identified as ARARs in this ROD are likely to be done under the authorities provided to the SWRCB and RWQCB under Title 27.

5.1 Chemical-Specific Applicable or Relevant and Appropriate Requirements and Performance Standards

Contaminants of concern for the Basewide OU sites are listed in the following subsections. These COCs were identified for soils (i.e., sediments, surface soils, and subsurface soils), and surface water. The chemical-specific ARARs and performance standards for these COCs are presented based on whether they are ARARs or performance standards, the type of contamination, and applicable medium.

5.1.1 Federal Chemical-Specific Applicable or Relevant and Appropriate Requirements and Performance Standards

The following federal chemical-specific ARARs and performance standards have been identified for the Basewide OU sites.

5.1.1.1 Soils

There are no federal chemical-specific ARARs for COCs identified in the soils (i.e., surface soils and subsurface soils) for the Basewide OU sites. Certain sites in the Basewide OU may impact or threaten to impact surface water (Site 87) or groundwater (Sites 10C/68, 18, 20, 23, 86, and 87). For these sites, chemical-specific performance standards were developed from the WQGs using the Designated Level Methodology (for inorganic and semi-volatile organic chemicals) or VLEACH modeling (for volatile organic chemicals). The numeric WQG was used as the regulatory factor for each COC identified at a site. The performance standards established for surface soils and subsurface soils are presented in Tables 5-1 and 5-2, respectively.

5.1.1.2 Surface Waters

Contaminants of concern were presented in the FFS [IT 1997a] for surface water at Site 87. Site 87 includes part of Morrison Creek, a tributary of the Sacramento River, which has beneficial use designation including municipal, domestic, and agricultural supply; water contact and non-contact recreation; esthetic enjoyment; navigation; groundwater recharge; freshwater replenishment; and preservation and enhancement of fish, wildlife, and other aquatic resources. Protection of surface waters will be achieved through remediation of the sediments, because they are a potential source of surface water pollution. If present during remediation, the water would be diverted around the contaminated area in order for the source to be removed and then returned

Table 5-1. State Chemical-Specific Performance Standards for Surface Soils

Chemical	Total Concentration (mg/kg [ppm])	
	Total Designated Level	Associated Sites
Metals		
Lead	1500 (a)	20, 86, 87
Organic Chemicals		
Benzo(a)pyrene	20	87
Benzo(b)fluoranthene	0.029	20
Benzo(k)fluoranthene	0.029	20
Benzo(g,h,i)perylene	0.28	87
Benzo(a)anthracene	0.029	20
Dibenz(a,h)anthracene	30	87
Fluoranthene	(b)	87
Phenanthrene	(b)	20, 87

mg/kg = milligrams per kilogram
ppm = parts per million

(a) Even though the total designated level is 1,500 ppm; a more stringent standard does exist (the soluble threshold limit concentration of 1,000 ppm).

(b) No Water Quality Goal currently available. Will be based on an evaluation if detected in the future.

Note: Surface soil cleanup goals were developed using the Designated Level Methodology (DLM) for metals and semivolatile organic chemicals. Designated Level Methodology parameter values vary with site conditions (e.g., depth to groundwater) and appropriate water quality objective (see Appendix E for an explanation of the DLM).

There are no federal performance standards.

Table 5-2. State Chemical-Specific Performance Standards for Subsurface Soils

Chemical	Total Concentration (mg/kg [ppm])	
	Total Designated Level	Associated Sites
Organic Chemicals		
Benzene	NA(1)	10C/68
Bis(2-ethylhexyl)phthalate	4	20
Carbon Tetrachloride	NA(1)	10C/68
Xylenes	NA(1)	10C/68, 23
TPH measured as gasoline	5	10C/68
TPH measured as diesel	100	10C/68
Toluene	NA(1)	10C/68
Ethylbenzene	NA(1)	10C/68
Oil and Grease	100	10C/68
TCE	NA(1)	18, 23
1,2-DCE	NA(1)	18, 23

NA = not applicable
ppm = parts per million
mg/kg = milligrams per kilogram
COC = contaminant of concern
PRG = preliminary remediation goal
TCE = trichloroethene
DCE = dichloroethene
TPH-D = total petroleum hydrocarbons as diesel
TPH-G = total petroleum hydrocarbons as gasoline

(1) COC identified through VLEACH modeling, PRGs have not been established.

Note: Subsurface soil cleanup goals were developed using VLEACH modeling for volatile organic chemicals and the Designated Level Methodology (DLM) for metals and semivolatile organic chemicals. Designated Level Methodology parameter values vary with site conditions (e.g., depth to groundwater) and appropriate water quality objective (see Appendix E for an explanation of the DLM).
There are no federal performance standards.

to its channel. If diversion dams are not appropriate, the water will be discharged to the POTW, if approved by Sacramento County.

5.1.2 State Chemical-Specific Applicable or Relevant and Appropriate Requirements and Performance Standards

The following State of California chemical-specific ARARs and performance standards have been identified for the Basewide OU sites.

5.1.2.1 Soils

There are no state chemical-specific ARARs for COCs identified in the soils (i.e., surface soils and subsurface soils) for the Basewide OU sites. The performance standards established for surface soils and subsurface soils are presented in Tables 5-1 and 5-2.

5.1.2.2 Surface Waters

Contaminants of concern were presented in the FFS [IT 1997a] for surface water at Site 87. Site 87 includes a portion of Morrison Creek, a tributary of the Sacramento River, which has beneficial use designation including municipal, domestic, and agricultural supply; water contact and non-contact recreation; esthetic enjoyment; navigation; groundwater recharge; freshwater replenishment; and preservation and enhancement of fish, wildlife, and other aquatic resources. However, since the surface water at this site is seasonal and may or may not be present during remedial actions, no cleanup goals for surface water were established. A potential source of surface water contamination, i.e., contaminated sediments, will be remediated through excavation. If present, the water would be diverted around the contaminated area in order for the source to be removed and then returned to its channel. If diversion dams are not appropriate, the water will be discharged to the POTW, if approved by Sacramento County.

5.2 Location-Specific Applicable or Relevant and Appropriate Requirements and Performance Standards

Location-specific ARARs and performance standards are requirements that place restrictions on the concentration of a COC or the conduct of activities due to the presence of unique site features such as surface waters and wetlands. The location of the Basewide OU sites were analyzed for unique site features to identify location-specific ARARs. The unique site features considered were:

- surface water;
- floodplain and wetlands;
- habitats of rare, threatened, endangered, and special status species;

- earthquake faults;
- historically or culturally significant properties;
- wilderness areas;
- wild and scenic rivers; and
- coastal zones.

Of these unique site features, flood plains and/or surface water occurs at or near Site 87. No other unique site features were identified.

The surface waters associated with this site is seasonal and builds up during the winter and spring as a result of heavy rains. Site 87 has natural drainage which conveys stormwater. Stormwater ARARs are listed as action-specific ARARs in Section 5.3 below.

5.3 Action-Specific Applicable or Relevant and Appropriate Requirements Performance Standards

Action-specific ARARs are technology- or activity-based requirements or limitations on actions taken with respect to the hazardous waste. The following sections describe the state and federal action-specific ARARs and performance standards. All action-specific ARARs are listed in Table 5-3 with each substantive requirement identified as either applicable or relevant and appropriate. Several of the requirements are marked with a footnote providing clarification to either their ARAR status or the legal interpretation of why they are considered ARARs for a particular site or remedial action. Sections 5.3.1 and 5.3.2 include a description of the sources of the action-specific ARAR regulations and the authorization the state regulatory agencies have to enforce these requirements. In addition, the Air Force position on substantive requirements of ARARs and how they apply to the selected remedial actions is described.

5.3.1 Federal Action-Specific Applicable or Relevant and Appropriate Requirements

The following federal action-specific ARARs and performance standards have been identified. The federal (and state) action-specific ARARs are listed in Table 5-3.

Table 5-3. State and Federal Action-Specific Applicable or Relevant and Appropriate Requirements

Source	Standard, Requirement, Criterion, or Limitation	ARAR Status	Description of Applicable or Relevant and Appropriate Requirements	Associated Site(s)
		Federal ARARs		
Federal Clean Water Act	40 CFR 122 - USEPA Administered Permit Programs: The National Discharge Elimination System	Subsection(s) as Listed Below	Requirements to ensure storm water discharges from Mather AFB remedial action activities do not contribute to a violation of surface water quality standards. All reasonable steps must be taken to minimize or prevent discharges which have a reasonable likelihood of causing adverse impacts on surface water quality (40 CFR 122.41(d)). Discharges into surface water must achieve federal and state water quality standards (40 CFR 122.44(d)).	87
	40 CFR 122.26	Applicable		
	40 CFR 122.41(d)	Applicable		
	40 CFR 122.41(e)	Applicable		
	40 CFR 122.44(d)	Applicable		
		State of California Hazardous Waste ARARs (Federal ARARs)		
California Hazardous Waste Control Law	Title 22, Division 4.5 (Environmental Health Standards for Management of Hazardous Waste), Chapter 11 (Standards Applicable to Generators of Hazardous Waste), Article 1 (Applicability)	Subsection(s) as Listed Below	Identifies whether the wastes are hazardous or non-hazardous for the purposes of being able to dispose onsite or dispose at an offsite landfill.	10C/68, 18, 23
	22 CCR 66261.1	Applicable		
	22 CCR 66261.2	Applicable		
	22 CCR 66261.3	Applicable		
	22 CCR 66261.4	Applicable		
	22 CCR 66261.5	Applicable		
	22 CCR 66261.6	Applicable		
	22 CCR 66261.7	Applicable		

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Table 5-3. State and Federal Action-Specific Applicable or Relevant and Appropriate Requirements (Continued)

Source	Standard, Requirement, Criterion, or Limitation	ARAR Status	Description of Applicable or Relevant and Appropriate Requirements	Associated Site(s)
California Hazardous Waste Control Law	Title 22, Division 4.5 (Environmental Health Standards for Management of Hazardous Waste), Chapter 14 (Standards for Owners and Operators of Hazardous Waste Transfer, Treatment, Storage, and Disposal Facilities), Article 9 (Use and Management of Containers)	Subsection(s) as Listed Below	The chemicals recovered from the sediments, surface soils, or subsurface soils, may need to be managed as either a RCRA or non-RCRA hazardous waste. The treatment, storage, and disposal requirements for these wastes are either applicable or relevant and appropriate (depending upon the classification of the waste material) and they include: using containers to store the recovered product that are compatible with this material (22 CCR 66264.172); using containers that are in good condition (22 CCR 66264.171); segregating the waste from incompatible wastes (22 CCR 66264.177); inspecting the containers (22 CCR 66264.176); and providing adequate secondary containment for the water stored (22 CCR 66264.175); containers must be closed during transfer (22 CCR 66264.173); and all hazardous material must be removed at closure (22 CCR 66264.178). If during excavation, treatment processes, or cleanup activities hazardous waste is identified throughout the waste characterization process, the hazardous waste will be managed in accordance with what the standards states in these sections of the regulations.	20, 86
	22 CCR 66264.171	Applicable		
	22 CCR 66264.172	Applicable		
	22 CCR 66264.173	Applicable		
	22 CCR 66264.174	Applicable		
	22 CCR 66264.175	Applicable		
	22 CCR 66264.176	Applicable		
	22 CCR 66264.177	Applicable		
	22 CCR 66264.178	Applicable		

Table 5-3. State and Federal Action-Specific Applicable or Relevant and Appropriate Requirements (Continued)

Source	Standard, Requirement, Criterion, or Limitation	ARAR Status	Description of Applicable or Relevant and Appropriate Requirements	Associated Site(s)
California Hazardous Waste Control Law	Title 22, Division 4.5 (Environmental Health Standards for Management of Hazardous Waste), Chapter 14 (Standards for Owners and Operators of Hazardous Waste Transfer, Treatment, Storage, and Disposal Facilities), Article 12 (Waste Piles)	Subsection(s) as Listed below	Delineates requirements for the management of waste piles for hazardous waste. This regulation is applicable to sites where excavated materials are classified as hazardous wastes and managed in waste piles. The titles of the regulations are 22 CCR 66264.251 - Design and Operating Requirements; 22 CCR 66264.254 - Monitoring and Inspection; 22 CCR 66264.256 - Special Requirements for Ignitable or Reactive Waste; 22 CCR 66264.257 - Special Requirements for Incompatible Wastes; 22 CCR 66264.258 - Closure and Post-Closure Care; and 22 CCR 66264.259 - Special Requirements for Hazardous Wastes F020, F021, F022, F023, F026, and F027. If during excavation, treatment processes, or cleanup activities, hazardous waste is identified through the proper characterization process, and land disposed within the meaning of the LDRs, the hazardous waste will be managed in accordance with the standards stated in these sections of the regulation.	10C/68, 20, 86, 87
	22 CCR 66264.251	Applicable		
	22 CCR 66264.254	Applicable		
	22 CCR 66264.256	Applicable		
	22 CCR 66264.257	Applicable		
	22 CCR 66264.258	Applicable		
	22 CCR 66264.259	Applicable		

Table 5-3. State and Federal Action-Specific Applicable or Relevant and Appropriate Requirements (Continued)

Source	Standard, Requirement, Criterion, or Limitation	ARAR Status	Description of Applicable or Relevant and Appropriate Requirements	Associated Site(s)
California Hazardous Waste Control Law	Title 22, Division 4.5 (Environmental Health Standards for Management of Hazardous Waste), Chapter 14 (Standards for Owners and Operators of Hazardous Waste Transfer, Treatment, Storage, and Disposal Facilities), Article 19 (Corrective Action for Waste Management Units)	Subsection(s) as Listed Below	CAMU: Placement, consolidation, and treatment of soils and wastes being generated as part of a corrective action under RCRA will not be considered a new disposal to land as long as the materials are handled in designated CAMUs. Land disposal restrictions (22 CCR 66268) are not invoked when remediation wastes are managed at a CAMU. A CAMU can only be used for the management of remediation wastes pursuant to implementing corrective actions at the facility. USEPA intended that the Federal CAMU rule be considered for the management of wastes generated at CERCLA sites. Excavation of wastes from the discharge and disposal sites might be managed at a CAMU for on-base disposal, or *ex situ* bioremediation. A CAMU is an area within a facility for the purpose of implementing corrective actions. Uncontaminated areas are allowed to be designated as part of a CAMU when they are necessary to achieve the overall goals for the facility and will enhance the protectiveness of the remedial action. The CAMU rule allows consolidation and treatment of wastes in a single unit, from other areas of the facility, without triggering minimum technology requirements and LDR found in other provisions of RCRA and HWCL: that is, placement of wastes into a CAMU is not considered land disposal and redeposition of treated wastes into the CAMU does not trigger the LDRs. Groundwater must be monitored at the CAMU in order to detect and characterize a release.	As of May 1998 a CAMU is not being proposed for the Basewide OU, thus there are no applicable sites. However, this regulation has been identified as an ARAR to allow flexibility in the event a CAMU is needed in the future.
	22 CCR 66264.552	Relevant and Appropriate		
	22 CCR 66264.553	Relevant and Appropriate		
California Hazardous Waste Control Law	Title 22, Division 4.5 (Environmental Health Standards for Management of Hazardous Waste), Chapter 18 (Land Disposal Restrictions), Article 1 (General)	Subsection(s) as Listed Below	Provides the purpose, scope, and applicability of LDRs. The title of the sections of the regulations are; 22 CCR 66268.3 - Dilution Prohibited As a Substitute for Treatment; 22 CCR 66268.7 - Waste Analysis and Recordkeeping; and 22 CCR 66268.9 - Special Rules Regarding Wastes That Exhibit a Characteristic. If during excavation, treatment processes, or cleanup activities hazardous waste is identified through the proper characterization process, and will be land disposed within the meaning of the LDRs, the hazardous waste will be managed in accordance with the standards stated in these sections of the regulation. Only applicable if hazardous wastes are disposed of or treated in an area not designated as a CAMU or disposed of or treated beyond the area of contamination.	20, 86, 87
	22 CCR 66268.3	Applicable Relevant and Appropriate		
	22 CCR 66268.7(a) & (b)	Applicable		
	22 CCR 66268.9	Applicable		

Table 5-3. State and Federal Action-Specific Applicable or Relevant and Appropriate Requirements (Continued)

Source	Standard, Requirement, Criterion, or Limitation	ARAR Status	Description of Applicable or Relevant and Appropriate Requirements	Associated Site(s)
California Hazardous Waste Control Law	Title 22, Division 4.5 (Environmental Health Standards for Management of Hazardous Waste), Chapter 18 (Land Disposal Restrictions), Article 3 (Prohibitions on Land Disposal)	Subsection (s) as Listed Below	These standards are applicable to sites where excavated material is classified as hazardous waste and is disposed of or treated in an area not designated as a CAMU. Provides waste-specific LDRs for 22 CCR 66268.30 - Waste Specific Prohibitions--Solvent Wastes; 22 CCR 66268.31 - Waste Specific Prohibitions--Dioxin-Containing Wastes; 22 CCR 66268.32 - Waste Specific Prohibitions--California List Wastes; 22 CCR 66268.33 - Waste Specific Prohibitions--First Third Wastes; 22 CCR 66268.34 - Waste Specific Prohibitions--Second Third Waste; and 22 CCR 66268.35 - Waste Specific Prohibitions--Third Waste. If during excavation, treatment processes, or cleanup activities hazardous waste is identified through the proper characterization process, and will be land disposed within the meaning of the LDRs, the hazardous waste will be managed in accordance with the standards stated in these sections of the regulation.	20, 86, 87
	22 CCR 66268.30	Applicable		
	22 CCR 66268.31	Applicable		
	22 CCR 66268.32	Applicable		
	22 CCR 66268.33	Applicable		
	22 CCR 66268.34	Applicable		
	22 CCR 66268.35	Applicable		
California Hazardous Waste Control Law	Title 22, Division 4.5 (Environmental Health Standards for Management of Hazardous Waste), Chapter 18 (Land Disposal Restrictions), Article 5 (Prohibitions on Storage)	Subsection(s) as Listed Below	This standard is applicable to sites where excavated material is classified as hazardous waste. The standard provides prohibitions on storage of restricted wastes. If during excavation, treatment processes, or cleanup activities hazardous waste is identified through the proper characterization process, and will be land disposed within the meaning of the LDRs, the hazardous waste will be managed in accordance with the standards stated in these sections of the regulation.	20, 86, 87
	22 CCR 66268.50	Applicable		

Table 5-3. State and Federal Action-Specific Applicable or Relevant and Appropriate Requirements (Continued)

Source	Standard, Requirement, Criterion, or Limitation	ARAR Status	Description of Applicable or Relevant and Appropriate Requirements	Associated Site(s)
			State of California Air ARARs	
California Clean Air Act	SMAQMD, Rule 202, Section 301	Applicable	This section of the rule requires the installation of BACT to a new emissions unit or modification of an existing emissions unit that will result in an emission of ROG, NOx, SOx, PM10, CO, lead, or mercury. Best Available Control Technology for any emission unit is the most stringent of the following: The most effective emission control device, emission limit, or technique, singly or in combination, which has been required or used for the type of equipment comprising such an emissions unit unless the applicant demonstrates to the satisfaction of the SMAQMD that such limitations required on other sources have not been demonstrated to be achievable. For remediation processes, a control efficiency (effluent/influent) of 95 percent is considered BACT. Sacramento Metropolitan Air Quality Management District will determine BACT for the technologies used under the remedial alternatives for each site. Top-down analysis process is the selection of any alternative basic equipment, fuel, process, emission control device, or technique, singly or in combination, determined to be technically feasible and cost-effective by the SMAQMD. In making a BACT determination for each affected pollutant the district may consider the overall effect on other affected pollutants. This regulation will apply to the treatment processes that release or cause to be released the pollutants listed in the regulation. The remedia alternatives utilizing air strippers, soil vapor extraction, and *ex situ* bioremediation (at the Mather bioremediation facility) must ensure BACT is used to control emissions in excess of levels specified in the rule.	10C/68, 18, 23

Table 5-3. State and Federal Action-Specific Applicable or Relevant and Appropriate Requirements (Continued)

Source	Standard, Requirement, Criterion, or Limitation	ARAR Status	Description of Applicable or Relevant and Appropriate Requirements	Associated Site(s)
California Clean Air Act	SMAQMD, Rule 202, Section 302	Applicable	This section of the rule requires an applicant to provide offsets for any stationary source with the potential to emit any pollutant in excess of the levels shown below. ROG.....150 lbs/day NOx.....150 lbs/day SOx.....150 lbs/day PM10....80 lbs/day CO......550 lbs/day Offsets for CO shall not be required if the applicant can demonstrate that ambient air quality standards will not be violated in the affected areas, and will not cause or contribute to a violation of the ambient air quality standard. All emissions increases in excess of the levels specified above need to be offset for the same calendar quarter. Emissions are determined by using actual stack test data, emission factors, engineering calculations, or other methods approved by the district in accordance with Section 411 of Rule 202. This regulation will apply to the treatment processes that release or cause to be released the pollutants listed in the regulation. The remedial alternatives utilizing air strippers, soil vapor extraction, and *ex situ* bioremediation must ensure offsets are used for emissions in excess of levels specified in the rule.	10C/68, 18, 23
California Clean Air Act	SMAQMD, Rule 401	Applicable	This rule prohibits the discharge of air contaminants which obscure visibility by more than 20 percent for a period of more than three minutes in any one hour. This regulation is applicable to any remedial action activity, which may cause a visible emission.	10C/68, 18, 23
California Clean Air Act	SMAQMD, Rule 402	Applicable	This rule prohibits the discharge of air contaminants in quantities which cause injury, detriment, nuisance, or annoyance to any considerable number of persons or which endangers the comfort, response, health, or safety of any such person or which causes or has natural tendency to cause injury or damage to business or property. This regulation is applicable to any remedial action activity, which may discharge air contaminants as defined by the rule.	10C/68, 18, 23

Table 5-3. State and Federal Action-Specific Applicable or Relevant and Appropriate Requirements (Continued)

Source	Standard, Requirement, Criterion, or Limitation	ARAR Status	Description of Applicable or Relevant and Appropriate Requirements	Associated Site(s)
California Clean Air Act	SMAQMD, Rule 403	Applicable	This rule requires a person to take every reasonable precaution not to cause or allow emissions of fugitive dusts from being airborne beyond the property line from which the emissions originated. This regulation is applicable to any remedial action activity, which may cause the release of fugitive dust.	All sites
California Clean Air Act	SMAQMD, Rule 404	Applicable	This rule prohibits the discharge of particulate matter from any source in excess of 0.1 grains per standard cubic foot. This regulation is applicable to any remedial action activity, which may cause the release of particulate matter.	All sites
California Clean Air Act	SMAQMD, Rule 405	Applicable	This rule controls the discharge of dust and condensed fumes into the atmosphere by establishing emission rates based on process weight. This regulation is applicable to any remedial action activity, which may cause the release of dust or condensed fumes.	All sites
State of California Groundwater and Soil ARARs[1]				
California Water Code	State Water Resources Control Board Order 92-08-DWQ (General order for storm water management at construction sites)	Relevant and Appropriate	Must identify the sources of sediment and other pollutants that affect the quality of storm water discharges and implement practices to reduce these discharges. Storm water discharges from construction sites must meet pollutant limits and standards. The narrative effluent standard includes the requirements to implement BMPs and/or appropriate pollution prevention control practices. Inspections of the construction site prior to anticipated storm events and after actual storm events need to be conducted to identify areas contributing to storm water discharge and evaluated for the effectiveness of BMPs and other control practices. Applies to construction sites five acres or greater in size. It also applies to smaller sites that are part of a larger common plan of development or sale. Administrative portions of this permit are not applicable in accordance with CERCLA.	Site 87

Table 5-3. State and Federal Action-Specific Applicable or Relevant and Appropriate Requirements (Continued)

Source	Standard, Requirement, Criterion, or Limitation	ARAR Status	Description of Applicable or Relevant and Appropriate Requirements	Associated Site(s)
California Water Code	State Water Resources Control Board Order (Waste Discharge Requirements [WDRs] for Discharges of Storm Water Associated with Industrial Activities Excluding Construction Activities) 97-03-DWQ	Applicable	Storm water discharges must meet the narrative standard of the permit, this standard includes implementing BMPs and prohibits the discharge of non-storm water. Discharges should identify the sources of pollutants to the storm water. Best Management Practices for these sources can include treatment of storm water discharge and source reduction. Non-storm water sources of pollutants include improper dumping, spills, and leaks. Monitoring must be conducted to demonstrate compliance and measure the effectiveness of BMPs. Monitoring includes performing visual inspections during the dry and wet seasons, conducting annual inspections, and sampling and analysis for specific analytical parameters. Administrative portions of this permit are not applicable in accordance with CERCLA.	20, 86, 87
Porter-Cologne Water Quality Control Act (California Water Code Sections 13000, 13140, 13240)	Central Valley Region Basin Plan	Applicable	Establishes water quality objectives, including narrative and numerical standards, that protect the beneficial uses of surface waters and groundwaters in the region. The uses are municipal, domestic, agricultural, and industrial service supply. Specific applicable portions of the Basin Plan include beneficial uses of affected water bodies water quality objectives to protect those uses. The state believes that several additional provisions of the CVR Basin Plan, including the cleanup and water quality objective policies are also ARARs. The state will not dispute their omission in the ROD; however, as the Air Force is complying with the substance of these provisions.	All Sites

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Table 5-3. State and Federal Action-Specific Applicable or Relevant and Appropriate Requirements (Continued)

Source	Standard, Requirement, Criterion, or Limitation	ARAR Status	Description of Applicable or Relevant and Appropriate Requirements	Associated Site(s)
Porter-Cologne Water Quality Control Act (California Water Code Sections 13000, 13140, 13240)	SWRCB Resolution 68-16	Applicable	The resolution establishes requirements for activities involving discharges of contamination directly into surface waters or groundwater (e.g., quality of pump and treat effluent into surface waters or groundwater). Substantive requirements established by the resolution include use of "best practicable treatment of control" for discharging the effluent. This regulation applies to remedial action activities that cause active discharges to surface waters or groundwater. The state believes that several additional provisions of the CVR Basin Plan, including the cleanup and water quality objective policies are also ARARs. The state will not dispute their omission in the ROD; however, as the Air Force is complying with substance of these provisions.	All Sites
Porter-Cologne Water Quality Control Act (California Water Code Sections 13000, 13140, 13240)	SWRCB Resolution 88-63	Applicable	Specifies that, with certain exceptions, all ground and surface waters have the beneficial use of municipal or domestic water supply. Applies in determining beneficial uses for waters that may be affected by discharges of waste. State Water Resources Control Board Resolution 88-63 applies to all sites that may be affected by discharges of waste to groundwater or surface water. The resolution specifies that, with certain exceptions, all groundwater and surface waters have beneficial use of municipal or domestic water supply. Consequently the more stringent of the Federal and California State primary MCLs are relevant and appropriate and are the ARAR for the remedial action. California Safe Drinking Water Act standards which may be ARARs for the site(s) are found in 22 CCR 66435, 22 CCR 64444.5, and 22 CCR 64473.	All sites

Table 5-3. State and Federal Action-Specific Applicable or Relevant and Appropriate Requirements (Continued)

Source	Standard, Requirement, Criterion, or Limitation	ARAR Status	Description of Applicable or Relevant and Appropriate Requirements	Associated Site(s)
Porter-Cologne Water Quality Control Act (California Water Code Sections 13140, 13240, 13260, 13263, 13267, 13300, 13304, 13307)	SWRCB Resolution 92-49 (as amended April 12, 1994) Subparagraph IIIG	Relevant and Appropriate	Section IIIG directs the Water Boards to ensure dischargers clean up and abate the "effects" of discharges in a manner promoting attainment of either background water quality or the best reasonable water quality if background quality is not feasible. (Feasibility is determined by the factors listed in Section IIIG and 23 CCR, Chapter 15, Section 2550.4.) Minimum water standards must be protective of the beneficial use(s). Section IIIG directs the Water Boards to apply 23 CCR, Chapter 15, Section 2550.4 in approving any alternative cleanup levels less stringent than background quality. The requirement to obtain the Water Board's approval is not a substantive requirement (ARAR); however, the Air Force will consult with the Water Board and USEPA in applying the State's criteria to establish alternative cleanup level(s). Subject to the limitations described above, this requirement is relevant and appropriate for establishing levels for effect to surface and groundwater quality caused by releases contaminants.	All sites
Porter-Cologne Water Quality Control Act (California Water Code Sections 13140-13147, 13172, 13260, 13263, 13267, 13304)	Title 23 (Waters), Division 3 (State Water Resources Control Board), Chapter 15 (Discharges of Waste to Land), Article 1 (General)	Subsection(s) as Listed Below	23 CCR 2511 (d) states actions taken by or at the direction of public agencies to cleanup or abate conditions of pollution or nuisance resulting from unintentional or unauthorized releases of waste or pollutants to the environment; provided that wastes, pollutants, or contaminated materials removed from the immediate place of release shall be discharged according to Article 2 of this Chapter; and further provided that remedial actions intended to contain such wastes at the place of release shall implement applicable provisions of this subchapter to the extent feasible. It should be noted that the California SWRCB regulations governing disposal to land, Title 23 CCR, Chapter 15, were recodified in Title 27. Due to the timing of these events, the Chapter 15 regulations have been retained in this ROD, however any enforcement actions of Chapter 15 regulations identified as ARARs in this ROD are likely to be done under the authorities provided to the SWRCB and RWQCB under Title 27.	All Sites
	23 CCR 2511(d)	Relevant and Appropriate[2]		

Table 5-3. State and Federal Action-Specific Applicable or Relevant and Appropriate Requirements (Continued)

Source	Standard, Requirement, Criterion, or Limitation	ARAR Status	Description of Applicable or Relevant and Appropriate Requirements	Associated Site(s)
Porter-Cologne Water Quality Control Act (California Water Code Sections 13140-13147, 13172, 13260, 13263, 13267, 13304)	Title 23 (Waters), Division 3 (State Water Resources Control Board), Chapter 15 (Discharges of Waste to Land), Article 2 (Waste Classification and Management)	Applicable or Relevant and Appropriate[3,4]	Waste Classification: Wastes must be classified as either: Hazardous waste (23 CCR 2521), designated waste (23 CCR 2522), nonhazardous solid waste (23 CCR 2523), or inert waste (23 CCR 2524). A hazardous waste can only be discharged to a Class I facility (unless a variance is applicable under Title 22 regulations). A designated waste can be discharged to a Class I or Class II facility. A nonhazardous solid waste can be discharged to a Class I, II, or III facility. Inert wastes do not need to be sent to a classified facility. Some of the sites have alternatives that involve excavation of the contaminated soil. At the conclusion of on-base treatment, the soils are proposed for use in the foundation layer of the landfill cap at Site 7. It is expected, based on engineering judgement, that most of the sites excavated will yield designated and not yield hazardous waste. However, until sampling is performed on the material at time of excavation, a final determination cannot be made. The excavated waste must be discharged to the appropriate facility pursuant to Article 2.	All Sites
	23 CCR 2521	Applicable or Relevant and Appropriate[3,4]		
	23 CCR 2522	Applicable or Relevant and Appropriate[3,4]		
	23 CCR 2523	Applicable or Relevant and Appropriate[3,4]		
	23 CCR 2524	Applicable or Relevant and Appropriate[3,4]		

Table 5-3. State and Federal Action-Specific Applicable or Relevant and Appropriate Requirements (Continued)

Source	Standard, Requirement, Criterion, or Limitation	ARAR Status	Description of Applicable or Relevant and Appropriate Requirements	Associated Site(s)
Porter-Cologne Water Quality Control Act (California Water Code Sections 13140-13147, 13172, 13260, 13263, 13267, 13304)	Title 23 (Waters), Division 3 (State Water Resources Control Board), Chapter 15 (Discharges of Waste to Land), Article 2 (Waste Classification and Management)	Subsection(s) as Listed Below	Classification and Siting Criteria (23 CCR 2530 (c & d): New waste piles shall be designed, constructed, and operated to ensure that wastes will be a minimum of five feet above the highest groundwater elevation. All containment structures at the unit shall have a foundation or base capable of supporting the structures and capable of withstanding hydraulic pressure gradients. The unit needs to be able to withstand flooding without washout, ground rupture, and rapid geological change. Class II (23 CCR 2532): Waste Management Units for Designated Waste: Waste management units will be isolated from the waters of the state through either natural or engineered barriers. Relevant to the waste being treated at the *ex situ* bioremediation facility. Excavated wastes from various sites will be spread in lifts in the Mather bioremediation cell. Treatment might include nutrient addition, irrigation, and aeration. This treatment is considered similar to a waste pile. Soils containing petroleum hydrocarbons are not anticipated to be classified as hazardous, but may be classified as designated wastes. Thus Class II requirements are considered most relevant.	20 (Applicable) 86 and 87 (Relevant and Appropriate)
	23 CCR 2530 (c)	Applicable[3,4]		
	23 CCR 2530 (d)	Applicable[3,4]		
	23 CCR 2532	Applicable[3,4] and Relevant and Appropriate		

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Table 5-3. State and Federal Action-Specific Applicable or Relevant and Appropriate Requirements (Continued)

Source	Standard, Requirement, Criterion, or Limitation	ARAR Status	Description of Applicable or Relevant and Appropriate Requirements	Associated Site(s)
Porter-Cologne Water Quality Control Act (California Water Code Sections 13140-13147, 13172, 13260, 13263, 13267, 13304)	Title 23 (Waters), Division 3 (State Water Resources Control Board), Chapter 15 (Discharges of Waste to Land), Article 5 (Water Quality Monitoring and Response Programs for Waste Management Units)	Subsection(s) as Listed Below[3]	These provisions of Chapter 15 address remediation of contamination at waste management units and monitoring of groundwater quality during the remedial action. The corrective action program requires that the cleanup objectives be met at the designated monitoring points and that they be met throughout the zone that is affected. Further, demonstration of the effectiveness of the remediation requires showing the concentrations at each monitoring point are at or below the cleanup levels for one year following completion of the corrective action(s). The evaluation monitoring program provides further substantive requirements regarding the designation of monitoring parameters and monitoring frequency.	
	23 CCR 2550.1	Relevant and Appropriate	Section 23 CCR Part 2550.1 describes the three types of groundwater monitoring programs; detection, statistical evaluation, and physical evaluation monitoring. Section 23 CCR Part 2550.10 (Corrective Action Program) requires that a groundwater monitoring program be implemented in conjunction with a corrective action to demonstrate the effectiveness of the remedial technologies.	10C/68, 18, 20, 23

Table 5-3. State and Federal Action-Specific Applicable or Relevant and Appropriate Requirements (Continued)

Source	Standard, Requirement, Criterion, or Limitation	ARAR Status	Description of Applicable or Relevant and Appropriate Requirements	Associated Site(s)
	23 CCR 2550.4	Relevant and Appropriate[5]	Cleanup levels must be set at background concentration levels or, if background levels are not technologically and economically feasible, then at the lowest levels that are economically and technologically feasible. Specific factors must be considered in setting cleanup levels above background levels. Cleanup levels above background levels shall be evaluated every five years. If the actual concentration of a constituent is lower than its associated cleanup level, the cleanup level shall be lowered to reflect existing water quality (23 CCR 2550.4). It has been determined that cleanup to background is not economically feasible and; therefore, not relevant and appropriate to aquifer cleanup standards.	10C/68, 18, 23
	23 CCR 2550.6	Relevant and Appropriate	Requires monitoring for compliance with cleanup standards for three years from the date of achieving cleanup levels (23 CCR 2550.6) at waste management units.	10C/68, 18, 20, 23
	23 CCR 2550.7	Relevant and Appropriate	Requires general soil, surface water, and groundwater monitoring (23 CCR 2550.7) which states: - there is a sufficient number of monitoring points, including background points; and - the monitoring points should be located at appropriate locations and screened in the zones of concern.	10C/68, 18, 20, 23
	23 CCR 2550.9	Relevant and Appropriate	Requires an assessment of the nature and extent of the release, including a determination of the spatial distribution and concentration of each constituent (23 CCR 2550.9).	10C/68, 18, 20, 23
	23 CCR 2550.10	Relevant and Appropriate	Requires implementation of corrective action measures that ensure that cleanup levels are achieved throughout the zone affected by the release by removing the waste constituents or treating them in-place. Source control may be required. Also requires monitoring to determine the effectiveness of corrective actions. To demonstrate cleanup, the concentration of each COC in the groundwater must be equal to, or less than, the cleanup goal for at least one year following suspension of the corrective action (23 CCR 2550.10).	All Sites

Table 5-3. State and Federal Action-Specific Applicable or Relevant and Appropriate Requirements (Continued)

Source	Standard, Requirement, Criterion, or Limitation	ARAR Status	Description of Applicable or Relevant and Appropriate Requirements	Associated Site(s)
		Other State of California ARARs		
	Fish and Game Code Section 1603	Relevant and Appropriate	It is unlawful for any person to substantially direct or obstruct the natural flow or substantially change the bed, channel, or bank of any river, stream, or lake designated by the department, or use any material from the streambeds, without first notifying the department of the activity.	87
	California Water Code, Chapters 1152, 1373, and 13801 (California Well Standards, DWR Bulletin 74-90, and Sacramento County Code, Title 6, Chapter 6.28)	Performance Standards	These provisions establish standards for the construction, operation, and abandonment of monitoring wells.	20

CCR = California Code of Regulation
CFR = Code of Federal Regulations
ROG = reactive organic gas
PM10 = particulate matter
MCL = maximum contaminant level
AFB = Air Force Base
USAF = U.S. Air Force
RWQCB = Regional Water Quality Control Board
CAMU = Corrective Action Management Unit
HWCL = Hazardous Waste Control Law
lbs/day = pounds per day
NOx = nitrogen oxide
CO = carbon monoxide
DWQ = Department of Water Quality
SWRCB = State Water Resource Control Board
BACT = Best Available Control Technology
ARAR = applicable or relevant and appropriate requirement
USEPA = United States Environmental Protection Agency
BMP = Best Management Practice
LDR = land disposal restrictions
SOx = sulfur oxide
ROD = Record of Decision
COC = contaminant of concern
OU = operable unit
CVR = Central Valley Region
RCRA = Resource Conservation and Recovery Act
SMAQMD = Sacramento Metropolitan Air Quality Management District
CERCLA = Comprehensive Environmental Response, Compensation, and Liability Act

1. The State does not agree on the characterization of certain ARARs in this table to be "Relevant and Appropriate" instead of "Applicable." However, since these requirements are included in the ROD as ARARs, the State will not dispute this ROD.
2. 23 CCR 2511(d) is applicable to waste management units in operation after November 27, 1984, and relevant and appropriate for units whose operations ceased prior to November 27, 1984.
3. Only as invoked by 23 CCR 2511(d).
4. Only as invoked through 23 CCR 2511(d).
5. Only as invoked by 92-49 IIIG.

The California DTSC regulations promulgated under the Hazardous Waste Control Law (HWCL) are applicable to ensure proper characterization of hazardous waste, and storage and disposal of such waste. Specific federal environmental programs allow authorized states to administer state regulations in lieu of parallel federal regulations. For a program to become authorized, each state requirement must be at least as stringent as its parallel federal requirement. Under authorized state programs, state requirements are federal ARARs. California has been authorized to administer state programs in lieu of the hazardous waste (Subtitle C) and UST (Subtitle I) portions of the RCRA. If any hazardous waste is identified, it will be managed under the permit by rule provisions of HWCL with treatment to render non-hazardous or disposed offsite. Other HWCL provisions are relevant and appropriate to treatment systems, such as *ex situ* bioremediation treatment cells, where soils with hazardous substances are managed. Many of the HWCL provisions are both relevant and appropriate because they describe requirements for the safe handling of contaminated materials and precautions for preventing further contamination.

The following chapters of Title 22, Division 4.5 Environmental Health Standards for Management of Hazardous Waste, have been identified as ARARs for remedial action sites at Mather AFB:

- Chapter 12 - Standards Applicable to Generators of Hazardous Waste, Article 1 - Applicability;
- Chapter 14 - Standards for Owners and Operators of Hazardous Waste Transfer, Treatment, Storage, and Disposal Facilities; Article 9 - Use and Management of Containers; Article 12 - Waste Piles; Article 19 - Corrective Action for Waste Management Units;
- Chapter 18 - Land Disposal Restrictions, Article 1 - General; Article 3 - Prohibitions on Land Disposal; and Article 5 - Prohibitions on Storage.

5.3.2 State Action-Specific Applicable or Relevant and Appropriate Requirements and Performance Standards

The following California statutes, laws, and regulations have been identified as ARARs and performance standards. The following subsections list the ARARs and performance standards in the following order: air, water, waste, and other state regulations.

The state action-specific ARARs are listed in Table 5-3, performance standards are listed in the text under other regulations and a brief description of the source of the ARARs are listed along with the regulations derived under the source. Also presented is the Air Force position on substantive requirements of these ARARs and how they apply to the selected remedial actions.

