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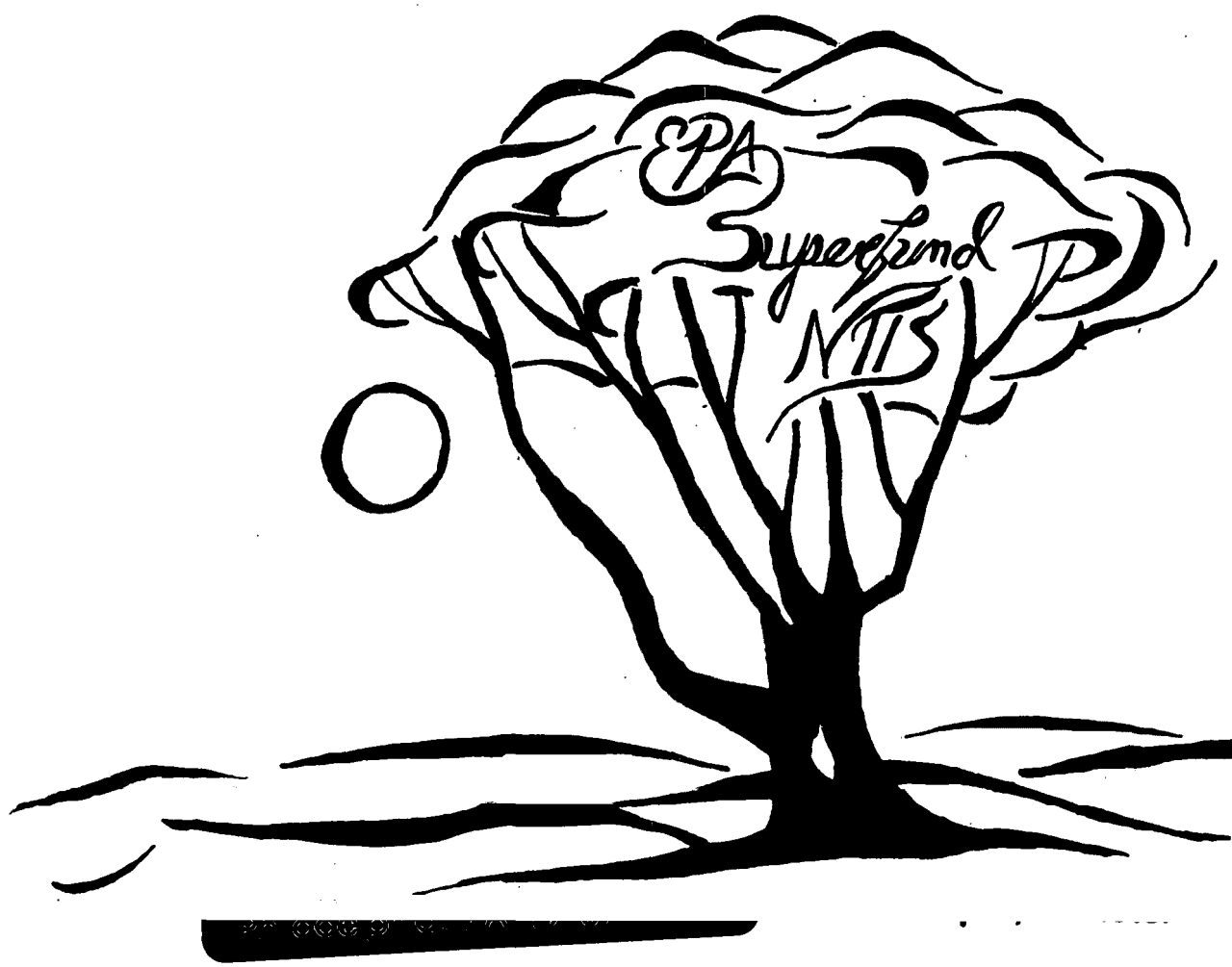
July 1994

EPA Superfund Record of Decision:

Aircraft Control and Warning Site, Mather Air Force Base, CA



SUPERFUND
RECORD OF DECISION:

AIRCRAFT CONTROL AND WARNING SITE

MATHER AIR FORCE BASE
SACRAMENTO COUNTY, CALIFORNIA

December 1993

Table of Contents

Table of Contents (Continued)

Table of Contents (Continued)

List of Tables

List of Figures

1.0 Declaration

Statutory Preference for Treatment as a Principal Element is Met and Five-Year Site Review is Required

1.1 Site Name and Location

Aircraft Control and Warning (AC&W) Site
Mather Air Force Base, Sacramento County, CA

1.2 Statement of Basis and Purpose

This decision document, a Record of Decision (ROD), presents the selected remedial action for the AC&W Site, Installation Restoration Program (IRP) Site 12, at Mather Air Force Base (AFB), Sacramento County, California which was chosen in accordance with the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA), as amended by the Superfund Amendments Reauthorization Act of 1986 (SARA) and, to the extent practicable, the National Oil and Hazardous Substances Pollution Contingency Plan (NCP). This decision is based on the Administrative Record for the AC&W Site. The content of this ROD is based on recommendations in the U.S. EPA's Interim Final Guidance on Preparing Superfund Decision Documents [EPA 1989a]. The Administrative Record Index, (Appendix A), identifies documents upon which the decision is based.

The purpose of this ROD is to set forth the remedial action to be conducted at the AC&W Site to remedy groundwater contamination associated with the AC&W Site. No further action is planned for IRP sites 25, 30, and 47, where three underground storage tanks (UST) and associated contamination have been completely removed. The UST at Site 47 was removed in January 1993.

The U.S. Environmental Protection Agency Region IX (EPA IX) and the State of California concur with the selected remedy.

1.3 Assessment of the Site

Reports indicate that from 1958 to 1966 waste solvents and transformer oils were disposed in a waste disposal pipe in the AC&W area. Investigations conducted as part of the Air Force Installation Restoration Program (IRP) failed to locate the waste disposal pipe but did find

trichloroethylene (TCE) contamination in the shallow water bearing zone (SWBZ) in the AC&W area. The SWBZ is classified as a potential source of drinking water by the State of California, although it is not currently used in the AC&W area. Actual or threatened releases of hazardous substances from this site, specifically TCE in the SWBZ, if not addressed by implementing the response action selected in this ROD, may present a current or potential threat to public health, welfare, or the environment.

Two other releases of hazardous substances occurred at the AC&W Site. Diesel fuel leaked from USTs at IRP Sites 25 and 30, and a UST containing unleaded gasoline at IRP Site 47 failed a tank integrity test and was assumed to have leaked. In 1987 the USTs and contaminated materials at IRP Sites 25 and 30 were removed. Analyses of soil samples from IRP Sites 25 and 30 has confirmed that no contamination remains. The UST at IRP Site 47 was removed in January 1993. Contaminated soil discovered during removal of the UST was completely removed. Because no contaminated material is present at IRP Sites 25, 30, and 47 there is no threat to public health, welfare, or the environment.

1.4 Description of the Selected Remedy

The selected remedy will address the potential threat to human health posed by TCE contamination in groundwater (primarily in the SWBZ). The SWBZ, although not presently used near the AC&W Site, is a potential source of drinking water, therefore the selected remedy will reduce the maximum concentration throughout the AC&W Site groundwater plume to the Federal drinking water standard of 5 parts per billion (ppb) for TCE.

The major components of the selected remedy include:

- Extraction of contaminated groundwater by pumping;
- Treatment of extracted groundwater by air stripping;
- Vapor phase carbon adsorption of TCE from the stripped vapor, as necessary;
- Off-site regeneration of spent activated carbon, as necessary; and
- On-site injection of treated water into the SWBZ.