5.3.2.1 State Air Applicable or Relevant and Appropriate Requirements

The California Clean Air Act, under the Federal Clean Air Act and 1990 Amendments, authorizes the State of California to develop a State Implementation Plan (SIP) to enforce clean air regulations and laws. The SIP, developed through state legislation, divided the state into local air control districts and allowed each district to enforce the requirements of the federal and state Clean Air Acts. Mather AFB is located in the SMAQMD; local air regulations are the most stringent ARARs. The SMAQMD applicable regulations are: Rule 202, Section 301 - Best Available Control Technology; Section 302 - Offsets; Rule 401 - Visible Emissions; Rule 402 - Nuisance; Rule 403 - Fugitive Dust; Rule 404 - Particular Matter; and Rule 405 - Dust and Condensed Fumes. Table 5-3 contains the applicable or relevant and appropriate sections of these regulations identifying the ARAR status and a brief description of the substantive requirements and applicability to either the site, remedial action, or technology used to cleanup the site and contaminated material.

5.3.2.2 State Water and Soil Applicable or Relevant and Appropriate Requirements

The Federal Clean Water Act regulates discharge to surface waters. Under this statute is the 40 Code of Federal Regulations 122 - USEPA Administrative Permit Program: National Discharge Elimination System regulation for storm water and other discharges to surface waters. This program is delegated to the state under the statute and therefore is considered a state ARAR.

The SWRCB has issued two general orders under the federal statute, Clean Water Act, that provides the substantive requirements for storm water management at industrial sites (SWRCB Order 92-13-DWQ) and construction sites (SWRCB Order 97-03-DWQ). The substantive requirements for industrial sites are meeting the narrative water quality standards, implementing best management practices, identifying and monitoring sources of storm water pollutants, and eliminating non-storm water sources of pollutants. The substantive requirements associated with construction activities such as excavation and grading include application of engineering measures and best management practices to control storm water runoff.

The Porter-Cologne Water Quality Control Act is one of the statutory bases for regulation of discharges of waste to land that could impair either surface water or groundwater quality in California. It establishes the authority of the SWRCB and the CVRWQCB to protect the quality of surface water and groundwater. The California Water Code sections used as a source for action-specific ARARs and performance standards are presented in Table 5-3 along with the associated regulatory citations. Under the Porter-Cologne Act, the following regulations or resolutions regulating and protecting the waters of the state are considered ARARs: Central Valley Region Basin Plan (specifically the water quality objectives and the beneficial uses enumerated in this plan); SWRCB Resolution 88-63; SWRCB Resolution 92-49; California Title 23, Division 3, SWRCB, Subchapter 15 - Discharges of Waste to Land, Article 1 - General; Article 2 - Waste Classification and Management; Article 3 - Waste Management Unit Classification and Siting (substantive requirements only); and Article 5 - Water Quality Monitoring and Response Programs for Waste Management Units. The State does not agree on the characterization of certain ARARs in this table to be "Relevant and Appropriate" instead of "Applicable." However, since these requirements are included in the ROD as ARARs, the State will not dispute this ROD.

Table 5-3 contains the applicable or relevant and appropriate sections of these regulations identifying the ARAR status and a brief description of the substantive requirements and applicability to either the site, remedial action, or technology used to clean up the site and contaminated material.

State Water Resources Control Board Resolution 68-16 has been identified as an applicable requirement for the protection of surface waters and groundwater of the state. The Air Force and the state do not agree on the full substantive requirements of this resolution and the impacts on the remedial action activities needed to cleanup Mather AFB. The state believes that this resolution also applies to *in-situ* migration of pollutants and in setting *in-situ* cleanup levels. The state will not dispute the above description; however, as the Air Force is complying with the substance of these provisions. The Air Force disagrees with the state's contention that the narrative language establishes chemical-specific ARARs for both soils and groundwater, and that discharges subject to the resolution include post-1968 migration of *in situ* contamination from the vadose zone to groundwater. The Air Force believes that discharges only encompass remedial activities that actively discharge to surface water and groundwater of the state and Resolution 68-16 is not included in this ROD since there are no sites which would "actively discharge.".

Section IIIG of SWRCB Resolution 92-49 contains substantive requirements that are ARARs. Section IIIG is the only provision of SWRCB Resolution 92-49 that arguably is relevant and appropriate in establishing water-related cleanup levels under limited circumstances yet to be determined. The portion of Section IIIG, through incorporation of certain provisions in Titles 22 and 23 CCR, that creates a presumption of media cleanup resulting in background groundwater concentration levels is not generally a relevant and appropriate requirement for vadose zone cleanup levels. The Air Force hopes to eventually resolve the ARAR status of SWRCB Resolution 92-49 through ongoing discussions with its U.S. Department of Defense counterparts, USEPA, and the state. For purposes of this ROD, the Air Force believes that if vadose zone contamination overlies a groundwater plume, that remediation of the COCs in the groundwater satisfies the requirement of Section IIIG to abate the effects of discharge. In that situation, Section IIIG is not a relevant and appropriate requirement for the remediation of the vadose zone, even though technical considerations, risk, cost-effectiveness, and other remedy-selection factors may warrant concurrent remediation of the vadose zone to promote the groundwater remediation. If these factors warrant concurrent vadose zone remediation, the Air Force will conduct such remediation but not based on the premise that Section IIIG requires such action.

The state's position is that SWRCB Resolution 92-49 is an applicable requirement for remedial actions in the vadose zone where there is an impact, or a threat of an impact, to the beneficial uses of the groundwater or surface waters. In such a case the state contends, SWRCB Resolution 92-49 requires remediation of the vadose zone to the lowest concentration levels of constituents technically and economically feasible, which must at least protect the beneficial uses of groundwater and surface waters, but need not be more stringent than is necessary to achieve background levels of the constituents in surface water and groundwater.

Many of the requirements for the proper handling and disposal of designated waste (23 CCR, Division 3, Chapter 15) have been incorporated through the use of the on-base *ex situ* bioremediation facility. This facility will first handle RCRA and/or designated waste from petroleum-only contaminated sites. These sites are, by definition, excluded from CERCLA but included within the Defense Environmental Restoration Program conducted pursuant to ten U.S. Code Section 2701 et. seq. These provisions require that Defense Environmental Restoration Program response actions be conducted consistent with CERCLA Section 120 and guidelines, rules, and regulations (e.g., NCP), and criteria established by the USEPA. The "petroleum only" contaminated sites were included in the RI, FFS [IT 1997a], and Proposed Plan [IT 1997b] in a manner consistent with the Federal Facility Agreement and Defense Environmental Restoration Program. The SWRCB identified Waste Discharge Requirements (WDRs) for the operation of the *ex situ* bioremediation site due to the use of the site for treatment of contaminated medium from the "petroleum only" contaminated sites. Substantive WDRs have been developed in order to implement the portions of WDRs that are substantive requirements for treating CERCLA wastes at the *ex situ* bioremediation facility. Under these circumstances, the WDRs served as a means of identifying the RWQCBs substantive requirements for the *ex situ* bioremediation facility. This expedient reference to the WDRs to identify substantive requirements is not intended to suggest that WDRs or any other form of permit are requirements for this ROD or any other CERCLA on-site response actions. The substantive WDRs for wastes being sent to and treated wastes removed from the ex-sites bioremediation facility are listed in Section 5.3.2.5. Operations at the *ex-situ* bioremediation facility and Site 7, the anticipated location that treated wastes will be disposed of, are addressed in the Mather Soils OU and Groundwater OU ROD [IT 1996a] and this document provides the ARARs associated with these operations.

5.3.2.3 Other State Regulations and Guidance

The State Fish and Game Code regulates to protect aquatic life living in the waters of the state. It is unlawful to substantially direct or obstruct the natural flow or substantially change the bed, channel, or bank of any river, stream, or lake. This requirement applies to remediation activities at Site 87.

California Well Standards (California Department of Water Resources [DWR], Bulletin 74-90, June 1991) and Sacramento County Code, Title 6, Chapter 6.28 - The California Water Code (Chapters 1152, 1373, and 13801) requires the DWR to establish standards for the construction, operation, and abandonment of water wells, monitoring wells, and cathodic protection wells. Sacramento County has developed well construction regulations based on authority granted to the county through enforcement of the state standards. These standards should be considered as performance standards for construction of monitoring wells at Site 20.

Several of the California regulations require certification by a professional geologist or engineer, registered or certified by the State of California. These portions of the regulations are considered procedural rather than substantive requirements. However, to the degree that federal contractors perform and/or supervise the engineering and geotechnical work, they will be certified professional or under the supervision of certified professionals as appropriate.

5.3.2.4 State Requirements for Ex Situ Soil Bioremediation Facility

The Air Force is currently operating the Mather Soil Bioremediation Facility onsite to treat excavated soils from Soil OU sites. Several of the remedial alternatives subsequently developed for the Basewide OU sites include using an existing on-base *ex situ* bioremediation component. Basewide OU sites for which excavation with on-base *ex situ* bioremediation is chosen as the preferred alternative are expected to also be treated at this bioremediation facility. This bioremediation facility consists of a single lined bioremediation cell and soil processing area.

During operation of the bioremediation facility for CERCLA-related response actions (e.g., treatment and disposal of treated soils from the sites discussed in this ROD), the Air Force will continue to comply with the substantive operational and closure requirements for Class II Waste Piles found in or derived from Chapter 15 of Title 23 CCR. These ARARs for the *ex-situ* bioremediation treatment facility are listed in the Soils OU and Groundwater OU ROD [IT 1996a]. The ARARs that have been used to define waste acceptance criteria for this facility (that are part of the Soil OU and Groundwater OU ROD [IT 1996a]), are ARARs for wastes from Basewide OU sites that will be treated at the *ex-situ* bioremediation facility. The Air Force agrees to comply with the following requirements for the wastes generated from the Basewide OU sites and treated at the Mather Soil Bioremediation Facility.

- Only soils that are not classified as "hazardous waste," using the criteria in Title 22 CCR, Division 4.5, Chapter 11, will be discharged to the bioremediation facility, subject to variances from hazardous waste management requirements established by the DTSC. Additionally, wastes that could potentially impair the integrity of containment structures, require a higher level of containment than provided by the unit, or which are restricted hazardous wastes will not be discharged to the bioremediation facility.

- The discharge of designated solid or liquid waste or leachate to surface water, surface water drainage courses, ponded water, or groundwater that would cause impairment to water quality is prohibited.

- Treated soils may be disposed of as "inert waste" if the following criteria are met:
  - the treated soil is not a hazardous waste as determined by criteria in 22 CCR Division 4, Chapter 11, including toxicity, ignitability, reactivity, and corrosivity;
  - TPH measure as gasoline and aromatic volatile organics (BTEX) are not detectable in representative samples of treated soil;
  - the leachable TPH measured as diesel concentration is less than 10 micrograms per liter;
  - the metal concentrations are less than the maximum area inorganic background concentrations (Aerojet and Mather [see Appendix F]); and
  - PAHs will not be discharged where they will be subject to erosion and transport to surface waters.

- Treated soil that originated from the Basewide OU (and Soil OU sites) and is taken from the bioremediation facility that is intended to be used as fill material at Site 7 will have total or leachable constituent concentrations equal to or less than those presented in Table 5-4. (Table 5-4 is provided in this ROD solely for convenience of the reader. The governing waste acceptance criteria for Site 7 are found in the final Explanation of Significant Difference (ESD) Site 7 which became final on December 14, 1997. The ESD is the primary and governing document.) Appendix D summarizes the approach for estimating the maximum contaminant concentration that can be delivered as backfill to Site 7 without adversely impacting groundwater quality. The acceptance criteria is the greater of the background concentration and the soluble concentration (from the waste extraction test). Soil not achieving these levels will be disposed at an offsite Class II waste disposal facility or treated and disposed in an appropriate manner.

Table 5-4. Site 7 Acceptance Criteria

Site 7 Acceptance Criteria Contaminant of Concern	Water Quality Goal (mg/L)	Soil Quantitation Limit (mg/kg)	Environmental Attenuation Factor	Soluble Designated Level (DI-WET) (mg/L)	WET Dilution	Background Concentration (ppm)	Recommended Level (A) (mg/kg)
Arsenic (24)	0.005	2.0	100	0.05	10	16	500
Barium (5)	1.0	40.0	100	10.0	10	1300	10000
Cadmium (1)	0.005	1.0	100	0.05	10	1	100
Chromium (5)	0.05	2.0	100	0.5	10	92	2500
Cobalt (13)	0.05	10.0	100	0.5	10	35	
Copper (17)	0.2	5.0	1000	20.0	10	93	
Lead (1)	0.015	0.6	1000	1.5	10	81	1000
Manganese (2)	0.05	3.0	100	0.5	10	5720	
Mercury (1)	0.002	0.2	100	0.02	10	ND	20
Nickel (1)	0.1	8.0	100	1.0	10	81	2000
Selenium (17)	0.02	1.0	100	0.2	10	ND	
Silver (2)	0.1	2.0	100	1.0	10	5	
Vanadium (22)	0.1	10.0	100	0.5	10	139	
Zinc (17)	2.0	4.0	1000	200.0	10	116	
Aroclor - 1248 (6)	0.0000045	0.033	100	0.001 (B)	10	NA	
Aroclor - 1254 (1)	0.0000045	0.033	100	0.001 (B)	10	NA	
Aroclor - 1260 (7)	0.0000045	0.033	100	0.001 (B)	10	NA	
4,4-DDD (7)	0.00015	0.0033	1000	0.015	10	NA	
4,4-DDE (7)	0.0001	0.0033	1000	0.01	10	NA	
4,4-DDT (7)	0.0001	0.0033	1000	0.01	10	NA	
Chlordane (7)	0.000029	0.0017	8620	0.25	10	NA	2.5
Dieldrin (7)	0.0000022	0.0033	364,000	0.8	10	NA	8

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Table 5-4. Site 7 Acceptance Criteria (Continued)

Site 7 Acceptance Criteria Contaminant of Concern	Water Quality Goal (mg/L)	Soil Quantitation Limit (mg/kg)	Environmental Attenuation Factor	Soluble Designated Level (DI-WET) (mg/L)	WET Dilution	Background Concentration (ppm)	Recommended Level (A) (mg/kg)
Dioxin & associated congeners (25)	2.2×10^{-10}	0.0000055	100	0.001 (C)	10	NA	0.01 (B)
Oil & Grease (21)	NA	50.0	NA	NA	10	NA	570
TPH measured as Diesel (10)	0.1	10.0	100	1.0	10	NA	300
TPH measured as Gasoline (10)	NA	1.0	NA	NA	10	NA	ND
Benzene (5)	NA	0.01	NA	NA	10	NA	ND
Carbon Tetrachloride (5)	NA	0.01	NA	NA	10	NA	ND
Ethylbenzene (1)	NA	0.01	NA	NA	10	NA	ND
Toluene (1)	NA	0.01	NA	NA	10	NA	ND
Xylene (1)	NA	0.01	NA	NA	10	NA	
Acenaphthene (21)	0.02	0.33	100	0.2	10	NA	
Acenaphthylene (22)	0.42	0.33	100	4.2	10	NA	
Benzo(a)Anthracene (7)	0.000029	0.33	100	0.00029	10	NA	
Benzo(b)Flouranthene (7)	0.000029	0.33	100	0.00029	10	NA	
Benzo(k)Flouranthene (7)	0.000029	0.33	100	0.00029	10	NA	
Benzo(g,h,i)Perylene (25)	No WQG	0.33	100	No WQG	10	NA	
Chrysene (1)	0.0002	0.33	100	0.002	10	NA	
Dibenz(a,h)Anthracene (7)	0.0000085	0.33	100	0.0003 (B)	10	NA	
Flouranthene (25)	No WQG	0.33	100	No WQG	10	NA	
Fluorene (22)	0.28	0.33	100	2.8	10	NA	
Indeno(1,2,3-CD)Pyrene (7)	0.000029	0.33	100	0.00043 (B)	10	NA	
Naphthalene (22)	0.02	0.33	100	0.2	10	NA	

Table 5-4. Site 7 Acceptance Criteria (Continued)

Site 7 Acceptance Criteria / Contaminant of Concern	Water Quality Goal (mg/L)	Soil Quantitation Limit (mg/kg)	Environmental Attenuation Factor	Soluble Designated Level (DI-WET) (mg/L)	WET Dilution	Background Concentration (ppm)	Recommended Level (A) (mg/kg)
Phenanthrene (25)	No WQG	0.33	100	No WQG	10	NA	
Pyrene (22)	0.21	0.33	100	2.1	10	NA	

(A) Total concentration criteria were developed from vadose zone modeling and negotiations with the RWQCB (September 1997).
(B) The soluble designated level is below the practical quantitation limit; therefore, the practical quantitation limit will be used.
(C) The soluble designated level has been established for Site 7 by the RWQCB as the hazardous level expressed as 2,3,7,8 - TCDD equivalent
(1) EPA Primary Drinking Water Standard
(2) EPA Secondary Drinking Water Standard
(5) California Primary MCL
(6) Taste and Odor Threshold (USEPA)
(7) Cal/EPA Cancer Potency Factor as Water Quality Criteria
(10) USEPA Health Advisory
(13) No promulgated standard for cobalt. Value obtained from "Water Quality for Agriculture" Food and Agriculture Organization of the United Nations - Irrigation and Drainage Paper No. 29.
(17) Agriculture WQG
(21) Taste and Odor Threshold (SWRCB)
(22) USEPA IRIS Reference Dose as a Water Quality Criterion
(24) California Proposition 65
(25) No WQG currently available. Will be based on an evaluation if detected in the future.

DDD = dichlorodiphenyldichloroethane
DDE = dichlorodiphenyldichloroethylene
DDT = dichlorodiphenyltrichloroethane
TPH = total petroleum hydrocarbon
WQG = water quality goal
RWQCB = Regional Water Quality Control Board
SWRCB = State Water Resources Control Board
TCDD = tetrachlorodibenzo-p-dioxin
IRIS = Integrated Risk Management System
USEPA = U.S. Environmental Protection Agency
NA = not applicable
EPA = Environmental Protection Agency
ND = non-detect
MCL = Maximum contaminant level
DI-WET = Deionized Waste Extraction Test
mg/L = milligrams per liter
mg/kg = milligrams per kilogram
ppm = parts per million

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TAB

Section 6

6.0 Responsiveness Summary

The public comment period for the "Proposed Plan for Environmental Cleanup at the Basewide Operable Unit Sites" [IT 1997b] at Mather AFB, began on May 23, 1997 and ended on June 23, 1997. A public meeting was held on May 29, 1997, at which the Proposed Plan was summarized, and questions and public comments solicited. The transcript from the public meeting is included in the Administrative Record File and reproduced here. Six members of the public asked questions at the public meeting, and two members of the public submitted letters with formal written comments on the Proposed Plan. The written comments are reproduced herein and are included in the Administrative Record. No other comments were received during the public comment period.

Note: Sites 82 and 83 are sites with only petroleum contamination and are excluded from regulation under CERCLA. No comments were received by the USAF on these sites; however, any public comments received on "petroleum only" sites will be considered by the CVRWQCB in approving cleanup activities at these sites.

The first seven comments consist of questions and comments from members of the public at the public meeting held on May 29, 1997. These questions and comments along with responses provided at the meeting are excerpted from the transcript of the meeting, and any additional responses are added immediately following the excerpt.

Comment 1 (see pages 21 - 23 of the public meeting transcript) and Response:

MS. VON ECKERT: Eloise Von Eckert.
I got lost in the residential sections. And I wasn't able to track, but what would be the housing area right in the middle near where we are?
SITE MANAGER WONG: Down here?
MS. VON ECKERT: Yeah, which sites are we there?
SITE MANAGER WONG: There's actually this ditch site. This one right here.
MS. VON ECKERT: 18 and 20 and 23?
SITE MANAGER WONG: 18 is up here.
MR. HUGHES: The only sites in this proposed plan that are nearby are what's called the Morrison Creek Reference Site. This drainage had three samples collected and right near the roadway there were some pesticides

detected. And it might have been from mosquito abatement in the past or something of that nature.

But two samples downstream didn't have any significant contaminants of concern, but we need to do a little more sampling to be really -- to well define the area that will need to be excavated. We don't believe that contamination extends near the housing here.

The second ditch that drains to the golf course maintenance area, again, pesticides in the ditch nearby where pesticides were mixed and stored for use on the golf course.

Again, the sample here had pesticides. Two more samples were collected that were very widely spaced. And additional samples need to be taken after being collected very soon to try to better define the actual length of the ditch that would require some remediation.

There's two other sites that were discussed in a past public meeting, and for which a Record of Decision has already been signed, that are in the housing area. One was an underground storage tank near the water tank. It was a -- I believe it was a generator fuel for a backup generator for the pumping of the water system. That site where -- the tank was removed and it's been remediated.

The second site is a former military gas station or actually military -- or actually -- yes, a military gas station that has fuel tanks. And that remediation is also under way. It was part of a past Record of Decision. That site is a petroleum-only site. That's been regulated by the Regional Water Quality Control Board.

So by and large there are not a lot of contaminated sites near the housing.

MS. VON ECKERT: Okay.

Additional response: The two ditch sites mentioned above are Installation Restoration Program (IRP) Sites assigned to the Basewide Operable Unit, and for which decisions are presented in this Record of Decision. The Morrison Creek Reference Site is IRP Site 88 and the Golf Course Maintenance Area Ditch is IRP Site 80. The underground storage tank near the water tank in the Mather Family Housing area is Installation Restoration Program Site 28 Installation Restoration Program Site 28. The tank was removed in 1988, and the site was determined to present no further risk to human health or the environment, as documented in the Superfund Record of Decision for Soil Operable Unit Sites and Groundwater Operable Unit Plumes, dated April 1996. The former military gas station at the Mather Family Housing area is Installation Restoration Program Site 34. The five underground storage tanks were removed in 1993. The soil at the site requires additional remediation, as documented in the Superfund Record of Decision for Soil Operable Unit Sites and Groundwater Operable Unit Plumes, dated April 1996. This cleanup is planned to begin in summer of 1997, under the oversight of the Regional Water Quality Control Board.

Comment 2 (see pages 23 - 24 of the public meeting transcript) and Response:

MR. VERDON: My name is Scott Verdon. I'm also a student. My question is the employment opportunities. What kind of thing is that?

Will there be employment generated from the work that's going to be brought in cleaning it up on the outside? Is that going to be mostly outside contractors or things of the nature where there are possible opportunities to employ myself?

SITE MANAGER WONG: The situation with environmental work here is that our agency who's headquartered out of Washington D.C. has a contracting agency out of Brooks Air Force Base in Texas. And what they do is they contract, you know, all the different environmental works at all the various bases that we control. And part of that contract that they have, is that whoever it is awarded to, a certain portion of it needs to be done locally.

They have to go out locally and get subcontractors. Our current contractor is Montgomery Watson. Their building is right over there. And they're our prime contractor for all remediation work. And they have a team of, you know, other contractors that they use. And they also go out locally.

So I can pass that information along in terms of, you know, for anything local that they might be able to do, but that's the way our process is.

Comment 3 (see pages 24 - 29 of the public meeting transcript) and Response:

MS. WALKER: My name is Annette Walker. And I would like to know what do the experts feel is the worst thing that can happen? And what preventative measures have you in place for the worst thing that can happen?

SITE MANAGER WONG: Is this specifically to the site here at Mather?

MS. WALKER: Yes. I mean, any of the contamination or whatever you may know from Aerojet or any information, because contamination is just contamination without a label.

SITE MANAGER WONG: Right. Well, in terms of Mather's contamination and specifically in terms of our proposed plan on these 18 sites, most of the contaminations are either, what we call VOCs or Volatile Organic Compounds or fuel constituents, or lead. Again, we do have treatment options available to us to take care of it. We are in the process through this Record of Decision to take care of that contamination, and prevent it from going anywhere. So I would hope the potential impact is very low. We have identified as much as we can, and we're moving forward. We're trying to get it cleaned up.

MS. WALKER: But I'm saying what has been identified as the worst thing that can happen? What has been identified?

SITE MANAGER WONG: In terms of the worst thing?

MS. WALKER: Yes.

SITE MANAGER WONG: Again, when we go through our risk assessment for human health and the ecology, we come up with numbers that tell us, you know, what levels that could potentially be out there and these risk assessments are associated with the one-in-a-million cancer risk. And anything that is above the one-in-a-million cancer risk, we have to deal with in terms of taking care of it.

So we feel we're at the low enough level right now where there is no risk as long as we take action.

MS. WALKER: I'm saying for the future generations. Do you understand? What I'm saying is right now, right, I understand that. But I'm just saying say for the next five years, ten years, what is probably the worst thing may/could happen if we do not clear this up within the allotted time?

SITE MANAGER WONG: Well, I can't answer that right now.

MS. WALKER: I'm saying have the experts said this is the worst scenario or not? They haven't looked at the worst thing that can happen?

SITE MANAGER WONG: Again, they look at it in terms of risk, and what the potential risk is. And if it falls into a certain category where action needs to be taken, we are taking action. I don't think they project out five years, ten years down the line.

MS. WALKER: Okay. And one other thing too that I would like to elaborate on what he just said. Since this is at a level of federal dollars, state dollars, county, city, dollars -- this is more of a comment -- I think that more of the monies and the dollars should be invested in our communities with some of the people here and employ them more so that maybe some of the contractors who are getting some of the governmental contracts and more so, we should probably invest in people.

SITE MANAGER WONG: Right. And again the government contract is going through AFCEE, which is in Texas, but that does not exclude them from hiring people locally. There is a process where packages describing what needs to be done is sent out to all the various contractors including the local ones, so they are usually at the same level as everyone else in terms of getting those contracts awarded.

In addition to that, there is also language in the contracts that requires, whoever gets the award, to hire locally a certain percentage. So those provisions are in there and they are government contract laws.

MS. WALKER: Does this include the plan -- does it include education to the public? How to better be able to live with the contaminate -- well, the possibility?

SITE MANAGER WONG: In addition to what we have here, is we have quarterly news letters, fact sheets, that, you know, we -- and again we can discuss this later in terms of, you know, all the water stuff we're doing, but we do have an ongoing community relations plan that we try to get information out to the public. We also have a Restoration Advisory Board here at Mather that we get public comment on, public input on in our whole process, which is something that's been just started recently within the last couple years.

We're looking at all the different avenues to get information out, to get the public aware of what's happening here. And again, you know, we're trying with our mailings, and we've done several mailings in terms of what's happening here. We've got a mailing list that is growing and will continue to grow as long as there's interest.

MS. WALKER: Okay. And just one other thing. Due to the environment, and like you say, the paper flow, I would like to suggest centrally located bulletin boards to update the community, such as maybe at the Franchise Tax Board, that's right off from the 50 freeway along with the movie goers and I would like to see more of being environmental friendly.

And also offering those kind of products -- I'm concerned too, as a citizen of the community who uses water -- some of the products that I'm using if they are environmentally safe. And then once they're mixed with the water while we're cleaning the bath tub when the children are getting in, are we doing more harm than we are good? So I really want to stress the education as to the people who are living here and some kind of solutions for future generations as well.

SITE MANAGER WONG: I appreciate the comment. And we will take the comment in terms of trying to get that information out there. We can work on getting our news letters and fact sheets out and posted like you said. And, you know, we have a couple of our RAB members here and our community relations specialists here, that you can -- you know, I'm sure they'll take those suggestions down and we'll see what we can do.

MS. WALKER: Thank you.

Additional response: The worst-case scenario based upon the contamination identified at IRP sites at Mather is that the sites that require cleanup to protect human health and the environment would not be cleaned up. However, all sites requiring cleanup are either in the process of being cleaned up or are proposed for cleanup in the Basewide Operable Unit Proposed Plan. Some of the sites have cleanup proposed to protect human health, based upon conservative estimates of human exposure to contamination **at any time** in the future. Other sites have cleanup proposed to protect the ecosystem or to protect water quality, even though the contamination at these sites may not pose a threat to human health.

Comment 1 (see pages 29 - 30 of the public meeting transcript) and Response:

MR. ALEXANDER: My name is K. Alexander here in Sacramento.

I see we have general information. Can we define it, the whole can of work in, you know, critical, highly critical, average, something like, you know, something like different phases? Sometimes you ask for more money, we can put which one into which phases, phase 1, 2, 3, 4, you address this situation here.

SITE MANAGER WONG: Right. And that boils down to risk. When we look at the information that we get through our investigations, we get numbers that tell us what kind of risk is out there. If there's anything that's a high risk, we'll go after it immediately and try to do anything we can to take care of it, you know, right away.

Based on what risk levels show up --

MR. ALEXANDER: It's here in the -- do you have the risk values in this figure here?

SITE MANAGER WONG: The actual risk values are in the Feasibility Study.

MR. ALEXANDER: Well, if it's a high risk, you better do it now to show those people we have a higher risk. Sometimes we do it later on, you know, because it costs a lot of more money. We justify it as a different risk, different critical, highly critical, something. I wish we included something in the report.

SITE MANAGER WONG: It's in our Feasibility Study --

MR. ALEXANDER: Here? Thank you.

SITE MANAGER WONG: -- where you can see the risk numbers.

Thank you.

Additional response: Although different sites have different levels of risk associated with them, the law (Comprehensive Environmental Response, Compensation, and Liability Act) requires that significant continuous work toward cleanup begin within 15 months of completion of the investigation and study, which is interpreted as the issuance of a Record of Decision for that site. Therefore, the USAF plans to accomplish all cleanup as required by law.

Comment 5 (see pages 30 - 31 of the public meeting transcript) and Response:

MS. MAKOWSKI: My name is Claudette Makowski. And I have a question about the plume back there. It's very close to the Citizen's Utilities wells.

Have those wells been affected, and what is in that plume?

SITE MANAGER WONG: That plume primarily consists of solvents, TCE.

MS. MAKOWSKI: What kind of solvents, TCE?

SITE MANAGER WONG: TCE, PCE and carbon tetrachloride. It has affected two wells with Citizen's wells. One well is shut down. The other well has a treatment system on it. And there's a picture of it in the lower right-hand corner there. It's an activated carbon unit, that is treating water right now. I think it's been operating for the last month.

MS. MAKOWSKI: When were those wells shut down?

SITE MANAGER WONG: The Explorer Well was shut down in 1994, September of 1994, and the Moonbeam Well was shut down in April of last year. The unit has been operating for the last month and it's been shut down between that time.

MS. MAKOWSKI: And you say that's TCE and carbon tetrachloride in there?

SITE MANAGER WONG: And PCE.

MS. MAKOWSKI: PCE.

Comment 6 (see pages 31 - 32 of the public meeting transcript) and Response:

MR. SEMBACH: My name is Erik Sembach. Have you guys -- has there been a projected target date for the completion of all the remedial actions?

SITE MANAGER WONG: Our intention is to get all remediation up and going in the year 1999. Now, what that means is, our systems will be in place. There is a prove-out period where we need to operate it and satisfy the regulation in terms of making sure it's operating correctly.

Once we get to that phase, it goes into the long-term phase, where we just operate the system. I think there's five-year review cycles to verify it's working correctly. And then maybe re-evaluate what needs to be done.

Comment 7 (see page 32 of the public meeting transcript) and Response:

MS. VON ECKERT: I have a comment, not so much formal, but what Annette Walker mentioned was what I look at. I know that because we play with so many technological toys that something is going to kick back and we're going to have to learn what we're dealing with. And Mather being brave enough to do this on an open forum, highly commendable. And it also should make us look at how we operate on a daily basis with pesticides and other cleaning products and fuels, gas tanks and so forth.

And rather than attack Mather or the program and use it as a fear tactic of what's going to happen to us or our children even, even though that is a concern of ours, to understand how we ourselves our responsible for the health of our environment, and to know that we run off of consumerism and how we're going to impact our economy and everybody who has jobs making whatever widgets are out there. There's no blame here as far as I see. It's just a learning process.

And I thank you.

The following comments were received in writing during the 30-day comment period ending June 23, 1997.

Comment 8 (comment from Annette Walker) and response:

Community Plans

We would like to see the United States of America s the example of "Humanity." We have been exposed to deadly chemicals that have taken our loved ones; caused our children to be constantly ill; women with an alarming rate of breast lumps; and even I have suffered the loss of our unborn child. There must be IMMEDIATE ATTENTION in the best interest of the health and well being of mankind, the environment, and our future generations to come.

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This disaster was not something that was planned by the United States Armed Forces, however, we can take a BAD situation to utilize our talents, skills, and knowledge to be solutions for a new global economy, reconstruction of deadly environmental habits, and most IMPORTANT...health-conscious society!

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1.a. IMMEDIATELY - RELOCATE FAMILIES OUT OF CONTAMINATED AREAS

There should not be any reason humans are made to eat and drunk deadly chemicals the United States has caused, because of economic finances. The Armed Forces are the most organized movers in the world, we should utilize our military to <u>help AMERICANS</u>; NOT ONLY TO HELP OTHER COUNTRIES, OR <u>KILL</u> OTHER HUMANS! (This will be an option for those who choose).

2.a. WATER TREATMENT SYSTEMS - FOR ALL SCHOOLS - BUSINESSES - RESIDENCES

Health needs to be the top priority! If we do not focus on health NOW, it will cost us more later. It is a fact, that water-treatment systems will give added security to the working taxpayer - property owner (who has seen our value depreciated 30% to 50%) and we do not feel the government is spending our money wisely. Furthermore, it will create jobs for our community - NOT RICH INVESTORS!! CAPITALIZING ON OUR LIVES.

The mass quantity of systems will also make the cost very affordable, and can be used as a community investment. There are multi-level marketing companies such as Amway, Equinox, etc. who have various products and systems that will benefit the entire community.

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The most important element is Quality Family Health Care! After we lost our unborn child in the fifth month of pregnancy, I went to Kaiser, Morse Avenue, where a routine D&C procedure was improperly performed; I almost lost my life...returned back to the same facility, where I was RAPED by the MEDICAL STAFF! We cannot allow this to continue. Again, we must give people the tools to fish...we as a community can pay the same premiums and co-payments, but we must have QUALITY FAMILY CARE, and the funding for rats can be used for humans to complete accurate studies for research for other areas, future generations, and education how to live with the contamination. We suggest the New Shriners and U.C. Davis Medical Centers as the project. We can use the multi-level marketing concept for vitamins to help supplement nutrition; AGAIN, the IMPORTANCE OF HEALTH - QUALITY FAMILY CARE, IS THE TOP PRIORITY!

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- All plans can be duplicated in ALL communities all over the country, with a NEW AMERICAN AGENDA.

Responses to Comment #8:

Much or all of the comment addresses concerns other than the Basewide Operable Unit Proposed Plan. However, several statements are about contamination and health effects in general. These are repeated and responded to below.

Comment: "We have been exposed to deadly chemicals that have taken our loved ones; caused our children to be constantly ill; women with an alarming rate of breast lumps; and even I have suffered the loss of our unborn child."

Response: There is no evidence indicating that anyone has been exposed to chemical contaminants from any of the Basewide Operable Unit sites nor any other contamination from Mather at unsafe levels. The independent federal Agency for Toxic Substances and Disease Registry is performing a Public Health Assessment of Mather Air Force Base, as is required for all sites on the Superfund, or National Priorities List. This assessment includes the evaluation of any past exposure history, current, and future risks, and determines whether follow-up studies are needed to determine if there are any health effects associated with past exposures.

Comment: "There should not be any reason humans are made to eat and drunk deadly chemicals the United States has caused, because of economic finances."

Response: The USAF is committed to protecting human health and the environment according to law. The law considers cost as one criteria in comparing cleanup alternatives, but a cleanup alternative must be protective of human health and the environment to be selected. In other words, the law requires the USAF to protect human health as a criteria under the Superfund law (the Comprehensive Environmental Response, Compensation, and Liability Act of 1980).

Comment:

"2.a. WATER TREATMENT SYSTEMS - FOR ALL SCHOOLS - BUSINESSES - RESIDENCES

Health needs to be the <u>top priority</u>! If we do <u>not</u> focus on health NOW, it will cost us more later. It is a fact, that water-treatment systems will give added security to the working taxpayer - property owner (who has seen our value depreciated 30% to 50%) and we do not feel the government is spending our money wisely. Furthermore, it will create jobs for our community - NOT RICH INVESTORS!! CAPITALIZING ON OUR LIVES.

The mass quantity of systems will also make the cost very affordable, and can be used as a community investment. There are multi-level marketing companies such as Amway, Equinox, etc. who have various products and systems that will benefit the entire community."

Response: Although this comment does not pertain to the Basewide Operable Unit, this response is offered. The USAF is committed to providing water treatment or an alternative water supply whenever contamination enters a drinking water supply at concentrations that are unsafe. The USAF has placed well-head treatment on the Moonbeam Drive well and is in the process of installing well-head treatment on the water system serving the Sacramento County facilities along Branch Center Drive.

Placing water treatment at the water source ensures that every user receives treated water, and only these central treatment systems need monitoring and maintaining. The total amount of activated carbon required is much less than would be required to treat water at each tap or household. In addition, if water treatment systems were placed in each household or place of water use, each treatment system would require periodic water testing to ensure that the carbon capacity was not used up. Monitoring water at each household would be prohibitively expensive when compared to monitoring at each well that provides drinking water, because there are hundreds of households or taps for each well in a large community water system.

Comment 9 (comment #1 from Sandra Lunceford) and response:

Carbon tetrachloride has presented a remediation problem for Mather Field in that its detection limit and cleanup level have been the same. It appears that one site on base has been pinpointed as the source area for this chemical, Site 10C. It does not seem reasonable that this could be the sole-source area for this contamination given its effects on off-base wells. My recommendation would be to further pursue investigation at the oil water separators, Site 18, and other appropriate sites to determine other source areas for this particular problem chemical, and perhaps other sources for PCE and TCE will also be uncovered.

Response to Comment #9: Several potential areas on Mather have been identified as potential sources in soil of carbon tetrachloride, TCE, or PCE contamination found in underlying groundwater. The Additional Site Characterization and Final Basewide Operable Unit Remedial Investigation Report provides details of the investigation for such sources at Site 23, 67, and 84. In addition, the Basewide Operable Unit Focused Feasibility Study Report explains the USAF plan to treat carbon tetrachloride, TCE, and PCE at Site 18 because they were successfully removed during pilot testing of a soil vapor extraction system at that site.

Comment 10 (comment #2 from Sandra Lunceford) and response:

I will look forward to Basewide ROD documentation discussing the UXO area on Mather Field.

Response to Comment #10: As the USAF has committed to the U.S. EPA, the Basewide Record of Decision will contain an explanation of how the USAF is investigating the site of reported ordnance disposal in the former weapons storage area. This location is not an Installation Restoration Program site, but could be added to the IRP if contamination is found at the site.

Comment 11 (comment #3 from Sandra Lunceford) and response:

I encourage, again, designated federal funding cites that are made available to guarantee that new, unaddressed contamination encountered on Mather Field and other closed bases be promptly remediated to forestall economic impacts to local communities.

Response to Comment #11: This comment is beyond the scope of the Basewide Operable Unit.

Comment 12 (comment #4 from Sandra Lunceford) and response:

Presumably Site 81 will be accepting contamination from other sites, as it is to be used as a land farm. I hope to see that the Basewide ROD documents acceptance criteria and restrictions in nontechnical language.

Response to Comment #12: There are no plans to accept any contamination from other sites at Site 81. The remedial alternative proposed in the Proposed Plan and selected in the Draft Record of Decision consists of land farming only contamination found at Site 81.

Comment 13 (comment #5 from Sandra Lunceford) and response:

Hopefully the Basewide ROD will briefly discuss the other sites comprising Mather and how they are being addressed.

Response to Comment #13: The Basewide Operable Unit Record of Decision provides an overview of all the Installation Restoration Program sites at Mather, and refers the reader to documents where more detail can be found for sites in other operable units.

Comments received from Annette Walker 6/23/97

Community Plans

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Comment received from Sandra Lunceford, 6/23/97:

Sandra Lunceford
121 Kennar Way
Folsom, CA 95630

23 June 1997

Anthony C. Wong
Mather Field Site Manager

Dear Tony:

Enclosed are my comments on the Final Basewide OU FFS.

GENERAL COMMENTS:

1) Carbon tetrachloride has presented a remediation problem for Mather Field in that its detection limit and cleanup level have been the same. It appears that one site on base has been pinpointed as the source area for this chemical, Site 10C. It does not seem reasonable that this could be the sole-source area for this contamination given its effects on off-base wells. My recommendation would be to further pursue investigation at the oil water separators, Site 18, and other appropriate sites to determine other source areas for this particular problem chemical, and perhaps other sources for PCE and TCE will also be uncovered.

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5) Hopefully the Basewide ROD will briefly discuss the other sites comprising Mather and how they are being addressed.

There is a void at this time between the Basewide ROD and off-base groundwater remediation If there is some way the USAF would or could address the events that are simultaneously occurring, it may go a long way towards producing a degree of closure to this process.

Once again, thank-you for allowing me to comment on documentation for Mather Field.

Sincerely,
(signed, Sandra Lunceford)

PUBLIC HEARING

DEPARTMENT OF THE AIR FORCE

MATHER AIR FORCE BASE

--o0o--

In the Matter of:)

THE PROPOSED PLAN FOR ENVIRONMENTAL CLEANUP AT THE BASEWIDE OPERABLE UNIT SITES)

Denker Hall
10460 Armstrong Avenue
Mather, California

Thursday, May 29, 1997
7:00 p.m.

JAMES F. PETERS, CSR, RPR
Certified Shorthand Reporter
License No. 10063

APPEARANCES

Anthony Wong, Air Force Site Manager, Environmental Coordinator

Kathleen Salyer, U.S. Environmental Protection Agency, Region 9

Kent Strong, California Department of Toxic Substances Control

James Taylor, Central California Regional Water Quality Control Board

INDEX

PROCEEDINGS

SITE MANAGER WONG: Let's go ahead and get started. It's scheduled to start at 7:00. So we'll try to get as close as possible to it as we can.

(Thereupon an overhead presentation was presented.)

SITE MANAGER WONG: I'd like to welcome everyone to our proposed plan public meeting for our basewide operable unit here at Mather Field.

My name is Tony Wong. I'm with the Air Force and I work for the Air Force Base Conversion Agency here at Mather.

Some other people in our crowd that may be of interest to you. We have our Region 9 EPA representative, Kathleen Salyer. She's right there. We have Kent Strong our Department of Toxic Substances Control representative. And we have James Taylor our Central California Regional Water Quality Control Board representative.

These are some of the regulators that help us come to these decisions and help guide us in terms of how we go about cleaning up the Base.

I hope everyone one picked up a handout with these slides on them on the front desk. If you don't have one, we'll have someone get you one. It might help facilitate following along. I don't know if this is bright enough or not.

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SITE MANAGER WONG: Again, basically, we're here to present to the public for public comment our proposed plan for our basewide operable unit. We'll also propose those sites that we consider no further action at. We have documentation available to the public, both at the Rancho Cordova Library, which is on Folsom Boulevard not far from the Base here, and also our wing headquarters building which is that building with the flag poles in front. You probably passed it on the way in. Those are both information repositories that we have all the supporting documentation to help us come to our decisions on how we clean up the Base.

We have some of the documentation here that supports this proposed plan, the basewide operable unit -- it's at the table right there -- that includes the focus Feasibility Study and some other ones.

Just a reminder. The public comment period is May 23rd through June 23rd 1997. So we are in that public comment period right now. You can submit comments several ways. You can do it tonight, both orally and in writing or you can submit more comments in writing to my office and the address is on the back of the proposed plan on where to send it to, or you can stop by and make written comments.

Again, the end date on that is June 23rd 1997.

What I want to try to do tonight is go through a formal presentation. I'll go through the slides and I'll have some overheads to help clarify the situation. And we also have a picture of the base map here that we can help orient you to where we're at and where these sites are.

Just to help you out. We're up in this area here. This building right there. And this building right there by the circle. There's the runway. Here's the Base housing. The golf course. And north is up.

After the presentation we'll have a question-and-answer period, where I'll accept questions from the audience. And I would prefer that if there were any questions and the follow-on comments, that the person would come up here and make those questions or comments available so our court reporter can clearly put them down.

And before you state your question, state your name and then he can keep a record of it.

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SITE MANAGER WONG: Just a little background in terms of where we are in our cleanup process. What we have going on here at Mather is that we're following what's called the Superfund process. That was a name that's given to a longer name called the Comprehensive Environmental Response Compensation and Liability Act, which was adopted in 1980. They shortened that to Superfund Act.

And what that entails is a process where you go through a couple of phases, an investigation phase. That includes remedial investigation. And then with that information, it gets rolled into the document and that's called the Feasibility Study. And that Feasibility Study takes that data that was gathered during our investigation phase, looks at the local or the regulators of the A-wires is what we call them, the applicable or relevant and appropriate requirements.

We try to match our cleanup options with those requirements to come up with something that will satisfy them. And that's presented in the Feasibility Study. And that Feasibility Study is then condensed or at least the major points in the options are proposed in the proposed plan, which is this document that was mailed to most of you. And if you don't have a copy of this, it's available in the back desk.

It's about 20 pages. And it briefly goes over all the options that we have available to us that are various sites. And in our process, as you can see right here in the middle, it stays right here where we've done the investigation. And we've come up with a Feasibility Study and again that's available on the table over there.

That's condensed and summarized into a proposed plan. It gives us our options. Once we accept public comment on those options, we roll those into a decision document, that's called a Record of Decision. In that document we pick our alternative or our option that we're going to use for clean up.

And from there on that document required a regulator's signature. So we have -- here at Mather we have what's called a Federal Facilities Agreement. And that's an agreement between the Air Force, the State and the USEPA. So as this document is finalized, we need all three concurrences on our remediation and our option that we are deciding to use.

So at that point, once the Record of Decision is signed, we'll go forward with our remediation, both the design and then the action.

Once the Record of Decision is signed, we're required by law to implement or start remedial action within 15 months. And just a little background in terms of Record of Decisions here at Mather. We have five Record of Decisions. What we did is we broke up this process into five units. We call them Operable Units.

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SITE MANAGER WONG: Our first unit is called the Aircraft Control and Warning site. And basically that's a groundwater plume emanating from our FAA -- the golf ball that you see out by the golf course, that area that comes down into the housing.

It's a groundwater plume, a TCE plume, and that Record of Decision was signed in 1993. We have remediation in place. And there's a picture of an air stripping tower back there on one of these tables. And that system is now pumping and treating that water and has been working for the last couple of years.

Our landfill operable unit Record of Decision was signed in 1995. And that included all our landfills on the Base. That's Site 3 and 4. That's Site 6, Site 2. And that Record of Decision allowed us to consolidate three of our landfills into landfill 4. Landfill 6, landfill 2 and landfill 5 were all excavated and moved to landfill 4.

So currently we have landfill 3 and 4 with caps on them. And the only thing left on that remedial action is to get a vegetative cap to grow on landfill 4, and then the fencing to go up around those landfills.

Our soils and groundwater operable units had a Record of Decision that was signed back in 1996. We are currently in the field implementing those remedial actions. We are putting in a pump and treat system in the main base area. And that's hoped to go in this summer or this construction season and start pumping by the fall.

And our last operable unit is our basewide operable unit. And that's come about because of the investigations. And these sites have kind of filtered through these other operable units and this is basically our catch-all Record of Decision. There's 18 sites associated with this Record of Decision. They're all soil sites. And I'll get into some further detail on what that is.

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SITE MANAGER WONG: Some of the sites that are included in this Record of Decision are a disposal site, some underground storage tank sites, fire training areas, sewage treatment facility, both the facility and the system, and some of the pipe work. There's a golf course maintenance area. There are some ditches, a gun range, and the skeet and trap range.

And what's done in terms of coming up with these options is that these sites are looked at. They're looked at to find out what chemicals are present in the ground and they look at three things. They look at the chemical and its protection or trying to protect the groundwater quality and its impact on the groundwater. They look at the human health risk and the ecological risk.

So based on those three factors, if the compound comes up as a concern, then that compound is tracked and that site needs to be cleaned up accordingly.

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SITE MANAGER WONG: Another thing we'll be getting into is what we're cleaning up to. There are three categories that we're looking at, residential, occupational and recreational. And that is more geared towards reuse, in terms of what the intended use of that land is going to be.

A simple breakdown is the residential use would have exposure or someone living there 350 days of the year. An occupational situation is someone being there 250 days a year, and the recreational situation is about 150 days a year. So that's some of the criteria that we look at for how we clean up the sites.

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SITE MANAGER WONG: Some of the cleanup technologies that are available to us are access restrictions, air monitoring, bioremediation, excavation, and groundwater monitoring.

Access restriction can be physical or institutional. Physical restrictions can be fence, as an example. Institutional restrictions can be something written in the deed that restricts any wells to be drilled or any certain type of activity based on the environmental condition.

Air monitoring includes instruments that detect any contamination in the air during any cleanup activities such as excavation or for example that air stripping tower is taking contamination out to a low enough level that it can be dispersed into the air. But we do have instrumentation to verify that.

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SITE MANAGER WONG: Bioremediation, if you want to look at that slide over there, is a process where you use the natural occurring organisms in the soil and then convert organic matter, primarily fuel constituents, gasoline and diesel and break them down into harmless components.

Excavation is what it says. You go in there and you take your back-hoe or your front-loader and just dig out everything you can to get rid of the contamination.

And groundwater monitoring is, our wells that we have several of, that we have put into the ground to pull up samples quarterly or monthly depending on where it's at and analyzed for several constituents based on what we're trying to look for, what we think is in the area. And that's an ongoing process.

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SITE MANAGER WONG: Some other technologies available to us are off-base disposal, where a lot of -- or some of the excavation that we pull up out of the ground may contain hazardous wastes or California designated waste, which is soil that is contaminated that could potentially impact the groundwater. Those type of materials we have to take off base to dispose of. And that's usually at a classified landfill in the area.

On-base disposal usually entails areas on the Base where, with regulated concurrence we have acceptance criteria with that. At certain levels that material can be used for foundation material, like in landfill caps or fill material. So we've got a site, Site 7, that we'll be talking about later that needs some of that soil. And we already have acceptance criteria that's agreed upon with the regulators that will allow us to test the soil as it comes up. And as long as it meets those criteria, we can take it there and dispose of it. And usually that's a lot cheaper alternative for us to get rid of that soil.

Another process we have available to us is called soil vapor extraction. There's a schematic of it over there on the overhead.

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SITE MANAGER WONG: And what that entails is basically a vacuum effect, where we have a pump that will pull air into the soil that has contamination in it, and then that air is pulled up into a unit that will take out the contamination and then vent off the rest of the air.

And that just deals with constituents or contamination that's in the soil between the ground and the groundwater because it's in the vapor there.

That's a very effective method and we have a site here that we're using it on that we're pulling up a lot of constituent.

Stabilization is another method that we have available to us. And what that entails is an additive that we add to the soil, that will bind the constituent to the soil and not allow water to filter through it and move that contamination around.

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SITE MANAGER WONG: An example of what we're going to see both in the post plan and also in our Feasibility Study is tables that are site specific. And these tables are basically laid out like this, where you'll have the site name and various options. And no action is always an option for us at each site.

Sometimes there's a cost associated with no action and that usually is associated with some kind of monitoring program, where we have to take samples of the groundwater and analyze it to verify what's there or not. In this case, there is no cost associated with no action.

This talks about in situ bioremediation, excavation of groundwater. And there's also an estimated dollar value associated with that. We have to come up with estimates on the various cleanup options that we have. And we use those estimates as sort of a working number to help us come to some decision and also just for programming purposes or getting money to clean up the site.

But every site does have various options. What I intend to do is go through the sites and show you the preferred alternative that we're looking at and explain that.

But before I get into that, I want to go through some of the criteria that needs to be discussed, and used in terms of coming to these decisions on what alternative, what option that we're pursuing.

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SITE MANAGER WONG: Threshold criteria consist of these two parts. And these criteria both have to be met to pick an option. And they are overall protection of human health and compliance with applicable or relevant and appropriate requirements. And that's what I had mentioned before in the regulations that the regulators are governed by and that we have to comply with. So whatever option that we consider, we have to meet these two criteria.

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SITE MANAGER WONG: Next, we have the, what's called the balancing criteria. These are used primarily to compare the different options. It's to come up with a solution to look at the long-term effectiveness of the option; how effective it is at reducing the toxicity, mobility and volume of the contamination; the short-term effectiveness, and how soon can it be put in place; and what risk is there involved during that time period; can we wait or do we have to do something more immediate.

Implementability, that's if something is feasible or not. And there's certain situations where it may not be technically feasible to go after that contamination. And we have to look at alternate methods. And there's costs. Is it worth the cost to go after it? Is it that much more or is it almost the same?

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SITE MANAGER WONG: And finally, there's the modifying criteria. These are state acceptance and community acceptance. And the community acceptance is the public being aware of our options. And again at this time in our process, this public comment period is when we accept those comments from the public and we need to respond to those comments.

And in one case here at Mather we had a community concern with our landfill. And at our landfill proposed plan meeting we had someone -- actually, it was the County of Sacramento -- but they expressed a concern on leaving that landfill, landfill 6 in that area. They had plans to develop that area. So their comment was that they would prefer to have that moved.

We went through some, I think a month or so of looking at the numbers and coming up with costs associated with that and trying to justify moving it from that point of view. And we ended up moving it, moving it all the way to landfill 4.

So community input is important. It does affect, you know, what is done here. And it's again very important that we get some comment. And it does and can modify the remedy that we have chosen.

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SITE MANAGER WONG: I'm going to start off with certain sites that, after investigation, that we found that there was no chemical of concern, that we feel there is no impact, both human health and the environment. So we call these No Further Action Sites. They include Site 8, the fire training area, Site 17 the weapons storage septic tank leach field, Site 19 the bulk fuel storage facility, Site 67 strategic air command area shop drainage system, and Site 84 the sanitary sewer line runway investigation. That's the sanitary line that ran underneath the runway.

So again, based on our investigation and analysis of the data, we felt there's no contamination of concern there, so we feel these sites will be proposed for no further action.

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SITE MANAGER WONG: Our next site is what we call the petroleum-only sites. As part of CERCLA or Superfund there is an exclusion for petroleum-only sites. Those sites that have only fuel contamination are not included in that process. And that has been delegated or that authority goes to the State, and in our case the State Water Board. So these two sites are being -- is under their jurisdiction and we are working closely with them to take care of these sites.

One of the sites we have is Site 83, the helicopter wash rack, is we feel no action. And Site 82, which is the golf course maintenance area, we have proposed that we will install three groundwater monitoring wells in that area to verify if there's any problem in terms of fuel. We intend to do that, and basically monitor it. And if there's anything that comes up in terms of contamination, we'll have to deal with it.

But the initial plan is to go ahead and put in the monitoring well and see what the data shows.

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SITE MANAGER WONG: Now, we start getting into the sites where we have categorized for residential use. There are several sites that we have identified with that criteria for evaluation. And I'll explain a little later what we mean by -- you'll see right here evaluation for occupational standards. First, we'll get into the Site 18, the old burial site.

MS. CORTENBACH: Burial of what?

SITE MANAGER WONG: Usually, it's --

MR. HUGHES: It was reported when the sites were first identified that this site had toolboxes and Ethel mercaptain, which is the chemical that you put in natural gas that you can smell it. And it was investigated for any debris or landfill material and nothing was found.

However, there were some petroleum fuels and some solvents found. And so it started out being investigated as a burial site, but ended up that we chose to remediate because it apparently received run off from aircraft washing operations.

One of the air photographs shows ponding of water. So it's called a burial site still, but it's really an area for wash water. It carried contamination in it and soaked into the soil.

SITE MANAGER WONG: Right. So as a result of the investigation, and we found solvents, the proposed remediation would be soil vapor extraction. And that's where we go in -- like I explained earlier, where we go in and start drawing the vapors off the soil and removing contamination that way.

Our site 20, the sewage treatment facility, is found south of the runway. What we have for our option is excavation and stabilization with ex situ bioremediation. And what that is, we'll go in and we'll dig the dirt up and move it to our bioremediation facility, which is located in that area, where they'll treat the soil and bring it down to levels acceptable to put it in our Site 7 area, the landfill foundation and fill.

In addition to that, we'll also put in groundwater monitoring wells and monitor the water there to verify what is or is not going into the groundwater.

And this is one of the sites that we evaluated for occupational standards. And as I explained earlier, there's standards based on exposure. And one of the things that we were looking at as part of the cleanup is, you know, what's the intended use there? Is there going to be light industrial or is it going to be residential or occupational?

And each one of those, because they're differential exposure ranges, you know, the number of days has slightly different cleanup standards. So when we go in and start evaluating our options for these sites, we kind of look at the intended reuse or the intended plan for that area and look at the options, occupational versus residential. And in this case, it came up, you know, the same, that if we went after occupational standards we would also look at the residential in terms of the constituents that we're cleaning up. So that's why we're categorizing this as residential.

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SITE MANAGER WONG: Some additional sites is Site 23. That's a sanitary sewer line in the main base area. It runs parallel to the -- not the runway but the ramp area.

And our plan there is to put in in situ -- I mean -- yeah, in situ soil vapor extraction. Again, the compound that we're concerned about is Volatile Organic Compounds, those constituents that we can pull out of the vapor and clean.

Our Site 80, the golf course maintenance ditch is over parallel to the golf course. And some of the constituents that we found there were pesticides and metals identified in the surface water that pose an ecological risk and a possible impact to surface water quality.

So our plan is to excavate, again with on-base disposal. That's our, hopefully, our Site 7 area, as long as it meets the acceptance criteria. And this one was one of the sites that we looked at in terms of recreational standards. It's in the area that is currently under lease with the County Parks. And they have a plan to develop that area with various recreational activities. So again, when we looked at that versus residential, it came up about the same. So we're looking at residential standards.

Site 8 is the sewage oxidation ponds located in the southern portion of the Base. Those ponds had metals found in them and some petroleum products. The plan there is, because the area is so large and there's such a large volume of soil that needs to be taken care of, any options in terms of digging it up and moving it to both on-base or off-base for remediation is just too costly.

So we came up with the option of what we call land-farming and that's remediation in place. We're going to go in and fix the area up so we won't get any more water coming in there and treat it in place until it gets to a low enough level. And again this is another one of the sites that was looked at for an occupational standard.

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SITE MANAGER WONG: Our next site is Site 85, the south ditch area. It's a ditch that runs parallel to the runway on the southern portion of it. It gets water from the northern area from underneath the runway and drains out to the south to Morrison Creek.

Some of the chemicals of concern there are metals and pesticides and some petroleum products. There is a potential risk to human health and the ecology. And there's a potential problem with getting into the groundwater. So the option we have there is excavation. And again, we hope to meet the acceptance criteria at Site 7 to put that soil there.

Site 86 is our military firing range. It's located in one of the southern-most portions of our base. There's a small arms firing range. And one of the compounds there is lead. And it was in the soil. So one of the -- our option that we prefer is to excavate it and treat it, and then dispose of it on base, again, as long as we meet the acceptance criteria.

Site 88, our Morrison Creek area, it had metals identified as a chemical of concern. Our plan there is to excavate it and use it for on-base disposal.

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SITE MANAGER WONG: One of the sites that we did meet the recreational criteria for was our Site 87, the skeet and trap range. It's located close to the golf ball out there by the golf course. It was a skeet range. And we found metals there, shell fragments. And there's also some problems. There's a petroleum by-product from the clay pigeons that were used out there. They need to be cleaned up. So our preferred alternative is to excavate it and dispose of it on base.

It's a pretty large area in the overhead there. It's a large volume of soil that needs to be taken care of.

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SITE MANAGER WONG: And the last site is our Site 10C/68. One of the sites that we identified as an occupational standard. It's in the -- it's just off the ramp there off the runway. And that area is being developed for the air cargo facility that the County has plans for. So we felt that it fits the occupational standards.

The plan there is to excavate. And there is lead found in the soil and metals, and again disposal on base. And some of the soil that we can't excavate and dispose of, we're going to treat in place with in situ treatment.

That concludes the presentation portion of this meeting.

What I'd like to do is answer any questions that you might have concerning the presentation. If you could, could you come over here and state your name and ask your question and we'll answer it. That helps our court reporter in terms of getting the information down clearly and correctly.

And once we finish with that portion of our meeting tonight, we'll go into our formal comment period. Again, I would ask that you come over here and make your comments so he can record it accurately. And again, we'll try to answer as best we can right now. And if we can't, we will have those comments answered in writing as part of our Record of Decision, which is the next phase that we need to go into in our process.

So at this time, are there any questions on the presentation?

MS. VON ECKERT: I have one.

SITE MANAGER WONG: Would you state your name for the reporter.

MS. VON ECKERT: Eloise Von Eckert.

I got lost in the residential sections. And I wasn't able to track, but what would be the housing area right in the middle near where we are?

SITE MANAGER WONG: Down here?

MS. VON ECKERT: Yeah, which sites are we there?

SITE MANAGER WONG: There's actually this ditch site. This one right here.

MS. VON ECKERT: 18 and 20 and 23?

SITE MANAGER WONG: 18 is up here.

MR. HUGHES: The only sites in this proposed plan that are nearby are what's called the Morrison Creek Reference Site. This drainage had three samples collected and right near the roadway there were some pesticides detected. And it might have been from mosquito abatement in the past or something of that nature.

But two samples downstream didn't have any significant contaminants of concern, but we need to do a little more sampling to be really -- to well define the area that will need to be excavated. We don't believe that that contamination extends near the housing here.

The second ditch that drains to the golf course maintenance area, again, pesticides in the ditch nearby where pesticides were mixed and stored for use on the golf course.

Again, the sample here had pesticides. Two more samples were collected that were very widely spaced. And additional samples need to be taken after being collected very soon to try to better define the actual length of the ditch that would require some remediation.

There's two other sites that were discussed in a past public meeting, and for which a Record of Decision has already been signed, that are in the housing area. One was an underground storage tank near the water tank. It was a -- I believe it was a generator fuel for a backup generator for the pumping of the water system. That site where -- the tank was removed and it's been remediated.

The second site is a former military gas station or actually military -- or actually -- yes, a military gas station that has fuel tanks. And that remediation is also under way. It was part of a past Record of Decision. That site is a petroleum-only site. That's been regulated by the Regional Water Quality Control Board.

So by and large there are not a lot of contaminated sites near the housing.

MS. VON ECKERT: Okay.

SITE MANAGER WONG: Any other questions?

MR. VERDON: My name is Scott Verdon. I'm also a student. My question is the employment opportunities. What kind of thing is that?

Will there be employment generated from the work that's going to be brought in cleaning it up on the outside? Is that going to be mostly outside contractors or things of the nature where there are possible opportunities to employ myself?

SITE MANAGER WONG: The situation with environmental work here is that our agency who's headquartered out of Washington D.C. has a contracting agency out of Brooks Air Force Base in Texas. And what they do is they contract, you know, all the different environmental works at all the various bases that we control. And part of that contract that they have, is that whoever it is awarded to, a certain portion of it needs to be done locally.

They have to go out locally and get subcontractors. Our current contractor is Montgomery Watson. Their building is right over there. And they're our prime contractor for all remediation work. And they have a team of, you know, other contractors that they use. And they also go out locally.

So I can pass that information along in terms of, you know, for anything local that they might be able to do, but that's the way our process is.

MS. WALKER: My name is Annette Walker. And I would like to know what do the experts feel is the worst thing that can happen? And what preventative measures have you in place for the worst thing that can happen?

SITE MANAGER WONG: Is this specifically to the site here at Mather?

MS. WALKER: Yes. I mean, any of the contamination or whatever you may know from Aerojet or any information, because contamination is just contamination without a label.

SITE MANAGER WONG: Right. Well, in terms of Mather's contamination and specifically in terms of our proposed plan on these 18 sites, most of the contaminations are either, what we call VOCs or Volatile Organic Compounds or fuel constituents, or lead. Again, we do have treatment options available to us to take care of it. We are in the process through this Record of Decision to take care of that contamination, and prevent it from going anywhere. So I would hope the potential impact is very low. We have identified as much as we can, and we're moving forward.

We're trying to get it cleaned up.

MS. WALKER: But I'm saying what has been identified as the worst thing that can happen? What has been identified?

SITE MANAGER WONG: In terms of the worst thing?

MS. WALKER: Yes.

SITE MANAGER WONG: Again, when we go through our risk assessment for human health and the ecology, we come up with numbers that tell us, you know, what levels that could potentially be out there and these risk assessments are associated with the one-in-a-million cancer risk. And anything that is above the one-in-a-million cancer risk, we have to deal with in terms of taking care of it.

So we feel we're at the low enough level right now where there is no risk as long as we take action.

MS. WALKER: I'm saying for the future generations. Do you understand? What I'm saying is right now, right, I understand that. But I'm just saying say for the next five years, ten years, what is probably the worst thing may/could happen if we do not clear this up within the allotted time?

SITE MANAGER WONG: Well, I can't answer that right now.

MS. WALKER: I'm saying have the experts said this is the worst scenario or not? They haven't looked at the worst thing that can happen?

SITE MANAGER WONG: Again, they look at it in terms of risk, and what the potential risk is. And if it falls into a certain category where action needs to be taken, we are taking action. I don't think they project out five years, ten years down the line.

MS. WALKER: Okay. And one other thing too that I would like to elaborate on what he just said. Since this is at a level of federal dollars, state dollars, county, city, dollars -- this is more of a comment -- I think that more of the monies and the dollars should be invested in our communities with some of the people here and employ them more so that maybe some of the contractors who are getting some of the governmental contracts and more so, we should probably invest in people.

SITE MANAGER WONG: Right. And again the government contract is going through AFCEE, which is in Texas, but that does not exclude them from hiring people locally. There is a process where packages describing what needs to be done is sent out to all the various contractors including the local ones, so they are usually at the same level as everyone else in terms of getting those contracts awarded.

In addition to that, there is also language in the contracts that requires, whoever gets the award, to hire locally a certain percentage. So those provisions are in there and they are government contract laws.

MS. WALKER: Does this include the plan -- does it include education to the public? How to better be able to live with the contaminate -- well, the possibility?

SITE MANAGER WONG: In addition to what we have here, is we have quarterly news letters, fact sheets, that, you know, we -- and again we can discuss this later in terms of, you know, all the water stuff we're doing, but we do have an ongoing community relations plan that we try to get information out to the public. We also have a Restoration Advisory Board here at Mather that we get public comment on, public input on in our whole process, which is something that's been just started recently within the last couple years.

We're looking at all the different avenues to get information out, to get the public aware of what's happening here. And again, you know, we're trying with our mailings, and we've done several mailings in terms of what's happening here. We've got a mailing list that is growing and will continue to grow as long as there's interest.

MS. WALKER: Okay. And just one other thing. Due to the environment, and like you say, the paper flow, I would like to suggest centrally located bulletin boards to update the community, such as maybe at the Franchise Tax Board, that's right off from the 50 freeway along with the movie goers and I would like to see more of being environmental friendly.

And also offering those kind of products -- I'm concerned too, as a citizen of the community who uses water -- some of the products that I'm using if they are environmentally safe. And then once they're mixed with the water while we're cleaning the bath tub when the children are getting in, are we doing more harm than we are good? So I really want to stress the education as to the people who are living here and some kind of solutions for future generations as well.

SITE MANAGER WONG: I appreciate the comment. And we will take the comment in terms of trying to get that information out there. We can work on getting our news letters and fact sheets out and posted like you said. And, you know, we have a couple of our RAB members here and our community relations specialists here, that you can -- you know, I'm sure they'll take those suggestions down and we'll see what we can do.

MS. WALKER: Thank you.

SITE MANAGER WONG: State your name for the reporter. It makes it easier for him to report.

MR. ALEXANDER: My name is K. Alexander here in Sacramento.

I see we have general information. Can we define it, the whole can of work in, you know, critical, highly critical, average, something like, you know, something like different phases? Sometimes you ask for more money, we can put which one into which phases, phase 1, 2, 3, 4, you address this situation here.

SITE MANAGER WONG: Right. And that boils down to risk. When we look at the information that we get through our investigations, we get numbers that tell us what kind of risk is out there. If there's anything that's a high risk, we'll go after it immediately and try to do anything we can to take care of it, you know, right away.

Based on what risk levels show up --

MR. ALEXANDER: It's here in the -- do you have the risk values in this figure here?

SITE MANAGER WONG: The actual risk values are in the Feasibility Study.

MR. ALEXANDER: Well, if it's a high risk, you better do it now to show those people we have a higher risk. Sometimes we do it later on, you know, because it costs a lot of more money. We justify it as a different risk, different critical, highly critical, something. I wish we included something in the report.

SITE MANAGER WONG: It's in our Feasibility Study --

MR. ALEXANDER: Here? Thank you.

SITE MANAGER WONG: -- where you can see the risk numbers.

Thank you.

MS. MAKOWSKI: My name is Claudette Makowski. And I have a question about the plume back there. It's very close to the Citizen's Utilities wells.

Have those wells been affected, and what is in that plume?

SITE MANAGER WONG: That plume primarily consists of solvents, TCE.

MS. MAKOWSKI: What kind of solvents, TCE?

SITE MANAGER WONG: TCE, PCE and Carbon tetrachloride. It has affected two wells with Citizen's wells. One well is shut down. The other well has a treatment system on it. And there's a picture of it in the lower right-hand corner there. It's an activated carbon unit, that is treating water right now. I think it's been operating for the last month.

MS. MAKOWSKI: When were those wells shut down?

SITE MANAGER WONG: The explorer well was shut down in 1994, September of 1994, and the moonbeam well was shut down in April of last year. The unit has been operating for the last month and it's been shut down between that time.

MS. MAKOWSKI: And you say that's TCE and Carbon tetrachloride in there?

SITE MANAGER WONG: And PCE.

MS. MAKOWSKI: PCE.

MR. SEMBACH: My name is Erik Sembach. Have you guys -- has there been a projected target date for the completion of all the remedial actions?

SITE MANAGER WONG: Our intention is to get all remediation up and going in the year 1999. Now, what that means is, our systems will be in place. There is a prove-out period where we need to operate it and satisfy the regulation in terms of making sure it's operating correctly.

Once we get to that phase, it goes into the long-term phase, where we just operate the system. I think there's five-year review cycles to verify it's working correctly. And then maybe re-evaluate what needs to be done.

Any other questions?

Do we have any formal comments that we need to address here or address in writing that we'll take down?

MS. VON ECKERT: I have a comment, not so much formal, but what Annette Walker mentioned was what I look at. I know that because we play with so many technological toys that something is going to kick back and we're going to have to learn what we're dealing with. And Mather being brave enough to do this on an open forum, highly commendable. And it also should make us look at how we operate on a daily basis with pesticides and other cleaning products and fuels, gas tanks and so forth.

And rather than attack Mather or the program and use it as a fear tactic of what's going to happen to us or our children even, even though that is a concern of ours, to understand how we ourselves our responsible for the health of our environment, and to know that we run off of consumerism and how we're going to impact our economy and everybody who has jobs making whatever widgets are out there. There's no blame here as far as I see. It's just a learning process.

And I thank you.

SITE MANAGER WONG: You're welcome.

Any other comments?

All right. Then we'll conclude this portion of the meeting. And if anyone wants to ask any more questions or wants any more information, we'll be available here and you can ask us.

Again, my office is the Wing headquarters building over there. If you have any other concerns, you have my address and the phone number. Stop by any time and we can discuss your concerns, let you know what our information is, our data is, and help you alleviate those concerns.

(Thereupon the Public Hearing on the Proposed Plan for Environmental Cleanup at the Basewide Operable Unit Sites was concluded at 7:50 p.m.)

CERTIFICATE OF REPORTER

I, James F. Peters, a Certified Shorthand Reporter of the State of California, and a Registered Professional Reporter do hereby certify:

That I am a disinterested person herein; that the foregoing Public Hearing on the Proposed Plan for Environmental Cleanup at the Basewide Operable Unit Sites, was reported by me, James F. Peters, and thereafter transcribed into typewriting.

I further certify that I am not of counsel or attorney for any of the parties to said hearing, nor in any way interested in the outcome of said hearing.

IN WITNESS WHEREOF, I have hereunto set my hand this 9th day of June, 1997.

(Signed)

James F. Peters, CSR, RPR

Certified Shorthand Reporter

License Number 10063

TAB

Section 7

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30 Dec 92	CVRWQCB comments on Background Soil Sampling Strategy	Mosbacher, Michael H California Regional Water Quality Control Board	892
Jan 93	Work Plan, Comprehensive Baseline Risk Assessment	IT Corp.	506
Jan 93	Draft No Further Action Decision Document, OT-23	IT Corp.	507
19 Jan 93	IT Letter with Comments to Base on Draft Final Work Plan, Comprehensive Baseline Risk Assessment	Dove, F Harvey IT Corp.	514
26 Jan 93	SAF/MIQ Letter to EPA on Dispute Resolution Under the Federal Facility Agreement	Vest, Gary D Deputy Assistant Secretary of the Air Force	515
25 Mar 93	Transcript of 25 Mar 93 RPM Meeting	Bailey, Doris M Peters Shorthand Reporting Corp.	534
26 Mar 93	Transcript of 26 Mar 93 TRC Meeting	Nicol, Janet H Peters Shorthand Reporting Corp.	535
Apr 93	RI Report, Volume 1 of 12, Group 2 Sites	Battelle Environmental Management Operations	1624
Apr 93	RI Report, Volume 2 of 12, Group 2 Sites	Battelle Environmental Management Operations	1625
Apr 93	RI Report, Volume 3 of 12, Group 2 Sites	Battelle Environmental Management Operations	1626
Apr 93	RI Report, Volume 4 of 12, Group 2 Sites	Battelle Environmental Management Operations	1627
Apr 93	RI Report, Volume 5 of 12, Group 2 Sites	Battelle Environmental Management Operations	1628

DOC. DATE	SUBJECT OR TITLE	AUTHOR or CORP. AUTHOR	AR FILE NUMBER
Apr 93	RI Report, Volume 6 of 12, Group 2 Sites	Battelle Environmental Management Operations	1629
Apr 93	RI Report, Volume 7 of 12, Group 2 Sites	Battelle Environmental Management Operations	1630
Apr 93	RI Report, Volume 8 of 12, Group 2 Sites	Battelle Environmental Management Operations	1631
Apr 93	RI Report, Volume 9 of 12, Group 2 Sites	Battelle Environmental Management Operations	1632
Apr 93	RI Report, Volume 10 of 12, Group 2 Sites	Battelle Environmental Management Operations	1633
Apr 93	RI Report, Volume 11 of 12, Group 2 Sites	Battelle Environmental Management Operations	1634
Apr 93	RI Report, Volume 12 of 12, Group 2 Sites	Battelle Environmental Management Operations	1635
16 Apr 93	CVRWQCB Letter to Base Concerning Additional Field Investigation Consensus Statement	Williams, Camilla California Regional Water Quality Control Board	543
03 May 93	Request for Historical Data on use of Pesticides and Herbicides	Blank, Richard A, LtCol 323rd Flying Training Wing	873
16 May 93	U.S.-EPA's review of Comprehensive Baseline Risk Assessment's 1) Human Health Risk Assessment and 2) Ecological Risk Assessment	Lowe, Debbie EPA Region IX	1047
16 May 93	EPA Draft Comments on Human Health Risk Assessment of CBRA	Serda, Sophia EPA Region IX	546
18 May 93	Draft Comments on Draft Comprehensive Baseline Risk Assessment	Christopher, John P California Department of Toxic Substances Control	547

DOC. DATE	SUBJECT OR TITLE	AUTHOR or CORP. AUTHOR	AR FILE NUMBER
07 Jun 93	CVRWQCB Letter to Base Providing Comments on Draft Final Work Plan, Appendix A: Background Soils and Groundwater Sampling Strategy	Taylor, James D California Regional Water Quality Control Board	553
07 Jun 93	EPA Letter to Base Transmitting Comments on Appendix A of Draft Final Comprehensive Baseline Risk Assessment Work Plan and Background Soils Sampling Strategy	Swarthout, Brian EPA Region IX	554
15 Jun 93	21 May 1993 Remedial Project Manager's Meeting Minutes	AFBCA/OL-D	958
28 Jun 93	Proposed Revision to Appendix D to Federal Facility Agreement	Smith, Charles H AFBCA/OL-D	875
30 Jun 93	EPA Letter to Base Concerning Extension for Submittal of Focused FS Reports for Groundwater/Comprehensive and Soils OUs	Swarthout, Brian EPA Region IX	561
Jul 93	Final Installation Restoration Program Data Summary	IT Corp.	915
Jul 93	Draft EE/CA Report, ST-20, ST-29, and ST-32	IT Corp.	563
07 Jul 93	DTSC Letter to Base on Draft Technical Memorandum Group 3 Sites	Strong, Kent California Department of Toxic Substances Control	564
09 Jul 93	EPA Letter with Comments to Base on Draft Technical Memorandum Group 3 Sites	Swarthout, Brian EPA Region IX	567
09 Jul 93	CVRWQCB Letter with Comments to Base on Draft Technical Memorandum Group 3 Sites	Williams, Camilla California Regional Water Quality Control Board	568

DOC. DATE	SUBJECT OR TITLE	AUTHOR or CORP. AUTHOR	AR FILE NUMBER
16 Jul 93	DTSC Letter to Base on Draft Final Work Plan, Appendix A, Groundwater and Soil Sampling	Strong, Kent California Department of Toxic Substances Control	572
22 Jul 93	RWQCB's letter regarding Draft Proposed Plan for Landfill OU	Williams, Camilla California Regional Water Quality Control Board	1079
30 Jul 93	CVRWQCB Letter to Base on Draft Technical Memorandum Group 3 Sites	Williams, Camilla California Regional Water Quality Control Board	574
30 Jul 93	EPA Letter to Base on Draft Technical Memorandum Group 3 Sites	Swarthout, Brian EPA Region IX	575
Aug 93	Draft Final Work Plan, Comprehensive Baseline Risk Assessment	IT Corp.	580
10 Aug 93	DTSC Letter to Base on Draft Technical Memorandum Group 3 Sites	Strong, Kent California Department of Toxic Substances Control	576
16 Aug 93	DTSC Letter to Base on Draft Technical Memorandum Group 3 Sites	Strong, Kent California Department of Toxic Substances Control	577
20 Aug 93	27 July 1993 Remedial Project Manager (BCT) Meeting Minutes	AFBCA/OL-D	957
31 Aug 93	IT Letter to AFCEE/ESB on RPM and TRC Meeting Minutes	Shafer, William C IT Corp.	579
03 Sep 93	IT Letter to Battelle on Response to Regulator Comments on Technical Memorandum for Group 3 Sites and Addendum	Robinson, Dennis M IT Corp.	581
22 Sep 93	CVRWQCB Letter to Base on Draft Final Work Plan, Comprehensive Baseline Risk Assessment	Williams, Camilla California Regional Water Quality Control Board	582

DOC. DATE	SUBJECT OR TITLE	AUTHOR or CORP. AUTHOR	AR FILE NUMBER
24 Sep 93	EPA Letter to Base on Draft Final Work Plan, Comprehensive Baseline Risk Assessment	Swarthout, Brian EPA Region IX	583
01 Oct 93	RWQCB's review comments on Draft Engineering Evaluation/Cost Analysis for Site 20, 29, and 32	Williams, Camilla California Regional Water Quality Control Board	586
01 Oct 93	DTSC Letter with Comments to Base on Draft EE/CA Report, ST-20, ST-29, and ST-32	Strong, Kent California Department of Toxic Substances Control	587
04 Oct 93	DTSC Memorandum with Comments on Draft EE/CA Report, ST-20, ST-29, and ST-32	Vest, Mark D California Department of Toxic Substances Control	588
13 Oct 93	Transcript of 13 Oct 93 TRC Meeting	Nicol, Janet H Peters Shorthand Reporting Corp.	589
26 Oct 93	Management Action Plan	Radian Corp.	392
28 Oct 93	RWQCB's review of Draft Technical Memorandum for Group 3 Sites	Williams, Camilla California Regional Water Quality Control Board	1066
28 Oct 93	EPA Letter to Base on Draft Final Technical Memorandum for Group 3 Sites	Swarthout, Brian EPA Region IX	664
29 Oct 93	Investigation of Disposal Site East of Facility 7080 and 7090, Site 10C	AFBCA/OL-D	1081
04 Nov 93	DTSC Letter to Base on Draft Technical Memorandum Group 3 Sites	Strong, Kent California Department of Toxic Substances Control	595
23 Nov 93	DTSC Letter to Base on Establishment of Restoration Advisory Board	Wang, David California Department of Toxic Substances Control	599
29 Nov 93	SOW for Contaminated Soil Removal, ST-20	US Army Corps of Engineers - Omaha District	666

DOC. DATE	SUBJECT OR TITLE	AUTHOR or CORP. AUTHOR	AR FILE NUMBER
Dec 93	Basewide Environmental Baseline Survey	Department of the Air Force	955
Dec 93	Final EE/CA Report, ST-20, ST-29, and ST-32	IT Corp.	603
01 Dec 93	EPA Letter to AFCEE Providing Comments on Preliminary Final Environmental Baseline Survey	Swarthout, Brian EPA Region IX	606
06 Dec 93	DTSC Letter to Base Providing Comments on the Background Inorganic Soils Report	Strong, Kent California Department of Toxic Substances Control	609
08 Dec 93	CVRWQCB Letter to Base Providing Comments on the Background Inorganic Soils Report	Williams, Camilla California Regional Water Quality Control Board	611
29 Dec 93	U.S. EPA's review comments on Draft Final Engineering Evaluation/Cost Analysis for Site 20, 29, and 32	Swarthout, Brian EPA Region IX	1053
06 Jan 94	Earth Technology's Giant Garter Snake Survey	Hildreth, Jane Earth Technology Corp.	1052
10 Jan 94	DTSC Letter to Base Transmitting Comments on Draft Final EE/CA, ST-20, ST-29, ST-32	Strong, Kent California Department of Toxic Substances Control	618
12 Jan 94	Removal of Hydrant Fueling System	Erikson, Susan Sacramento County Environmental Management Department	1096
18 Jan 94	EPA Letter with Review Comments to AFBDA/NW-D on EE/CA, ST-20, ST-29 and ST-32	Lowe, Debbie EPA Region IX	671