The effluent reinjected outside of the contaminated plume and into clean groundwater will have a discharge median monthly TCE concentration level of 0.5 micrograms per liter ($\mu g/\ell$) or ppb. Reinjection of the effluent within the contaminated plume will have a median

monthly TCE concentration level not exceeding the concentration of TCE in the groundwater at the point of reinjection. However, in no case will the maximum discharge concentration level exceed 5.0 $\mu g/\ell$ (ppb), the federal and state maximum contaminant level (MCL) drinking water standard.

Additional discharge options for the treated groundwater will be evaluated in the future as redevelopment and re-use of Mather AFB occurs and the Groundwater OU and Soil OU Focused Feasibility Study is developed.

No further action is required at IRP sites 25, 30, or 47, former UST sites, to protect public health, welfare, or the environment.

1.5 Statutory Determinations

The selected remedy satisfies the statutory requirements of Section 121 of CERCLA, as amended by SARA, in that the following four mandates are attained:

- The selected remedy is protective of human health and the environment.
- The selected remedy complies with federal and state requirements that are legally applicable or relevant and appropriate to the remedial action.
- The selected remedy is cost-effective.
- The selected remedy utilizes permanent solutions and alternative treatment technologies or resource recovery technologies, to the maximum extent practicable.

The selected remedy satisfies the statutory preference for remedies that employ treatment that reduces toxicity, mobility, or volume as a principal element. Because this remedy will result in hazardous substances remaining on-site above health-based levels during the remedial action, Five-Year Site Reviews will apply to this action [55 FR 8730 and 40 CFR 300.430 (f)(4)(ii)].

1.6 Signatures

12-29-93

John C. Wise
Deputy Regional Administrator, Region IX
U.S. Environmental Protection Agency

Date

28 Dec 93

Charles H. Smith, PhD, P.E.
BRAC Environmental Coordinator
Remedial Project Manager - Mather
U.S. Air Force Base Conversion Agency

Date

12-28-93

Anthony J. Landis
DSMOA Technical Program Manager
Department of Toxic Substances Control
California Environmental Protection Agency

Date

2.0 Decision Summary

2.1 Site Name, Location, and Description

Mather Air Force Base (AFB) is a formerly active military facility approximately 12 miles east of Sacramento and due south of Rancho Cordova (unincorporated) in Sacramento County California, as shown in Figure 2.1-1. The Base is due south of U.S. Highway 50, a major highway connecting Sacramento and South Lake Tahoe. The Base encompasses 5845 acres (129 acres of easements) in an unsurveyed part of Township 8 North, Ranges 6 East and 7 East, as shown by Figure 2.1-2. Mather AFB was closed under the Base Closure and Realignment Act (BCRA) on September 30, 1993. Environmental activities at the facility continue under the management of the Air Force Base Disposal Agency, with oversight by the U.S. Environmental Protection Agency and the California Environmental Protection Agency.

The Aircraft Control and Warning (AC&W) Site is near the east central part of Mather AFB, as shown in Figure 2.1-2. Access to the AC&W Site is via Security Road from Mather Boulevard. Vegetation at the AC&W Site consists of annual grasses and a few trees. Topography of the site consists of several low gentle hills. Surface elevations range from about 107 to 134 feet above mean sea level. Surface water in the area drains directly into Morrison Creek and into an unnamed tributary of Morrison Creek.

Surface features in the AC&W area include an enclosed radar dome operated by the Federal Aviation Administration (FAA), about ten one-story buildings, at least eight small sheds and storage units, above ground tanks containing water, fuel, and oil, electrical and heating/ventilation/air conditioning (HVAC) service units, paved driveways, and other improvements, as shown in Figure 2.1-3. Subsurface features are also shown on Figure 2.1-3 and include abandoned-in-place septic tanks and tile field, sites where fuel and gasoline tanks were removed, and the location of the former AC&W water supply well; which was destroyed and sealed on March 22 and 23, 1990. All of the underground fuel tanks shown in Figure 2.1-3 have now been removed.

Natural resources are not utilized at the AC&W Site.

The nearest residential area, the Mather AFB Base Housing area, is 2700 feet from the AC&W Site, as measured from the former AC&W water supply well.

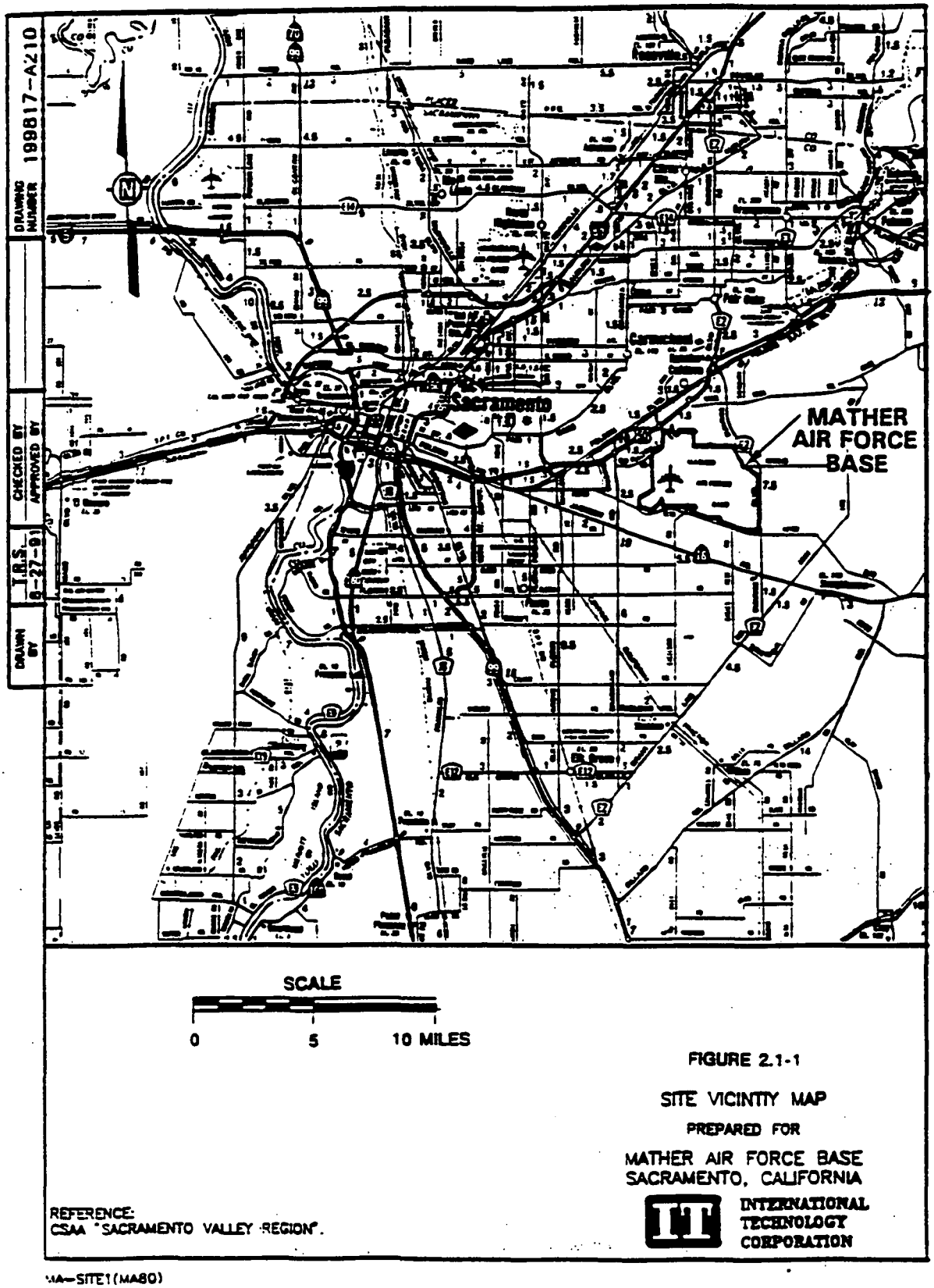


FIGURE 2.1-1

SITE VICINTIY MAP

PREPARED FOR

MATHER AIR FORCE BASE
SACRAMENTO, CALIFORNIA

INTERNATIONAL TECHNOLOGY CORPORATION

MA—SITE1(MA80)