DOC. DATE	SUBJECT OR TITLE	AUTHOR or CORP. AUTHOR	AR FILE NUMBER
19 Jan 94	State's concurrence with Final Engineering Evaluation and Cost Analysis (EE/CA)	Strong, Kent California Department of Toxic Substances Control	1051
24 Jan 94	13 January 1994 Restoration Advisory Board (RAB) Meeting Minutes	Smith, Charles H AFBCA/OL-D	619
Feb 94	Proposed Plan for Environmental Cleanup at Three Sites on Mather Air Force Base	AFBCA/OL-D	620
01 Feb 94	State's comments on Draft Proposed Plan for Environmental Cleanup at Three Sites (20, 29, and 32)	Strong, Kent California Department of Toxic Substances Control	1050
01 Feb 94	Public Notice for 1) Remediation of Landfill Sites 1-6, 2) Interim Actions at Sites 20, 29, and 32, and 3) Use of treated groundwater for irrigation	AFBCA/OL-D	1093
01 Feb 94	DTSC Letter to Base on Draft Proposed Plan for Environmental Cleanup, ST-20, ST-29 and ST-32	Strong, Kent California Department of Toxic Substances Control	672
01 Feb 94	DTSC Letter to Base on Environmental Baseline Survey	Strong, Kent California Department of Toxic Substances Control	673
15 Feb 94	Department of Health Services comments on Basewide Environmental Baseline Survey	Williams, Camilla California Regional Water Quality Control Board	1048
15 Feb 94	Transcript of 15 Feb 94 Public Hearing	Nicol, Janet H Peters Shorthand Reporting Corp.	623

DOC. DATE	SUBJECT OR TITLE	AUTHOR or CORP. AUTHOR	AR FILE NUMBER
15 Feb 94	CVRWQCB Letter with Comments to DTSC on Environmental Baseline Survey	Williams, Camilla California Regional Water Quality Control Board	674
04 Mar 94	IT Corp Letter to Battelle on Preliminary Draft Removal Action Memorandum, ST-20, ST-29 and ST-32	Robinson, Dennis M IT Corp.	676
23 Mar 94	CVRWQCB Letter to Base Concerning No Further Action Sites, and Additional Field Investigation Dispute	Williams, Camilla California Regional Water Quality Control Board	629
16 May 94	State's request for Federal Facility Agreement Extension to Draft Comprehensive Baseline Risk Assessment	Strong, Kent California Department of Toxic Substances Control	1046
18 May 94	State's comments on Draft Comprehensive Baseline Risk Assessment	Strong, Kent California Department of Toxic Substances Control	1045
19 May 94	EPA Letter to Base on Draft Removal Action Memorandum, ST-20, ST-29 and ST-32	Lowe, Debbie EPA Region IX	679
20 May 94	State's comments on the Preliminary Draft Removal Action Memorandum	Strong, Kent California Department of Toxic Substances Control	1044
14 Jun 94	IT Corp.'s surrogate toxicity values for Comprehensive Baseline Risk Assessment (COBRA)	Dove, Harvey IT Corp.	1043
16 Jun 94	IT Corp.'s Strawman Outline for Additional Ecological Risk Assessment sampling	Dove, Harvey IT Corp.	1042
17 Jun 94	U.S.-EPA's summary of Comprehensive Baseline Risk Assessment revisions	Lowe, Debbie EPA Region IX	1041

DOC. DATE	SUBJECT OR TITLE	AUTHOR or CORP. AUTHOR	AR FILE NUMBER
23 Jun 94	CVRWQCB Letter to DTSC Providing Comments on Draft Additional Field Investigation Report	Taylor, James D California Regional Water Quality Control Board	129
23 Jun 94	Draft Groundwater and Soil Operable (OU-2, OU-3) Units Additional Field Investigation Remedial Investigation Report	Taylor, James California Regional Water Quality Control Board	714
24 Jun 94	DTSC Letter to Base Providing Comments on Draft RI Additional Field Investigation Report	Strong, Kent California Department of Toxic Substances Control	139
24 Jun 94	EPA Letter to Base Providing Comments on Draft RI Additional Field Investigation Report	Lowe, Debbie EPA Region IX	281
29 Jun 94	U.S. EPA's comments on the Strawperson Outline for Additional Ecological Sampling	Lowe, Debbie EPA Region IX	1040
Jul 1994	RAB comments on Proposed Plan for Landfill ROD, RAM, Draft Comprehensive Baseline Risk Assessment	RAB members	995
14 Jul 94	U.S. EPA's suggested inclusions to program strategies of Additional Field Investigation, Focused Feasibility Study, and Risk Assessment reports	Lowe, Debbie EPA Region IX	1038
18 Jul 94	Air Force's request for extension of Draft Final Comprehensive Baseline Risk Assessment Report	Wong, Anthony AFBCA/OL-D	1032
18 Jul 94	Note on U.S. EPA's program strategy letter involving Additional Field Investigation, Focused Feasibility Study, and Risk Assessment Reports	Hughes, William Operational Technologies Corp	1039

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19 Jul 94	Request for Extension for Draft Final Removal Action Memorandum	Wong, Anthony AFBCA/OL-D	1036
26 Jul 94	IT Corp Memo Transmitting Comments and Responses to the Draft Additional Field Investigation	IT Corp.	681
Aug 94	RI, Final Additional Field Investigation Report, Vol I of VI, Text and Appendices A-B	IT Corp.	632
Aug 94	RI, Final Additional Field Investigation Report, Vol II of VI, Appendix C	IT Corp.	633
Aug 94	RI, Final Additional Field Investigation Report, Vol III of VI, Appendices D-F	IT Corp.	634
Aug 94	RI, Final Additional Field Investigation Report, Vol IV of VI, Appendices G-L	IT Corp.	635
Aug 94	RI, Final Additional Field Investigation Report, Vol V of VI, Appendix M	IT Corp.	636
Aug 94	RI, Final Additional Field Investigation Report, Vol VI of VI, Appendix M (Cont'd)	IT Corp.	637
18 Aug 94	Draft Final Mather Baseline Risk Assessment Consensus Statement for Delivery of Draft Final Report and evolution of name from Comprehensive Baseline Risk Assessment	Smith, Charles H., AFBCA/OL-D; Lowe, Debbie, EPA Region IX; Strong, Kent, California Department of Toxic Substances Control	1035

DOC. DATE	SUBJECT OR TITLE	AUTHOR or CORP. AUTHOR	AR FILE NUMBER
18 Aug 94	AFBCA submits proposed revision to Appendix D to accommodate Request for Extension, Draft Final Comprehensive Baseline Risk Assessment Report	Wong, Anthony AFBCA/OL-D	981
19 Aug 94	Preliminary Summary Tables for Comprehensive Baseline Risk Assessment Revised Risk Estimates	IT Corp.	794
23 Aug 94	Proposed Scope for Additional Field Investigation	Wong, Anthony AFBCA/OL-D	1034
23 Aug 94	EPA Letter to DTSC on Removal Action Memorandum, ST-20, ST-29 and ST-32	Lowe, Debbie EPA Region IX	690
29 Aug 94	Course of Action to Finalize Removal Action Memorandum for Sites 20, 29, and 32	Wong, Anthony AFBCA/OL-D	1033
31 Aug 94	EPA Letter to SWRCB on Proposed ARARs, ST-20	Estrada, Thelma K EPA Region IX	692
Sep 94	Removal Action Memorandum, ST-20, ST-29 and ST-32	IT Corp.	703
Sep 94	Draft Final UST Removal and Fuel Hydrant System Decommissioning Report, Vol I of II	OGDEN Environmental and Energy Services	704
Sep 94	Draft Final UST Removal and Fuel Hydrant System Decommissioning Report, Vol II of II	OGDEN Environmental and Energy Services	705
Sep 94	Draft Final UST Removal and Fuel Hydrant System Decommissioning Report, Appendix A and B	OGDEN Environmental and Energy Services	706
Sep 94	Draft Final UST Removal and Fuel Hydrant System Decommissioning Report, Appendix C	OGDEN Environmental and Energy Services	707

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Sep 94	Draft Final UST Removal and Fuel Hydrant System Decommissioning Report, Appendix D	OGDEN Environmental and Energy Services	708
02 Sep 94	DTSC Letter to EPA on Proposed ARARs, ST-20	Small, Suzanne California Department of Toxic Substances Control	696
09 Sep 94	Sacramento Metropolitan Air Quality Management District's Regulatory Oversight of Remedial Activities at Military Bases	DeGuzman, Jorge Sacramento County Air Pollution Control District	977
12 Sep 94	Response to Agency Comments and Revised Response to Comments on the Removal Action Memorandum	Marks, Barbara IT Corp.	829
23 Sep 94	Mather Baseline Risk Assessment (MBRA) suggested changes and effects on the Groundwater and Soil Operable Unit Focused Feasibility Study	Lowe, Debbie EPA Region IX	715
26 Sep 94	Camilla Williams replacement by James Taylor, CVRWQCB	Vorster, Antonia California Regional Water Quality Control Board	976
28 Sep 94	IT Corp Letter to AFCEE Transmitting Comments on Appendix J of Draft Mather Baseline Risk Assessment	Dove, F Harvey IT Corp.	701
28 Sep 94	Draft Mather Baseline Risk Assessment revised comment resolution	Dove, F. Harvey, Ph.D., P.H. IT Corp.	716
04 Oct 94	October 1994 BCT Meeting Minutes	AFBCA/OL-D	922
21 Oct 94	Transmittal of Revised Scope of Work for Upcoming Additional Field Investigation	Smith, Charles H AFBCA/OL-D	867

DOC. DATE	SUBJECT OR TITLE	AUTHOR or CORP. AUTHOR	AR FILE NUMBER
17 Nov 94	Review Comments on Draft Quality Project Plan for Mather Pipeline Removal Projects	Ogden Environmental and Energy Services	904
17 Nov 94	State's announcement of applicability of Resolution 92-49	Strong, Kent California Department of Toxic Substances Control	1060
21 Nov 94	Mather Phase II Detailed Ecological Risk Assessment: Proposed Tasks	Meyers-Schone, Linda IT Corp.	1031
Dec 94	Final Quality Project Plans for Fuel Distribution System Pipeline Removal and Abandonment-In-Place	OGDEN Environmental and Energy Services	693
07 Dec 94	Proposed Tasks for the Mather Phase II Ecological Risk Assessments	Meyers-Schone, Linda IT Corp.	1030
21 Dec 94	Draft Petroleum Exclusion Language for the Soil and Groundwater Operable Units Focused Feasibility Study	Lowe, Debbie EPA Region IX	1058
21 Dec 94	Identification of ARARs	Strong, Kent California Department of Toxic Substances Control	917
Jan 95	10 January 1995 BCT Meeting Minutes	AFBCA/OL-D	924
Jan 95	Draft Health and Safety Plan for the Mather Soils Management Area (OU-3)	Montgomery Watson	720
17 Jan 95	U.S. EPA's comments on Draft Environmental Operation and Maintenance Plan for the Soil Bioremediation at the Old RV Storage Area	Lowe, Debbie EPA Region IX	1026

DOC. DATE	SUBJECT OR TITLE	AUTHOR or CORP. AUTHOR	AR FILE NUMBER
23 Jan 95	U.S. EPA's comments on the Quality Program Plan, Vol. IV: Sampling and Analysis Plan for Mather AFB Remedial Action Contract	Lowe, Debbie EPA Region IX	1025
23 Jan 95	ARARs Identified by the Sacramento Metropolitan Air Quality Management District for the Groundwater Operable Unit and Soil Operable Unit Focused Feasibility Study	DeGuzman, Jorge Sacramento Metropolitan Air Quality Management District	807
24 Jan 95	U.S. EPA's comments on the Draft Quality Program Plan for Soil Treatment at the Old RV Storage Area, Section 3, Sampling and Analysis Plan	Lowe, Debbie EPA Region IX	1024
25 Jan 95	15 November 1994 BCT Meeting Minutes	AFBCA/OL-D	724
30 Jan 95	30 November 1994 Restoration Advisory Board (RAB) Meeting Minutes	Byrne, Ruth AFBCA/OL-D	937
31 Jan 95	Montgomery Watson's Meeting Notes for 10-11 January BCT Meeting	Scott, John Montgomery Watson Americas, Inc	1011
07 Feb 95	State's comments on Draft Technical Plans for Site 20	Strong, Kent California Department of Toxic Substances Control	1010
07 Feb 95	Groundwater and Soils Operable Unit (OU-2, OU-3) Focused Feasibility Study State ARARs	Strong, Kent California Department of Toxic Substances Control	732
10 Feb 95	Cover letter for State's comments on Draft Technical Plans and Sampling and Analysis Plan for Site 20	Bernheisel, Paul AFCEE/ERB	1007
14 Feb 95	U.S. EPA's comments on Draft Technical Plans and Quality Program Plans for Site 20	Lowe, Debbie EPA Region IX	1009

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22 Feb 95	State's comments on Draft Environmental Operation and Maintenance Plan for Soil Bioremediation at the Old RV Storage Area	Strong, Kent California Department of Toxic Substances Control	1004
23 Feb 95	U.S. EPA's comments on Draft Phase II Ecological Risk Assessment Work Plan	Lowe, Debbie EPA Region IX	1002
24 Feb 95	Thelma Estrada, U.S. EPA's, comment responses on the revised ARARs Table for the Soil and Groundwater Feasibility Study	Estrada, Thelma EPA Region IX	719
08 Mar 95	Proposed Revisions to Site 20 Sample Analysis Plan.	Scott, John Montgomery Watson Americas, Inc	1000
14 Mar 95	08 February 1995 Restoration Advisory Board (RAB) Meeting Minutes	Byrne, Ruth AFBCA/OL-D	938
17 Mar 95	Cleanup Criteria and Monitoring for VOC's Discussion Paper for Draft Groundwater and Soils Operable Unit (OU-2, OU-3) Focused Feasibility Study	Taylor, James California Regional Water Quality Control Board	741
20 Mar 95	"White Paper" for Groundwater and Soil Operable Units (OU-2, OU-3) Focused Feasibility Study	Wong, Tony AFBCA/OL-D	742
27 Mar 95	28 February 1995 BCT Meeting Minutes	AFBCA/OL-D	925
30 Mar 95	State's comments on Soil Gas "White Paper"	Strong, Kent California Department of Toxic Substances Control	1055
12 Apr 95	Solicitation of Applicable or Relevant and Appropriate Requirements (ARARs) for the Groundwater and Soil Operable Units (OU-2, OU-3) Focused Feasibility Study	Wong, Anthony AFBCA/OL-D	731

DOC. DATE	SUBJECT OR TITLE	AUTHOR or CORP. AUTHOR	AR FILE NUMBER
18 Apr 95	Draft Final Phase II Detailed Ecological Risk Assessment Work Plan for Groundwater and Soils OU	IT Corp.	723
18 Apr 95	Draft Health and Safety Plan for the Mather Soils Management Area (OU-3), comments from AFBCA	Smith, Charles H AFBCA/OL-D	764
16 May 95	U.S. EPA suggestions regarding Special Status Plant, Wildlife, and Species Assessment	Lowe, Debbie EPA Region IX	850
26 May 95	Quality Program Plan for Mather AFB	Montgomery Watson Americas, Inc.	923
Jun 95	Draft Final Technical Plan and Quality Program Plan for Site 20	Montgomery Watson Americas, Inc.	781
07 Jun 95	DTSC ARARs for the Groundwater and Soil Operable Units (OU-2, OU-3) Record of Decision	Strong, Kent AFBCA/OL-D	743
14 Jun 95 25 July 95	31 May - 01 June 1995 BCT Meeting Minutes, and corrections to same	Wong, Anthony C. Smith, Charles H., Phd, P.E. AFBCA	926
27 Jun 95	Air Force review of ARARs on Draft Mather Groundwater and Soil Operable Units (OU-2, OU-3) ROD	Rupe, Sam C., LtCol Department of the Air Force, Office of the Regional Counsel/ Western Region	751
10 Jul 95	26 April 1995 Restoration Advisory Board Meeting Minutes	Byrne, Ruth AFBCA/OL-D	939
12 Jul 95	Cal-EPA's and Regional Water Quality Control Board's comments on the Draft Remedial Investigation, Additional Site Characterization for the Soil and Groundwater Operable Units	Taylor, James Regional Water Quality Control Board	749

DOC. DATE	SUBJECT OR TITLE	AUTHOR or CORP. AUTHOR	AR FILE NUMBER
14 Jul 95	US-EPA request for extended review of Remedial Investigation, Additional Site Characterization, and Remedial Design Support Draft Work Plan	Lowe, Debbie EPA Region IX	748
21 Jul 95	US-EPA's comments on Draft Remedial Investigation, Additional Site Characterization and Remedial Design Support Work for Soil and Groundwater Operable Units	Lowe, Debbie EPA Region IX	746
21 Jul 95	Dioxin and Furan Sampling Request in the Draft Remedial Investigation, Additional Site Characterization, and Remedial Design Work Plan	Strong, Kent California Department of Toxic Substances Control	813
24 Jul 95	19 July 1995 Restoration Advisory Board Meeting Minutes	Smith, Charles H. AFBCA	940
25 Jul 95	12-13 July 1995 BCT Meeting Minutes	Smith, Charles H. AFBCA	927
28 Jul 95	EPA Request for Extension for Review and Comment on Mather Baseline Risk Assessment	Lowe, Debbie EPA Region IX	758
28 Aug 95	RWQCB's Waste Discharge Requirements for Soil Bioremediation at the Old RV Storage Area	Crooks, William Regional Water Quality Control Board	1072
30 Aug 95	U.S. EPA's request for extension for review and comment of Draft Final Mather Baseline Risk Assessment	Lowe, Debbie EPA Region IX	836
31 Aug 95	Approval of Extension for Review of Draft Final Mather Baseline Risk Assessment to 15 Sep 1995	Smith, Charles H AFBCA/OL-D	771
05 Sep 95	Special-Status Plant and Wildlife Species Assessment for Landfill Areas	Sugnet & Associates	849

DOC. DATE	SUBJECT OR TITLE	AUTHOR or CORP. AUTHOR	AR FILE NUMBER
07 Sep 95	29-30 August 1995 BCT Meeting Minutes	Smith, Charles H. AFBCA	928
07 Sep 95	30 August 1995 Restoration Advisory Board Meeting Minutes	Smith, Charles H. AFBCA	941
12 Sep 95	State's request for extension for review of the Draft Final Mather Baseline Risk Assessment	Strong, Kent California Department of Toxic Substances Control	827
14 Sep 95	AFCEE requests extension for delivery of MBRA from HSC/PKVA	Loudon, Fred AFCEE/ERB	1115
18 Sep 95	Revised Proposed Waste Discharge Requirements (WDRs) for Soil Bioremediation Unit	Rupe, Sam, Lt Col Dept. of Air Force, Office of the Regional Counsel/Western Region	1106
19 Sep 95	U.S. EPA approves extension request for Draft Final Mather Baseline Risk Assessment (MBRA)	Lowe, Debbie EPA Region IX	935
29 Sep 95	27-28 September 1995 BCT Meeting Minutes	Smith, Charles H. AFBCA	929
Oct 95	Additional Site Characterization and Remedial Design Support Work (vol 1 Work Plan; vol 2-4 SAP, QAPP, and HSP)	IT Corp.	1118
05 Oct 95	Draft Final Mather Baseline Risk Assessment, comments from EPA Region IX	Lowe, Debbie EPA Region IX	768
06 Oct 95	Mather Baseline Risk Assessment comments from California Department of Toxic Substances Control	Strong, Kent California Department of Toxic Substances Control	767

DOC. DATE	SUBJECT OR TITLE	AUTHOR or CORP. AUTHOR	AR FILE NUMBER
16 Oct 95	11 October 1995 Amended Restoration Advisory Board Meeting Minutes	Hovander, Brian, P.E. AFBCA	943
19 Oct 95	Contractor Response to Regulators' Comments on the Draft Final Mather Baseline Risk Assessment	Meyers-Schone, Linda IT Corp.	1099
27 Oct 95	State's review comments on Additional Site Characterization Contract Modification, Draft Work Plan Addendum	Christopher, John California Department of Toxic Substances Control	1069
14 Nov 95	07-08 November 1995 BCT Meeting Minutes	Smith, Charles H. AFBCA	930
16 Nov 95	15 November 1995 Restoration Advisory Board Meeting Minutes	Smith, Charles H. AFBCA	942
20 Nov 95	State's request for delivery extension for Draft Final Mather Baseline Risk Assessment and Draft Final Soils OU and Groundwater OU Record of Decision	Strong, Kent California Department of Toxic Substances Control	936
21 Nov 95	State's Request for Additional Extensions on Revised Draft Final Mather Baseline Risk Assessment and Draft Final Soil and Groundwater ROD	Smith, Charles H AFBCA/OL-D	971
22 Nov 95	Comments from the State on Additional Site Characterization Contract Modification, Draft Workplan Addendum	Strong, Kent California Department of Toxic Substances Control	818
22 Nov 95	U.S. EPA's Request for Extended Review of Additional Site Characterization Work Plan Addendum	Lowe, Debbie EPA Region IX	825
Dec 1995	Draft Report of Analytical Results Site 20 Characterization Investigation	Montgomery Watson Americas, Inc.	786

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01 Dec 95	US-EPA Request for Extension for Review of Additional Site Characterization Work Plan Addendum	Lowe, Debbie EPA Region IX	820
05 Dec 95	U.S. EPA's review comments on the Comprehensive and Final Baseline Risk Assessment Workplan	Lowe, Debbie EPA Region IX	1098
05 Dec 95	U.S. EPA's comments on Draft Additional Site Characterization Addendum Work Plan	Lowe, Debbie EPA Region IX	822
13 Dec 95	Request for Extension for Community Relations Plan	Smith, Charles H AFBCA/OL-D	803
18 Dec 95	Estimate of Constraints to Reuse Posed by Contamination and Remediation at Mather AFB	Smith, Charles H AFBCA/OL-D	816
19 Dec 95	Draft Final Mather Baseline Risk Assessment, vol. 1-4	IT Corp.	762
Jan 96	Additional Site Characterization for Groundwater, Soil, and Basewide Operable Units, vol. 1-4 (Final Work Plan, SAP, QAPP, and Health and Safety Plan)	IT Corp.	765
Jan 96	January 1996 Draft Final Community Relations Plan	Gutierrez-Palmenberg, Inc.	805
10 Jan 96	09-10 January 1996 BCT Meeting Minutes	Dennis, Randall E. AFBCA	931
17 Jan 96	Mather RAB Meeting Minutes, 10 January, 1996	AFBCA/DBM	944
07 Feb 96	Work Plan Addendum, Additional Site Characterization Contract Modification Plan Addendum	IT Corp.	761

DOC. DATE	SUBJECT OR TITLE	AUTHOR or CORP. AUTHOR	AR FILE NUMBER
16 Feb 96	State's comments on Draft Report of Analytical Results Site 20 Characterization Investigation	Strong, Kent California Department of Toxic Substances Control	961
20 Feb 96	U.S. EPA requests a two week extension for review of the Draft Landfill Closure Plan and a seven day extension to review the Report of Analytical Results, Site 20, and an additional three days to review the Draft Technical Plans and Quality Program Plan for Removal Actions for Soil Operable Unit Sites 56, 59, 60, 62, and 65	Lowe, Debbie EPA Region IX	948
21 Feb 96	State's comments and ARARs from IWMB regarding disposal of treated soils from Mather bioremediation unit into Site 7	Strong, Kent California Department of Toxic Substances Control	985
23 Feb 96	U.S. EPA's comments on Draft Technical Plans and Draft Quality Program Plan for Removal Actions for Soils Operable Units, Sites 56, 59, 60, 62, and 65 and Draft Report of Analytical Results, Site 20 Characterization Investigation Report	Lowe, Debbie EPA Region IX	986
18 Mar 96	Mather RAB Meeting Minutes, 13 March, 1996	AFBCA/DBM	1598
12 Mar 96	Draft Technical Information Report on Soil Vapor Extraction Pilot Testing at Sites 18, 39, and 57	Loy, Ken IT Corp.	1014
18 Mar 96	13 March 1996 RAB Meeting Minutes	Wong, Anthony C. AFBCA	1076
20 Mar 96	13-14 March 1996 BCT Meeting Summary	Wong, Anthony C. AFBCA	1077

DOC. DATE	SUBJECT OR TITLE	AUTHOR or CORP. AUTHOR	AR FILE NUMBER
26 Mar 96	Air Force's solicitation from State of potential ARARs pertaining to Final OU	Wong, Anthony AFBCA/OL-D	1086
29 Apr 96	Final Record of Decision for Soil Operable Unit Sites and Groundwater Operable Unit Plumes	AFBCA/OL-D	945
08 May 96	Mather RAB Meeting Minutes, May 1, 1996	AFBCA/DBM	1599
09 May 96	Minutes of the BRAC Cleanup Team Meeting, 1 and 2 May, 1996	AFBCA/DBM	1580
17 May 96	Final Technical Report, Pipeline Removal and Abandonment-in Place, for Delivery Order 21	Scher, Patrick OGDEN	1219
19 Jun 96	Minutes of the BRAC Cleanup Team Meeting and Reuse Meeting, 18 - 20 June, 1996	AFBCA/DBM	1581
24 Jun 96	Mather RAB Meeting Minutes, 18 June, 1996	AFBCA/DBM	1600
25 Jun 96	Draft Final Technical Information Report on Soil Vapor Extraction Pilot Testing At Installation Restoration Program Sites 18, 39, and 57	IT Corp.	1130
01 Jul 96	Mather AFB Federal Facility Agreement Appendix D Document Deliverable Dates	Wong, Anthony C. AFBCA/OL-D	1140
25 Jul 96	Mather BCT and Reuse Meeting Minutes 23-24 July 1996	AFBCA/DBM	1582
31 Jul 96	Mather RAB Meeting Minutes, 23 July, 1996	AFBCA/DBM	1601
Sep 96	Additional Site Characterization and Final Basewide OU Remedial Investigation Report, vol 1 of 6	IT Corp.	1636

DOC. DATE	SUBJECT OR TITLE	AUTHOR or CORP. AUTHOR	AR FILE NUMBER
Sep 96	Additional Site Characterization and Final Basewide OU Remedial Investigation Report, vol 2 of 6	IT Corp.	1637
Sep 96	Additional Site Characterization and Final Basewide OU Remedial Investigation Report, vol 3 of 6	IT Corp.	1638
Sep 96	Additional Site Characterization and Final Basewide OU Remedial Investigation Report, vol 4 of 6	IT Corp.	1639
Sep 96	Additional Site Characterization and Final Basewide OU Remedial Investigation Report, vol 5 of 6	IT Corp.	1640
Sep 96	Additional Site Characterization and Final Basewide OU Remedial Investigation Report, vol 6 of 6	IT Corp.	1641
10 Sept 96	Memorandum for IT, Review of Contractor's Response to Comments on the Revised Draft of the Comprehensive Baseline Risk	Watts, Debra, Major HQ AFCEE/ERB	1173
17 Sep 96	Transmittal of Removal Action Memorandum (RAM) for Site 10C	Wong, Anthony C. AFBCA/OL-D	1150
19 Sep 96	Transmittal of the Draft Technical Plans and Quality Program Plans for Remedial Action at Site 57 and Remedial Action Pilot Test at Site 10C/68	Wong, Anthony C. AFBCA/OL-D	1153
22 Sep 96	Mather BCT and Reuse Meeting Minutes 11 - 12 September, 1996	AFBCA/DBM	1583
22 Sep 96	Mather RAB Meeting Minutes, 11 September, 1996	AFBCA/DBM	1602

DOC. DATE	SUBJECT OR TITLE	AUTHOR or CORP. AUTHOR	AR FILE NUMBER
23 Sep 96	Submission of the Draft Final Work Plan for Remediation and Closure of Petroleum Sites 19, 20 (facility) 2595 and (facility) 18015, Contract F41624-94-D-8090, Delivery Order 06	Scott, John Montgomery Watson Americas, Inc.	1152
01 Oct 96	Request for FFA Schedule Adjustments, Final CBRA and Draft Proposed Plan	Wong, Anthony C. AFBCA/DBM	1162
15 Oct 96	Mem for IT: Review of Draft Additional Site Characterization and Final Basewide Operable Unit Work Plan Addendum	Watts, Debra, Major HQ AFCEE/ERB	1172
17 Oct 96	Comprehensive Baseline Risk Assessment, Vol I of III	IT Corp.	626
17 Oct 96	Comprehensive Baseline Risk Assessment, Vol II of III, Appendices A-I	IT Corp.	627
17 Oct 96	Comprehensive Baseline Risk Assessment, Vol III of III, Appendices J-L	IT Corp.	628
17 Oct 96	Final Comprehensive Baseline Risk Assessment (transmittal of replacement pages)	Dove, F. Harvey IT Corp.	1175
18 Oct 96	Memorandum for HQ AFCEE/ERB, Comments on Draft Site Characterization and Basewide Operable Unit Work Plan Addendum: IRP sites 86 and 87	Wong, Anthony C. AFBCA/DBM	1174
21 Oct 96	Review of Draft Basewide Operable Unit Focused Feasibility Study, Mather AFB, CA	Watts, Debra, Major HQ AFBCA/EV	1183
21 Oct 96	Request for Addition to Administrative Record Comprehensive Baseline Risk Assessment (CBRA)	Watts, Debra, Major HQ AFCEE/ERB	1191

DOC. DATE	SUBJECT OR TITLE	AUTHOR or CORP. AUTHOR	AR FILE NUMBER
22 Oct 96	Draft Basewide Operable Unit Focused Feasibility Study Report, Mather (Review extension)	Strong, Kent California Department of Toxic Substances Control	1176
31 Oct 96	Comments for Draft Basewide Operable Unit Focused Feasibility Study Report for MAFB	Lowe, Debbie U.S. EPA Region IX	1198
01 Nov 96	Mather BCT and Reuse Meeting Minutes, 23-24 October, 1996	AFBCA/DBM	1584
01 Nov 96	Amended Summary, Mather RAB Meeting, 23 October 1996	AFBCA/DBM	1603
08 Nov 96	Draft Basewide Operable Unit Focused Feasibility Study Report for Mather Air Force Base	Strong, Kent California Department of Toxic Substances Control	1197
12 Nov 96	Lunceford comments to Draft Basewide Focused Feasibility Study	Lunceford, Sandra	1199
18 Nov 96	(Comments on) Draft Final Work Plans for Remediation and Closure of Petroleum Sites 19, 20, 2595 and 18015, Mather Air Force Base(MAFB) Sacramento County	Taylor, James California Regional Water Quality Control Board	1207
19 Nov 96	EPA comments to Draft Technical Plans and Quality Program for Remedial Action at Site 57 and Remedial Action Test at Site 10C/68 for Mather AFB	Lowe, Debbie U.S. EPA Region IX	1206
20 Dec 96	Transmittal of Draft Final Additional Site Characterization and Basewide Operable Unit Work Plan Addendum: IRP Sites 86 and 87	Wong, Anthony C. AFBCA/DBM	1220
23 Dec 96	Mather BCT and Reuse Meeting Minutes, 11-12 December, 1996	AFBCA/DBM	1585

DOC. DATE	SUBJECT OR TITLE	AUTHOR or CORP. AUTHOR	AR FILE NUMBER
23 Dec 96	Mather RAB Meeting Minutes, 11 Dec, 1996	AFBCA/DBM	1604
06 Jan 97	FFA Schedule Adjustments, Draft Final Mather AFB Off-Base Water Supply Contingency Plan, Draft Final Basewide Operable Unit Focused Feasibility Study, and Draft Basewide Operable Unit Proposed Plan	Wong, Anthony C. AFBCA/DBM	1224
10 Jan 97	Review of Draft Site Characterization Report for IRP Sites 86 and 87, Mather AFB, CA	Watts, Debra, Major AFCEE/ERB	1246
13 Jan 97	Transmittal of Final Work Plans for Remediation and Closure of Petroleum Sites 19, 20, 2595, and 18015.	Wong, Anthony C. AFBCA/DBM	1227
13 Jan 97	Transmittal of Draft Final Technical Plans, Quality Program, and Construction Package for Remedial Action at Site 57 and Remedial Action Pilot Test at Site 10C/68	Wong, Anthony C. AFBCA/DBM	1228
13 Jan 97	Transmittal of Draft Final Site Characterization Report for IRP Sites 86 and 87	Wong, Anthony C. AFBCA/DBM	1231
21 Jan 97	Transmittal of Consensus Statement for FFA Schedule Adjustments, Draft Final Basewide Operable Unit Focused Feasibility Study	Wong, Anthony C. AFBCA/DBM	1229
27 Jan 97	Mather BCT and Reuse Meeting Minutes, 15-16 January 1997	AFBCA/DBM	1586
27 Jan 97	Mather Restoration Advisory Board Meeting Minutes, 15 January, 1997	AFBCA/DBM	1605

DOC. DATE	SUBJECT OR TITLE	AUTHOR or CORP. AUTHOR	AR FILE NUMBER
04 Feb 97	FFA Schedule Extension Request for the Draft Final Basewide Operable Unit Focused Feasibility Study, and Draft Basewide Operable Unit Proposed Plan	Wong, Anthony C. AFBCA/DBM	1239
11 Mar 97	Mather BCT and Reuse Meeting Minutes, 26-27 February, 1997	AFBCA/DBM	1587
11 Mar 97	Mather Restoration Advisory Board Meeting Minutes, 26 February, 1997	AFBCA/DBM	1606
08 Apr 97	AFCEE Draft Basewide OU FFS Comments	Loy, Ken IT Corp.	1271
17 Apr 97	EPA comments to the [Draft] Proposed Plan for Environmental Cleanup at the Basewide Operable Unit Sites, May 1997	Salyer, Kathleen U.S. EPA Region IX	1288
18 Apr 97	Mather Restoration Advisory Board Meeting Minutes, 09 April 1997	AFBCA/DBM	1607
19 Apr 97	Transmittal of the Final Basewide Operable Unit Focused Feasibility Study	Wong, Anthony C. AFBCA/DBM	1312
21 Apr 97	Site 7 Acceptance Criteria Table	Taylor, James Regional Water Quality Control Board	1283
21 Apr 97	Air Force Center for Environmental Excellence (AFCEE) Final Basewide OU FFS Comments	Loy, Ken HQ AFCEE/ERB	1337
22 Apr 97	RWQCB comments to Draft Basewide Operable Unit Proposed Plan, Mather Air Force Base (MAFB), Sacramento County	Taylor, James California Regional Water Quality Control Board	1285
23 Apr 97	Mather BCT and Reuse Meeting Minutes, 09-10 April, 1997	AFBCA/DBM	1588

DOC. DATE	SUBJECT OR TITLE	AUTHOR or CORP. AUTHOR	AR FILE NUMBER
24 Apr 97	Basewide OU comments	Vorster, Ton California Regional Water Quality Control Board	1339
29 Apr 97	Transmittal of the Draft Closure Report for Soil Operable Unit Site 20	Wong, Anthony C. AFBCA/DBM	1292
12 May 97	Wetlands/Endangered or Threatened Species Issues at Sites 13, 15 and 85	Cummings, John R. Montgomery Watson Americas, Inc.	1317
13 May 97	IT Responses to Proposed Plan Basewide OU	Silva, Mike IT Corp.	1338
13 May 97	EPA review of Draft Annual 1996 Basewide Groundwater Monitoring Report, Mather AFB, March, 1997	Salyer, Kathleen U.S. EPA Region IX	1309
16 May 96	Quarterly Groundwater Monitoring Report, Second Quarter 1995	Ramage, Joseph IT Corp.	1404
19 May 97	Transmittal of the Final Basewide Operable Unit Proposed Plan	Wong, Anthony C. AFBCA/DBM	1310
20 May 97	First Quarter 1997 Basewide Groundwater Monitoring Report	Wong, Anthony C. AFBCA/DBM	1307
28 May 97	EPA review of Draft Closure Report for Soil Operable Unit Site 20, April 1997	Salyer, Kathleen U.S. EPA Region IX	1334
29 May 97	(Corrected 9/23/97) Public Hearing The Proposed Plan for Environmental Cleanup at the Basewide Operable Unit Sites	Peters, James F. CSR, RPR Peters Shorthand Reporting Corporation	1327
02 Jun 97	EPA review of U.S. Air Force Installation Restoration Program Community Relations Plan	Salyer, Kathleen U.S. EPA Region IX	1336
03 Jun 97	Mather Restoration Advisory Board Meeting Minutes, 21 May 1997	AFBCA/DBM	1608

DOC. DATE	SUBJECT OR TITLE	AUTHOR or CORP. AUTHOR	AR FILE NUMBER
06 Jun 97	Mather BCT and Reuse Meeting Minutes, 21-22 May, 1997	AFBCA/DBM	1589
12 Jun 97	Basewide Operable Unit Focused Feasibility Study, Mather (IWMB)	Strong, Kent California Department of Toxic Substances Control	1340
19 Jun 97	Meeting Agenda	California Regional Water Quality Control Board	1341
23 Jun 97	Community Plan (Comments on Basewide OU Proposed Plan)	Walker, Annette	1325
23 Jun 97	Comments to Final Basewide OU FFS	Lunceford, Sandra	1326
30 Jun 97	Basewide Operable Unit Focused Feasibility Study (DTSC comments were addressed)	Strong, Kent California Department of Toxic Substances Control	1342
01 Jul 97	Transmittal of the Draft Superfund Record of Decision for the Basewide Operable Unit Sites	Wong, Anthony C. AFBCA/DBM	1350
10 Jul 97	Draft Final Annual 1996 Basewide Groundwater Monitoring Report	Wong, Anthony C. AFBCA/DBM	1356
21 Jul 97	Cal/EPA review of Draft Operation and Maintenance Manual for Site 19 Bioventing System, Mather AFB	Taylor, James California Regional Water Quality Control Board	1357
Aug 97	Second Quarter 1997 Basewide Groundwater Monitoring Report	Wong, Anthony C. AFBCA/DBM	1436
05 Aug 97	Revised Appendix D: Proposed FFA Deadlines for Draft Primary Documents	Wong, Anthony C. AFBCA/DBM	1366

DOC. DATE	SUBJECT OR TITLE	AUTHOR or CORP. AUTHOR	AR FILE NUMBER
05 Aug 97	Substantive Requirements for Site 57 and Site 10C/68 at Mather AFB	DeGuzman, Jorge Sacramento Metropolitan Air Quality Management District	1376
14 Aug 97	Mather BCT and Reuse Meeting Minutes, 30-31 July, 1997	AFBCA/DBM	1590
18 Aug 97	Mather Restoration Advisory Board Board Meeting Minutes, 31 July 1997	AFBCA/DBM	1609
20 Aug 97	EPA request for 30 day extension for the Draft Superfund Record of Decision Basewide Operable Unit Sites, Mather Air Force Base, California, July 1, 1997.	Salyer, Kathleen U.S. EPA Region IX	1387
20 Aug 97	(Comments on) Draft Superfund Record of Decision for Basewide Operable Units	Rak, Andrew HQ AFCEE/ERB	1406
21 Aug 97	Transmittal of the Draft Explanation of Significant Differences (ESD) from the ROD for the Soils Operable Unit Sites and Groundwater Operable Unit Plumes	Wong, Anthony C. AFBCA/DBM	1379
26 Aug 97	Final Basewide Groundwater Monitoring Sampling and Analysis Plan	Wong, Anthony C. AFBCA/DBM	1388
26 Aug 97	Draft Final Closure Report for Soil Operable Unit Site 20	Wong, Anthony C. AFBCA/DBM	1389
08 Sept 97	Mather AFB Quality Program Plan, Volume IV, Sampling and Analysis Plan	Montgomery Watson Americas, Inc.	1390
12 Sep 97	BCT and Reuse Meeting Minutes, 04 February 1997	AFBCA/DBM	1591
16 Sep 97	Mather Restoration Advisory Board Meeting Minutes, 03 September, 1997	AFBCA/DBM	1610

DOC. DATE	SUBJECT OR TITLE	AUTHOR or CORP. AUTHOR	AR FILE NUMBER
19 Sept 97	Compliance source tests for 1000 cfm thermal oxidizer system at Site 10C/68, Mather	Scott, John Montgomery Watson Americas, Inc.	1478
19 Sept 97	Draft Final Operations and Maintenance Manual for Site 19 Bioventing System (Also Manufacturer Literature Book)	Wong, Anthony C. AFBCA/DBM	1426
22 Sept 97	Draft Explanation of Site 7 Acceptance Criteria, Informal Technical Information Report, September 1997, Mather Air Force Base	Hogg, Linda D. California Department of Toxic Substances Control	1400
26 Sept 97	(Comments on) Draft Superfund Record of Decision for the Basewide Operable Unit Sites	Truszkowski, Thomas County of Sacramento, Dept. of Economic Development	1402
30 Sept 97	Submission of EPA Region IX Questionnaire for Federal Facility Cleanup Sites, Mather Air Force Base, California	Scott, John Montgomery Watson Americas, Inc.	1427
30 Sept 97	Comments on the Basewide OU ROD (Submitted through the RAB)	Lunceford, Sandra	1403
01 Oct 97	(Comments on) Draft Record of Decision, Basewide Operable Unit Sites, Mather Field	Taylor, James California Regional Water Quality Control Board	1414
02 Oct 97	EPA Comments on the Draft Superfund Record of Decision, Basewide Operable Unit Sites	Salyer, Kathleen U.S. EPA Region IX	1423
02 Oct 97	(Comments on) Draft Record of Decision for the Basewide Operable Unit Sites	Strong, Kent California Department of Toxic Substances Control	1416

DOC. DATE	SUBJECT OR TITLE	AUTHOR or CORP. AUTHOR	AR FILE NUMBER
08 Oct 97	EPA review of Soil Operable Unit Draft Explanation of Significant Differences (ESD) from the Record of Decision, Disposal of Contaminated Soil at Site 7/11, Mather Air Force Base, 22 August 1997	Salyer, Kathleen U.S. EPA Region IX	1430
14 Oct 97	Submission of the Third Quarter 1997 Basewide Groundwater Monitoring Report	Wong, Anthony C. AFBCA/DBM	1422
15 Oct 97	Draft Explanation of Significant Differences from the Record of Decision for the Soil Operable Unit/Disposal of Contaminated Soil, at Site 7/11, Mather	Taylor, James California Regional Water Quality Control Board	1424
16 Oct 97	EPA Additional Comments on the Draft Superfund Record of Decision, Basewide Operable Unit Sites	Salyer, Kathleen U.S. EPA Region IX	1616
12 Nov 97	Comments on Draft Superfund Record of Decision, Basewide Operable Unit Sites	Wong, Anthony C. AFBCA/DBM	1437
13 Nov 97	CVRWQCB Meeting	Taylor, James California Regional Water Quality Control Board	1442
14 Nov 97	Transmittal of the Draft Final Explanation of Significant Differences (ESD) from the ROD for the Soils Operable Unit Sites and Groundwater Operable Unit Plumes	Wong, Anthony C. AFBCA/DBM	1438
17 Nov 97	Investigation of Bombing Activities on Mather Field, Mather, California	Strong, Kent California Department of Toxic Substances Control	1439
18 Nov 97	BRAC Cleanup Team (BCT) and Reuse Meeting Minutes, 04 November, 1997	AFBCA/DBM	1592

DOC. DATE	SUBJECT OR TITLE	AUTHOR or CORP. AUTHOR	AR FILE NUMBER
18 Nov 97	Mather Restoration Advisory Board Meeting Minutes, 05 November, 1997	AFBCA/DBM	1611
18 Nov 97	Proposed Institutional Control Language for Basewide Record of Decision, Mather	Hogg, Linda D. California Department of Toxic Substances Control	1444
20 Nov 97	Preliminary Analytical Results of Site 81 Surface Soil Sampling Contract F41624-94-D-6090	Scott, John Montgomery Watson Americas, Inc.	1479
21 Nov 97	EPA requests 14 day extension on comment period for Draft Technical Plans and Quality Program Plan for Remedial Action at Sites 56 and 60 and Monitoring Wells Installation at Site 82, Sept 1997 and Draft Remedial Action Work Plan and Quality Program Plan Phase II Groundwater Remediation at Mather AFB	Salyer, Kathleen U.S. EPA Region IX	1445
24 Nov 97	Review of Draft Technical Plans and Quality Program Plan for Remedial Action at Sites 56 and 60 and Monitoring Well Installation at Site 82, Mather Air Force Base, Sacramento	Taylor, James California Regional Water Quality Control Board	1458
26 Nov 97	Final Operations and Maintenance Manual and Manufacturer Literature for Site 19 Bioventing System	Wong, Anthony C. AFBCA/DBM	1451
26 Nov 97	FFA Schedule Extension Request for the Draft Final Basewide Operable Unit Record of Decision	Wong, Anthony C. AFBCA/DBM	1452
Dec 97	Volume I, Underground Storage Tank Removal Reports Sites 20, 2527, 2527B, 4540, and 10052	EA Engineering, Science, and Technology, Inc.	1558

DOC. DATE	SUBJECT OR TITLE	AUTHOR or CORP. AUTHOR	AR FILE NUMBER
Dec 97	Volume II, Underground Storage Tank Removal Reports Sites 20, 2527, 2527B, 4540, and 10052	EA Engineering, Science, and Technology, Inc.	1559
Dec 97	Volume I Bioventing System Installation Report Sites 19, 2595 and 18015	EA Engineering, Science, and Technology, Inc.	1565
Dec 97	Volume III Bioventing System Installation Report Sites 19, 2595, and 18015 (Site 19(Appendix B)(Continued))	EA Engineering, Science, and Technology, Inc.	1567
Dec 97	Volume IV Bioventing System Installation Report Sites 19, 2595, and 18015 (Site 2595 and 18015(Appendix B))	EA Engineering, Science, and Technology, Inc.	1568
Dec 97	Site Investigation and SVE System Installation Report Site 10C/68	Montgomery Watson Americas, Inc.	1575
03 Dec 97	Mather BCT and Reuse Meeting Minutes, 03-04 December, 1997	AFBCA/DBM	1593
15 Dec 97	Mather Restoration Advisory Board Meeting Minutes, 03 December, 1997	AFBCA/DBM	1612
17 Dec 97	Project Definition Investigation Sampling Plan for Surface Soil Sampling Sites 86 and 87	Scott, John Montgomery Watson Americas, Inc.	1550
19 Dec 97	EPA review of the proposed disclosure notices for contaminated soil in Parcels A, F and G, dated September 30, 1997. At Sites 80, 81, 82 and 85.	Salyer, Kathleen U.S. EPA Region IX	1469
30 Dec 97	Draft Technical Plans and Quality Program Plan for Remedial Action At Sites 56 and 60 and Monitoring Well Installation at Site 82, Mather Air Force Base, Sacramento County	AFBCA	1463

DOC. DATE	SUBJECT OR TITLE	AUTHOR or CORP. AUTHOR	AR FILE NUMBER
16 Jan 98	Basewide Operable Unit Record of Decision Consensus Statement	Wong, Anthony C.	1687
22 Jan 98	Draft Final Technical Plan and Quality Program Plan for Remedial Action At Sites 56 and 60 and Monitoring Well Installation at Site 82, Mather Field	Taylor, James California Regional Water Quality Control Board	1498
22 Jan 98	Draft Site Investigation and SVE System Installation Report Site 10C/68, Mather Field	Taylor, James California Regional Water Quality Control Board	1506
27 Jan 98	Transmittal of the red-line revised Draft Superfund Record of Decision for the Basewide Operable Unit Sites	Wong, Anthony C. AFBCA/DBM	1517
29 Jan 98	Draft Project Definition Investigation Report for Surface Soil Sites 10C, 69, 80, 81, and 88	Wong, Anthony C. AFBCA/DBM	1509
30 Jan 98	Soil Vapor Extraction Systems Sites 29, 57, and 10C/68 Quarterly Emissions Monitoring Report Fourth Quarter 1997	Wong, Anthony C. AFBCA/DBM	1508
30 Jan 98	Draft Technical Plans and Quality Program Plan for Sites 20, 86, and 87	Wong, Anthony C. AFBCA/DBM	1513
02 Feb 98	BRAC Cleanup Team (BCT) and Reuse Meeting Minutes, 28-29 January, 1998	AFBCA/DBM	1594
02 Feb 98	Mather Restoration Advisory Meeting Minutes, 28 January, 1998	AFBCA/DBM	1613
20 Feb 98	Status Report for Site 10C/68, Mather Field, Sacramento County	Taylor, James California Regional Water Quality Control Board	1520

DOC. DATE	SUBJECT OR TITLE	AUTHOR or CORP. AUTHOR	AR FILE NUMBER
27 Feb 98	Quarterly Emissions Monitoring Report Fourth Quarter 1997	Wong, Anthony C. AFBCA/DBM	1556
03 Mar 98	Phase II Project Definition Investigation Sampling Plan for Soil Sampling Sites 86 and 87, Former Small Arms Range and Skeet Range Mather Air Force Base, California	Scott, John Montgomery Watson Americas, Inc.	1530
12 Mar 98	Basewide Operable Unit Record of Decision Consensus Statement, 3/12/98	Wong, Anthony C. AFBCA/DBM	1537
17 Mar 98	Revised Draft Explanation of Significant Difference from the Landfill Operable Unit Record of Decision and Modification to Site 7/11 Acceptance Criteria Former Mather Air Force Base, Sacramento County	Taylor, James California Regional Water Quality Control Board	1543
17 Mar 98	Draft Explanation of Significant Difference (ESD), Landfill Operable Unit Record of Decision, and Modification to Site 7/11 Acceptance Criteria, Mather Field, Sacramento County	Hogg, Linda D. California Department of Toxic Substances Control	1544
23 Mar 98	Mather Restoration Advisory Board Meeting Minutes, 16 March, 1998	AFBCA/DBM	1614
24 Mar 98	Base Cleanup Team (BCT) and Reuse Meeting Minutes, 11 March, 1998	AFBCA/DBM	1595
24 Mar 98	RCRA ARARs for Vadose Zone Cleanup	Kathleen Salyer U.S. EPA, Region IX	1710
25 Mar 98	Additional Applicable or Relevant and Appropriate Requirements (ARARs) for the Draft Basewide Record of Decision	Hogg, Linda D. California Department of Toxic Substances Control	1554

DOC. DATE	SUBJECT OR TITLE	AUTHOR or CORP. AUTHOR	AR FILE NUMBER
07 Apr 98	DTSC request for extension on Draft Document Review of Technical Plan for Sites 20, 86 and 97; and Draft Project Definition Investigation Report for Sites 10C, 69, 80, 81, and 88	Hogg, Linda D. California Department of Toxic Substances Control	1571
20 Apr 98	Request for Review and Comment - Resolution of Remaining Issues for Basewide Operable Unit Record of Decision	Wong, Anthony C. AFBCA/DBM	1577
20 Apr 98	DTSC Comments on Interim Draft Final Basewide Record of Decision (ROD), Mather Air Force Base, Sacramento County	Hogg, Linda D. California Department of Toxic Substances Control	1578
21 Apr 98	Transmittal of Adopted Resolution No. 98-105, Former Mather Air Force Base, Sacramento County	Vorster, Antonia K. J. California Regional Water Quality Control Board	1618
30 Apr 98	Interim Draft Final Record of Decision for Basewide Operable Unit Sites, Former Mather Air Force Base, Sacramento County	Taylor, James California Regional Water Quality Control Board	1619
1 May 98	EPA review of Interim Draft Final Record of Decision for Basewide Operable Unit Sites, Mather AFB, March 30, 1998	Salyer, Kathleen U.S. EPA Region IX	1660
05 May 98	Draft Technical Plans and Quality Program Plan for Remedial Actions for Sites 20, 86 and 87, January 1998, Mather AFB	Hogg, Linda D. California Department of Toxic Substances Control	1620
05 May 98	Base Cleanup Team (BCT) and Reuse Meeting Minutes, April 22, 1998	AFBCA/DBM	1596
07 May 98	EPA review of Draft Technical Plans and Quality Program Plan for Remedial Actions Sites 20, 86, and 87, Mather AFB, January 1998	Salyer, Kathleen U.S. EPA Region IX	1621

DOC. DATE	SUBJECT OR TITLE	AUTHOR or CORP. AUTHOR	AR FILE NUMBER
08 May 98	EPA review of Draft Project Definition Investigation Report for Surface Soil Sites 10C, 69,80,81, and 88, Mather AFB, January 1998	Salyer, Kathleen U.S. EPA Region IX	1622
08 May 98	Draft Project Definition Investigation Report for Surface Soil Sites 10C, 69, 80, 81, and 88, Former Mather Air Force Base, Sacramento County	Taylor, James California Regional Water Quality Control Board	1623
11 May 98	Comments on Interim Draft Final Basewide Record of Decision (ROD), Mather Air Force Base, Sacramento County	Hogg, Linda D. California Department of Toxic Substances Control	1617
11 May 98	Draft Project Definition Investigation Report for Soil Sites 10C, 69, 80, 81 and 88, January 1998, Mather Air Force Base, Sacramento County	Hogg, Linda D. California Department of Toxic Substances Control	1616
12 May 98	Review of Report on Mather Field Range Activities	Wong, Anthony C. AFBCA/DBM	1642
19 May 98	Basewide Operable Unit Record of Decision Consensus Statement	Wong, Anthony C.	1682
21 May 98	Evaluation of Cleanup Standards for Basewide Operable Unit Soils	Wong, Anthony C. AFBCA/DA Mather	1054
29 May 98	Draft Final Superfund Record of Decision, Basewide Operable Unit Sites, Mather Air Force Base, California	HQ AFCEE/ERB	1661
June 98	Draft Final Technical Plans and Quality Program Plan for Remedial Actions Sites 20, 86, and 87	Montgomery Watson	1678
9 June 98	Applicability of RCRA Regulations to Vadose Zone Cleanup at Mather (reference your letter of 24 March 1998)	Wong, Anthony C. AFBCA/DA Mather	1670

DOC. DATE	SUBJECT OR TITLE	AUTHOR or CORP. AUTHOR	AR FILE NUMBER
9 Jun 98	Applicability of RCRA Regulations to Vadose Zone Cleanup at Mather (reference your letter of 25 March, 1998)	Wong, Anthony C.	1702
19 June 98	Basewide Operable Unit Record of Decision Consensus Statement	Wong, Anthony C. AFBCA/DBM	1669
29 June 98	Review of Ecological Risk Assessment for Mather Firing Range Sites	Wong, Anthony C. AFBCA/DA Mather	1673
29 Jun 98	Transcription of Comments on Draft Final Basewide Operable Unit Record of Decision	Hughes, Bill WPI	1711
30 June 98	Final Site Investigation and SVE System Installation Report for Site 10C/68	Montgomery Watson	1676
7 July 98	Mather Draft Final Basewide ROD	Taylor, James Regional Water Quality Control Board	1712
14 July 98	Draft Final Record of Decision for the Basewide Operable Unit Sites, Former Mather Air Force Base, Sacramento County	Taylor, James Regional Water Quality Control Board	1688
15 Jul 98	EPA review of Draft Final Superfund Record of Decision for Basewide Operable Unit Sites, Mather AFB dated May 29, 1998	Salyer, Kathleen U.S. EPA Region IX	1695
17 Jul 98	Comments on Draft Final Basewide Record of Decision (ROD) May 1998, Mather Air Force Base, Sacramento County	Hogg, Linda D. CA DTSC	1696
23 July 98	Mather Air Force Base Site 87 Ecological Risk Assessment	Chernoff, Gerald F., PhD CA Dept. Fish & Game	1713

DOC. DATE	SUBJECT OR TITLE	AUTHOR or CORP. AUTHOR	AR FILE NUMBER
24 Jul 98	Basewide Operable Unit ROD: Proposed Text for Institutional Controls at Site 87 and for Emissions Monitoring for Dioxin	Wong, Anthony C. AFBCA DA Mather	1698
31 July 98	Transmittal of the Revised Draft Final CERCLA Record of Decision for the Basewide Operable Unit Sites	Wong, Anthony C. AFBCA/DAM	1714
Aug 98	Revised Draft Final Comprehensive Environmental Response, Compensation, and Liability Act of 1980, Record of Decision	HQ AFCEE/ERB	1704
13 Aug 98	Basewide Operable Unit Record of Decision Consensus Statement	Wong, Anthony C. AFBCA/DBM	1716
13 Aug 98	Mather Air Force Base Site 87 Ecological Risk Assessment and Record of Decision	Chernoff, Gerald F., PhD CA Dept of Fish & Game	1717
19 Aug 98	Changes to Revised Draft Final Basewide Operable Unit Record of Decision	Wong, Anthony C. AFBCA/DAM	1715

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TAB

Appendix B

Appendix B

Mather Air Force Base Sites 86 and 87

Human Health Risk Assessment

Table of Contents

List of Tables

List of Acronyms

µg/L	micrograms per Liter
AFB	Air Force Base
CBRA	Comprehensive Baseline Risk Assessment
COPC	chemicals of potential concern
DTSC	Department of Toxic Control
FS	feasibility study
HI	hazard index
HQ	hazard quotient
ILCR	incremental lifetime cancer risk
IRIS	Integrated Risk Information System
IRP	Installation Restoration Program
mg/L	milligrams per Liter
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
ppm	parts per million
RAGS	Risk Assessment Guidance for Superfund
RfD	reference dose
RI	remedial investigation
RME	reasonable maximum exposure
SF	slope factor
USEPA	United States Environmental Protection Agency

B.1 Introduction

This appendix addresses the overall human health effects of exposure to chemicals of potential concern (COPC) in soil, sediment, and surface water at Installation Restoration Program (IRP) Site 86 (the Former Military Firing Range) and Site 87 (the Former Skeet/Trap Range) for Mather Air Force Base (AFB). The methodology for conducting the risk assessment will be summarized below. For complete methodology, refer to the Final Comprehensive Baseline Risk Assessment (CBRA) for Mather AFB [IT 1996].

A risk assessment is an interpretive link between a remedial investigation (RI) and a feasibility study (FS). It is designed to use data generated by a RI to evaluate potential health effects at a site and to formulate the goals to be used in selecting remedial actions in the FS. This risk assessment was performed in accordance with the Risk Assessment Guidance for Superfund (RAGS) [USEPA 1989] and with guidance provided by the U.S. Environmental Protection Agency (USEPA), Region IX, and the California Department of Toxic Control (DTSC).

This appendix presents discussions on major risk assessment elements including identification of COPC (Section B.2), exposure assessment (Section B.3), toxicity assessment (Section B.4) and risk characterization (Section B.5).

B.2 Identification of Chemicals of Potential Concern

This section identifies the COPC for Sites 86 and 87 at Mather AFB. Pertinent data collection considerations are discussed, and the data evaluation process is presented.

Data collected during the IRP Sites 86 and 87 investigations were evaluated for use in this risk assessment in accordance with USEPA guidance [USEPA 1989]. This process included evaluating the sample collection and analytical methods used, evaluating the quality of the data, and selection of the COPC. The COPC selection process was three-fold: (1) to identify those chemicals that are likely to be site-related, (2) to determine the acceptability of the analytical data for use in the risk assessment, and (3) to focus the risk assessment on those constituents that represent the dominant potential risks at these sites. The analytical data are summarized in the "Final Site Characterization Report for IRP Sites 86 and 87" [IT 1997].

B.2.1 Site Descriptions

This section briefly describes the historical activities at Sites 86 and 87. For additional information refer to the "Final Site Characterization Report for IRP Sites 86 and 87" [IT 1997].

B.2.1.1 Site 86 - Former Military Firing Range

The Former Military Firing Range is located on the southeast portion of Mather AFB. The range was opened in the late 1950s when the Strategic Air Command wing moved to Mather AFB. The firing range was operated by the military until closure in 1993. The site consisted of the rifle and pistol range which covered an area of approximately 112,900 square feet. Recently, portions of the firing range have been dismantled or altered. Soil on the interior target faces of the berm have been removed and stockpiled at the site. The outer portions of the berms were used as construction material in a landfill under construction at IRP Site 4.

B.2.1.2 Site 87 - Former Skeet /Trap Range

The Former Skeet/Trap Range is located on the eastern portion of Mather AFB and consists of an open grassy area. The skeet/trap range was operated by a local shooting club. The range was constructed in phases. The eastern-most two sets of the skeet/trap range were built sometime between 1968 and 1972. A third set of firing stations was added to the west of the other two sets between 1974 and 1976. A fourth set was added between 1988 and 1989. Prior to being used as a skeet/trap range, the site was a parasail course.

B.2.2 Methodology for Selection of Chemicals of Potential Concern

This section presents the procedure used to identify the COPC for Sites 86 and 87. The analytical data were organized by IRP site and medium into individual data sets (e.g., Site 86 surface soil). For individual data sets that contained nondetects (i.e., data which were "U" or "UJ" qualified), the detection limit of the nondetected result was divided by two before any statistical calculation were performed. Samples with duplicates were averaged and treated as a single result for any statistical calculations. Both of these steps are in accordance with USEPA guidance [USEPA 1989]. All statistical calculations were performed using STATISTICA for Windows Version 5 [StatSoft, Inc. 1996]. The following statistical manipulations were performed on each of the individual data sets:

- Frequency Sampled - Number of samples that were collected and analyzed for a particular chemical in a specific medium. Field duplicate samples for the same sample locations were averaged and counted as a single sample.

- Number of Detections - Number of detections of a particular chemical in a specific medium.

- Maximum Concentration - Highest concentration of a particular chemical in a specific medium.

- Minimum Concentration - Lowest concentration of a particular chemical in a specific medium. This value may be one half of the detection limit for data sets which contain nondetects.
- Mean Concentration - Arithmetic mean of a particular chemical in a specific medium.
- Standard Deviation - Sample standard deviation of a particular chemical in a specific medium.
- Upper 95-Percent Confidence Limit of the Mean - Upper 95-percent confidence limit of the mean was calculated for a chemical in a specific medium using the Student's *t* statistic and assuming that the analytical data are normally distributed.

Refer to the CBRA [IT 1996] for additional information on the summary statistics calculation methodology outlined above.

Subsequent to the statistical calculations, analytical results were screened using criteria from USEPA guidance [USEPA 1989] to focus the risk assessment process onto those constituents that were COPC. The screening criteria included the following:

- Chemicals of potential concern which were 100 percent nondetects for a given medium were eliminated from consideration.
- If inorganic chemicals were present in soil at naturally occurring background levels (the maximum detected concentration were evaluated for comparison), they were eliminated from consideration.
- All metals which are considered essential nutrients were eliminated from consideration.

The remaining COPC were carried through the risk assessment process. For further information on the screening criteria outlined above, refer to the CBRA [IT 1996].

B.2.3 Chemicals of Potential Concern

The analytical data for Sites 86 and 87 are summarized in Tables B-1 through B-4. Included in this summary are the number of samples, the number of detections, the maximum and minimum values, the mean, the standard deviation, the 95 percent upper confidence limit of the mean, if the analyte is a COPC, and the reason for exclusion if the analyte is not a COPC.

Table B-1. Statistical Summary for Chemicals of Potential Concern for Site 86 Soils at Mather Air Force Base(a)

Chemical	Units	Background	Number Sampled	Number Detected	Minimum Value	Maximum Value	Mean	Standard Deviation	95% Confidence Limit on the Mean	Chemical of Concern	Reason for Exclusion
Antimony	mg/kg	12	5	4	0.1	5.2	1.4	2.1	4.1	No	(b)
Arsenic	mg/kg	8	5	5	9	11	10	1	11	Yes	
Barium	mg/kg	375	5	5	96	258	196	61	271	No	(b)
Copper	mg/kg	93	5	5	34	118	57	35	113	Yes	
Lead	mg/kg	14	5	5	86	1660	467	675	1305	Yes	
Tin	mg/kg	NA	5	0	NA	NA	NA	NA	NA	No	(c)
Zinc	mg/kg	116	5	5	53	72	59	8	68	No	(b)

(a) One half of the detection limit reported for nondetects, and duplicate samples were averaged.
(b) Chemical not of concern based on comparison to background.
(c) Chemical not of concern, all samples nondetects.
mg/kg = milligram per kilogram.
NA = Not applicable.

Table B-2. Statistical Summary for Chemicals of Potential Concern for Site 87 Soils at Mather Air Force Base(a)

Chemical	Units	Background	Number Sampled	Number Detected	Minimum Value	Maximum Value	Mean	Standard Deviation	95% Confidence Limit on the Mean	Chemical of Concern	Reason for Exclusion
Antimony	mg/kg	12	11	6	0.1	4.9	1.3	1.9	2.6	No	(b)
Arsenic	mg/kg	8	11	11	5	18	8	4	11	Yes	
Barium	mg/kg	375	11	11	92	270	152	48	185	No	(b)
Copper	mg/kg	93	11	11	14	53	22	11	30	No	(b)
Lead	mg/kg	14	11	11	9	1330	390	488	718	Yes	
Tin	mg/kg	NA	11	1	37	105	43	21	57	Yes	
Zinc	mg/kg	116	11	11	28	81	43	14	53	No	(b)
Acenaphthene	µg/kg	NA	13	0	NA	NA	NA	NA	NA	No	(c)
Acenaphthylene	µg/kg	NA	13	0	NA	NA	NA	NA	NA	No	(c)
Anthracene	µg/kg	NA	13	0	NA	NA	NA	NA	NA	No	(c)
Benzo(a)anthracene	µg/kg	NA	13	9	1	2390	506	771	972	Yes	
Benzo(a)Pyrene	µg/kg	NA	13	9	1	3670	819	1152	1515	Yes	
Benzo(b)Fluoranthene	µg/kg	NA	13	9	1	2800	603	868	1127	Yes	
Benzo(g,h,i)perylene	µg/kg	NA	13	9	1	3380	737	1033	1361	Yes	
Benzo(k)Fluoranthene	µg/kg	NA	13	9	1	1110	242	342	449	Yes	
Chrysene	µg/kg	NA	13	9	1	3750	817	1203	1544	Yes	
Dibenz(a,h)anthracene	µg/kg	NA	13	8	2.6	970	282	334	484	Yes	
Fluoranthene	µg/kg	NA	13	6	1	2720	704	993	1304	Yes	
Fluorene	µg/kg	NA	13	0	NA	NA	NA	NA	NA	No	(c)
Indeno(1,2,3-cd)Pyrene	µg/kg	NA	13	9	1	2540	526	771	992	Yes	
Naphthalene	µg/kg	NA	13	0	NA	NA	NA	NA	NA	No	(c)
Phenanthrene	µg/kg	NA	13	6	1	603	208	217	339	Yes	
Pyrene	µg/kg	NA	13	8	1	4900	1075	1666	2082	Yes	

(a) One half of the detection limit reported for nondetects, and duplicate samples were averaged.
(b) Chemical not of concern based on comparison to background.
(c) Chemical not of concern, all samples nondetects.
mg/kg = milligram per kilogram.
µg/kg = microgram per kilogram.
NA = Not applicable.

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Table B-3. Statistical Summary for Chemicals of Potential Concern for Site 87 Sediment at Mather Air Force Base(a)

Chemical	Units	Background	Number Sampled	Number Detected	Minimum Value	Maximum Value	Mean	Standard Deviation	95% Confidence Limit on the Mean	Chemical of Concern	Reason for Exclusion
Antimony	mg/kg	NA	4	2	0.1	21.0	6.7	9.9	22.4	Yes	
Arsenic	mg/kg	NA	4	4	6	49	19	20	51	Yes	
Barium	mg/kg	NA	4	4	131	302	189	76	311	Yes	
Copper	mg/kg	NA	4	4	18	58	31	18	60	Yes	
Lead	mg/kg	NA	4	4	29	6305	1966	2973	6697	Yes	
Tin	mg/kg	NA	4	0	NA	NA	NA	NA	NA	No	(b)
Zinc	mg/kg	NA	4	4	34	93	55	27	97	Yes	
Acenaphthene	µg/kg	NA	2	0	NA	NA	NA	NA	NA	No	(b)
Acenaphthylene	µg/kg	NA	2	0	NA	NA	NA	NA	NA	No	(b)
Anthracene	µg/kg	NA	2	0	NA	NA	NA	NA	NA	No	(b)
Benzo(a)anthracene	µg/kg	NA	2	1	4.8	9.4	7.1	3.25	NA	Yes	
Benzo(a)Pyrene	µg/kg	NA	2	1	8	18	13	6.7	NA	Yes	
Benzo(b)Fluoranthene	µg/kg	NA	2	1	6.5	66	36	42	NA	Yes	
Benzo(g,h,i)perylene	µg/kg	NA	2	1	16.5	27	22	7.1	NA	Yes	
Benzo(k)Fluoranthene	µg/kg	NA	2	1	6	7	6.5	0.71	NA	Yes	
Chrysene	µg/kg	NA	2	1	33.5	55	44	15	NA	Yes	
Dibenz(a,h)anthracene	µg/kg	NA	2	1	10.5	13	12	1.6	NA	Yes	
Fluoranthene	µg/kg	NA	2	0	NA	NA	NA	NA	NA	No	(b)
Fluorene	µg/kg	NA	2	0	NA	NA	NA	NA	NA	No	(b)
Indeno(1,2,3-cd)Pyrene	µg/kg	NA	2	1	13.8	16	15	1.6	NA	Yes	
Naphthalene	µg/kg	NA	2	0	NA	NA	NA	NA	NA	No	(b)
Phenanthrene	µg/kg	NA	2	0	NA	NA	NA	NA	NA	No	(b)
Pyrene	µg/kg	NA	2	1	53.5	95	74	29	NA	Yes	

(a) One half of the detection limit reported for nondetects, and duplicate samples were averaged.
(b) Chemical not of concern, all samples nondetects.
mg/kg = milligram per kilogram.
µg/kg = microgram per kilogram.
NA = Not applicable.

Table B-4. Statistical Summary for Chemicals of Potential Concern for Site 87 Surface Water at Mather Air Force Base(a)

Chemical	Units	Background	Number Sampled	Number Detected	Minimum Value	Maximum Value	Mean	Standard Deviation	95% Confidence Limit on the Mean	Chemical of Concern	Reason for Exclusion
Antimony	mg/L	NA	2	1	0.8	2	1.4	0.9	NA	Yes	
Arsenic	mg/L	NA	2	0	NA	NA	NA	NA	NA	No	(b)
Barium	mg/L	NA	2	2	87	89	88	1.4	NA	Yes	
Copper	mg/L	NA	2	0	NA	NA	NA	NA	NA	No	(b)
Lead	mg/L	NA	2	1	0.6	1	0.8	0.3	NA	Yes	
Tin	mg/L	NA	2	0	NA	NA	NA	NA	NA	No	(b)
Zinc	mg/L	NA	2	0	NA	NA	NA	NA	NA	No	(b)
Acenaphthene	µg/L	NA	2	0	NA	NA	NA	NA	NA	No	(b)
Acenaphthylene	µg/L	NA	2	0	NA	NA	NA	NA	NA	No	(b)
Anthracene	µg/L	NA	2	0	NA	NA	NA	NA	NA	No	(b)
Benzo(a)anthracene	µg/L	NA	2	0	NA	NA	NA	NA	NA	No	(b)
Benzo(a)Pyrene	µg/L	NA	2	0	NA	NA	NA	NA	NA	No	(b)
Benzo(b)Fluoranthene	µg/L	NA	2	0	NA	NA	NA	NA	NA	No	(b)
Benzo(g,h,i)perylene	µg/L	NA	2	0	NA	NA	NA	NA	NA	No	(b)
Benzo(k)Fluoranthene	µg/L	NA	2	0	NA	NA	NA	NA	NA	No	(b)
Chrysene	µg/L	NA	2	0	NA	NA	NA	NA	NA	No	(b)
Dibenz(a,h)anthracene	µg/L	NA	2	0	NA	NA	NA	NA	NA	No	(b)
Fluoranthene	µg/L	NA	2	0	NA	NA	NA	NA	NA	No	(b)
Fluorene	µg/L	NA	2	0	NA	NA	NA	NA	NA	No	(b)
Indeno(1,2,3-cd)Pyrene	µg/L	NA	2	0	NA	NA	NA	NA	NA	No	(b)
Naphthalene	µg/L	NA	2	0	NA	NA	NA	NA	NA	No	(b)
Phenanthrene	µg/L	NA	2	0	NA	NA	NA	NA	NA	No	(b)
Pyrene	µg/L	NA	2	0	NA	NA	NA	NA	NA	No	(b)

(a) One half of the detection limit reported for nondetects, and duplicate samples were averaged.
(b) Chemical not of concern, all samples nondetects.
mg/L = milligram per liter.
µg/L = microgram per liter.
NA = Not applicable.

B.3 Exposure Assessment

This chapter identifies exposure pathways and quantifies chemical intakes. The purpose of this exposure assessment is to estimate the type and magnitude of exposure to humans.

B.3.1 Exposure Pathways

For exposure and potential risks to occur, complete exposure pathways must exist. A complete pathway requires the following elements [USEPA 1989]:

- a source and mechanism for release of contamination;
- a transport or retention medium;
- a point of potential human contact (exposure point); and
- an exposure route at the exposure point.

If any one of these elements is missing, the pathway is not considered complete. The following is a brief discussion of the exposure pathway elements.

Exposure points are locations of human contact with contaminated media. Exposure points consider human activity patterns and the location of potentially exposed individuals relative to the location of contaminated media. There are two scenarios for the metals (primarily lead) where potential contact may occur. The first assumes the potential receptor ingests intact lead shot or slugs in soil, and the second assumes that the lead shot has decomposed and dispersed throughout the soil. The analytical data summarized in Section B.2.3 assumes that the lead has decomposed and is dispersed throughout the soil. Risks due to ingestion of intact lead shot are discussed in Section B.5.4 below. Risks due to the decomposition of lead are summarized in Section B.5.5.

For this risk assessment, contact with potentially contaminated media takes place as a result of occupational, residential, and recreational receptors. To maintain the conservative methodology of RAGS [USEPA 1989], the contact point for soil contamination with all exposure scenarios is assumed to be located at the contaminant source.

An exposure route is a way in which a chemical enters or comes into contact with the human body. The following three exposure routes may be parts of exposure pathways:

- Ingestion;
- Inhalation;

- Dermal Contact; and
- Ingestion of Secondary Pathways.

Because of the current conditions at Mather AFB (i.e., the base is closed), there is no exposure point (point of human contact) for the contamination considered in this risk assessment under current conditions. The only complete exposure pathways occur under potential future land-use scenarios. Refer to the CBRA [IT 1996] for additional information on the selection of potential exposure pathways at Mather AFB. The complete exposure pathways are residential ingestion, dermal contact, and ingestion of home grown produce for soil and sediment; residential ingestion of surface water; occupational ingestion and dermal contact with soil and sediment; occupational ingestion of surface water; recreational ingestion and dermal contact with soil and sediment; and recreational ingestion of surface water.

B.3.2 Quantification of Exposure

This section describes the estimation of exposure (intake) for the COPC that may come in to contact with human receptors. The process involves the following:

- Identification of applicable human exposure models and input parameters.
- Determination of the concentration of each chemical in environmental media at the point of human exposure.
- Estimation of human intakes.

For each potentially complete future exposure pathway identified in Section B.3.1, a reasonable maximum exposure (RME) scenario has been developed. The RME is the highest exposure that is reasonably expected to occur at a site [USEPA 1989]. The intent of the RME, as defined by the USEPA, is to estimate a conservative exposure case (i.e., well above the average case) that is still within the possible range of exposures. The RME is both protective and reasonable but not the worst possible case [USEPA 1991a].

B.3.2.1 Exposure Models

The primary source for the exposure models used in this baseline risk assessment is RAGS [USEPA 1989]. Shown below is the generalized equation for calculating chemical intakes:

$$I = C\,\frac{CR\ EFD}{BW\ AT}$$

where:

I	=	Intake; the amount of chemical at the exchange boundary (milligrams [mg] per kilogram [kg] body weight - day).
C	=	Chemical concentration at the exposure point; the concentration contacted over the exposure period (e.g., mg per liter water or mg per kg soil).
CR	=	Contact rate; the amount of contaminated medium contacted per unit time or event (e.g., mg per day soil ingestion rate or cubic meters per hour air inhalation rate).
EFD	=	Exposure frequency and duration; describes how often and how long exposure occurs. Often calculated using two terms (EF times ED).
EF	=	Exposure frequency (days/year).
ED	=	Exposure duration (years).
BW	=	Body weight; the average body weight over the exposure period (kg).
AT	=	Averaging time; period over which exposure is averaged (days).

The exposure models used in the calculation of intakes for Site 86 and 87 were identical to the exposure models presented in the CBRA [IT 1996].

B.3.2.2 Exposure Parameters

Three types of parameters are used in exposure models to estimate intake [USEPA 1989]:

- Chemical-related parameters (e.g., exposure point concentrations).
- Parameters that describe the exposed population (e.g., contact rate, exposure frequency and duration, and body weight).
- Toxicity-related parameters (i.e., slope factors and reference doses).

The exposed population and exposure-related parameters are summarized in Table 3-13 of the CBRA [IT 1996]. Please refer to the CBRA for a complete summary of the exposure parameters used. The exposure parameters were taken from USEPA guidance [USEPA 1989] and are based on best professional judgement using site-specific information where available. Upper-bound values are generally 90th or 95th percentile values, depending on the data available for each parameter. A combination of upper-bound and average exposure parameters were used to estimate the RME for each scenario.

B.3.2.3 Intakes for Chemicals of Potential Concern

Noncarcinogenic and carcinogenic intakes at Sites 86 and 87 are tabulated and presented in Section B.5.

B.4 Toxicity Assessment

The primary source for toxicity values, both reference doses (RfD) and slope factors (SF), is the Integrated Risk Information System (IRIS) [USEPA 1997]. If a toxicity value for a given chemical is not available in IRIS, the secondary sources included the Health Effects Assessment Summary Tables [USEPA 1996], and the Region IX Cancer Potency Factors [CEPA 1994]. If the SFs in the Region IX Cancer Potency Factors were more stringent, these toxicity value were used in the calculation of risk. No surrogate values were developed for chemicals for which no toxicity information existed in either of the above references for IRP Sites 86 and 87. The CBRA [IT 1996] provides detailed information, including toxicity profiles, for all of the COPC summarized below. Table B-5 summarizes the COPC toxicity information, including the RfDs, SFs, and cancer classes.

B.5 Risk Characterization

This section provides a characterization of the potential health risks associated with the intake of chemicals at Site 86 and 87. Risk characterization compares estimated potential cancer risks with reasonable levels of risk for carcinogens and compares estimated daily intake (rate) with reference levels for noncarcinogens. Carcinogens may also pose a systemic (noncarcinogenic) hazard, and these potential hazards are characterized in the same manner as other noncarcinogens.

Estimation of potential risk from exposure to the site contaminants is based on RAGS [USEPA 1989]. This assessment employs a health-protective bias that leads to the overestimation of the risk. Individuals are exposed to an RME in Section B.3.1 and evaluated in Section B.3.2 to provide estimates of daily intakes. These estimated intakes (rates) are combined with the individual chemical toxicological values (Section B.4.1) to determine the potential carcinogenic risks and the potential systemic impacts on human health.

B.5.1 Estimation of Carcinogenic Risk

In weighing occupational exposure to potentially carcinogenic compounds, a reasonable level of risk must be selected. The USEPA used an incremental lifetime cancer risk (ILCR) (also referred to as excess cancer risk) of one-in-one-million (1×10^{-6}) as the lower bound of an acceptable range for developing drinking water standards. The upper bound of an acceptable ILCR recommended by the USEPA for drinking water is one-in-ten-thousand (1×10^{-4}) [USEPA 1987]. In addition, the USEPA specifies a risk range of 10^{-6} to 10^{-4} associated with the

Table B-5. Human Toxicity Factors Used for Calculation of Incremental Lifetime Cancer Risk and Hazard Index from Exposure to Chemicals of Potential Concern at IRP Site 86 and 87(a)

	Reference Doses		Slope Factors		
Contaminant of Concern	Oral (mg/kg-day)	Inhalation (mg/kg-day)	Oral $(mg/kg\text{-}day)^{-1}$	Inhalation $(mg/kg\text{-}day)^{-1}$	Cancer Class
Antimony	4.0×10^{-04}	ND	ND	ND	ND
Arsenic	3.0×10^{-04}	ND	1.5	$1.5 \times 10^{+01}$	A
Barium	7.0×10^{-02}	ND	ND	ND	ND
Copper	3.7×10^{-02}	ND	NA	NA	D
Lead	ND	ND	ND	ND	ND
Tin	6.0×10^{-01}	ND	ND	ND	ND
Zinc	3.0×10^{-01}	ND	NA	NA	D
Benzo(a)anthracene	ND	ND	7.3×10^{-01}	ND	B2
Benzo(a)Pyrene	ND	ND	$1.2 \times 10^{+01}$	ND	B2
Benzo(b)Fluoranthene	ND	ND	7.3×10^{-01}	ND	B2
Benzo(g,h,i)perylene	ND	ND	NA	NA	D
Benzo(k)Fluoranthene	ND	ND	7.3×10^{-01}	ND	B2
Chrysene	ND	ND	7.3×10^{-03}	ND	B2
Dibenz(a,h)anthracene	ND	ND	7.3	ND	B2
Fluoranthene	4.0×10^{-02}	ND	NA	NA	D
Indeno(1,2,3-cd)Pyrene	ND	ND	7.3×10^{-01}	ND	B2
Phenanthrene	3.0×10^{-01}	ND	NA	NA	D
Pyrene	3.0×10^{-02}	ND	NA	NA	D

Note: The U.S. Environmental Protection Agency definition of cancer class is: Class A - definite human carcinogen; Class B2 - probable human carcinogen based on sufficient evidence of animal data; and Class D - non carcinogenic.

(a) All toxicity values from Integrated Risk Information System [USEPA 1997], unless otherwise stated.
ND = No data available to establish toxicity factor
NA = Not considered to be carcinogenic to humans [USEPA 1997]
mg/kg = milligrams per kilogram

consideration and selection of remedial alternatives for contaminated land in the "National Oil and Hazardous Substances Pollution Contingency Plan" (NCP) [USEPA 1990].

Based on the regulatory precedents cited above, a reasonable and appropriate ILCR range would be from 10^{-6} to 10^{-4}. As implemented under the NCP, pathway ILCR greater than 10^{-6} must receive risk management consideration [USEPA 1990]. The quantitative risk assessment is one of many factors that is considered in the decision-making process for remediation. Therefore, there is no single risk value that defines "acceptable" and "unacceptable" risk. The purpose of this risk assessment is to present quantitative and qualitative estimates of potential risk, and thus, all pathway risk greater than the lower bound of 10^{-6} will be examined.