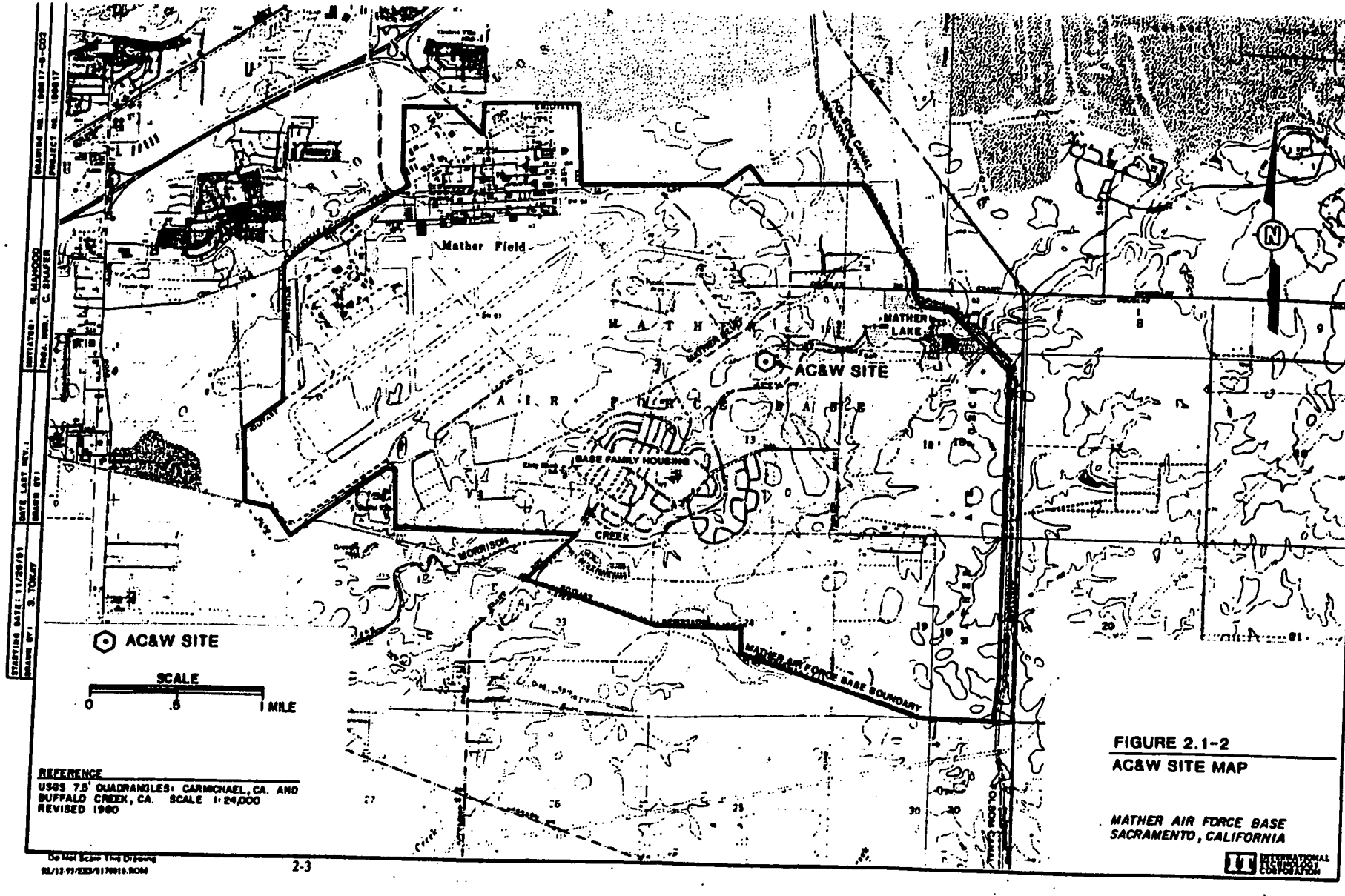


FIGURE 2.1-2

AC&W SITE MAP

MATHER AIR FORCE BASE
SACRAMENTO, CALIFORNIA

INTERNATIONAL TELEPHONE AND TELEGRAPH CORPORATION

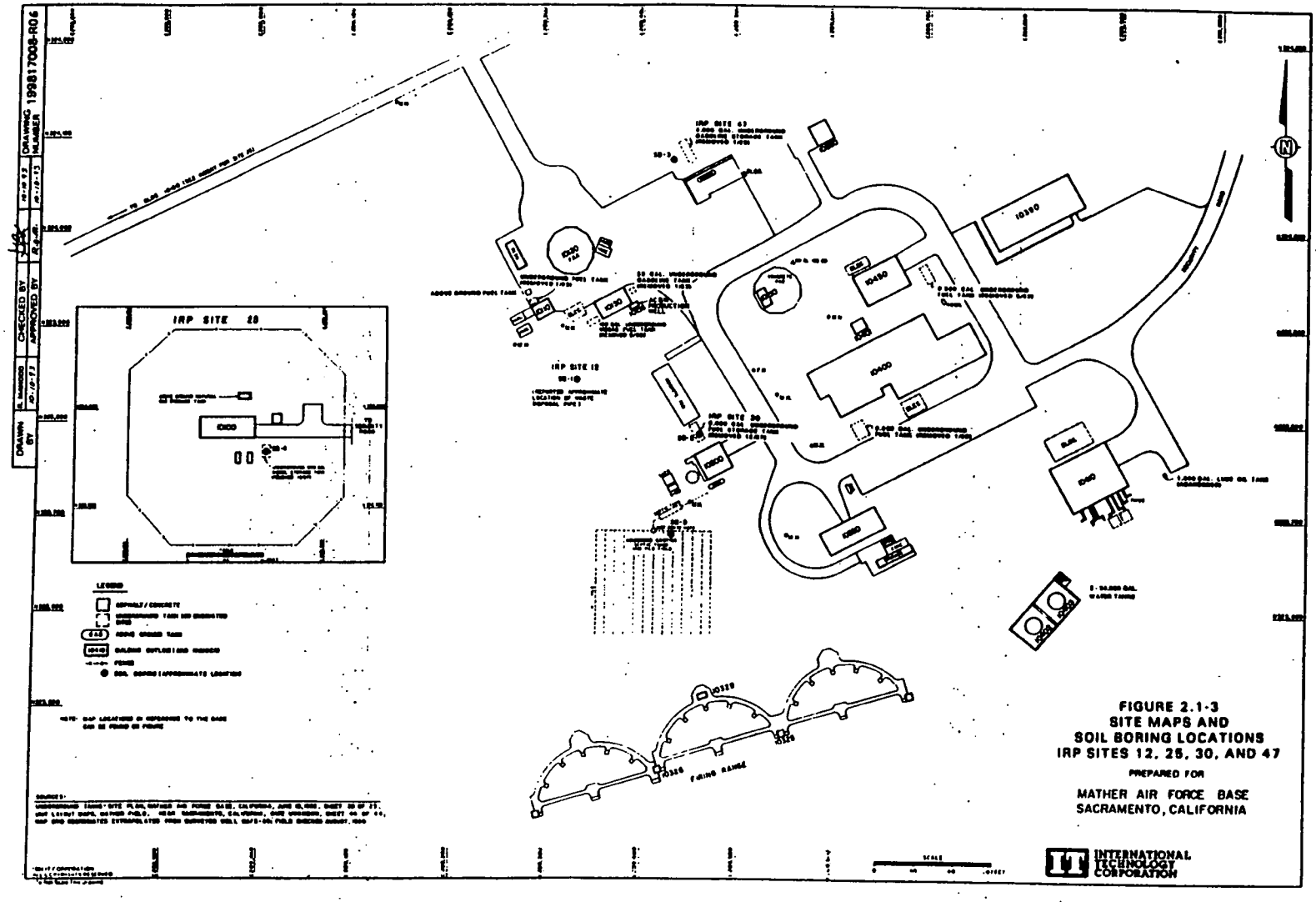


FIGURE 2.1-3
SITE MAPS AND
SOIL BORING LOCATIONS
IRP SITES 12, 28, 30, AND 47

PREPARED FOR

MATHER AIR FORCE BASE
SACRAMENTO, CALIFORNIA

INTERNATIONAL TECHNOLOGY CORPORATION

2.1.1 Land Use

On Mather AFB near the AC&W Site, there are three current land use categories: residential, administrative/occupational, and recreational. Land uses, both on-base and off-base, have changed since Mather AFB closed on September 30, 1993. The nearest residential area, currently unoccupied, is the Mather AFB Base Family Housing area, 2700 feet from the AC&W Site, as measured from the former AC&W water supply well. Administrative/occupational personnel of the FAA currently occupy buildings/facilities at the site. Recreational uses of land in the immediate vicinity include golfing and trap shooting.

Generalized current land use patterns off-base are as follows:

- North and Northwest: Mostly single family residential development, with major retail centers and other business uses centered along Folsom Boulevard, Mather Field Road, and Zinfandel Road; this area includes schools and outdoor public recreation facilities;
- West and Southwest: Mostly open rural land with some farming and pasture land;
- East and Northeast: Mostly industrial use, with some commercial agricultural areas; and
- South: Mostly agricultural use with some commercial or industrial areas.

2.1.2 Surface Water Resources

Morrison Creek is the surface water feature closest to the AC&W Site. The creek is an ephemeral stream that runs through the southeast corner of the AC&W area and is about 700 feet southeast of the former AC&W water supply well, as shown by Figure 2.1-2. It is commonly dry in summer and early fall. It flows onto the Base from the northeast via an aqueduct into Mather Lake, flows out of the lake towards the AC&W Site, past the site and flows off-base to the southwest. An artificial pond on Morrison Creek is about 1000 feet southwest of the former AC&W water supply well. The pond covers about one-tenth of an acre.

Mather Lake is the largest surface water feature near the AC&W Site. It encompasses 64 acres and is about 3000 feet northeast of the former AC&W water supply well. The lake is an impoundment of Morrison Creek. It is an aquatic habitat and a recreational resource for the Base. The lake is fed by two ephemeral streams that cross Folsom South Canal by aqueducts and then flow into the lake. The lake level is maintained by surface water runoff,

by water pumped from Folsom South Canal, and in 1991 by groundwater pumped into the lake. Several siltation ponds associated with aggregate mining are about 6000 feet north of the AC&W Site. They contain standing water throughout the year. The siltation ponds are not part of Mather AFB property.

2.1.3 Groundwater Resources

Groundwater resources in the region of the AC&W Site occur in the Shallow Water Bearing Zone (SWBZ), the Lower Water Bearing Zone (LWBZ) of the Laguna Formation, and in underlying deeper aquifers in the Mehrten Formation.

The SWBZ is at least 60 feet in thickness. It has the water table as an upper surface, about 120 feet below land surface (bls), and the top of the LWBZ as a lower boundary. Groundwater from the SWBZ is not currently utilized in the vicinity of the AC&W Site.

The top of the LWBZ occurs between 180 to 200 feet bls. The base of the LWBZ is defined in Wells MAFB-68 and MAFB-78. At the MAFB-78 drilling locality, the base of the LWBZ in the AC&W Site area may be defined by a clayey silt layer about 250 feet bls. The former AC&W water supply well, destroyed and sealed on March 22 and 23, 1990, was completed in the LWBZ. However, most of the groundwater pumped by Family Housing Area (FH) water production Wells FH-1, FH-3, New FH-4, FH-5, and FH-6 is from depths greater than 318 feet bls, i.e., from the deeper aquifers in the Mehrten Formation.

2.2 Site History and Enforcement Activities

Mather AFB was constructed in 1918 and its primary mission was a flight training school. The Mather AFB AC&W Site was constructed in the late 1950s as part of the Air Defense Command early warning system. The 668th AC&W Squadron, which operated the site jointly with the FAA, left Mather AFB in 1966. The AC&W Site is currently occupied by the FAA.

It has been reported that trichloroethylene (TCE), used as a solvent and degreaser in facility operations, and waste transformer oil were commonly disposed into a waste disposal pipe in the AC&W area during the period between 1958 and 1966. This pipe, the suspected main source of contamination at the AC&W Site, Installation Restoration Program (IRP) Site 12, was reported to be about 100 feet southwest of Building 10150. The existence of the waste disposal pipe has never been verified, all attempts to locate the pipe have been unsuccessful. Estimates suggest that about 1200 gallons of TCE, and 1400 gallons of transformer oil may

have been disposed in this manner. Three additional suspected releases occurred near the AC&W Site involving underground storage tanks (UST). These releases were investigated as part of the AC&W Remedial Investigation/Feasibility Study (RI/FS) [IT 1991a, 1991b] and included:

- Diesel fuel leaked from a 550-gallon steel UST which was installed in 1951 near Building 10100 (IRP Site 25). During the UST removal in November 1987, a small hole was found in the tank. Soil samples taken beneath the tank contained diesel fuel at a concentration of 5738 parts per million (ppm). Contaminated soil was removed from the UST excavation and replaced with clean backfill. Samples collected during the RI and FS [IT 1991a and 1991b] confirmed that no contamination remains in the soil.

- Diesel fuel leaked from an 8000-gallon UST which was installed in 1951 near Building 10300 (IRP Site 30). The UST was last used in 1982, and was removed in 1987. During the UST removal, in the excavation near the fill end of the tank, soil eight feet bls was found to contain 2206 ppm of diesel fuel. Contaminated soil was removed from the UST excavation and replaced with clean backfill. No contamination was detected in soil samples collected at the UST site during the RI and FS [IT 1991a and 1991b].

  These UST removal and remediation actions were undertaken by the Mather AFB Environmental Management (323 FTW/EM) and Civil Engineering Squadrons (323 CES/DEV) squadrons [IT 1991a]. The squadrons also took similar action at 18 other USTs at Mather AFB. Soils removed from the UST excavations were stockpiled, sampled, and analyzed for petroleum constituents. All soils having concentrations of petroleum constituents greater than 100 ppm were disposed in the Casmalia, Class I, landfill. Soils containing less than 100 ppm petroleum constituents were used as fill material on Mather AFB.

- A leak of unleaded gasoline occurred at a 4000-gallon UST located 250 feet northwest of Building 10400 (IRP Site 47). The UST was installed in 1983 and has been out of service since 1989 [IT 1991a]. The UST failed an integrity test and may have leaked as much as 10000 gallons but no contamination was detected in soil samples collected at the UST site during the RI and FS [IT 1991a and 1991b]. Contaminated soil was discovered upon removal of the UST in January 1993 [IT 1993a]. The contaminated soil was removed and replaced with clean fill.

Since no contamination remains at these three UST sites, and there is no threat posed to public health, welfare, or the environment posed by past releases, no further action is required.