For IRP Sites 86 and 87, cumulative site ILCRs were developed. These cumulative ILCRs included all media and pathways that were appropriate to combine. These pathways occur when there is potential for an individual to be exposed to multiple pathways at the same given instant in time. Where the cumulative site ILCR to an individual based on the RME for both current and future land use is less than 10^{-4}, action generally is not warranted unless there is adverse environmental impacts [USEPA 1991b].

Carcinogenic risk is estimated as the probability of an additional incidence of cancer above background. This risk is:

$$ILCR = SF \; Intake$$

where:

ILCR	=	ILCR (unitless)
SF	=	Carcinogenic SF [(mg/kg-day)$^{-1}$]
Intake	=	Chronic daily intake averaged over a 70-year lifetime (mg/kg-day).

The carcinogenic SFs for the COPC were presented in Table B-5.

For a given pathway and medium with exposure to several carcinogens, the following equation was used to sum the cancer risk:

$$HI = \sum_{i=1}^{I} HQ_i$$

where:

$Risk_{i,p}$	=	Total cancer risk for pathway p (unitless)
$ILCR_p(chem_i)$	=	Individual cancer risk for constituent i through exposure pathway p (unitless).

Estimates of ILCRs are provided for each exposure pathway in Section B.5.5.

B.5.2 Estimation of Noncarcinogenic Risk

Chemicals that pose a health threat other than cancer were evaluated by comparing an exposure level or intake to an acceptable level or RfD. The ratio of estimated daily intake to the RfD is termed the hazard quotient (HQ) and is defined as:

$$HQ_{i,p} = \frac{I_{i,p}}{RfD_i}$$

where:

$HQ_{i,p}$	=	Individual HQ for exposure to constituent i through exposure pathway p (unitless)
$I_{i,p}$	=	Daily intake via a specific pathway p for constituent i (mg/kg-day)
RfD_i	=	RfD for exposure by the specific pathway (limited to oral and inhalation values) for constituent i (mg/kg-day).

The RfD is an estimate of the intake level to which a human population, including sensitive subpopulations, may be chronically exposed without a significant risk of adverse health effects [USEPA 1989]. The RfDs for the COPC are listed in Table B-5. Because the HQ does not define intake response relationships, its numerical value should not be construed as a direct estimate of risk, but it does suggest that a given situation should be more closely scrutinized. The concept of the HQ implies the existence of a threshold for systemic health effects. It is a numerical indication of the fraction of acceptable limits of exposure or the degree to which acceptable exposure levels are exceeded. As this quotient increases toward unity, concern for the potential hazard of the constituent increases. A value above unity is an indication of risk, although a direct correlation to the magnitude of the risk cannot be drawn.

In the case of simultaneous exposure to several chemicals, the hazard index (HI) is calculated to evaluate the potential risk from exposure to the mixture by summing the HQs for each chemical, media, and pathway. The total HI incorporates the assumption of additive effects when dealing with a mixture of components. The HI formula is as follows [USEPA 1989]:

$$HI = \sum_{i=1}^{i} HQ_i$$

where:

HI	=	Hazard index (unitless)
HQ_i	=	Hazard quotient for exposure to constituent i (unitless).

Summation of the individual HQs could result in an HI that exceeds 1.0, even if no single chemical exceeds its acceptable level. Mechanistically, it is not appropriate to sum HQs unless the constituents that make up the mixture have similar modes of action on an identical organ. Consequently, the summing of HQs for a mixture of compounds that is not expected to include the same type of effects could overestimate the potential risk. The USEPA recommends that if the total HI is greater than unity, the components of the mixture should be grouped by critical effect, and separate hazard indices should be calculated for each effect.

Estimates of noncarcinogenic risks for each occupational exposure pathway are provided in the following section.

B.5.3 Department of Toxic Control Leadspread VI

Risk for inorganic lead in soil was calculated using the DTSC LEADSPREAD model Version VI [DTSC 1992]. LEADSPREAD was run for both Sites 86 and 87, due to the fact that lead concentrations for both sites were above 130 parts per million (ppm). This level was established as an "action level". Lead concentrations below 130 ppm do not pose significant risk [DTSC 1992].

Four different LEADSPREAD runs were completed for each IRP site considered; one with plant uptake on and one with plant uptake off, for both the 95 percent upper confidence limit concentration and the maximum concentration. Therefore, the potential worst case scenario of on-site gardening at the maximum concentrations has been considered. Lead in dissolved water at a concentration of 15 micrograms per liter (μg/L) (the LEADSPREAD default) was not changed. This default is based on the federal action level concentration of lead in tap water. The highest concentration for lead in groundwater on Mather AFB to date is 1.6 μg/L. There are no regional or site specific data for lead in air, therefore, the LEADSPREAD default value of 0.15 micrograms per cubic meter was used.

B.5.4 Risks Due to Chronic Exposure to Largely Intact Lead Shot or Slugs

Risks due to the chronic ingestion of largely intact lead shot, are difficult to evaluate because of the numerous factors that influence ingestion rates which are unknown or hard to quantify. These factors include:

- surface area of soil to which the child is exposed;,
- probability of a locating lead shot in the given exposure area;
- probability of ingesting a single lead shot;
- probability of locating and ingesting multiple lead shot; and
- percentage of lead shot which is biologically available.

The above factors in combination with the uncertainties already built into the LEADSPREAD model make it difficult to quantify the risk due to total lead shot. However, with some simple assumptions it may be possible to quantify the number of shot per a given area which would exceed allowable lead soil concentrations. These assumption would include:

- the amount (or percentage) of lead shot which has decomposed;
- the mass of the remaining lead shot in soil including any crust material which may have built up on the shot; and
- the percentage of lead in shot which is bioavailable.

B.5.5 Results of the Human Health Risk Characterization

Tables B-6 through B-9 summarize the risks for the each exposure pathway for IRP Sites 86 and 87 at Mather AFB. Included in this summary is the carcinogenic and noncarcinogenic intakes; ILCR and HQ for each COPC and pathway; and pathway total ILCR and HQ.

Table B-10 summarizes the LEADSPREAD run for Sites 86 and 87. This output summarizes the blood lead level concentrations for three potential receptors: adult, child, and occupational. Children are the most sensitive subpopulation, and represent the greatest potential for risk due to exposure to lead. The whole-blood level of concern for children is 10 µg/deciliter of whole blood. The point of departure for risk management is a 0.01 (99 percent confidence) risk of exceeding this value [DTSC 1992].

The human health risk assessment suggests that the level of soil contamination found at both of these sites does pose a potential significant risk. Both sites had soil lead levels above the acceptable residential soil lead level of 130 ppm. Site 86 had a total cumulative site residential

Table B-6. Estimated Daily Intakes and Incremental Lifetime Cancer Risks at Site 86 for Mather Air Force Base

Potentially Exposed Population	Exposure Pathway	Constituent	Estimated Intake (mg/kg-day)	ILCR
Residential	Incidental Ingestion of Soil	Arsenic	1.7E-05	2.5E-05
Residential	Dermal Contact with Soil	Arsenic	5.7E-06	8.6E-06
Occupational	Incidental Ingestion of Soil	Arsenic	1.9E-06	2.8E-06
Occupational	Dermal Contact with Soil	Arsenic	3.5E-06	5.3E-06
Recreational	Incidental Ingestion of Soil	Arsenic	7.3E-06	1.1E-05
Recreational	Dermal Contact with Soil	Arsenic	3.7E-06	5.5E-06

ILCR = incremental lifetime cancer risk
mg/kg = milligrams per kilogram

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Table B-7. Estimated Daily Intakes and Hazard Quotients at Site 86 for Mather Air Force Base

Potentially Exposed Population	Exposure Pathway	Constituent	Estimated Intake (mg/kg-day)	HQ
Residential	Incidental Ingestion of Soil	Arsenic Copper Total	1.5E-04 1.6E-03	5.1E-01 4.3E-02 5.5E-01
Residential	Dermal Contact with Soil	Arsenic Copper Total	4.1E-05 1.4E-04	1.4E-01 3.9E-03 1.4E-01
Occupational	Incidental Ingestion of Soil	Arsenic Copper Total	5.3E-06 5.5E-05	1.8E-02 1.5E-03 1.9E-02
Occupational	Dermal Contact with Soil	Arsenic Copper Total	9.9E-06 3.4E-05	3.3E-02 9.3E-04 3.4E-02
Recreational	Incidental Ingestion of Soil	Arsenic Copper Total	6.6E-05 6.8E-04	2.2E-01 1.8E-02 2.4E-01
Recreational	Dermal Contact with Soil	Arsenic Copper Total	1.8E-05 6.2E-05	5.9E-02 1.7E-03 6.1E-02

mg/kg = milligrams per kilogram
HQ = hazard quotient

Table B-8. Estimated Daily Intakes and Incremental Lifetime Cancer Risks at Site 87 for Mather Air Force Base

Potentially Exposed Population	Exposure Pathway	Constituent	Estimated Intake (mg/kg-day)	ILCR
Residential	Incidental Ingestion of Soil	Arsenic	1.7E-05	2.5E-05
		Benzo(a)Pyrene	2.4E-06	2.8E-05
		Benzo(b)Fluoranthene	1.8E-06	1.3E-06
		Benzo(k)Fluoranthene	7.0E-07	5.1E-07
		Chrysene	2.4E-06	1.8E-08
		Dibenz(a,h)anthracene	7.6E-07	5.5E-06
		Indeno(1,2,3-cd)Pyrene	1.6E-06	1.1E-06
		Total		6.2E-05
Residential	Dermal Contact with Soil	Arsenic	5.6E-06	8.4E-06
		Benzo(a)Pyrene	4.0E-06	4.8E-05
		Benzo(b)Fluoranthene	3.0E-06	2.2E-06
		Benzo(k)Fluoranthene	1.2E-06	8.7E-07
		Chrysene	4.1E-06	3.0E-08
		Dibenz(a,h)anthracene	1.3E-06	9.4E-06
		Indeno(1,2,3-cd)Pyrene	1.8E-06	1.3E-06
		Total		7.0E-05
Residential	Ingestion of Home Grown Produce (soils)	Benzo(a)Pyrene	2.0E-06	2.4E-05
		Benzo(b)Fluoranthene	1.4E-06	1.0E-06
		Benzo(k)Fluoranthene	4.3E-07	3.2E-07
		Chrysene	2.2E-06	1.6E-08
		Dibenz(a,h)anthracene	5.2E-07	3.8E-06
		Indeno(1,2,3-cd)Pyrene	1.0E-06	7.5E-07
		Total		3.0E-05
Occupational	Incidental Ingestion of Soil	Arsenic	1.9E-06	2.8E-06
		Benzo(a)Pyrene	2.6E-07	3.2E-06
		Benzo(b)Fluoranthene	2.0E-07	1.4E-07
		Benzo(k)Fluoranthene	7.8E-08	5.7E-08
		Chrysene	2.7E-07	2.0E-09
		Dibenz(a,h)anthracene	8.5E-08	6.2E-07
		Indeno(1,2,3-cd)Pyrene	1.7E-07	1.3E-07
		Total		6.9E-06
Occupational	Dermal Contact with Soil	Arsenic	3.5E-06	5.2E-06
		Benzo(a)Pyrene	2.5E-06	3.0E-05
		Benzo(b)Fluoranthene	1.8E-06	1.3E-06
		Benzo(k)Fluoranthene	7.3E-07	5.4E-07
		Chrysene	2.5E-06	1.8E-08
		Dibenz(a,h)anthracene	7.9E-07	5.8E-06
		Indeno(1,2,3-cd)Pyrene	1.1E-06	7.9E-07
		Total		4.3E-05

Table B-8. Estimated Daily Intakes and Incremental Lifetime Cancer Risks at Site 87 for Mather Air Force Base (Continued)

Potentially Exposed Population	Exposure Pathway	Constituent	Estimated Intake (mg/kg-day)	ILCR
Recreational	Incidental Ingestion of Soil	Arsenic	7.1E-06	1.1E-05
		Benzo(a)Pyrene	1.0E-06	1.2E-05
		Benzo(b)Fluoranthene	7.6E-07	5.5E-07
		Benzo(k)Fluoranthene	3.0E-07	2.2E-07
		Chrysene	1.0E-06	7.6E-09
		Dibenz(a,h)anthracene	3.2E-07	2.4E-06
		Indeno(1,2,3-cd)Pyrene	6.7E-07	4.9E-07
		Total		2.6E-05
Recreational	Dermal Contact with Soil	Arsenic	3.6E-06	5.4E-06
		Benzo(a)Pyrene	2.6E-06	3.1E-05
		Benzo(b)Fluoranthene	1.9E-06	1.4E-06
		Benzo(k)Fluoranthene	7.7E-07	5.6E-07
		Chrysene	2.6E-06	1.9E-08
		Dibenz(a,h)anthracene	8.3E-07	6.0E-06
		Indeno(1,2,3-cd)Pyrene	1.1E-06	8.3E-07
		Total		4.5E-05
Residential	Incidental Ingestion of Sediment	Arsenic	7.6E-05	1.1E-04
		Benzo(a)Pyrene	2.7E-08	3.3E-07
		Benzo(b)Fluoranthene	1.0E-07	7.5E-08
		Benzo(k)Fluoranthene	1.1E-08	8.0E-09
		Chrysene	8.6E-08	6.3E-10
		Dibenz(a,h)anthracene	2.0E-08	1.5E-07
		Indeno(1,2,3-cd)Pyrene	2.5E-08	1.8E-08
		Total		1.1E-04
Residential	Dermal Contact with Sediment	Arsenic	2.6E-05	3.9E-05
		Benzo(a)Pyrene	4.6E-08	5.6E-07
		Benzo(b)Fluoranthene	1.7E-07	1.3E-07
		Benzo(k)Fluoranthene	1.9E-08	1.4E-08
		Chrysene	1.5E-07	1.1E-09
		Dibenz(a,h)anthracene	3.4E-08	2.5E-07
		Indeno(1,2,3-cd)Pyrene	2.8E-08	2.1E-08
		Total		4.0E-05
Residential	Ingestion of Home Grown Produce (Sediment)	Benzo(a)Pyrene	2.3E-08	2.8E-07
		Benzo(b)Fluoranthene	8.3E-08	6.0E-08
		Benzo(k)Fluoranthene	6.7E-09	4.9E-09
		Chrysene	7.8E-08	5.7E-10
		Dibenz(a,h)anthracene	1.4E-08	1.0E-07
		Indeno(1,2,3-cd)Pyrene	1.7E-08	1.2E-08
		Total		4.6E-07

Table B-8. Estimated Daily Intakes and Incremental Lifetime Cancer Risks at Site 87 for Mather Air Force Base (Continued)

Potentially Exposed Population	Exposure Pathway	Constituent	Estimated Intake (mg/kg-day)	ILCR
Occupational	Incidental Ingestion of Sediment	Arsenic	8.5E-06	1.3E-05
		Benzo(a)Pyrene	3.1E-09	3.7E-08
		Benzo(b)Fluoranthene	1.1E-08	8.4E-09
		Benzo(k)Fluoranthene	1.2E-09	8.9E-10
		Chrysene	9.6E-09	7.0E-11
		Dibenz(a,h)anthracene	2.2E-09	1.6E-08
		Indeno(1,2,3-cd)Pyrene	2.8E-09	2.0E-09
		Total		1.3E-05
Occupational	Dermal Contact with Sediment	Arsenic	1.6E-05	2.4E-05
		Benzo(a)Pyrene	2.9E-08	3.4E-07
		Benzo(b)Fluoranthene	1.1E-07	7.8E-08
		Benzo(k)Fluoranthene	1.1E-08	8.4E-09
		Chrysene	9.0E-08	6.6E-10
		Dibenz(a,h)anthracene	2.1E-08	1.5E-07
		Indeno(1,2,3-cd)Pyrene	1.7E-08	1.3E-08
		Total		2.4E-05
Recreational	Incidental Ingestion of Sediment	Arsenic	3.3E-05	4.9E-05
		Benzo(a)Pyrene	1.2E-08	1.4E-07
		Benzo(b)Fluoranthene	4.4E-08	3.2E-08
		Benzo(k)Fluoranthene	4.7E-09	3.4E-09
		Chrysene	3.7E-08	2.7E-10
		Dibenz(a,h)anthracene	8.6E-09	6.3E-08
		Indeno(1,2,3-cd)Pyrene	1.1E-08	7.8E-09
		Total		4.9E-05
Recreational	Dermal Contact with Sediment	Arsenic	1.7E-05	2.5E-05
		Benzo(a)Pyrene	3.0E-08	3.6E-07
		Benzo(b)Fluoranthene	1.1E-07	8.2E-08
		Benzo(k)Fluoranthene	1.2E-08	8.7E-09
		Chrysene	9.4E-08	6.9E-10
		Dibenz(a,h)anthracene	2.2E-08	1.6E-07
		Indeno(1,2,3-cd)Pyrene	1.8E-08	1.3E-08
		Total		2.6E-05
Residential	Incidental Ingestion of Surface Water	No carcinogenic chemicals of potential concern		
Occupational	Incidental Ingestion of Surface Water	No carcinogenic chemicals of potential concern		

ILCR = incremental lifetime cancer risk
mg/kg = milligrams per kilogram

Table B-9. Estimated Daily Intakes and Hazard Quotients at Site 87 for Mather Air Force Base

Potentially Exposed Population	Exposure Pathway	Constituent	Estimated Intake (mg/kg-day)	HQ
Residential	Incidental Ingestion of Soil	Arsenic	1.5E-04	5.0E-01
		Tin	8.1E-04	1.3E-03
		Benzo(a)anthracene	1.4E-05	2.0E-04
		Fluoranthene	1.8E-05	4.6E-04
		Phenanthrene	4.8E-06	1.6E-05
		Pyrene	2.9E-05	9.8E-04
		Total		5.0E-01
Residential	Dermal Contact with Soil	Arsenic	4.1E-05	1.4E-01
		Tin	7.3E-05	1.2E-04
		Benzo(a)anthracene	1.2E-06	1.8E-05
		Fluoranthene	2.5E-05	6.3E-04
		Phenanthrene	6.5E-06	2.2E-05
		Pyrene	4.0E-05	1.3E-03
		Total		1.4E-01
Residential	Ingestion of Home Grown Produce (soils)	Benzo(a)anthracene	2.9E-06	4.1E-05
		Fluoranthene	1.0E-05	2.5E-04
		Phenanthrene	3.7E-06	1.2E-05
		Pyrene	1.6E-05	5.4E-04
		Total		8.5E-04
Occupational	Incidental Ingestion of Soil	Arsenic	5.2E-06	1.7E-02
		Tin	2.8E-05	4.6E-05
		Benzo(a)anthracene	4.8E-07	6.8E-06
		Fluoranthene	6.4E-07	1.6E-05
		Phenanthrene	1.7E-07	5.5E-07
		Pyrene	1.0E-06	3.4E-05
		Total		1.7E-02
Occupational	Dermal Contact with Soil	Arsenic	9.7E-06	3.2E-02
		Tin	1.7E-05	2.9E-05
		Benzo(a)anthracene	3.0E-07	4.2E-06
		Fluoranthene	6.0E-06	1.5E-04
		Phenanthrene	1.6E-06	5.2E-06
		Pyrene	9.5E-06	3.2E-04
		Total		3.3E-02
Recreational	Incidental Ingestion of Soil	Arsenic	6.4E-05	2.1E-01
		Tin	3.5E-04	5.8E-04
		Benzo(a)anthracene	5.9E-06	8.4E-05
		Fluoranthene	7.9E-06	2.0E-04
		Phenanthrene	2.1E-06	6.9E-06
		Pyrene	1.3E-05	4.2E-04
		Total		2.2E-01

Table B-9. Estimated Daily Intakes and Hazard Quotients at Site 87 for Mather Air Force Base (Continued)

Potentially Exposed Population	Exposure Pathway	Constituent	Estimated Intake (mg/kg-day)	HQ
Recreational	Dermal Contact with Soil	Arsenic	1.7E-05	5.8E-02
		Tin	3.1E-05	5.2E-05
		Benzo(a)anthracene	5.3E-07	7.6E-06
		Fluoranthene	1.1E-05	2.7E-04
		Phenanthrene	2.8E-06	9.3E-06
		Pyrene	1.7E-05	5.7E-04
		Total		5.9E-02
Residential	Incidental Ingestion of Sediment	Antimony	3.0E-04	7.4E-01
		Arsenic	6.9E-04	2.3E+00
		Barium	4.3E-03	6.1E-02
		Copper	8.2E-04	2.2E-02
		Zinc	1.3E-03	4.4E-03
		Benzo(a)anthracene	1.3E-07	1.9E-06
		Pyrene	1.3E-06	4.5E-05
		Total		3.1E+00
Residential	Dermal Contact with Sediment	Antimony	2.7E-05	6.7E-02
		Arsenic	1.9E-04	6.2E-01
		Barium	3.9E-04	5.5E-03
		Copper	7.4E-05	2.0E-03
		Zinc	1.2E-04	4.0E-04
		Benzo(a)anthracene	1.2E-08	1.7E-07
		Pyrene	1.8E-06	6.1E-05
		Total		7.0E-01
Residential	Ingestion of Home Grown Produce (Sediment)	Benzo(a)anthracene	2.8E-08	4.0E-07
		Pyrene	7.4E-07	2.5E-05
		Total		2.5E-05
Occupational	Incidental Ingestion of Sediment	Antimony	1.0E-05	2.6E-02
		Arsenic	2.4E-05	7.9E-02
		Barium	1.5E-04	2.1E-03
		Copper	2.8E-05	7.6E-04
		Zinc	4.5E-05	1.5E-04
		Benzo(a)anthracene	4.6E-09	6.6E-08
		Pyrene	4.6E-08	1.5E-06
		Total		1.1E-01
Occupational	Dermal Contact with Sediment	Antimony	6.4E-06	1.6E-02
		Arsenic	4.4E-05	1.5E-01
		Barium	9.2E-05	1.3E-03
		Copper	1.8E-05	4.8E-04
		Zinc	2.8E-05	9.5E-05
		Benzo(a)anthracene	2.9E-09	4.1E-08
		Pyrene	4.4E-07	1.5E-05
		Total		1.7E-01

Table B-9. Estimated Daily Intakes and Hazard Quotients at Site 87 for Mather Air Force Base (Continued)

Potentially Exposed Population	Exposure Pathway	Constituent	Estimated Intake (mg/kg-day)	HQ
Recreational	Incidental Ingestion of Sediment	Antimony	1.3E-04	3.2E-01
		Arsenic	2.9E-04	9.8E-01
		Barium	1.8E-03	2.6E-02
		Copper	3.5E-04	9.5E-03
		Zinc	5.6E-04	1.9E-03
		Benzo(a)anthracene	5.7E-08	8.1E-07
		Pyrene	5.8E-07	1.9E-05
		Total		1.3E+00
Recreational	Dermal Contact with Sediment	Antimony	1.2E-05	2.9E-02
		Arsenic	8.0E-05	2.7E-01
		Barium	1.7E-04	2.4E-03
		Copper	3.2E-05	8.6E-04
		Zinc	5.1E-05	1.7E-04
		Benzo(a)anthracene	5.2E-09	7.4E-08
		Pyrene	7.8E-07	2.6E-05
		Total		3.0E-01
Residential	Incidental Ingestion of Surface Water	Antimony	1.2E-07	2.9E-04
		Barium	5.1E-06	7.3E-05
		Total		3.6E-04
Occupational	Incidental Ingestion of Surface Water	Antimony	3.8E-08	9.4E-05
		Barium	1.7E-06	2.4E-05
		Total		1.2E-04

HQ = hazard quotient
mg/kg = milligrams per kilogram

Table B-10. Lead Blood Level Summary

Site	Media	95 % UCL Soil Concentration (ppm)	Maximum Soil Concentration (ppm)	Receptor	95% Blood Level at UCL Concentration (µg/dL)	99% Blood Level at UCL Concentration (µg/dL)	95% Blood Level at Maximum Concentration (µg/dL)	99% Blood Level at Maximum Concentration (µg/dL)
With Plant Uptake								
86	Soil	1305	1660	Adult	10.1	12.9	12.0	15.2
				Child	27.2	34.6	33.0	42.1
				Industrial Adult	4.7	6.0	5.1	6.5
87	Soil	718	1330	Adult	7.1	9.0	10.3	13.1
				Child	17.5	22.3	27.6	35.2
				Industrial Adult	4.1	5.3	4.8	6.1
87	Sediment	6305	6305	Adult	35.9	45.7	35.9	45.7
				Child	109.5	139.5	109.5	139.5
				Industrial Adult	10.0	12.7	10.0	12.7
With No Plant Uptake								
86	Soil	1305	1660	Adult	5.2	6.6	5.6	7.1
				Child	15.5	19.7	18.1	23.0
				Industrial Adult	4.7	6.0	5.1	6.5
87	Soil	718	1330	Adult	4.4	5.6	5.2	6.6
				Child	11.2	14.2	15.6	19.9
				Industrial Adult	4.1	5.3	4.8	6.1

Table B-10. Lead Blood Level Summary (Continued)

Site	Media	95 % UCL Soil Concentration (ppm)	Maximum Soil Concentration (ppm)	Receptor	95% Blood Level at UCL Concentration (µg/dL)	99% Blood Level at UCL Concentration (µg/dL)	95% Blood Level at Maximum Concentration (µg/dL)	99% Blood Level at Maximum Concentration (µg/dL)
87	Sediment	6305	6305	Adult	11.5	14.7	11.5	14.7
				Child	52.0	66.3	52.0	66.3
				Industrial Adult	10.0	12.7	10.0	12.7

UCL = upper confidence limit
ppm = parts per million
µg/dL = micrograms per deciliter

ILCR of 3.4 x 10^{-5} with arsenic contributing all of the risk. However, the cumulative ILCR is less than 1 x 10^{-4} and therefore, the site as a whole does not pose significant carcinogenic risk. None of the COPC at Site 86 exceeded a HQ of 1.0. Site 87 had a total cumulative site residential ILCR of 1.6 x 10^{-4} for soils and 1.5 x 10^{-4} for sediment with arsenic and polycyclic aromatic hydrocarbons contributing all of the risk. Arsenic also exceeded a HQ of 1.0 for residential incidental ingestion of sediment.

B.5.6 General Uncertainties

The overriding uncertainties associated with the risk characterization are as follows:

- The extrapolation of toxic effects observed at the high doses necessary to conduct animal studies to effects that might occur at much lower, more realistic doses.
- The extrapolation from toxic effects in laboratory animals to toxic effects in humans (i.e., responses of animals may be different from responses of humans).
- Pathway analyses have been conservative and generally do not include fate and transport considerations (such as dispersion, adsorption, etc.) in the estimates.

Extrapolations from laboratory animal studies form the basis for the derivation of factors used to estimate risks. Uncertainties are taken into account when deriving RfDs and SFs. The risk assessment utilized USEPA guidance in minimizing the uncertainties through the use of published standards and criteria to evaluate risks posed by chemicals measured at George AFB.

In addition to the general uncertainties listed above, the sources of uncertainty in characterizing risk at Sites 86 and 87 include the following paragraph

Risk assessment is ultimately an integrated evaluation of historical, chemical, analytical, environmental, demographic, and toxicological data that are as site-specific as possible. To safe guard against the effects of uncertainty in the evaluation, each step is biased toward health protective estimations. Because each step builds on the previous one, this biased approach should more than compensate for risk assessment uncertainties. In addition, the calculations presented in this risk assessment do not necessarily accurately represent currently existing or expected future exposure or health risks. Rather, they are estimates of potential risk only if all the conservative assumptions are realized.

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TAB

Appendix C

Appendix C
Ecological Risk Assessment for Mather Air Force Base Sites 86 and 87

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List of Acronyms

AFB	Air Force Base
CBRA	Comprehensive Baseline Risk Assessment
CEPA	California Environmental Protection Agency
COPEC	chemicals of potential ecological concern
DTSC	Department of Toxic Substances Control
IRP	Installation Restoration Program
mg/kg	milligrams per kilogram
NOAEL	no-observed-adverse-effect levels
PAH	polycyclic aromatic hydrocarbons
USEPA	U.S. Environmental Protection Agency

C.1 Introduction

This appendix addresses the overall ecological risks associated with exposure to chemicals of potential ecological concern (COPECs) in surface soil, sediment, and surface water associated with Installation Restoration Program (IRP) Site 86 (former Military Firing Range) and Site 87 (former Skeet/Trap Range) at Mather Air Force Base (AFB) in Sacramento, California. The ecological risk assessment process performed for these sites follows the methodology used in the Final Comprehensive Baseline Risk Assessment (CBRA) for Mather, AFB, California [IT 1996]. The methodology is consistent with a phased approach in the evaluation of ecological risks as recommended in the updated USEPA guidance "Proposed Guidelines for Ecological Risk Assessment" [USEPA 1996a] and in the guidance for Ecological Risk Assessment at Hazardous Waste Sites and Permitted Facilities, part A: Overview" [DTSC 1996]. The ecological risk assessment performed for Sites 86 and 87, as presented here, is a screening level evaluation.

This appendix presents discussion on major risk assessment elements including problem formulation, analysis, and risk characterization.

C.2 Problem Formulation

Problem formulation the first step of an ecological risk assessment process. It can be defined as a systematic planning step that identifies the major factors to be considered in a particular assessment [USEPA 1992a]. In short, it establishes the goals, breadth, and focus of the assessment and is linked to the regulatory and policy context of the assessment. The problem formulation process begins with the initial stages of characterizing exposure and ecological effects expected and observed. It describes the relationships among assessment and measurement endpoints, data required, and methodology that will be used to analyze the data.

Because Sites 86 and 87 were formerly used as firing ranges, environmental media from these sites are expected to contain elevated concentrations of constituents found in lead shot, clay pigeons, and bullet slugs. Ways in which ecological receptors may come into contact with these agents and their chemical contents will be evaluated in the risk assessment. Points of contact were eliminated from further consideration where an element necessary to complete an exposure pathway was determined to be lacking.

C.2.1 Study Site Identification

This section briefly describes previous land use activities and identifies COPECs at Sites 86 and 87. For additional information refer to the Site Characterization Report for IRP Sites 86 and 87 [IT 1997].

C.2.1.1 Site 86 - Former Military Firing Range

The Former Military Firing Range (Site 86) is located on the southeastern portion of Mather AFB. The site formerly consisted of the rifle and pistol range (approximately 380 feet long and 215 feet wide) and the former pistol range (approximately 240 feet long and 130 feet wide) which covered an area approximately 112,900 square feet. The source of contamination is small arms ammunition. Chemicals of potential ecological concern include antimony, copper, and lead from bullets; copper, tin, and zinc from the bullet jackets; and antimony and barium from the primers.

C.2.1.2 Site 87 - Former Skeet/Trap Range

The Former Skeet/Trap Range (Site 87) is located on the eastern portion of Mather AFB and consists of an open grassland area. The skeet/trap range, which is currently closed, was operated by a local shooting club since the early 1970s and covers an area approximately 1,271,700 square feet. The source of suspected contamination at the site is predominately lead shot resulting from the discharge of shotgun shells. In addition to lead, other COPECs associated with lead shot include antimony, arsenic, and copper. Asphalt or coal tar pitch and limestone may also be present from the manufacturer of the "clay pigeons" (small airborne targets).

C.2.2 Ecosystems Potentially at Risk

This section briefly describes the ecological conditions and potentially complete pathways at both Sites 86 and 87. Tables C-1 and C-2 identify habitat specific pathways and environmental media of potential ecological concern for each sites, respectively.

C.2.2.1 Sites 86 - The Former Military Firing Range

Site 86 primarily consists of semi-disturbed grassland. The principal terrestrial wildlife species consist of small mammals, such as house mice (*Mus musculus*), deer mice (*Peromyscuc maniculatus*), and California voles (*Microtus californicus*). Larger herbivores include blacktail jackrabbits (*Lepus californicus*) and desert cottontails (*Sylvilagus auduboni*). Common terrestrial predators include the gopher snake (*Pituophis melanoleucus*) and the coyote

Table C-1. Summary of Habitat-Specific Pathways Evaluated for Mather Sites 86 and 87

Site No.	Grassland	Surface Water Drainage System	Seasonal Surface Water/Vernal Pools	No Pathways
86	X	NA	NA	NA
87	X	X	NA	NA

NA = not applicable

Table C-2. Environmental Media of Potential Ecological Concern Present at Mather Installation Restoration Program Sites 86 and 87

Site No.	Surface Soil	Surface Water	Sediment	Air
86	X	NA	NA	NA
87	X	X	X	NA

NA = not applicable

(*Canis latrans*). Common birds within this habitat are western meadowlarks (*Sturnella neglecta*), house finches (*Carpodacus mexicanus*), northern mocking birds (*Mimus polyglottos*), and American crows (*Corvus brachyrhynchos*). Raptors are also common, with red-tailed hawks (*Buteo jamaicensis*) and northern harriers (*Cirus cyaneus*), being the most common hawks.

Contaminant migration from the site to the ecologically accessible environment is most likely to occur through the direct uptake or exposure through the food chain in contaminants associated with surface soils. Surface water is nor readily accessible at this site and is not considered as a media of potential ecological concern. As shown in Figure C-1 and Table C-1, only grassland receptors are of potential ecological concern at Site 86.

C.2.2.2 Site 87 - The Former Skeet/Trap Range

Site 87 is similar in habitat and species composition to Site 86 with the exception of Morrison Creek. Morrison Creek is an ephemeral stream that runs from the northeast to the southwest corners of the site. The water level within this creek fluctuates with seasonal precipitation and is commonly dry in summer and early fall. Damming of the creek has created a small pond which covers approximately one-tenth of an acre on the western edge of the site [IT 1997].

This man made pond attracts waterfowl, shore birds, and wading birds, particularly mallards (*Anas platyrhynchos*), which breed in and around these habitats, killdeer (*Charadrius*

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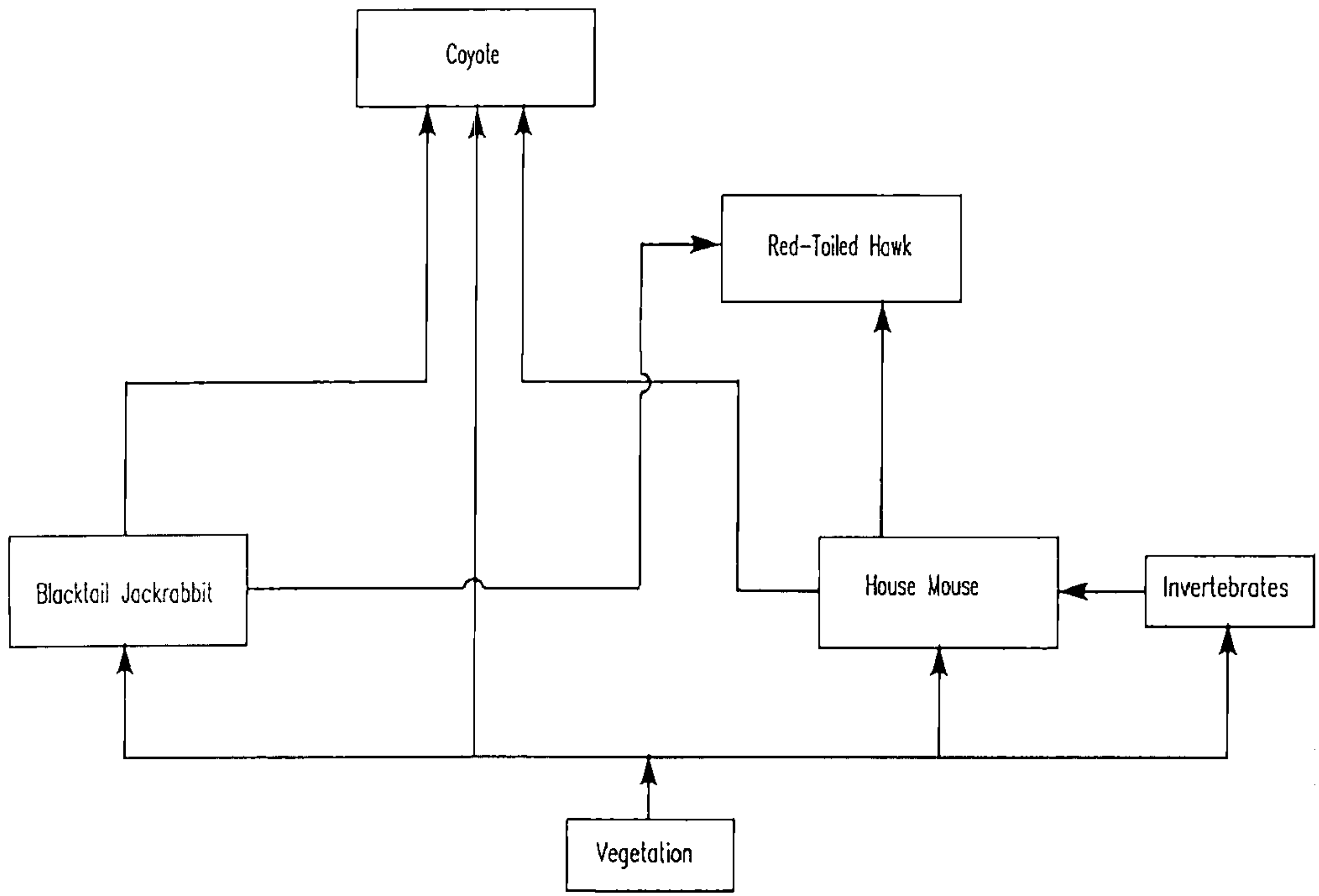


Figure C-1
Generalized Food Web for the Grassland Communities at Mather IRP Sites 86 and 87

vociferus), and great egrets (*Casmerodius albus*). Wildlife species that are more dependent upon permanent surface water are also attracted to this habitat type including muskrats (*Ondatra zibethica*), red-winged blackbirds (*Agelaius phoenceus*), tadpoles (e.g., western spadefoots [*Scaphiopus hammondii*], Pacific treefrogs [*Hyla regilla*]), and bullfrogs (*Rana catesbeiana*) which provide a food source to great blue herons (*Ardea herodias*), green-backed herons (*Butorides striatus*), and raccoons (*Procyon lotor*) that feed around the permanent water bodies on the base.

As illustrated in Table C-1 and Figure C-2, terrestrial and semi-aquatic receptors are likely to be exposed to contaminants through the ingestion of water or through the direct uptake or exposure through the food chain in contaminants associated with sediment. The potential for food-chain transfers from aquatic biota to the terrestrial receptors is also possible.

C.2.3 Endpoint Selection

The endpoint selected estimation of risk associated with Sites 86 and 87 are similar to those listed in the CBRA [IT 1996]. As in the CBRA, emphasis is placed on habitat type. The endpoints and associated management goals for the grassland habitats are:

- Management Goal - Protection of the natural plant diversity of the grasslands associated with Sites 86 and 87
  - Assessment Endpoint - Toxicity of surface soil to plants.
  - Measurement Endpoints - Comparison of surface soil chemistry data with phytotoxicity benchmark values.

- Management Goal - Protection of the natural animal diversity of the grasslands associated with Sites 86 and 87.
  - Assessment Endpoint - Toxicity of surface soil to terrestrial wildlife.
  - Measurement Endpoints - Use of the quotient method with hazard quotients greater than 1.0 as indicative of potential risk.

The endpoints and associated measurement goals for the surface water drainage system habitat are:

- Management Goal - Protection of the wetland ecosystems of the surface water drainage system associated with Site 87.
  - Assessment Endpoints - Toxicity of surface water and sediments to freshwater biota, benthic invertebrates, emergent plants, and semiaquatic and terrestrial wildlife populations.