The AC&W Site was placed on the Superfund (CERCLA) National Priorities List (NPL) in July, 1987 after TCE was detected in groundwater in concentrations ranging from 4 ppb to 790 ppb in shallow monitoring wells [AeroVironment 1988], and in concentrations of 112 ppb in the former AC&W water supply well [Weston 1986]. AeroVironment Inc. [1988] performed the sampling in November and December of 1986. In July 1989, the U.S. Air Force, the U.S. EPA and the State of California signed a Federal Facility Agreement (FFA) 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 public health, welfare, and the environment. 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 AC&W Site.

Remedial investigations conducted at the AC&W Site are part of the U.S. Air Force IRP. Ten investigations have been conducted at the AC&W Site and routine groundwater monitoring is an ongoing activity. The dates, type of studies, and organizations involved in these are summarized in Table 2.2-1 and include:

- Initial investigation, Mather AFB Bioenvironmental Engineering Staff, November 1979 [Weston 1986];
- IRP Records Search for Mather AFB, Phase I, June 1982, [CH2M-Hill Inc. 1982];
- IRP Phase II Confirmation/Quantification, Stage 1 Investigation, June 1986, Roy F. Weston Inc., [Weston 1986];
- IRP Phase II Confirmation/Quantification, Stage 3 Investigation, February 1988, AeroVironment Inc., [AeroVironment 1988];
- IRP Sampling and Analysis for Site Monitor Wells October/November 1988, IT Corporation [IT 1990a];
- IRP Site Inspection Report, IT Corporation, August 1990 [IT 1990b];
- IRP Remedial Investigation, IT Corporation, March 1991 [IT 1991a];
- IRP Quarterly Routine Groundwater Monitoring, EA E, S and T Corporation and IT Corporation, [EA 1990a, EA 1990b, EA 1990c, IT 1991c, IT 1991d, IT 1992a, IT 1992b, IT 1992c, IT 1992d, IT 1993b, IT 1993c, and IT 1993d]
- IRP Feasibility Study, IT Corporation, August 1991 [IT 1991b];

- FS Preliminary Design Investigation, IT Corporation, [IT 1992e]; and
- Underground storage tank removal, IT Corporation [IT 1993a].

The Mather AFB Bioenvironmental Engineering Staff conducted the first investigation at the AC&W Site during November 1979 in an attempt to locate the suspected waste disposal pipe [Weston 1986]. They excavated an area about 30 feet long and 15 feet wide to depths of four to six feet bls, south or southwest of Building 10150, the pump house for the AC&W well, and collected soil samples for analysis of TCE and polychlorinated biphenyls (PCBs). The pipe was not located and no organic chemicals were detected in the soil [Weston 1986]. A groundwater sample collected on August 12, 1980 from the AC&W water supply well was found to contain 112 ppb of TCE [Weston 1986].

In 1982 the Air Force Engineering and Services Center retained CH2M-Hill to conduct a Phase I on-base records search [CH2M-Hill 1982]. The search suggested that TCE, waste engine oils, carbon tetrachloride, antifreeze, and transformer oil were reportedly disposed into the pipe from 1958 to 1966. The pipe reportedly received about 120 gallons of TCE and 130 gallons of transformer oil per year during that period. During the early 1960s an additional 150 gallons of waste TCE were generated at the AC&W Site, and in 1966 an additional 225 gallons of waste transformer oil were also generated. Estimates suggest that about 1200 gallons of TCE, and 1400 gallons of transformer oil may have been disposed in this manner. The records search also indicated detections of TCE in analyses of water from the AC&W production well over the period of August 1979 to August 1981 [CH2M-Hill 1982].

The Phase I records search was followed by the Phase II, Stage 1 investigation [Weston 1986]. As part of this study in 1985, Roy F. Weston, Inc. installed three shallow groundwater monitoring wells (MAFB-1, -2, and -3) down gradient of the AC&W Site and began the sampling and analysis of groundwater for aromatic compounds (e.g., benzene, etc.), halogenated organic compounds (e.g., TCE, etc.), oil and grease, and PCBs. The major results of this study are summarized by Table 2.2-1.

The Phase II, Stage 2 Investigation of Mather AFB conducted by AeroVironment [1987] did not address the AC&W Site. However, during March 1986 to March 1987, the Phase II, Stage 3 investigation of the AC&W Site was conducted by AeroVironment [1988] which included monitoring well installation, groundwater sampling, and a soil gas survey.

Table 2.2-1 Investigations at the AC&W Site

Phase and Investigator	Soil Investigation and Significant Analytical Results	Monitoring Wells Constructed	Groundwater Investigation and Significant Analytical Results	Other Activities	References
Initial Investigation - Mather AFB Bioenvironmental Engineering Staff	Excavation to find waste disposal pipe, seven soil samples analyzed for TCE and PCBs: neither detected, pipe not located	None	Water production wells sampled, TCE found in AC&W water production well at a maximum of 112 $\mu g/\ell$ in sample collected on August 12, 1980.	None	[Weston 1986]
IRP Phase I, Records Search - CH2M Hill	None	None	None	Base records search	[CH2M-Hill 1982]
IRP Phase II, Confirmation / Quantification Stage 1 - Roy F. Weston Inc.	None	Three shallow wells: MAFB-1 MAFB-2 MAFB-3	TCE found in MAFB-1, -2, and -3 (5.1 to 460 $\mu g/\ell$). Oil and grease found in MAFB-1, -2, and -3 (190 to 760 mg/ℓ). Toluene found in MAFB-1 and -2 (< 100 $\mu g/\ell$). PCBs were not detected.	None	[Weston 1986]
IRP Phase II Stage 3 Investigation - AeroVironment	Soil gas survey found low levels of TCE (0.02 $\mu g/\ell$), PCE and TCA. Soil gas volatile organic compound concentrations ranged from 0.0002 $\mu g/\ell$ to 0.007 $\mu g/\ell$, although the data are considered suspect [IT 1991b]. Soil contamination levels not significant.	Five shallow wells: MAFB-50 through MAFB-54 Six deep wells: MAFB-67 through MAFB-72	TCE found in MAFB-1, -2, -3 and -52 (4.1 to 790 $\mu g/\ell$), No TCE found in MAFB-51, -53, -54, or in deep wells. Benzene (22 $\mu g/\ell$) and dichlorobenzene (1.6 $\mu g/\ell$) were detected in MAFB-70. Xylene found in MAFB-71 (23 $\mu g/\ell$).	Geophysical surveys did not locate the reported AC&W waste disposal pipe	[AeroVironment 1988]

AC&W = Aircraft Control and Warning AFB = Air Force Base IRP = U.S. Air Force Installation Restoration Program
PCE = perchloroethylene PCBs = polychlorinated biphenyls TCA = trichloroethane TCE = trichloroethylene TPHD = total petroleum hydrocarbons as diesel
VOCs = volatile organic compounds $\mu g/\ell$ = microgram per liter ppb = 1 part per billion mg/kg = milligram per kilogram ppm = 1 part per million

Table 2.2-1 Investigations at the AC&W Site (continued)