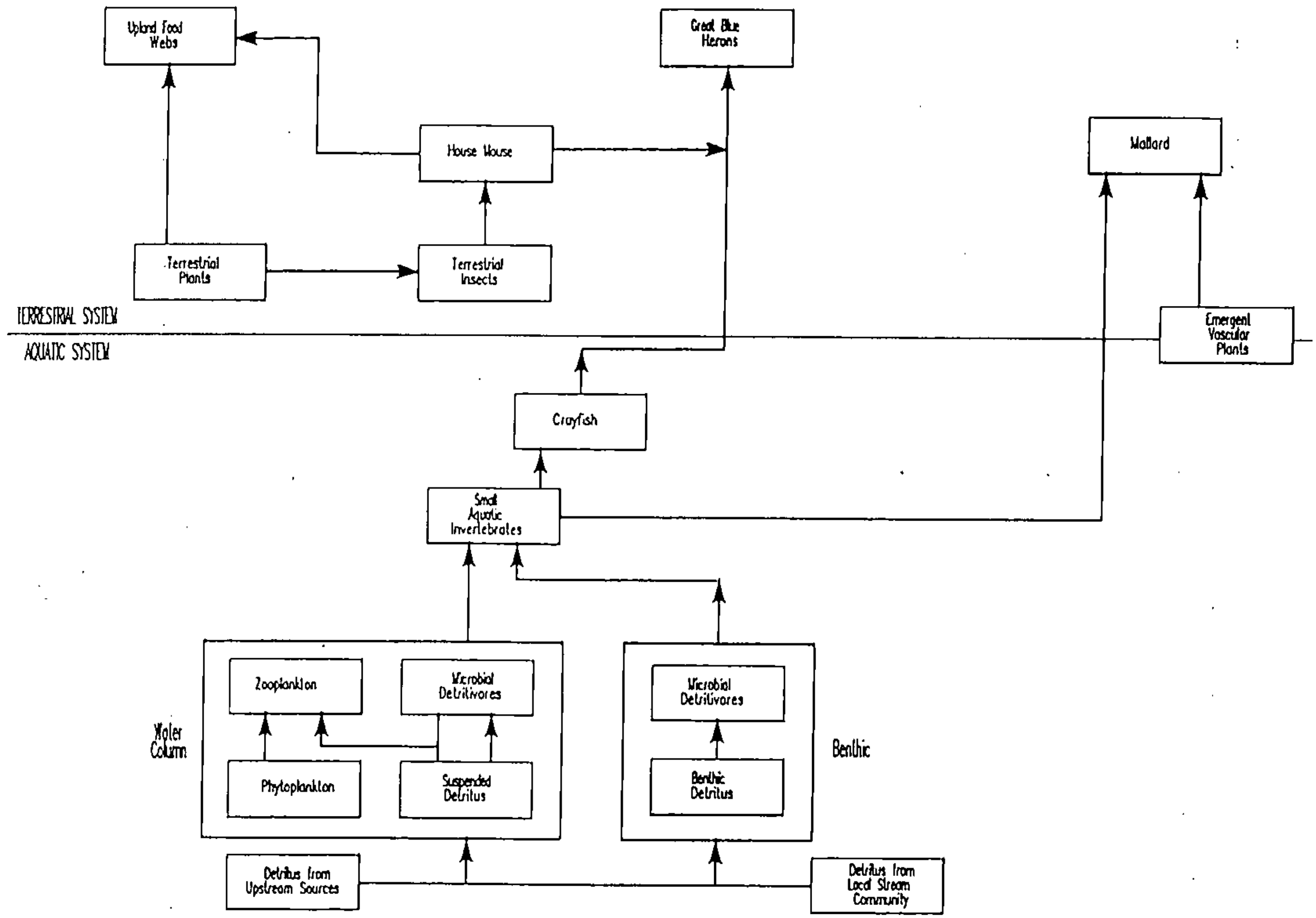


Figure C-2
Generalized Food Web for the Surface Water Drainage System Communities at Mather IRP Site 87

- Measurement Endpoints - Comparison of surface water chemistry data to water quality criteria, comparison of sediment chemistry data to sediment quality criteria and phytotoxicity benchmark values, and use of the quotient method to predict potential risk to vertebrates.

C.2.4 Conceptual Model

Conceptual models for the two habitat types are presented in Figures C-3 and C-4. Primary routes of exposure within the grassland habitats of Sites 86 and 87 are expected to occur through ingestion and direct uptake of soil, and through consumption of surface water. major routes of exposure of ecological receptors to contaminants within the surface water drainage system of Site 87 are through ingestion and direct uptake. For both habitat types ingestion includes food chain related pathways.

C.2.5 Chemicals of Potential Ecological Concern

Chemicals of potential ecological concern for the two sites were determined as stated in the CBRA [IT 1996}. The selection process is also discussed in Appendix B - the Human Health Risk Assessment for Sites 86 and 87. The process used for human health was identical to that used for this ecological risk assessment. The COPECs for Sites 86 and 87 are presented in Tables C-3 and C-4. The COPECs at IRP Site 86 occur in surface soil and consist of arsenic, copper, and lead. The COPEC at IRP Site 87 occur in surface soil, sediment, and surface water. Arsenic, benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(g,h,i)perylene, benzo(k)fluoranthene, chrysene, dibenz(a,h)anthracene, fluoranthene, indeno(1,2,3-cd)pyrene, lead, phenanthrene, pyrene, and tin are COPECs in surface soil. Antimony, barium, and lead occur in surface water. Antimony, arsenic, barium, benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(g,h,i)perylene, benzo(k)fluoranthene, chrysene, copper, dibenz(a,h)anthracene, indeno(1,2,3-cd)pyrene, lead, pyrene, and zinc in sediment.

C.3 Analysis Phase

The analysis phase of an ecological risk assessment is basically the exposure section of a risk assessment. Based on information provided in the Problem Formulation and site-specific data exposure to ecological receptors are assessed. This section specifically addressed the quantification of exposure and characterization of potential toxicological effects. Methods used in this screening level assessment are identical to those presented in the CBRA [IT 1996].

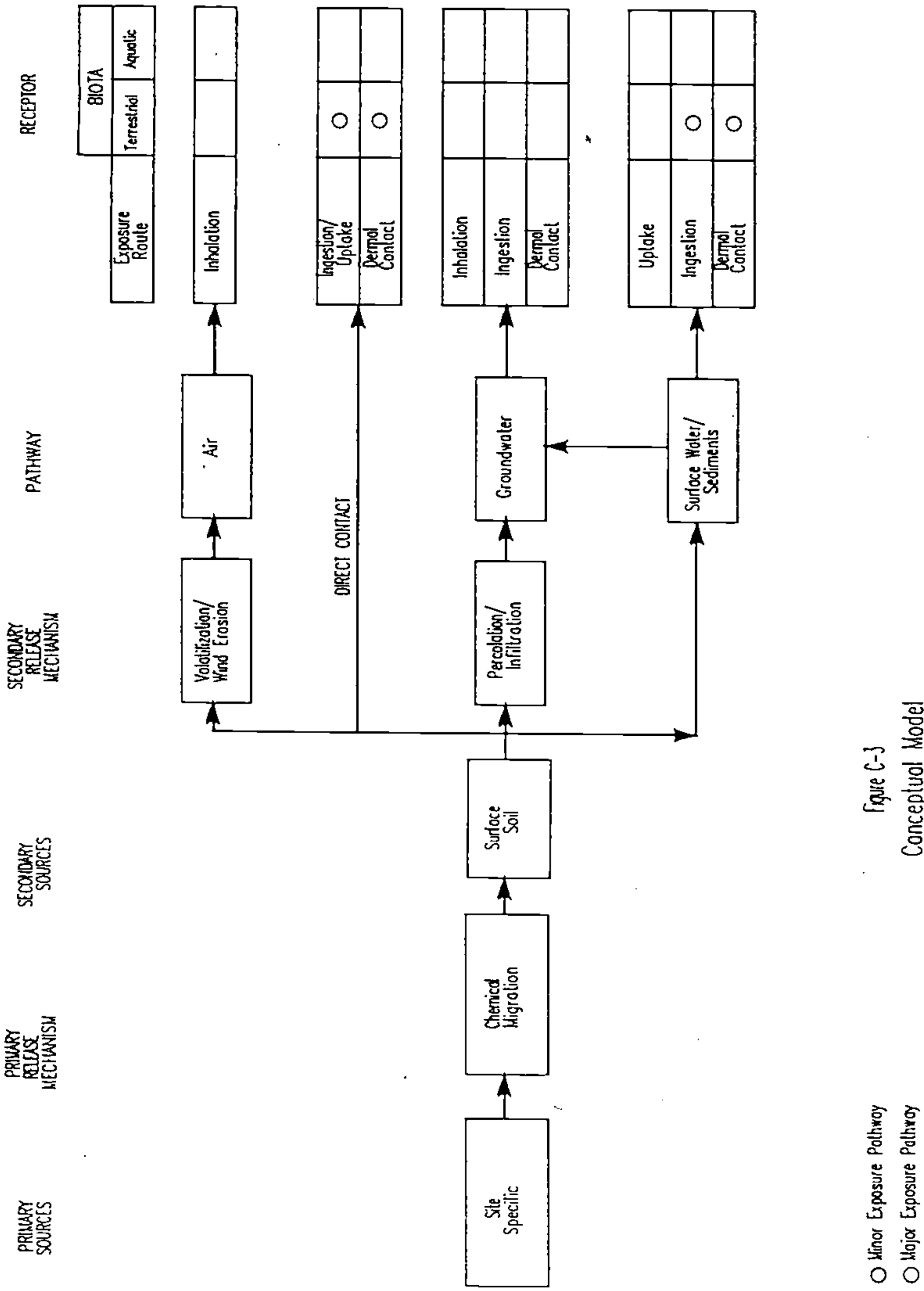
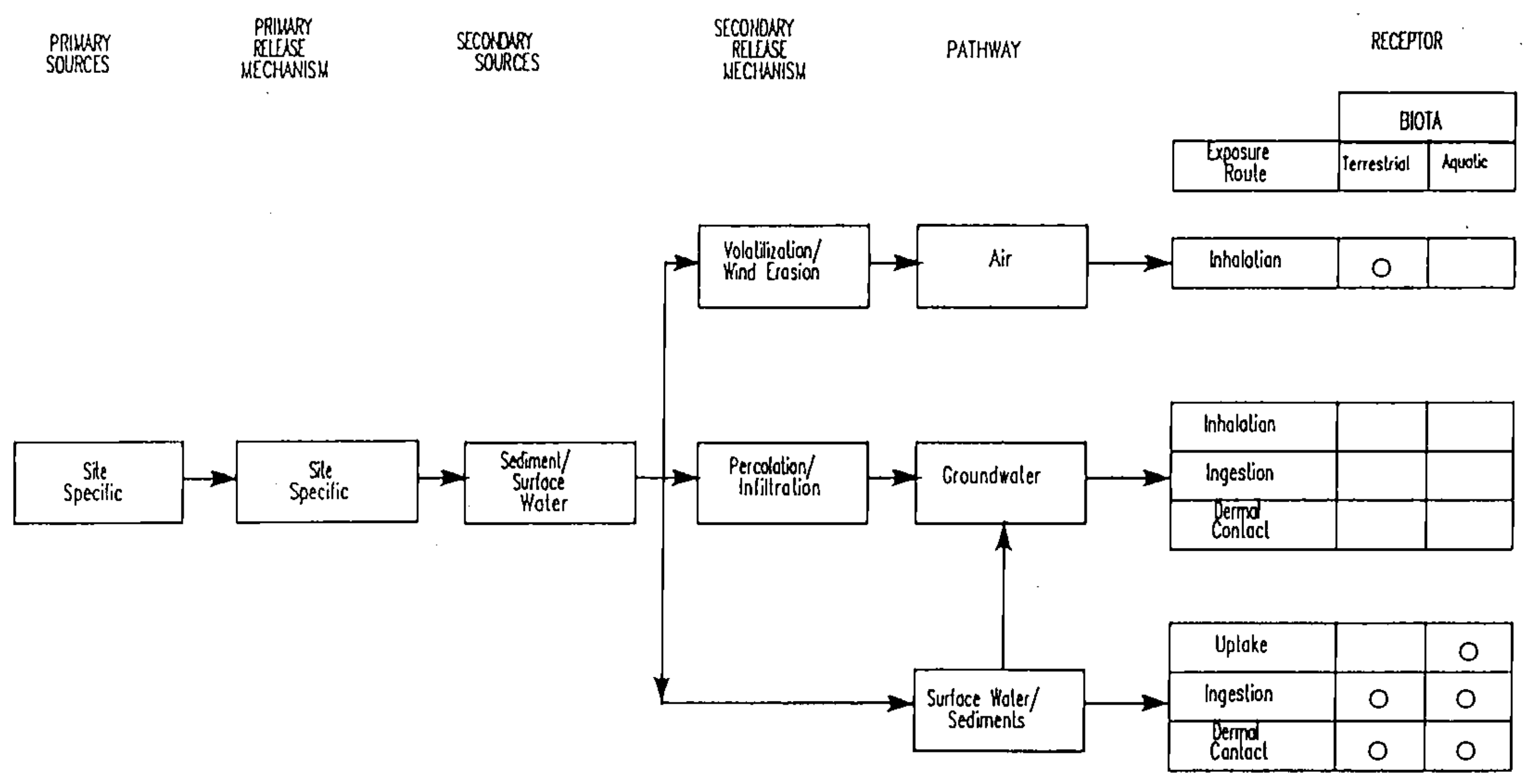


Figure C-3
Conceptual Model
Grasslands



○ Minor Exposure Pathway
○ Major Exposure Pathway

Figure C-4
Conceptual Model
Surface Water Drainage Systems

Table C-3. Chemicals of Potential Ecological Concern Associated with Site 86

Chemical of Potential Ecological Concern(a)	Surface Soil Concentration (mg/kg)
Inorganic	
Arsenic	10.81
Copper	112.86
Lead	1304.62

(a) Surface soil concentrations are either the 95 percent upper confidence limit of the mean or the maximum concentration, whichever is lowest.

mg/kg = milligrams per kilogram

Table C-4. Chemicals of Potential Ecological Concern Associated with Site 87

Chemical of Potential Ecological Concern(a)	Surface Soil Concentration	Sediment Concentration	Surface Water Concentration
Inorganic(b)			
Antimony	--(c)	21	0.002
Arsenic	10.59	48.5	--
Barium	--	301.5	0.089
Copper	--	58	--
Lead	717.71	6305	0.001
Tin	56.89	--	--
Zinc	--	93	--
Organic(d)			
Benzo(a)anthracene	971.74	9.4	--
Benzo(a)pyrene	1515.42	17.5	--
Benzo(b)fluoranthene	1127.19	65.5	--
Benzo(g,h,i)perylene	1361.20	26.5	--
Benzo(k)fluoranthene	448.79	7	--
Chrysene	1543.84	55	--
Dibenz(a,h)anthracene	483.82	12.8	--
Fluoranthene	1304.15	--	--
Indeno(1,2,3-cd)pyrene	991.79	16	--
Phenanthrene	339.11	--	--
Pyrene	2082.40	95	--

(a) All values are either the 95 percent upper confidence limit of the mean or the maximum concentration. whichever is lowest.
(b) Inorganic values are in milligrams per kilogram
(c) Dash indicates value could not be determined
(d) Organic values are in micrograms per kilogram

C.3.1 Quantification of Exposure

The concentrations of COPEC in plants and animals were modeled in order to assess the potential hazards associated with organic and inorganic contaminants in surface soils, surface waters, and sediment Sites 86 and 87 biota. Models used to quantify ecological exposure in both terrestrial and aquatic environments were developed as part of the CBRA [IT 1996] and are addressed in the following subsections.

C.3.1.1 Terrestrial Exposure Models

Potential risks to terrestrial biota were assessed following direct and indirect exposure to COPEC in soil and surface water. Exposure concentrations used for the evaluation of potential effects on terrestrial indicator species were the lowest of either the 95 percent upper confidence limit of the arithmetic mean concentrations or the maximum concentration measured [USEPA 1989a]. Indicator species considered in terrestrial exposure pathways include a generic annual plant, house mouse, blacktail jackrabbit, coyote, and red-tailed hawk.

C.3.1.1.1 Vegetation

Estimates of the concentrations of COPEC in Mather AFB terrestrial plants were made using the chemical-specific concentration in surface soil from the particular site of interest. Direct uptake of contaminants from soil was assumed to be the major route of exposure of plants to contaminants, with exposure of plants to wind-blown soil and associated contaminants and uptake of contaminants in surface water assumed to be minor routes of exposure. As mentioned above, the indicator plant species selected was assumed to be a generic annual plant.
Soil-to-plant transfer factors for metals in vegetative plant parts (a mixture of pasture grass, hay, leafy vegetables, and mixed silages) were obtained from Baes et al. [1984] [IT 1996]. Those for antimony and tin, COPECs not previously addressed in the CBRA, are presented in Table C-5. Soil-to-plant (vegetative plant parts only) transfer coefficients for organic compounds of potential concern were estimated using the equation derived by Travis and Arms [1988] based on the linear regression of the log of the K_{ow} for 29 organic compounds ranging from 1.15 to 9.35 and the log of analytically derived soil-to-plant bioconcentration factors [IT 1996]. These transfer factors are conservative and do not consider such factors as the bioavailability of a chemical in soil, the biodegradation rate of a compound in soil or the metabolic transformation of compounds in plants. Concentrations in the aboveground vegetative part of plants were

Table C-5. Soil-to-Plant and Soil-to-Insect Transfer Factors for Inorganic Analytes in Vegetative Plant Parts

Element	Soil-to-Plant Transfer Factor(a)	Soil-to-Insect Transfer Factor(b)
Antimony	2.0E-01	1 (c)
Tin	3.0E-02	1 (c)

(a) Transfer factors from Baes, et al. 1984, are all based on dry soil and dry plant weights.
(b) Transfer factors based on dry soil and dry invertebrate weight.
(c) Default value

Baes, C.F., III, R.D. Sharp, A.L. Sjoreen, and R.W. Shor, 1984, "A Review and Analysis of Parameters for Assessing Transport of Environmentally Release Radionuclides through Agriculture," *ORNL-5786*, Oak Ridge National Laboratory, Oak Ridge, Tennessee.

estimated using the following equation from Baes et al. [1984]:

$$C_v = (C_s)(B_v)$$

where:

- C_v = Concentration of the chemical of potential concern in vegetation (milligrams per kilogram [mg/kg], dry weight).
- C_s = Concentration of the chemical of potential concern in soil (mg/kg, dry weight).
- B_v = Soil-to-plant transfer factor for the specific chemical (mg/kg dry weight plant per mg/kg dry weight soil).

All concentrations are in mg/kg dry weight.

C.3.1.1.2 Wildlife

Exposure of each of the terrestrial wildlife indicator species to soil COPEC was estimated using exposure models adapted from the USEPA [1989]. As mentioned earlier, the wildlife indicator species were assumed to be exposed to contaminants through ingestion. Ingestion-related pathways included one or more of the following: soil, vegetation, insects, or other wildlife species, and water. All other potential pathways were considered to be of minor importance. Total intake values include intake rates for all dietary components, including soil. Water intake was treated separately.

Ingestion of Plant Matter: Intake of contaminants in vegetation was estimated using a modification of an equation from USEPA's Human Health Evaluation Manual [USEPA 1989], in which:

$$I_v = \frac{[(C_v)(Q_v)(F)]}{(M)}$$

where:

I_v	=	Intake rate of chemical in vegetation (mg/kg-day).
C_v	=	Concentration of chemical of potential concern in vegetation (mg/kg) (dry weight).
Q_v	=	Ingestion rate (kilograms per day [kg/day]) (dry weight).
D_v	=	Dietary fraction consisting of vegetation (unitless).
F	=	Fraction ingested from contaminated source (unitless).
M	=	Body weight (kg) (wet weight).

This equation was used to predict the intake of contaminants in vegetation by blacktail jackrabbits and omnivorous house mice. Because all modeled individuals were assumed to spend their entire lives at each site, the exposure duration times the exposure frequency divided by the averaging time (from the USEPA intake equation) was assumed to equal one. Species-specific values for parameters such as ingestion rate and body weight are presented in the CBRA [IT 1996]. The fraction ingested from a contaminated source was based on the animal's typical home range. The amount of food and water expected to be consumed from contaminated areas is assumed to be proportional to the fraction of the home range occupied by the particular site. This value is therefore both species-specific and site-specific (Table C-6).

Table C-6. Home Range Factors for Mather Air Force Base Indicator Species

Mather AFB Location	Area (Ha)	Blacktail Jackrabbit(a)	House Mouse(b)	Coyote(a)	Mallard(a)	Red-Tailed Hawk(a)	Great Blue Heron(a)
Site 86	1.05	6.99E-03	1.00E+00	9.60E-04	3.75E-03	1.84E-03	NA
Site 87	11.81	7.88E-02	1.00E+00	1.09E-02	4.22E-02	2.07E-02	1.00E+02

AFB = Air Force Base
Ha = hectare
NA = not applicable
(a) One range factor is defined as the area of the Mather AFB location divided by the home range of the indicator species.
(b) The home range factor for the house mouse is 1.0 for all Mather AFB locations.
(c) The home range factor for the great blue heron at IRP Site 87 is 1.0.

For each chemical, site-specific intake rates for vegetation were summed with those obtained for soil ingestion to obtain the total intake values for the omnivorous mouse and rabbit. Total intake rates for the omnivorous mouse and coyote were a summation of intake rates for vegetation and animal matter.

Ingestion of Insects: Because the feeding habits of the house mouse are opportunistic in nature, the omnivorous mouse was assumed to ingest 48 percent plant matter, 50 percent insects, and two percent soil in its diet. When soil-to-terrestrial insect transfer factors were available in the literature, such values were used to estimate concentrations of specific chemicals in insects. When such information was not available, concentrations in insects were estimated using the methodology presented below.

Very little information exists on the estimation of chemical concentrations in terrestrial invertebrates. As a consequence, a conservative approach was taken in the estimation of such concentrations. The terrestrial insects used in the models were assumed to be a subterranean invertebrate (specifically, an earthworm). Because earthworms can absorb chemicals across their moist epidermis more readily than insects can across their cutaneous exoskeleton, it was assumed that the use earthworm models would provide a conservative estimate of contaminant concentrations in subsurface insects.

Concentrations of COPEC in invertebrates living below the ground surface were estimated using transfer factors obtained from the literature or derived for earthworms (depurated) [IT 1996]. Preference was given to information specific to insects. Soil-to-earthworm concentration factors for the inorganic contaminants were obtained from references such as Ma [1982]. For those inorganic analytes where no soil-to-insect or soil-to-earthworm transfer factor could be found, either the transfer factor for an analogous metal or a value of one was used as a default value. As shown in Table C-5, default values of one were used for both antimony and tin.

When necessary, concentration factors for subterranean insect larvae exposed to organic compounds were estimated using one of two models selected according to the lipophilic properties of the compound. The criterion for defining a compound as being strongly lipophilic was based on the same criterion used in the Great Lakes study reported by USEPA [1993a] to identify organic compounds as capable of biomagnification. Specifically, compounds with log K_{ow} values equal to or greater than four are capable of biomagnification and are, therefore, considered here as strongly lipophilic.

According to Menzie et al. [1992], critical components to consider in the bioaccumulation of highly lipophilic compounds by earthworms are the organic carbon content of the soil and the lipid content of the organism. For this reason, the following equation was used to estimate the bioaccumulation of organic compounds with log K_{ow} values equal to or greater than four:

$$BAF = \frac{Y_L}{0.66\, f_{oc}}$$

The bioaccumulation factors were assumed to be equivalent to bioconcentration factors and were based on a transfer from a soil dry-weight concentration to fresh-weight insect values.

Ingestion of Animal Matter: In order to evaluate the potential exposure of predators such as the resident coyote and the red-tailed hawk to COPECs, estimates were made of the amount of a chemical assimilated into prey tissues. Intake values for predators were estimated using the following equation:

$$I_p = \frac{1}{M}\sum_{i=1}^{s} (C_i)(Q)(D_i)(F)$$

where:

I_p	=	Intake rate of chemical of potential concern by the predator (mg/kg-day, wet weight).
C_i	=	Concentration of chemical of potential concern in prey species (mg/kg, wet weight, assumes C_i = intake rate of chemical of potential concern by the prey [mg/kg-day, wet weight] x assimilation coefficient for the chemical [unitless]).
Q	=	Ingestion rate of the predator (kg/day) (wet weight).
D_i	=	Dietary fraction consisting of the particular prey species (unitless).
F	=	Fraction ingested from contaminated source (unitless).
M	=	Body weight of the predator (kg).
s	=	Number of prey species.

The ingestion rate was converted from dry weight to wet weight with a conversion factor of 3.125 [Morrison 1959].

Assimilation coefficients were obtained from Owen [1990]. Eleven of the inorganic analytes of potential ecological concern have specific absorption coefficients listed in the Owen [1990] document. Absorption coefficients for inorganics not listed by Owen [1990] were assumed to be equal to 0.5. This applies specifically to antimony and tim. Absorption coefficients for the organics of potential ecological concern are listed in Owen [1990]. These values range from 0.5 to 1.0. Because of this wide range, the conservative approach was used, and a default value of 1.0 was used for all organics not listed in the CBRA [IT 1996].

The biomagnification of specific chemicals in the terrestrial foodwebs at Sites 86 and 87 was assumed to be insignificant. Although some polycyclic aromatic hydrocarbons (PAHs) may biomagnify, this process was not considered significant to the pathways examined. The organic compounds mentioned above all have log K_{ow} values less than 5.4. According to the USEPA [1993], such compounds are estimated to have food-chain multiplier values of less than or equal to eight for the mammalian and avian predators of interest. Taking into consideration the generally herbivorous nature of the prey species used in the exposure models, the relatively low food-chain multiplier values, and the inherent uncertainties associated with the exposure models, it was assumed that, if biomagnification of the organic compounds were to occur, it would be minimal.

Ingestion of Soil: Ingestion of contaminated soil was considered a viable pathway for evaluation for the house mouse and the blacktail jackrabbit. Soil intake for both the blacktail jackrabbit and the house mouse was assumed to be two percent of the total dietary consumption rate (dry weight) for each species [IT 1996].

Soil intake was estimated using an equation similar to that used to estimate the intake of plant matter. The concentration of a chemical in soil was substituted for the vegetation concentration and 0.02 was used as the dietary fraction.

Water Consumption: Wildlife indicator species from Sites 86 and 87 were assumed to consume water from Site 87. As with the other terrestrial pathways, intake of water by each species was estimated by utilizing either the 95 percent upper confidence limit of the mean concentration or the maximum concentration of a given contaminant measured in Site 87 surface water, whichever value was lowest. The following equation was used to estimate intake of a contaminant in water:

$$I_w = \frac{(C_w)(Q_w)(F)}{(M)}$$

where:

I_w	=	Intake rate of chemical of potential concern in surface water (mg/kg-day).
C_w	=	Concentration of chemical of potential concern in surface water (milligrams per liter [mg/L]).
Q_w	=	Ingestion rate (liters per day [L/day]).
F	=	Fraction ingested from contaminated source (unitless).
M	=	Body weight (kg) (wet weight).

As in the plant ingestion model, all modeled organisms were assumed to spend their entire lives at each site, the exposure duration times the exposure frequency divided by the averaging time was assumed to be one in the intake equation. Species-specific parameters used in the equation are presented in the CBRA [IT 1996].

C.3.1.2 Aquatic Exposure Models

Risks to aquatic species were evaluated for exposure to contaminants in surface water at Site 87. Exposure of aquatic organisms to COPECs was assumed to occur through direct uptake or ingestion of contaminated water and sediment or by indirect exposure through uptake through the food chain. Chronic exposures of aquatic biota to contaminants in surface water and sediments were estimated using the lowest value of either the 95 percent upper confidence limit of the arithmetic mean concentrations of a contaminant or the maximum concentration of a specific contaminant measured in Site 87 surface waters or sediments. Surface water and sediment were considered environmental media of concern in the aquatic exposure pathways. Total intake values were determined for each chemical based on the sum of dietary and sediment-ingestion intake values for a given species. Consumption of contaminated surface water was considered independently. Indicator species with aquatic related exposure pathways were the generic emergent aquatic plant, the mallard, the great blue heron, and generic aquatic macroinvertebrates.

C.3.1.2.1 Vegetation

The uptake of contaminants in sediment was evaluated for wetland emergent plants using the same method outlined for terrestrial vegetation. Exposure of emergent plants to aquatic contaminants was assumed to occur primarily from the uptake of chemicals from sediments and not from the water column. This is expected to be the major route of exposure for emergent vegetation.

C.3.1.2.2 Wildlife

Two species were selected as wildlife indicator species for the aquatic environments associated with Site 87. These are the mallard and great blue heron. The quantification of exposure to COPEC for each of these species is discussed in the following paragraphs.

Ingestion of Animal Matter: Both mallards and great blue herons were assumed to ingest animal matter. With regard to the mallard, concentrations in nonbenthic macroinvertebrates (i.e., amphipods) were estimated using bioconcentration factors reported in the literature. Herons were assumed to ingest crayfish and house mice from Site 87. Concentrations of chemicals in crayfish were also estimated using bioconcentration factors reported in the literature. The bioconcentration factors used represented the upper range of values and were therefore assumed conservative. Exposure of these invertebrates to contaminants within the aquatic environments was assumed to occur through surface water only. The model that was used to estimate exposure of the mallard and heron to contaminants in macroinvertebrates and crayfish was similar to that presented for ingestion of vegetation. The concentration of a chemical in the invertebrates, however, was substituted for the concentration of the chemical in vegetation.

Exposure of great blue herons to contaminants in house mice occupying drainage ditch areas was estimated utilizing the model discussed earlier for terrestrial wildlife. The model included the intake of contaminated wetland vegetation, insects, and sediment by the house mouse followed by the subsequent ingestion of the mice by the heron.

Water Consumption: Mallards and great blue heron were assumed to drink water from contaminated surface-water sources. The exposure model used to estimate intake of contaminants in surface water via this route was similar to that presented for terrestrial wildlife. Mallards, herons, and mice were assumed to be exposed to surface water contaminants within the areas from which they feed.

C.3.1.2.3 Aquatic Macroinvertebrates

Aquatic macroinvertebrates were exposed to chemical contaminants in surface water and to contaminants. Because risk was evaluated by direct comparison of either surface water concentrations to water quality criteria or sediment concentrations to sediment quality benchmark values, it was not necessary to utilize exposure models. Exposure concentrations used in the models are either the 95 percent upper confidence limit of the arithmetic mean or the maximum measure concentration, whichever is lower.

C.3.2 Effects Characterization

A part of the analysis phase of an ecological risk assessment is the documentation of stressor-response characteristics [USEPA 1996a]. This includes a discussion of the chemical stressors of concern and adverse ecological effects that may be associated with them. In this document, Section C.3.2 will summarize benchmark toxicity values for terrestrial plants, wildlife, and aquatic biota. These values were obtained from the literature and are summarized in the CBRA [IT 1996]. Although synergetic and antagonistic effects may occur following exposure to a mixture of chemicals, only chemical-specific responses will be discussed in this section.

C.3.2.1 Plants

General information on the chronic toxicity of inorganic analytes and organic compounds to vascular plants was primarily obtained in the CBRA [IT 1996]. Phytotoxicity benchmark screening values based on soil concentrations have been proposed for a variety of inorganic chemicals and a few organic compounds. The threshold for significant effects is based on a 20 percent reduction in growth or plant yield. In addition, tissue concentrations of specific elements that are known to elicit toxic responses in vascular plants, with the exclusion of very sensitive or highly tolerant species, have also been compiled. Values obtained for antimony and tin, chemicals not previously considered as COPECs in the CBRA [IT 1996] are listed in Table C-7. The phytotoxicity benchmark screening values presented in the CBRA [IT 1996] were used to screen those constituents likely to adversely affect plants.

Table C-7. Ecological Toxicity Summary Table: Plant Screening and Toxicity Values

Chemical	Phytotoxicity Benchmark Screening Value for Soil mg/kg (dry weight)(a)	Excessive or Toxic Plant Tissue Concentration mg/kg (dry weight)(b)	Plant Tissue Concentration Resulting in 10% Loss in Crop Yield (dry weight)(c)
Inorganics			
Antimony	5	60	--(d)
Tin	50	150	--

(a) Values obtained from Will Suter, 1995. (A 20 percent reduction in growth or yield was used as the threshold for significant effects).

(b) Values obtained from Kabata-Pendias and Pendias, 1992. Concentrations do not consider very sensitive or highly tolerant plant species.

(c) Value obtained from Macnicol and Beckett, 1985. Concentrations do not consider very sensitive or highly tolerant plant species.

(d) Dash indicates value could not be determined.

C.3.2.2 Wildlife

The toxicities of contaminants in Mather AFB surface soils, sediment, and surface waters to the wildlife receptors were primarily evaluated based on chronic no-observed-adverse-effect levels (NOAEL). Wildlife-specific NOAELs were either obtained from the literature or derived from laboratory toxicity data and are presented in the CBRA [IT 2996]. Emphasis was placed on toxicity data-specific to reproduction, development, and survival whenever possible. Estimations of wildlife-specific NOAEL values were made using a body-weight-based allometric equation presented in Opresko et al. [1994]. In addition, laboratory toxicity data were modified with uncertainty factors to adjust lowest-observed-adverse-effect level to NOAELs and to adjust subchronic data to chronic data. In each case, an uncertainty factor or less than or equal to ten was used [Opresko et al. 1994]. An uncertainty factor of ten was also used to adjust for phylogenetic differences, specifically between mammals and birds, when avian toxicity data were not available. In cases where only an LD_{50} value (lethal dose that will result in the death of 50 percent of the test animals) could be found for a particular chemical, the NOAEL was estimated using the ratio between the LD_{50} and NOAEL values of a closely related chemical [Opresko et al. 1994]. Tables C-8 and C-9 present the NOAELs for mammalian and avian wildlife indicator species not previously determined in the CBRA [IT 1996].

C.3.2.3 Aquatic Life

Several sources of published information were utilized to evaluate the toxicity of surface-water and sediment contaminants to freshwater biota such as fish, macroinvertebrates, and submergent aquatic plants. Ambient water quality criteria for the protection of freshwater aquatic life were derived by the USEPA [USEPA 1996b; USEPA 1992b] for a number of the inorganic and organic COPEC. In all cases, California water quality objectives for the protection of freshwater aquatic life [CEPA 1993] are in agreement with the federal criteria. Advisory values have been calculated by Suter and Mabrey [1994] for many chemicals not listed by the USEPA [USEPA 1996b; USEPA 1992b] or the California Environmental Protection Agency (CEPA) [IT 1993]. These values are presented in the CBRA [IT 1993]. Table C-10 presents toxicity data-specific to antimony, barium, and lead not previously addressed in the CBRA [IT 1996].

Direct comparisons of measured concentrations in water with freshwater aquatic screening and toxicity values should be made with caution. A number of both biotic and abiotic factors can influence the toxicity of chemicals to aquatic life. Exposure and toxicity to a particular chemical can be affected by the age, growth stage, and food habits of an organism.

Table C-8. Ecological Toxicity Summary Table: Mammalian Wildlife Screening and Toxicity Values

Chemical	House Mouse			Blacktailed Jackrabbit			Coyote	
	Estimated Dietary NOAEL(a) (mg/kg/d)	Estimated Drinking Water NOAEL(a) (mg/L)	Estimated Inhalation NOAEL(b) ($mg/m^3/d$)	Estimated Dietary NOAEL(a) (mg/kg/d)	Estimated Drinking Water NOAEL(a) (mg/L)	Estimated Inhalation NOAEL(b) ($mg/m^3/d$)	Estimated Dietary NOAEL(a) (mg/kg/d)	Estimated Drinking Water NOAEL(a) (mg/L)
Inorganics								
Antimony	1.54E-01	1.03E+00		3.08E-02	3.33E-01		1.54E-02	2.05E-01
Tin	2.88E+01	1.92E+02		5.77E+00	6.24E+01		2.88E+00	3.84E+01

(a) Chronic no-observed-adverse-effect level (NOAEL) values were adapted from Opresko et al. 1994. Body weights and water consumption rates used are those presented in Section 4.1.2 of the CBRA [IT 1996].
(b) NOAEL values were estimated using published laboratory toxicity data [USEPA 1996; NLM 1996].
mg/kg/d = milligrams per kilogram per day mg/L = milligrams per liter $mg/m^3/d$ = milligrams per cubic meter per day

Table C-9. Ecological Toxicity Summary Table: Avian Screening and Toxicity Values

Chemical	Red-Tailed Hawk		Mallard		Great Blue Heron	
	Estimated Dietary NOAEL(a) (mg/kg/d)	Estimated Drinking Water NOAEL(a) (mg/L)	Estimated Dietary NOAEL(a) (mg/kg/d)	Estimated Drinking Water NOAEL(a) (mg/L)	Estimated Dietary NOAEL(a) (mg/kg/d)	Estimated Drinking Water NOAEL(a) (mg/L)
Inorganics						
Antimony	3.72E-03	6.57E-02	3.78E-03	6.57E-02	2.90E-03	6.54E-02
Tin	3.47E+00	6.11E+01	3.52E+00	6.12E+01	2.70E+00	6.09E+01

(a) Chronic no-observed-adverse-effect level (NOAEL) values were adapted from Opresko et al. 1994. Body weights and water consumption rates used are those presented in Section 4.1.2.
mg/kg/d = milligrams per kilogram per day mg/L = milligrams per liter

Table C-10. Ecological Toxicity Summary Table: Freshwater Aquatic Screening and Toxicity Values

Chemical	Ambient Water Quality Criteria(a) (µg/L)		Tier II Value(b) (µg/L)		Lowest Chronic Value(b) (µg/L)	
	Acute	Chronic	Acute	Chronic	Acute	Chronic
Inorganics						
Antimony			1.80E+02	3.00E+01	1.60E+03	5.40E+03
Barium			6.91E+01	3.80E+00		5.80E+03
Lead	8.20E+01	3.20E+00			1.89E+01	1.23E+01

(a) Values obtained from U.S. Environmental Protection Agency (USEPA), 1996a, and USEPA, 1986b, with water hardness of 100 milligrams per liter assumed.
(b) Information obtained fro Suter and Tsao, 1996.
µg/L = micrograms per liter

Water-chemistry parameters such as hardness, total suspended solids, dissolved oxygen concentration, and pH can have a significant impact on the availability and subsequent toxicity of inorganic chemicals to aquatic biota. For example, as water hardness increases, the toxicity of most heavy metals decreases. Such factors as these should be considered in evaluating potential toxic effects associated with contaminated aquatic environments.

The toxicity of organic COPEC to sediment associated benthic macroinvertebrates was evaluated utilizing sediment quality benchmark criteria. Benthic macroinvertebrates were assumed to be exposed to nonionic organic compounds within the interstitial water of sediments. The partitioning of these compounds into interstitial waters was estimated utilizing an assumed fraction of organic carbon of 0.01 and K_{oc} (organic carbon adsorption coefficient) based on K_{ow} values [Hull and Suter 1994; Lyman 1982]. Sediment quality benchmark criteria were also based on water quality benchmark values such as USEPA ambient water quality criteria for the protection of freshwater aquatic life [USEPA 1996b; USEPA 1992b] were used as screening values in this risk assessment. The value used for antimony, a chemical not previously discussed in the CBRA [IT 1996] was 2 mg/kg.

C.4 Risk Characterization

Risk characterization is the final stage of an ecological risk assessment which involves the estimation of risk and the description of predicted risk. Potential risk at Sites 86 and 87 as addressed in the following subsections, includes exposure to chemical elements compounds and lead shot and bullet slugs.

C.4.1 Risk Estimation

Risk estimation methods used in this assessment are identical to that used in the CBRA [IT 1996]. Risk to ecological receptors associated with the grassland and aquatic habitats of Sites 86 and 87 were addressed for each of the COPECs discussed earlier. Risks to vegetation were assessed by comparison of the exposure concentration in soil/sediment (refer to Section C.3) to benchmark screening values and comparison to estimated plant tissue concentrations to plant tissue benchmark values. If both benchmarks were exceeded, the COPEC was predicted to be potentially hazardous to plant life. For aquatic life, exposure concentrations were compared to water quality criteria or sediment quality criteria as appropriate. For wildlife receptors, estimated daily exposures/intake were compared with benchmark screening values. In each case, if the quotient of the site value divided by the benchmark exceeded unity, the COPEC was predicted to be potentially hazardous.

Risk estimates associated with exposure of ecological receptors to lead shot and bullet slugs was more qualitative. This estimate was based on the likelihood of exposure and potential oral toxicity associated with lead in shot and slugs.

C.4.2 Risk Characterization

Because this is a screening level assessment, potential risks to biota associated with Sites 86 and 87 were estimated based on comparisons to toxicity based benchmark screening values and the likelihood of exposure to lead shot and slugs. Risks predicted for each of these sites are summarized below.

C.4.2.1 Risk Assessment with Contaminants of Potential Ecological Concern

Risks associated with exposure to each of the COPECs at Sites 86 and 87 are presented below. The final characterization of ecological risks at each site was based on screening assessment results and comparison of existing media concentrations to those found at other Mather sites where Phase II detailed ecological risk evaluations were performed.

C.4.2.1.2 Site 86

Site 86 was evaluated for potential ecological risks to receptors within a grassland habitat. Specifically, this site was evaluated for potential risks to terrestrial species following exposure to surface-soil contaminants. Risks to terrestrial plants and house mice were predicted through modeling to be exposed to hazardous chemical concentrations (Tables C-11 and C-12). Only copper and lead were predicted to be at levels potentially toxic to plant life. The jackrabbit, coyote, and red-tailed hawk were not predicted to be exposed to hazardous chemical concentrations at this site. Based on modeling results, arsenic was predicted to be potentially hazardous to the omnivorous house mouse via food-related pathways associated with soil.

Comparisons with other IRP locations on Mather AFB with a similar habitat type (i.e., grassland) show that soil concentrations for arsenic at this site were similar to those identified at IRP Site 3 (10.7 mg/kg and 10.81 mg/kg, respectively) [IT 1996]. Previous field surveys did not indicate differences in small mammal populations between Site 3 and reference locations. Field surveys showed that both the density and diversity of small mammals at Site 3 fall within the range of the reference sites. Although small mammal surveys were not conducted at Site 86, the similarity of habitat conditions, as with Site 3, suggest that the modeling estimates may have over predicted hazards to the mouse. Based on the modeling results and comparison to data from Site 3, ecological risks associated with Site 86 were designated as low.