Phase and Investigator	Soil Investigation and Significant Analytical Results	Monitoring Wells Constructed	Groundwater Investigation and Significant Analytical Results	Other Activities	References
IRP Sampling and Analysis for Site Monitor Wells - IT Corp.	None	None	All AC&W wells sampled. TCE found in MAFB-1, -2, -3, and -52 (6-560 µg/ℓ), toluene in MAFB-1 (58 µg/ℓ), and phenol in MAFB-67, -69, and -71 (48-540 µg/ℓ)	All AC&W wells redeveloped	[IT 1990a]
IRP Phase IV-A, Site Inspection - IT Corp.	Evaluated all geologic and chemical data relating to environmental contamination at Mather AFB. No sampling or analyses conducted.	None	Evaluated all geologic and chemical data relating to environmental contamination at Mather AFB. Data from 1988 groundwater sampling included, but not data from Remedial Investigation [IT 1991b]. Two rounds of water level measurements conducted for all on-base monitoring wells. No sampling or analyses of groundwater.	None	[IT 1990b]
IRP Remedial Investigation - IT Corp.	VOCs and TPHD in soil gas at two fuel spill areas, by septic leach field, and area where waste disposal pipe reported to be. TCE less than 11 ppm. TPHD less than 247 ppm. In seven surface soil samples PCBs and TCE not detected, 1 µg/kg PCE in one sample. Five soil borings, SB-1 through SB-5. Organic lead found in every sample from SB-4, with a maximum of 0.8 mg/kg, although data are suspect. Xylenes, 1.0 µg/kg at 1.5 feet, and TCE, 5 and 4 µg/kg at 111 and 121 feet, found in SB5.	Seven shallow wells: MAFB-74 MAFB-77 MAFB-79 MAFB-81 MAFB-82 MAFB-83 MAFB-84 Two deep wells: MAFB-78 MAFB-80	Aquifer testing, groundwater modeling, groundwater sampling. TCE in shallow wells MAFB-1, -2,-3, -50, -51, -52, -53, -54, and -83. Maximum TCE in MAFB-83 (520 µg/ℓ). TCE not found in wells MAFB-79, -81, -82, and -84. Other contaminants include toluene and xylenes. In deep wells MAFB-67, -68, -69 contaminants included low concentrations of benzene, xylenes, ethylbenzene, and dichlorobenzene. TCE found in MAFB-67 and -68 at a maximum concentration of 9.6 µg/ℓ. Down gradient extent of plume not defined.	Geophysical surveys Aquifer testing AC&W water supply well sealed and destroyed	[IT 1991a]

AC&W = Aircraft Control and Warning AFB = Air Force Base IRP = U.S. Air Force Installation Restoration Program PCE = perchloroethylene PCBs = polychlorinated biphenyls TCE = trichloroethylene TPHD = total petroleum hydrocarbons as diesel VOCs = volatile organic compounds µg/ℓ = microgram per liter ppb = 1 part per billion mg/kg = milligram per kilogram ppm = 1 part per million

Table 2.2-1 Investigations at the AC&W Site (continued)

Phase and Investigator	Soil Investigation and Significant Analytical Results	Monitoring Wells Constructed	Groundwater Investigation and Significant Analytical Results	Other Activities	References
IRP Quarterly Routine Groundwater Sampling - IT Corp. and EA E S and T, Inc.	None	None	All Mather AFB wells sampled, including AC&W wells. AC&W Site data for selected constituents summarized in Quarterly Groundwater Monitoring Report(s) from second quarter 1991 [IT 199] through second quarter 1993 [IT 1993c]. See ROD Table 2.2-2 for summary of quarterly AC&W Site TCE data.	None	[EA 1990a] [EA 1990b] [EA 1990c] [IT 1991c] [IT 1991d] [IT 1992a] [IT 1992b] [IT 1992c] [IT 1992d] [IT 1993a] [IT 1993b]
IRP Feasibility Study - IT Corp.	16 Surface soil samples. Organic lead not detected.	Three shallow pumping wells: AT-1 AT-2 AT-3 One deep pumping well: AT-4	Aquifer testing, groundwater modeling, groundwater sampling. Four aquifer tests (pump tests) completed. Maximum concentrations of TCE noted in report were found in well AT-2 (800 $\mu g/\ell$) and in MAFB-1 and -83 (400-500 $\mu g/\ell$).	None	[IT 1991b]

AT = Aquifer test wells, pumped only during aquifer testing IRP = U.S. Air Force Installation Restoration Program
TCE = trichloroethylene $\mu g/\ell$ = microgram per liter ppb = 1 part per billion mg/kg = milligram per kilogram ppm = 1 part per million

Table 2.2-1 Investigations at the AC&W Site (continued)

Phase and Investigator	Soil Investigation and Significant Analytical Results	Monitoring Wells Constructed	Groundwater Investigation and Significant Analytical Results	Other Activities	References
IRP Preliminary Design Investigation - IT Corp.	None	Nine shallow wells: MAFB-190 - MAFB-198	Groundwater sampled during drilling in one to four depth intervals and at screened interval after well completion and purging. Wells were screened at the water table (MAFB-190, -192, -197) or in the lower SWBZ near the SWBZ/LWBZ interface (MAFB-191, -193, -194, -195, -196, -198). In PDI well MAFB-196 the concentrations of TCE at the water table was 390 µg/ℓ. In all other PDI wells the concentrations of TCE at the water table were less than 1.3 µg/ℓ or non detectable. In PDI wells MAFB-194 and MAFB-196, screened at or near the base of the SWBZ, concentrations of TCE were 210 µg/ℓ and 180 µg/ℓ. In other PDI wells screened at or near the base of the SWBZ TCE was not detectable. Downgradient extent of plume established. Size and shape of plume refined. The calculated amount of pure TCE in the plume is 15 gallons or 180.6 pounds (81.94 kg) and adsorbed on SWBZ sediments is 16 gallons or 194.9 pounds (88.44 kg).	Two stratigraphic borings	[IT 1992]
UST Removal Project - IT Corp.	UST and contaminated soil removed from IRP Site 47 (UST 10400B)	None	None	None	[IT 1993a]

IRP = U.S. Air Force Installation Restoration Program LWBZ = Lower water bearing zone
PDI = Preliminary Design Investigation SWBZ = Shallow water bearing zone TCE = trichloroethylene UST = underground storage tank
µg/ℓ = microgram per liter ppb = 1 part per billion mg/kg = milligram per kilogram ppm = 1 part per million

Trichloroethylene was detected in groundwater samples collected during November and December of 1986. The concentrations ranged from 4 ppb to 790 ppb in samples from shallow monitoring wells [AeroVironment 1988]. These analytical results contributed to the placement of the AC&W Site CERCLA NPL in July, 1987. Results of the Phase II, Stage 3 Investigation activities are summarized by Table 2.2-1.

In the fall of 1988, IT Corporation conducted a redevelopment and groundwater sampling program for all useable wells on Mather AFB, including those at the AC&W Site [IT 1990]. Results of the sampling are summarized in Table 2.2-1.

IT Corporation conducted field work for the Remedial Investigation (RI) at the AC&W Site, from August 1989 through March 1990. This work consisted of:

- Soil gas surveys to assess vadose zone contamination;
- Installation of soil borings near the suspected AC&W waste disposal site, at the fuel spill sites, and near the septic tank and leach fields to assess vadose zone contamination and collect geologic data;
- Installation, monitoring, and sampling of nine monitoring wells;
- Aquifer testing; and
- Abandonment of the former AC&W production well.

The RI confirmed the presence of dissolved phase TCE near the water table in the SWBZ. Non-aqueous phase liquids (NAPLs) were not found. Sampling data from Well MAFB-67 indicated that the TCE may have extended into the underlying LWBZ. However, as shown in Table 2.2-2, TCE in Well MAFB-67 has not been detected since the August 1990 sampling round, suggesting the detection may not reflect significant aquifer contamination. Significant contamination was not found in soils and sediments sampled from near the ground surface to the water table. The low levels of organic lead (< 1 ppm) detected in samples from soil borings are not considered significant since subsequent analyses showed no detectable organic lead [IT 1991b]. Significant contamination was absent in samples collected from soil borings at the three UST sites. This indicates that the removal of contaminated soil during UST removal at IRP Sites 25 and 30 was successful for protection of public health, welfare, and the environment. The results of the RI are summarized in Table 2.2-1. A baseline risk assessment was also prepared as part of the RI.

Quarterly sampling and analysis of groundwater of all Mather AFB monitoring wells began in autumn of 1989 and has continued through the present as follows:

- IT Corporation performed sampling and analysis from October 1989 until February of 1990;
- EA Engineering, Science and Technology performed sampling and analysis from May 1990 until December 1990 [EA 1990a, EA 1990b, and EA 1990c]; and
- IT Corporation has been performing the sampling and analysis from December 1990 to the present.

The TCE concentrations found in all AC&W Site wells sampled during the quarterly monitoring from October 1989 through May 1993 are shown in Table 2.2-2 [IT 1991c, IT 1993c]. The fluctuations in TCE concentrations in some wells are thought to be caused by dynamic mechanisms of the plume, and by effects of sampling and analysis.

The AC&W Feasibility Study (FS) field work began in the summer of 1990. The FS field investigations were conducted to provide data to support the specification of remedial alternatives. In the summer and fall of 1990, four additional wells were drilled and aquifer tests were performed at each well. These tests provided hydrologic data for determining groundwater flow and transport within and between the SWBZ and LWBZ. Pumping the LWBZ continuously for seven days at nearly 600 gallons per minute (gpm) during one aquifer test failed to effect contaminant transport across the SWBZ/LWBZ interface; i.e., from the SWBZ into the LWBZ. This limited hydraulic communication between the SWBZ and LWBZ supports the predictions in computer fate and transport modeling [IT 1991a]. Samples collected during drilling also suggested that the plume extends further down gradient as was suspected from the RI [IT 1991a].

In summer and fall of 1991 nine additional monitoring wells were installed and two stratigraphic borings were also completed in the Preliminary Design Investigation (PDI), as shown in Table 2.2-1. Purposes of the PDI were to:

- Characterize the vertical distribution of TCE in the SWBZ;
- Characterize the areal extent of TCE contamination;
- Collect data to refine the understanding of the stratigraphy of the SWBZ; and
- Reassess the remedial alternatives proposed in the FS [IT 1991b].

Table 2.2-2 TCE Concentrations In AC&W Site Wells, Quarterly Sampling [IT 1991d and IT 1993c]

WELL NO.	DATE SAMPLED (quarterly sampling round)	TRICHLOROETHYLENE (concentration in $\mu g/\ell$)
MAFB-1 (shallow well)	10/89	240
	02/90	450
	06/90	410
	08/90	360
	12/90	50.8
	03/91	88
	05/91	101
	08/91 - 11/92 (six sampling rounds)	NA - Insufficient water volume in well
	02/93	NS - Well not sampled
	04/93	NA - Insufficient water volume in well
MAFB-2 (shallow well)	10/89	31
	02/90	32
	06/90	28
	08/90	25
	12/90	5.3
	03/91	19
	05/91	29
	08/91 - 11/92 (six sampling rounds)	NA - Insufficient water volume in well
	02/93	NS - Well not sampled
	04/93	NA - Insufficient water volume in well
MAFB-3 (shallow well)	10/89	210
	02/90	240
	06/90	210
	08/90	370
	12/90	109
	03/91	250
	05/91	270
	08/91	180
	11/91	NA - Insufficient water volume in well
	03/92	160
	04/92	71
	07/92	NA - Insufficient water volume in well
	11/92	NA - Insufficient water volume in well
	02/93	NS - Well not sampled
	04/93	47

Table 2.2-2 TCE Concentrations In AC&W Site Wells, Quarterly Sampling [IT 1991d and IT 1993c] (continued)

WELL NO.	DATE SAMPLED (quarterly sampling round)	TRICHLOROETHYLENE (concentration in µg/ℓ)
MAFB-50 (shallow well)	10/89	4.7
	02/90	10.0
	06/90	9.6
	08/90	7.0
	12/90	3.5
	03/91	3.1
	05/91	2.8
	08/91	3.4 J - Concentration estimated
	11/91	ND
	02/92	1.8
	04/92	3.1
	07/92	2.8
	10/92	2.7
	02/93	NS - Well not sampled
	04/93	3.5
MAFB-51 (shallow well)	10/89	0.7
	02/90	0.9
	06/90	0.6
	08/90	0.2
	12/90 - 10/92 (nine sampling rounds)	ND
	02/93	NS - Well not sampled
	05/93	NP - Constituent not analyzed
MAFB-52 (shallow well)	10/89	27.0
	02/90	26.0
	06/90	22.0
	08/90	16.0
	12/90	6.4
	03/91	15.0
	05/91	20.0
	08/91	17.0 J - Concentration estimated
	11/91	12.0
	03/92	16
	04/92	18
	07/92	13
	10/92	15
	02/93	NS - Well not sampled
	04/93	13

Table 2.2-2 TCE Concentrations In AC&W Site Wells, Quarterly Sampling [IT 1991d and IT 1993c] (continued)

WELL NO.	DATE SAMPLED (quarterly sampling round)	TRICHLOROETHYLENE (concentration in $\mu g/\ell$)
MAFB-53 (shallow well)	10/89	0.6
	02/90	0.7
	06/90	ND
	08/90	0.4
	12/90	ND
	03/91	1.8
	05/91	2.7
	08/91	10.0 J = Concentration estimated
	11/91	ND
	03/92	4.6
	04/92	4.4
	07/92	6.4
	10/92	9.2
	02/93	NS - Well not sampled
	04/93	7.5
MAFB-54 (shallow well)	10/89	0.5
	02/90	0.4
	06/90	0.3
	08/90 - 03/92 (eight sampling rounds)	ND
	04/92	0.6
	07/92	ND
	10/92	ND
	02/93	NS - Well not sampled
	05/93	ND
MAFB-67 (deep well)	10/89	1.1
	02/90	9.6
	06/90	4.6
	08/90	1.0
	12/90 - 10/92 (nine sampling rounds)	ND
	02/93	NS - Well not sampled
	05/93	ND

Table 2.2-2 TCE Concentrations In AC&W Site Wells, Quarterly Sampling [IT 1991d and IT 1993c] (continued)

WELL NO.	DATE SAMPLED (quarterly sampling round)	TRICHLOROETHYLENE (concentration in µg/ℓ)
MAFB-68 (deep well)	10/89 02/90 - 10/92 (twelve sampling rounds) 02/93 04/93	2.0 ND NS - Well not sampled ND
MAFB-69 (deep well)	10/89 - 10/92 (thirteen sampling rounds) 02/93 04/93	ND NS - Well not sampled NP - Constituent not analyzed
MAFB-70 (deep well)	10/89 - 08/90 (four sampling rounds) 12/90 03/91 - 03/92 (five sampling rounds) 05/92 - 11/92 (three sampling rounds) 02/93 04/93	ND 2.0 NA - Well obstructed ND NS - Well not sampled ND
MAFB-71 (deep well)	10/89 - 07/92 (twelve sampling rounds) 10/92 02/93 05/93	ND 1.7 NS - Well not sampled NP - Constituent not analyzed
MAFB-72 (deep well)	10/89 - 10/92 (thirteen sampling rounds) 02/93 - 05/93 (two sampling rounds)	ND NS - Well not sampled

Table 2.2-2 TCE Concentrations In AC&W Site Wells, Quarterly Sampling [IT 1991d and IT 1993c] (continued)

WELL NO.	DATE SAMPLED (quarterly sampling round)	TRICHLOROETHYLENE (concentration in µg/ℓ)
MAFB-74 (shallow well)	10/89	100
	02/90	130
	06/90	49.0
	08/90	84.0
	12/90	40.2
	02/91	150
	05/91	200
	08/91	87.0
	11/91	140
	03/92	180
	04/92	270
	07/92 - 10/92 (two sampling rounds)	NA - Insufficient water volume in well
	02/93	NS - Well not sampled
	05/93	NA - Insufficient water volume in well
MAFB-77 (shallow well)	10/89	2.9
	02/90	11.0
	06/90	1.2
	08/90	1.5
	12/90	ND
	03/91	2.3
	05/91	1.1
	08/91	0.6
	11/91	0.8
	03/92	5.2
	04/92	1.2
	07/92	1.0
	10/92	ND
	02/93	9.6
	04/93	7.1
MAFB-78 (deep well)	10/89 - 10/92 (thirteen sampling rounds)	ND
	02/93	NS - Well not sampled
	05/93	ND
MAFB-79 (shallow well)	10/89 - 10/92 (thirteen sampling rounds)	ND
	02/93	NS - Well not sampled
	04/93	ND