Table C-11. Comparison of Concentrations of Chemicals of Potential Ecological Concern in Soils and Plants to Phytotoxicity Benchmark Values: Mather Air Force Base Site 86

Chemical	Concentration in Surface Soil (mg/kg) (dry weight)(a)	Benchmark Concentration in Soil (mg/kg) (dry weight)(b)	Exceeds Soil Benchmark Value	Predicted Plant Tissue Concentration (mg/kg) (dry weight)(c)	Excessive or Toxic Plant Concentration (mg/kg) (dry weight)(d)	Exceeds Plant Tissue Benchmark Value	Exceeds Both Soil and Plant Tissue Benchmark Value
Arsenic	10.81	10	Yes	0.432	5-20	No	No
Copper	112.86	100	Yes	45.1	20-100	Yes	Yes
Lead	1304.62	50	Yes	58.7	30-300	Yes	Yes

mg/kg = milligrams per kilogram
(a) Concentration in soil is the lowest of either the 95 percent upper confidence limit of the mean or maximum soil concentration.
(b) Benchmark values reported in Will and Suter 1994.
(c) Predicted plant concentration based on the lowest of either the 95 percent upper confidence limit of the mean or maximum soil concentration and soil to plant transfer factors reported in Baes et al. 1984, for metals or derived transfer factors organics as recommended in Travis and Arms 1988.
(d) Information from Kabata-Pendias and Pendias 1992.

Table C-12. Ecological Hazard Quotients for Terrestrial Wildlife Indicator Species Exposed to Contaminants Associated with Surface Soils: Mather Air Force Base Site 86

Chemical	House Mouse	Blacktail Jackrabbits	Coyote	Red-Tailed Hawk
Inorganic				
Arsenic	**6.98E+00**(a)	1.04E-02	3.67E-03	3.35E-05
Copper	1.52E-01	2.54E-03	1.17E-04	1.54E-05
Lead	6.66E-01	9.48E-03	2.45E-04	1.33E-04

(a) Values in bold are greater than 1.0.

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C.4.2.1.3 Site 87

Site 87 was evaluated for potential ecological risk to receptors associated with grassland and surface water habitats. Ecological receptors at Site 87 were exposed to contaminants in surface soil, surface water, and sediment. With regard to surface soil, only lead exceeded soil quality criteria and was predicted to be potentially hazardous to terrestrial plants (Table C-13). Based on modeling results, arsenic, and the sum total of PAHs were predicted to be hazardous to house mice via food-related pathways associated with soil (Table C-14). Individual analytes within this organic group of chemicals predicted to be hazardous to the dibenz(a,h)anthracene, fluoranthene, and indeno(1,2,3-cd)pyrene. The sum total of PAHs were also predicted to be hazardous to the hawk; however, no one individual analyte had a hazard quotient greater than 1.0.

With reference to the aquatic habitat, modeling results indicated direct consumption and sole utilization of Site 87 surface water (i.e., Morrison Creek) as not hazardous to the mammalian or avian receptors at this site (Table C-15). Concentrations of antimony, barium, and lead were detected in surface water, however, none were found to exceed USEPA or CEPA water quality criteria for the protection of freshwater aquatic life (Table C-16). Sediment quality criteria that were exceeded for benthic invertebrates were for antimony, arsenic, copper, and lead (Table C-17). No additional chemicals were predicted to be potentially hazardous to terrestrial wildlife following the summation of food and water exposure pathways.

With reference to aquatic and semiaquatic receptors, concentrations of antimony, arsenic, lead, and zinc in sediment exceeded sediment quality criteria. In addition, concentrations of lead and zinc in sediment were predicted to be at levels toxic to emergent plant life (Table C-18). Modeling results indicate antimony may be potentially hazardous to the mallard and heron via food-related pathways (Table C-19). The sum total of PAHs were also predicted to be hazardous to the heron; however, no one individual analyte had a hazard quotient bigger than 1.0. Based on all available information ecological risks associated with Site 87 were designated as low-medium.

C.4.2.2 Risk Associated with Lead Shot and Bullet Slugs

Studies have shown that certain wildlife species, especially waterfowl, can ingest lead shot [e.g., Kendall et al. 1996]. Ingestion can occur as a result of birds mistaking shot for grit [e.g., Pain 1991] or mistaking shot for food [e.g., Bellrose 1951]. Furthermore, ingested lead shot has been shown to be toxic [e.g., Kendall et al. 1996, Whitehead and Tschirner 1991, and Anderson 1975]. Based on this information it is possible that exposure of ecological receptors to lead shot may occur and prove toxic. Although this is true for lead shot, it is not likely to be true

Table C-13. Comparison of Concentrations of Chemicals of Potential Ecological Concern in Soils and Plants to Phytotoxicity Benchmark Values: Mather Air Force Base Site 87

Chemical	Concentration in Surface Soil (mg/kg) (dry weight)(a)	Benchmark Concentration in Soil (mg/kg) (dry weight)(b)	Exceeds Soil Benchmark Value	Predicted Plant Tissue Concentration (mg/kg) (dry weight)(c)	Excessive or Toxic Plant Concentration (mg/kg) (dry weight)(d)	Exceeds Plant Tissue Benchmark Value	Exceeds Both Soil and Plant Tissue Benchmark Value
Arsenic	10.59	10	Yes	0.424	5-20	No	No
Copper	717.71	50	Yes	32.3	30-300	Yes	Yes
Lead	56.89	50	Yes	1.71	150	No	No
PAHs (total)	10.3	18	No	0.216	--(e)	--	No

(a) Concentration in soil is the lowest of either the 95 percent upper confidence limit of the mean or maximum soil concentration.
(b) Benchmark values reported in Will and Suter 1994.
(c) Predicted plant concentration based on the lowest of either the 95 percent upper confidence limit of the mean or maximum soil concentration and soil to plant transfer factors reported in Baes et al. 1984, for metals or derived transfer factors organics as recommended in Travis and Arms 1988.
(d) Information from Kabata-Pendias and Pendias 1992.
(e) Dash indicates value could not be determined.
mg/kg = milligrams per kilogram
PAHs = polycyclic aromatic hydrocarbons

Table C-14. Ecological Hazard Quotients for Terrestrial Wildlife Indicator Species Exposed to Contaminants Associated with Surface Soils: Mather Air Force Base Site 87

Chemical	House Mouse	Blacktail Jackrabbit	Coyote	Red-Tailed Hawk
Inorganics				
Arsenic	**6.84E+00**(a)	1.15E-01	4.08E-02	3.71E-04
Lead	3.66E-01	5.88E-02	1.53E-03	8.50E-04
Tin	1.96E-01	2.78E-03	6.13E-04	1.47E-03
Organics				
PAHs (total)	**2.13E+01**	9.66E-03	1.22E-01	**1.59E+00**

(a) Values in bold are greater than 1.0.
PAHs = polycyclic aromatic hydrocarbons

Table C-15. Potential Hazards to Wildlife Following Ingestion of Surface Water: Mather Air Force Base Site 87

Chemical	Concentration in Water (mg/L)(a)	Ecological Hazard Quotient(b)					
		House Mouse	Blacktail Jackrabbit	Coyote	Red-Tailed Hawk	Mallard	Great Blue Heron
Antimony	2.00E-03	1.94E-03	6.01E-03	9.76E-03	3.04E-02	3.04E-02	3.06E-02
Barium	8.90E-02	9.44E-04	2.91E-03	4.71E-03	2.18E-04	2.18E-04	2.19E-04
Lead	1.00E-03	6.71E-06	2.07E-05	3.36E-05	3.14E-05	3.14E-05	3.15E-05

(a) Concentration in water (milligrams per liter [mg/L]) is the maximum surface water concentration.
(b) Ecological hazard quotients based on estimated no-observed-adverse-effect levels.

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Table C-16. Comparison of Surface Water Concentrations to Water Quality Objectives/Criteria for the Protection of Freshwater Aquatic Life: Mather Air Force Base Site 87

Constituent	Concentration Measured in Water(a) (μg/L)	California Chronic Exposure Objective(b) (μg/L)	USEPA Chronic Continuous Exposure Criterion(c) (μg/L)	Other Chronic Benchmark Advisory Values (μg/L)
Antimony	2			30(d)
Barium	89		50,000(e)	3.9(d)
Lead	1	1.6(f)	1.6(g)	2.5(h)

(a) Surface water concentration is either the 95 percent upper confidence limit of the mean or the maximum concentration, whichever is lowest. Values in bold exceed water quality criteria.
(b) Four-day average values reported in CEPA 1993.
(c) USEPA 1992b and 1996.
(d) Value is not a USEPA criterion. The value reported is a tolerance value obtained fro USEPA 1986b.
(e) Tier II values calculated in Suter Marbery 1994, as reported in USEPA 1996, Ecotox thresholds (Ambient Water Quality Criteria).
(f) Value is a four-day average concentration, based on a water hardness of 58.33 milligrams per liter (mg/L) formula reported in CEPA 1993.
(g) Value is calculated and based on a total water hardness of 58.33 mg/L and a water effect ratio of 1.0 for USEPA 1992b.
(h) USEPA 1996, Ecotox thresholds (Ambient Water Quality Criteria).

Table C-17. Comparison of Sediment Concentrations with Sediment Benchmark: Mather Air Force Base Site 87

Chemical	Concentration in Sediment (mg/kg)	Concentration in Sediment (mg/kg)	Exceeds Sediment Benchmark Value
Antimony	21	2(a)	Yes
Barium	301.5	--(b)	--

(a) NOAA; Long and Morgan 1991
(b) Dash indicates value could not be determined
mg/kg = milligrams per kilogram

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Table C-18. Comparison of Concentrations of Chemicals of Potential Ecological Concern in Sediments and Plants to Phytotoxicity Benchmarks Values: Mather Air Force Base Site 87

Chemical	Concentration in Sediment (mg/kg) (dry weight)(a)	Benchmark Concentration in Soil (mg/kg) (dry weight)(b)	Exceeds Soil Benchmark Value	Predicted Plant Tissue Concentration (mg/kg) (dry weight)(c)	Excessive or Toxic Plant Concentration (mg/kg) (dry weight)(d)	Exceeds Plant Tissue Benchmark Vale	Exceeds Both Soil and Plant Tissue Benchmark Values
Antimony	21	5	Yes	4.20	60	No	No
Arsenic	48.5	10	Yes	1.94	5-20	No	No
Barium	301.5	500	No	45.2	--(e)	--	No
Copper	58	100	No	23.2	20-100	Yes	No
Lead	6305	50	Yes	284	30-300	Yes	Yes
Zinc	93	50	Yes	140	100-400	Yes	Yes
PAHs (total)	0.305	18	No	0.00791	--	--	No

(a) Concentration in sediment is the lowest of either the 95 percent upper confidence limit of the mean or maximum sediment concentration.
(b) Benchmark values reported in Will and Suter 1994.
(c) Predicted plant concentration based on the lowest of either the 95 percent upper confidence limit of the mean or maximum sediment concentration and soil-to-plant transfer factors reported in Baes et al. 1984, for metals and derived transfer factors for organics as recommended in Travis and Arms 1988.
(d) Information from Kabata-Pendias and Pendias 1992.
(e) Dash indicates value could not be determined
mg/kg = milligrams per kilogram
PAHs = polycyclic aromatic hydrocarbons

Table C-19. Ecological Hazard Quotients for the Mallard and Great Blue Heron Exposed to Contaminants Associated with Sediments and Surface Waters: Mather Air Force Base Site 87(a)

Chemical	Mallard	Heron(b)
Inorganics		
Antimony	**2.54E+00(c)**	**4.73E+01**
Arsenic	8.11E-04	8.13E-02
Barium	4.13E-03	1.24E-02
Copper	1.33E-03	4.26E-03
Lead	3.30E-01	3.80E-01
Zinc	9.99E-02	2.25E-01
Organics		
PAHs (total)	5.57E-04	**2.25E+00**

(a) Hazard quotients consider food related pathways only. Maximum concentrations detected in sediments and surface water from a given site were used in the estimation of risk.
(b) The heron was assumed to consume 50 percent omnivorous mice and 50 percent crayfish.
(c) Values in bold are greater than 1.0.
PAHs = polycyclic aromatic hydrocarbons

for bullet slugs. This is because slugs are much larger in size that shot and consumption of bullet slugs by wildlife is deemed an unlikely exposure scenario.

C.4.2.2.1 Site 86

Although Site 86 has a history of use as a skeet/trap and pistol range, exposure of wildlife to shot within this area is unlikely because of more current remediation practices. According to IT [1997], the grounds of Site 86 have been scraped and removed. Dirt and associated lead shot and slugs have either been used elsewhere as fill or stockpiled on Site 86. Current exposure of wildlife to shot is unlikely. Because these stockpiles are scheduled for removal, future exposure is not expected to occur.

C.4.2.2.2 Site 87

Lead shot associated with Site 87 is likely to be hazardous to wildlife within the area. Surveys of lead shot within the area revealed concentrations of greater than 100 shots/sample as occurring directly over Morrison Creek [IT 1997]. Adjacent grasslands have also been found to contain high densities of the shot. This distribution correlates with lead concentrations recently measured in soils at the site [IT 1997]. Because mallards and other wildlife have been observed utilizing the creek and associated grassland areas of Site 87, it is possible that ecological receptors may currently be at risk to lead from ingestion of lead shot within this area. As for future risks, the top six inch to one foot of soil at Site 87 is scheduled to be remediated. Such an action would result in the removal of shot and associated risk from the area.

C.4.3 Identification of Uncertainties

The approach used to quantify exposure to the ecological receptors involved both modeling with conservative default values and the validation of these models through toxicity tests and residue analyses. As mentioned in the CBRA work plan [IT 1993], modeling was conducted as a screening assessment.

With reference to the models, the use of either the 95 percent upper confidence limit of the arithmetic mean or the measured maximum concentration of a specific chemical in the exposure medium contributes significantly to the uncertainty associated with the estimation of risk. This may greatly overestimate the chemical concentration to which the plant or animal is actually exposed. Uncertainties are also associated with the use of non-site-specific data in the exposure models. Because site-specific soil-to-pant transfer factors for the COPEC were not available at the time the screening assessment was performed, transfer factors for inorganic chemicals were obtained from the literature and those for organic compounds were derived from log K_{ow} values as recommended by Travis and Arms [1988]. Other examples of the utilization of non-site-specific data in this ecological risk assessment include the use of literature obtained bioconcentration factors for the aquatic invertebrates in the diets of the mallard and heron and the use of wet weight to dry weight conversion values reported in the literature. Dietary intake values were estimated with allometric equations and the time spent at a given site by each species was based on home range information in the literature or were estimated from soil-to-earthworm data or bioaccumulation models. In addition, estimates were made of the transfer of chemicals through food webs. This involved the use of a default absorption coefficients of one for all chemicals with a gastrointestinal adsorption coefficient that could not be located in the literature. Once again, this a very conservative assumption. Lastly, potential risk associated with exposure to lead shot is extremely difficult to predict due to lack of information associated with the likelihood of exposure and the percentage of lead from ingested shot that is actually toxic. Each of these factors and assumptions contribute substantially to the overall uncertainty in the estimation of exposure of the indicator species to contaminants at Sites 86 and 87.

C.5 Summary and Conclusions

Ecological risks are predicted for Sites 86 and 87 through a screening level risk assessment. Risk to ecological receptors associated with the grassland habitats at Site 86 was predicted to be low. Chemicals that remain of concern in soil are possibly arsenic to the mouse, and copper and lead to plants. Lead shot and bullet slugs do not appear to be an issue because of previously conducted activities at the site which have resulted in the removal and relocation of surface soils from the area. Some of this soil remains on site as stockpiles which are scheduled for removal.

Risks predicted at Site 87 are greater than those predicted at Site 86. Screening predictions indicate lead may be hazardous to grassland plants and PAHs to small mammals associated with the grassland habitats of Site 87. Surface water does not appear to be hazardous. With reference to sediment, sediment quality criteria were exceeded for antimony, arsenic, copper, and lead and could therefore be potentially toxic to benthic invertebrates. Lead and zinc in sediment may also be hazardous to emergent plants. Polycyclic aromatic hydrocarbons and antimony were also predicted to be potentially hazardous to heron and mallard, respectively, associated with the surface water habitat. Because lead shot is present in relatively high concentrations at Site 87, it is possible that species such as the mallard, which utilize the creek, may be at risk. Overall ecological risk associated with Site 87 are currently rated as medium.

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TAB

Appendix D

Appendix D
Estimation of Contaminant Concentrations for Waste Disposal at Site 7

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List of Acronyms

COC	chemical of concern
DLM	designated level methodology
MCL	maximum contaminant level
MSMA	Mather Soils Management Facility
SAC	Strategic Air Command
TPH-D	total petroleum hydrocarbon measured as diesel
USEPA	U.S. Environmental Protection Agency
WQG	water quality goal

The following summarizes Montgomery Watson's approach for estimating the maximum contaminant concentrations that can be delivered to Site 7 as backfill without adversely impacting groundwater quality. The chemicals of concern (COCs) include arsenic, barium, cadmium, chromium, lead, nickel, mercury, diesel, and oil and grease. This list was selected from known COCs at Sites 13, 15, 86, and 87, which will be excavated as part of future remedial actions. The excavated soils at these sites represent major potential sources of backfill to regrade the large depression at Site 7.

The initial estimations were made using the designated level methodology (DLM) as recommended by the California Regional Water Quality Control Board. One parameter in the DLM (i.e., the leachability factor) was updated to include data and statistical information specific to the soils that will represent major contributions to the backfill at Site 7. In addition, the water quality goals (WQG) were updated to conform with those being proposed in the Final Focused Feasibility Study for the Basewide Operable Unit [IT 1997a].

D.1 Water Quality Goals

The WQGs shown on Table D-1 were obtained from the California maximum contaminant levels (MCLs) with the following exceptions:

- Total petroleum hydrocarbon measured as diesel (TPH-D) was based on the cleanup levels adopted in the Final Superfund Record of Decision for Soil Operable Unit Sites and Groundwater Operable Unit Plume [IT 1996].
- Arsenic was based on concentrations identified in the California Proposition 65 regulatory level and used as a water quality criterion.
- Lead was based on the primary MCL according to the Federal drinking water standard by the U.S. Environmental Protection Agency (USEPA).

D.2 Leachability Factors

The leachability factor used in the DLM for inorganic constituents was 100, as recommended by the Regional Water Quality Control Board, except for sites where site-specific or base-specific leaching data was available. This data included analytical results form paired soils samples (i.e., samples having both total and soluble analyses) where the soluble samples were analyzed with

Table D-1. Site 7 Acceptance Criteria for evaluated Contaminants of Concern
Designated Level Methodology
Mather Air Force Base, California

Analyte	Water Quality Goal	Environmental Attenuation Factor	WET Dilution	Soluble Designated Level	Leachability Factor	Leachability Reference	Total Designated Level	Recommended Site 7 Acceptance Criteria
TPH-diesel [a]	100 ug/L	100	10	1,000 ug/L	107	[b]	1,070 mg/kg	300 mg/kg
Arsenic [c]	5 ug/L	100	10	50 ug/L	3,735	[d]	1,868 mg/kg	500 mg/kg
Barium [e]	1000 ug/L	100	10	10,000 ug/L	230	[d]	23,000 mg/kg	10,000 mg/kg
Cadmium [e]	5 ug/L	100	10	50 ug/L	100	[f]	50 mg/kg	100 mg/kg
Chromium [e]	50 ug/L	100	10	500 ug/L	100	[f]	500 mg/kg	3,500 mg/kg
Lead [g]	15 ug/L	1000	10	1,500 ug/L	719	[d]	10,785 mg/kg	1,000 mg/kg
Mercury [e]	2 ug/L	100	10	20 ug/L	100	[f]	20 mg/kg	20 mg/kg
Nickel [e]	100 ug/L	100	10	1,000 ug/L	100	[f]	1,000 mg/kg	2,000 mg/kg

Notes:
[a] Water Quality Goal [WQG] based on cleanup levels in Final Superfund Record of Decision for Soil Operable Unit Sites and Groundwater Unit Plumes, 6/27/96.
[b] Leachability Factor based on Final Analytical Results of Soil Stockpiles at MSMA, ORVSA, and Strategic Air Command Areas, Montgomery Watson, 6/96.
[c] WQG based on California Proposition 65 regulatory level as a water quality criterion.
[d] Leachability Factor based on average values from Site Characterization Report for Installation Restoration Program Sites 86 and 87, IT Corporation, February 1997.
[e] WQG based on Primary Maximum contaminant levels [MCLs] of California Department of Health Services.
[f] Leachability Factor based on Designated Level Methodology, Central Valley Regional Water Quality Control Board.
[g] WQG based on Primary MCLs of U.S. Environmental Protection Agency

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the waste extraction test using deionized water. The leachability factors used in the DLM were derived from the following investigations:

- Arsenic, barium, and lead were based on nine samples that were analyzed for total and soluble concentrations at Sites 86 and 87, the small arms range and skeet range, respectively. These results reported by IT Corporation in the Draft Final Site Characterization Report for Installation Restoration Program Sites 86 and 87 [IT 1997b].

- The leachability factors for TPH-D was based on fifteen soil samples that were analyzed for total and soluble concentrations at a number of underground storage tank stockpiles location at the Mather Soils Management Facility (MSMA), the Old RV Storage Area, and Strategic Air Command (SAC) Service areas. These results reported by Montgomery Watson in the Final Report of Analytical Results of Soil Stockpiles at MSMA, ORVSA, and SAC Service areas, June 1996.

Table D-2 includes the supporting data and compilation of leaching factors statistics for arsenic, barium, and lead. Table D-3 includes the data regression analysis establishing the relationship between total and soluble TPH-D concentrations.

D.3 Designated Level Methodology Calculations

Table D-1 shows the results of the DLM in terms of the calculated and recommended total and soluble designated levels for the selected list of constituents. The calculated results of the total designated levels for arsenic, barium, and lead exceed the regulatory levels for classification as a hazardous waste. As a result, the recommended concentrations for these metals were limited to their respective Total Threshold Limit Concentrations. Total designated levels are the preferred criteria for evaluating acceptance for backfill at Site 7 due to the lower analytical cost of the total concentrations and the more rapid turn around times from the analytical laboratories.

D.4 Further Evaluations

To further evaluate and demonstrate the conservatism of the DLM calculations, additional estimations are being made with the aid of fate and transport models that simulate the vadose zone and saturated zone. Vadose zone simulations will be performed to estimate contaminant concentrations (mass) reaching the water table. The estimated mass reaching the water table will then be applied to the saturated zone model to estimate groundwater concentrations. The allowable soil concentrations will then be estimated using the simulation results.

Table D-2. Leachability Factors for Selected Metals
Sites 86 and 87
Mather Air Force Base, California

Site 86

Analyte	Mather Inorganic Background (mg/kg)	Sample SSA-086-A02 Total (mg/kg)	Sample SSA-086-A02 Soluble (ug/L)	Sample SSA-086-A02 LF	Sample SSA-086-D12 Total (mg/kg)	Sample SSA-086-D12 Soluble (ug/L)	Sample SSA-086-D12 LF	Sample SSA-086-R02 Total (mg/kg)	Sample SSA-086-R02 Soluble (ug/L)	Sample SSA-086-R02 LF	Leachability Factors Sites 86 and 87 Mean	Leachability Factors Sites 86 and 87 Deviation
Arsenic	8	9.2	2.1	4,381	9.1	2.1	4,333	10	2.1	4,762	3,735	2,170
Barium	375	199	992	201	96	703	137	258	2,350	110	230	115
Copper	93.2	34	26	1,308	118	780	151	46	180	256	1,208	733
Lead	13.5	98	113	867	1,660	16,000	104	340	892	381	719	363
Zinc	116	56	28	2,000	72	180	400	57	110	518	2,008	1,092

Site 87

Analyte	Mather Inorganic Background (mg/kg)	Sample SSA-087-05B Total (mg/kg)	Sample SSA-087-05B Soluble (ug/L)	Sample SSA-087-05B LF	Sample SSA-087-08D Total (mg/kg)	Sample SSA-087-08D Soluble (ug/L)	Sample SSA-087-08D LF	Sample SSA-087-10C Total (mg/kg)	Sample SSA-087-10C Soluble (ug/L)	Sample SSA-087-10C LF	Sample SSA-087-12E Total (mg/kg)	Sample SSA-087-12E Soluble (ug/L)	Sample SSA-087-12E LF	Sample SSA-087-13B Total (mg/kg)	Sample SSA-087-13B Soluble (ug/L)	Sample SSA-087-13B LF	Sample SSA-087-04D Total (mg/kg)	Sample SSA-087-04D Soluble (ug/L)	Sample SSA-087-04D LF
Arsenic	8	7.7	5.7	1,351	8.5	4.4	1,932	5.2	2.1	2,476	5	2.1	2,381	18	2.1	8,571	7.2	2.1	3,429
Barium	375	165	390	423	157	403	390	139	492	283	116	843	138	270	1,090	248	156	1,090	143
Copper	93.2	21	10.9	1,927	18	9.2	1,957	16	10	1,600	18	19	947	53	26	2,038	22	32	688
Lead	13.5	690	562	1,228	1,330	1,660	801	340	281	1,210	8.5	8.5	690	690	1,120	616	38	66.2	574
Zinc	116	42	17	2471	38	17	2,235	37	17	2,176	33	8.9	3,708	81	26	3,115	39	27	1,444

Note: Where soluble concentrations were less than the reporting limit, the reporting limit was used for the leachability factor calculation.

LF (Leachability Factor) is the total concentration divided by the soluble concentration.

Table D-3. Analytical Comparision
Total Petroluem Hydrocarbons as Diesel vs.
Deionized Waste Extration Test Concentration

Sample	TPH-D (mg/kg)	TPH-D WET (a) (mg/L)
USTE-R-9-C	8.9	0.26
USTA-R-8-1	9.4	0.33
USTE-R-1-C	9.5	0.35
USTB-R-8-2	16	0.19
USTD-R-1-C	28	0.38
AFIG3-R-3-C	28	0.23
MSMA-SCRN-3	30	0.32
RVI-R-4-C	82	0.62
MSMA-SCRN-2	86	0.27
AFIG3-R-1-C	94	0.58
USTG-R-2-C	110	1.3
RVH-R-6-C	160	4.2
USTG-R-1-C	190	1.2
MSMA-SCRN-1	210	0.88
RVH-R-1-2	240	1.4
RVI-R-2-C	480	4.3
RVI-R-3-C	570	5.2
RVI-R-9-C	620	10
RVH-R-9-4	710	77
RVI-R-6-C	720	13
RVH-R-5-4	3900	89

(a) DI water

Vadose zone simulations will be conducted with the Vadose Zone Leaching Model (VLEACH Version 2.2). VLEACH is a one-dimensional finite-difference computer code for estimating the impact of contamination in the vadose zone on groundwater quality. It was originally developed by CH2M Hill in 1990 for the USEPA Region IX. Wherever possible, site-specific data will be used to represent model parameters. In the absence of site data, conservative estimates of model parameters will be used.

Saturated zone simulations will be performed with MODFLOW (for flow simulations) and MT3D96 (for transport simulations).

D.5 References

IT Corporation (IT), 1997a, "Final Basewide Operable Unit Focused Feasibility Study Report for Mather Air Force Base, California," Prepared by IT Corporation, Richland, Washington for Air Force Center for Environmental Excellence, Brooks Air Force Base, Texas, April 997.

IT Corporation (IT), 1997b, "Final Site Characterization Report for Sites 86 and 87 for Mather Air Force Base, California," Prepared by IT Corporation for Air Force Center for Environmental Excellence, Brooks Air Force Base, Texas, February 20, 1997.

IT Corporation (IT), 1996, "Soil Operable Unit and Groundwater Operable Unit Record of Decision," prepared by IT Corporation, Richland, Washington for Air Force Center for Environmental Excellence.

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Appendix E

Appendix E
Designated Level Methodology

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List of Acronyms

COPC	chemicals of potential concern
WQG	water quality goal
MCL	maximum contaminant level
EAF	environmental attenuation factor
FFS	Focused Feasibility Factor
LF	leachability factor
TDL	total designated level

E.1 Designated Level Methodology

The California Regional Water Quality Control Board - Central Valley Region's Designated Level Methodology [CVRWQCB 1989] was used to evaluate or estimate potential impact to the groundwater from chemicals of potential concern (COPCs) in surface and subsurface soils. The application of this methodology consisted of the following steps:

- Determined the desired water quality goal (WQG) for each constituent: Promulgated regulations and standards were used where available (primary Maximum Contaminant Levels (MCLs) were used as WQGs for surface soil and subsurface soil evaluations. In the absence of promulgated regulations, contaminant goals, health advisories, or risk-based values were used as WQGs.

- Determined the environmental attenuation factor (EAF) for each constituent: This factor was used to transform WQGs into site-specific designated levels (concentrations of constituents in the soils that have the potential to degrade water quality at the site of discharge). For purposes of determining COPCs in the Focused Feasibility Study (FFS) [IT 1997] and consistency with DLM guidance [CVRWQCB 1989], the EAFs presented in Table E-1 were used.

Table E-1. Environmental Attenuation Factors

Depth to Groundwater (from deepest constituent detection)	Environmental Attenuation Factor
	Subsurface and Surface Soils
>30 feet	100(a)
29-11 feet	10(b)
≤ 10 feet	1(c)

(a) 1000 for copper, zinc and dichlorodiphenyldichloroethane (DDD), dichlorodiphenyldichloroethylene (DDD), and dichlorodiphenyltrichloroethane (DDT) since these constituents have a greater than average degree of environmental attenuation.

(b) 100 for copper, zinc, DDD, DDE, and DDT.

(c) 10 for copper, zinc, DDD, DDE, and DDT.

(d) Sediments assumed in contact with surface water; therefore, 10 for copper, zinc, DDD, DDE, and DDT.

- Determined a Leachability Factor (LF): This factor was used to determine the fraction of the total constituent concentration available for leaching from the waste. The remaining portion of the constituent is immobile or unavailable for leaching due to encapsulation in the waste matrix or chemical bonding. When available, site-specific waste extraction test analysis results were used to establish LFS for each constituent. In the absence of site-specific Waste Extraction Test results (or extrapolation from the Waste Extraction Test data), a LF of 100 was used for inorganic constituents and ten for organic constituents as prescribed in the DLM guidance [CVRWQCB 1989].

- Determined a Total Designated Level (TDL): This level represents the concentration of a constituent in the soils which, if exceeded, may threaten the water quality. The TDL was calculated using the following equation:

Total Designated Level = Water Quality Goal x Environmental Attenuation Factor x Leachability Factor

The COPCs for which the 95 percent upper confidence level (or in some cases the maximum concentration) was less than the associated TDL were eliminated from further consideration.

As mentioned above, the DLM analysis established COPCs for inorganic and semi-volatile constituents. Volatile constituents were analyzed using VLEACH modeling to determine whether or not the volatile contaminants are to be considered a COPCs as presented in Appendix D of the FFS [IT 1997].

E.2 References

Central Valley Regional Water Quality Control Board (CVRWQCB), 1989, "The Designated Level Methodology for Waste Characterization and Cleanup Level Determination," California Regional Water Quality Control Board, Central Valley Region Staff Report, October 1986 (updated June 1989).

IT Corporation (IT), 1997, "Final Basewide Operable Unit Focused Feasibility Study Report for Mather Air Force Base, California," Prepared by IT Corporation, Richland, Washington for Air Force Center for Environmental Excellence, Brooks Air Force Base, Texas, April 1997.

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Appendix F

Appendix F
Background Distributions of Soil Constituents at Mather Air Force Base

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List of Tables

Table *Title*

List of Acronyms

AFB	Air Force Base
UCL	upper confidence limit
UTLV	upper tolerance limit value
USEPA	U.S. Environmental Protection Agency

F.1 Background Distributions of Soil Constituents at Mather Air Force Base

Background distributions of naturally occurring constituents at Mather Air Force Base (AFB) were recalculated using appropriate methodology in response to comments received on the Draft Basewide Operable Unit Record of Decision. The following provides a description of the methodology used to establish background distributions (Section F.1), followed by descriptions of the background distributions (Section F.2).

A set of background values were identified in the Basewide Operable Unit Focused Feasibility Study which were comprised of data sets from McCellan AFB, Mather AFB, and the local Sacramento area. The maximum value for each constituent was used as the "background" to be used for site comparisons and for setting cleanup goals. However, comments were received from the regulatory agencies that the "background" data set was not appropriate and that a revised data set be compiled by combining data sets from Mather AFB and Aerojet. The following subsections describe the processes followed to statistically combine and evaluate the data sets in order to arrive at one representative "background" data set.

F.1.1 Handling of Nondetections

A proportion of nondetections are common in background data sets for anthropogenic constituents and naturally occurring trace metals. A variety of methods to deal with nondetections have been proposed, each of which has advantages and disadvantages with respect to introducing unwanted bias into the description of background.

In the case of naturally occurring constituents, the U.S. Environmental Protection Agency (USEPA) guidance of replacing nondetections with a value equal to one-half of the practical quantitation limit for that analyte [USEPA 1989] was used. Data sets were screened for "high nondetects" which are defined as a nondetect with a detection limit that is two times higher than the median of the detected values. These nondetections are rejected from the data sets because they contain very little information, and assigning a value of one-half the detection limit to these data points will introduce large uncertainties in the calculated summary statistics. However, none of the background distributions contained high detections limits.

F.1.2 Calculation of Summary Statistics, Upper Tolerance Limit Values, and Upper Confidence Limits

A complete description of the background distributions of each detectable constituent is provided based on the Mather background data set, the Aerojet background data set, and the combined Mather and Aerojet data sets. This description includes the number of samples, minimum, maximum, median, mean, standard deviation, 95th upper confidence limit (UCL), and 95th upper tolerance limit value (UTLV). As with the Mather background statistics, all of the distributions were assumed to be normally distributed [IT 1993]. All of the summary statistics were calculated using the Statistical Version 5.0 for Windows software package.

The UCL is defined as:

$$UCL_{95} = \bar{X} + (t_{0.05,\, n-1} \bullet S/\sqrt{n})$$

where:

UCL_{95} = Upper 95-percent confidence limit
$\bar{X}$ = Arithmetic mean of the data set
$t_{0.05,\, n-1}$ = Student's t statistic for a one-sided, 95-percent confidence interval with n-1 degrees of freedom
S = Standard deviation of the data set
n = Number of samples.

The 95 percent UCL of the mean provides reasonable confidence that the true average will not be underestimated. That is, there is a 95 percent confidence that the average concentration is below the 95 percent UCL.

The UTLV is defined as:

$$UTLV_{95} = \bar{X} + (K \bullet S)$$

where:

$UTLV_{95}$ = 95th Upper tolerance limit value
$\bar{X}$ = Arithmetic mean of the data set
S = Standard deviation of the data set
K = One-sided normal tolerance factor.

The UTLV establishes a concentration range that is constructed to contain a specified proportion of the population with a specified confidence. The proportion of the population included is referred to as the coverage, and the probability with which the tolerance interval included the proportion is referred to as the tolerance coefficient. The one-sided normal tolerance factor (K) in the above equation is a function of the desired percent coverage, the desired tolerance coefficient, and the number of samples. The USEPA-recommended coverage value of 95 percent and tolerance coefficient value of 95 percent [USEPA 1989] are used in this report to calculate the UTLVs. This 95th UTLV implies that five percent, or one in 20 of the values from subsequent sampling rounds would be expected to be above the 95th UTLV or 95th percentile and do not necessarily represent contamination.

F.2 Results

Tables F-1 through F-3 describe the background distributions for metals at Mather, Aerojet, and the combined data sets. It is recommended that the combined data set, based on the 95th UTLV, is representative of the site and will be used in the evaluation of sample data and setting of cleanup criteria.

F.3 References

IT Corporation (IT), 1993, "Background Inorganic Soils for Mather Air Force Base," IT Corporation, Albuquerque, New Mexico and Richland, Washington.

U. S. Environmental Protection Agency (USEPA), 1989, Statistical Analysis of Ground–Water Monitoring Data at RCRA Facilities, Interim Final Guidance," EPA/530–SW-89–026, U.S. Environmental Protection Agency, Office Of Solid Waste, Waste Management Division, Washington, D.C.

Table F-1
Summary Statistics For Mather Air Force Base Background Soils

Metal	Valid N	Minimum	Maximum	Median	Mean	95 % UCL	95 % UTLV
Silver	64	1	1	1	1.000	--	--
Aluminum	64	7060	41200	16250	18667	20918	36714
Arsenic	64	0.46	8	2.35	2.90	3.33	6.36
Barium	64	43.2	375	117.5	140	158	286
Beryllium	64	0.44	3	0.875	1.04	1.19	2.22
Calcium	64	555	6580	2970	2949	3302	5779
Cadmium	64	0.5	0.5	0.5	0.5	--	--
Cobalt	64	6	25.6	14.1	14.0	15.3	23.9
Chromium	64	6.2	176	34.95	39.4	46.5	96.3
Copper	64	7.8	104	34.3	37.5	42.8	80
Iron	64	11600	43700	24050	24659	26761	41515
Mercury	64	0.1	0.1	0.1	0.1	--	--
Potassium	64	475	5670	1755	1805	2027	3867
Magnesium	64	780	8260	3845	4323	4785	8028
Manganese	64	110	2350	428.5	513	606	1253
Molybdenum	64	20	20	20	20.0	--	--
Nickel	64	8	68.9	26.35	28.6	32.4	58.4
Lead	64	2.7	13.5	6.4	6.7	7.5	12.8
Selenium	64	6	6	6	6.0	--	--
Thallium	64	0.48	1	1	1.0	1.0	1.14
Vanadium	64	31.7	153	67.9	67.9	74.2	119
Zinc	64	29	116	59.25	61.6	66.2	98.6

Note: all constituent concentrations are in parts per million
N = number of samples
UCL = upper confidence limit
UTLV = upper tolerance limit value

Table F-2
Summary Statistics For Aerojet Background Soils

Metals	Valid N	Minimum	Maximum	Median	Mean	95 % UCL	95 % UTLV
Silver	60	0.01	0.16	0.02	0.032	0.039	0.087
Aluminum	0	--	--	--	--	--	--
Arsenic	60	0.2	15.6	4.4	4.567	5.413	11.2
Barium	60	140	980	630	612	648	891
Beryllium	60	0.25	1.5	0.5	0.446	0.512	0.963
Calcium	0	--	--	--	--	--	--
Cadmium	60	0.05	0.3	0.05	0.072	0.085	0.179
Cobalt	60	7	36	18.5	18.58	20.16	30.9
Chromium	60	20	161	98.5	99.0	107.3	164
Copper	60	5.8	218.2	20.4	27.510	34.806	84.5
Iron	0	--	--	--	--	--	--
Mercury	60	0.01	0.12	0.02	0.024	0.029	0.061
Potassium	0	--	--	--	--	--	--
Magnesium	60	0.13	1.72	0.355	0.521	0.612	1.23
Manganese	60	140	1760	922.5	868	964	1616
Molybdenum	60	0.1	2	0.6	0.690	0.783	1.42
Sodium	0	--	--	--	--	--	--
Nickel	60	7	106	40	41.40	46.74	83.1
Potassium	60	--	630	380	373.2	409.5	657
Lead	60	4.5	19	11	10.79	11.53	16.6
Selenium	60	0.1	0.8	0.2	0.22	0.26	0.521
Thallium	60	0.05	0.5	0.3	0.27	0.30	0.5
Vanadium	60	69	306	132.5	138.2	148.3	217
Zinc	60	18	112	41	47.63	53.46	93.1

Note: All constituent concentrations are in Parts per million
N = number of samples
UCL = upper confidence limit
UTLV = upper tolerance limit value

Table F-3
Summary Statistics For Combined Background Soils

Metal	Valid N	Minimum	Maximum	Median	Mean	95 % UCL	95 % UTLV
Silver	124	0.01	1	1	0.531	0.618	1.6
Aluminum	64	7060	41200	16250	18667	20918	36714
Arsenic	124	0.2	15.6	3.4	3.705	4.188	9.6
Barium	124	43.2	980	292.5	369	415	942
Beryllium	124	0.25	3	0.5	0.751	0.848	1.95
Calcium	64	555	6580	2970	2949	3302	5779
Cadmium	124	0.05	0.5	0.5	0.293	0.332	0.705
Cobalt	124	6	36	16	16.24	17.30	27.5
Chromium	124	6.2	176	60.65	68.27	75.81	149
Copper	124	5.8	218.2	25.95	32.68	37.17	80.4
Iron	64	11600	43700	24050	24659	26761	41515
Mercury	124	0.01	0.12	0.1	0.063	0.070	0.151
Potassium	64	475	5670	1755	1805	2027	3867
Magnesium	124	0.13	8260	1670	2231	2683	7821
Manganese	124	110	2350	604	685.10	757.90	1460
Molybdenum	124	0.1	20	20	10.66	12.38	28.90
Nickel	124	7	106	32.1	34.81	38.18	70.7
Lead	124	2.7	19	9	8.70	9.33	15.5
Selenium	124	0.1	6	6	3.20	3.72	8.69
Thallium	124	0.05	1	0.83	0.64	0.71	1.34
Vanadium	124	31.7	306	100.5	101.9	110.4	193
Zinc	124	18	116	49	54.85	58.70	96

Note: All constituent concentrations are in parts per million
N = number of samples
UCL = upper confidence limit
UTLV = upper tolerance limit value

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