Table 2.2-2 TCE Concentrations In AC&W Site Wells, Quarterly Sampling [IT 1991d and IT 1993c] (continued)

WELL NO.	DATE SAMPLED (quarterly sampling round)	TRICHLOROETHYLENE (concentration in $\mu g/\ell$)
MAFB-80 (deep well)	10/89 - 10/92 (thirteen sampling rounds)	ND
	02/93	NS - Well not sampled
	04/93	ND
MAFB-81 (shallow well)	10/89 - 10/92 (thirteen sampling rounds)	ND
	02/93	NS - Well not sampled
	05/93	NP - Constituent not analyzed
MAFB-82 (shallow well)	10/89 - 10/92 (thirteen sampling rounds)	ND
	02/93 - 04/93 (two sampling rounds)	NS - Well not sampled
MAFB-83 (shallow well)	10/89	400
	02/90	540
	06/90	490
	08/90	770
	12/90	120
	02/91	350
	05/91	303
	08/91	350
	11/91	330 J - Concentration estimated
	03/92	470
	04/92	330
	07/92	310
	10/92	280
	02/93	NS - Well not sampled
	04/93	290
MAFB-84 (shallow well)	10/89 - 10/92 (thirteen sampling rounds)	ND
	02/93	NS - Well not sampled
	05/93	NP - Constituent not analyzed

J = Concentration estimated
NA = Not available, dry well or insufficient well volume, or well obstructed
ND = Not detected at method detection limit, i.e., EPA Method 8010
NP = Constituent not an analyte per current Project Work Plans [IT 1993b].
NS = Well not scheduled to be sampled per current Project Work Plans [IT 1993b]

In the PDI, groundwater samples were collected during drilling and after completion of the monitoring wells to establish the vertical distribution of TCE in the SWBZ and to determine the areal extent of the plume. Data from the analyses were used to estimate the amounts of pure TCE present in the SWBZ plume, i.e., 15 gallons dissolved in SWBZ groundwater, and 16 gallons adsorbed onto SWBZ materials. Review of the new PDI data revealed no conditions at the AC&W Site that are detrimental to the selected remedy.

In 1993 all remaining USTs at the AC&W Site were removed and closed under the U.S. Army Corps of Engineers UST Removal Project. The UST northwest of building 10400 (IRP Site 47) was removed in January of 1993 [IT 1993a]. The removal of contaminated soil during UST removal at IRP Site 47 was successful for protection of public health, welfare, and the environment. The 50-gallon UST adjacent to building 10150 was removed in January of 1993 and the abandoned 8500-gallon UST was removed in May of 1993.

2.3 Highlights of Community Participation

The Remedial Investigation Report for the AC&W Site was released to the public in April 1991. The Feasibility Study Report for the AC&W Site was released to the public in September 1991. The Proposed Plan for the AC&W Site was released to the public in September 1991. The Revised Proposed Plan for the AC&W Site was released to the public in March 1992. These four documents were made available to the public in both the Administrative Record file and in information repositories maintained at the following locations:

- The Environmental Management Office, Mather AFB;
- The Mather AFB Library (now closed);
- The Sacramento Central Library;
- The Rancho Cordova Community Library; and
- The U.S. EPA Region IX Docket Room in San Francisco.

The notice of availability for the RI Report [IT 1991a], FS Report [IT 1991b], and the Proposed Plan was published in the *Sacramento Bee* on September 23, 1991. The notice of availability of the Revised Proposed Plan was published in the *Sacramento Bee* and *Sacramento Union* on March 11 through March 15, 1992.

Two public comment periods were held; the first from October 1, 1991 to October 31, 1991, and the second from March 16, 1992 to April 15, 1992. Two public meetings were held at the Rancho Cordova Public Library; the first on October 1, 1991 and the second on April 1,

1992. The public comment periods and public meetings addressed the Proposed Plan and the Revised Proposed Plan. Representatives from the U.S. Air Force (USAF), U.S. EPA-Region IX, the California Regional Water Quality Control Board (RWQCB), and the California Department of Toxic Substances Control (DTSC) were present at the meetings. Representatives from the Air Force and regulatory agencies answered questions about the site and the remedial alternatives under consideration. The Responsiveness Summary, Section 3.0 of this ROD contains responses to questions from both meetings and also documents that no comments were received during the public comment periods.

The public participation requirements of CERCLA Sections 113(k)(2)(B)(i-v) and 117 were met in the remedy selection. This ROD presents the selected remedial action for the AC&W Site, at Mather AFB, California, chosen in accordance with CERCLA (as amended by SARA) and to the extent practicable, the National Contingency Plan. The decision for this site is based on the Administrative Record.

2.4 Scope and Role of Response Action

This ROD addresses the planned response action to address the primary risk at the AC&W Site posed by TCE in groundwater, primarily in the SWBZ, a potential source of drinking water. If wells were to be installed in the SWBZ in the future at the AC&W Site area, the water could contain TCE in concentrations above regulatory standards for drinking water. The purpose of the response action is to prevent future exposure to contaminated groundwater at the AC&W Site (principally in the SWBZ) by removal of the contaminants.

2.5 Summary of Site Characteristics

2.5.1 Summary of Hazardous Material Releases

Groundwater at the AC&W Site has been impacted by past waste disposal practices and is the affected media at the AC&W Site. The primary risk at the AC&W Site is posed by groundwater contamination, a finding supported by Sections 2.5.2.1 and 2.6.1 of this ROD. Soil was impacted by fuel releases and waste disposal practices in the past. However, contamination from fuel releases has been removed, and contamination from other sources has not been confirmed. Therefore, soil is no longer an affected medium at this site.

It has been reported that TCE, used as a solvent and degreaser in facility operations, and waste transformer oil were commonly disposed into a waste disposal pipe in the AC&W area during the period between 1958 and 1966. This pipe, the suspected main source of contamination at the AC&W Site (IRP Site 12) was reported to be about 100 feet southwest

of Building 10150. The existence of the waste disposal pipe has never been verified, all attempts to locate the pipe have been unsuccessful. Estimates suggest that about 1200 gallons of TCE, and 1400 gallons of transformer oil may have been disposed in this manner.

Three additional suspected releases may have occurred near the AC&W Site involving USTs. These releases were investigated as part of the AC&W Site RI/FS [IT 1991a and 1991b] and as part of a subsequent UST removal project [IT 1993a] and are summarized in Section 2.2 of this ROD.

2.5.2 Nature and Extent of Contamination

2.5.2.1 Soils

The types of contaminants suspected to have been present in soils at the AC&W Site included TCE, waste transformer oil, waste motor oil, diesel fuel, unleaded gasoline, carbon tetrachloride, and antifreeze [IT 1990b, 1991a]. These contaminants may have entered the soil via the reported AC&W waste disposal pipe, and in the case of diesel fuel and unleaded gasoline via leaks and releases from three USTs. The quantity of contaminants is not known beyond the estimated volume potentially disposed into the AC&W waste disposal pipe as reported above.

Significant contamination in the soil has only been found in excavations surrounding the two USTs that leaked diesel fuel, i.e., at IRP Sites 25 and 30, and one UST that leaked unleaded gasoline, i.e., at IRP Site 47. The contaminated soil at IRP Sites 25, 30, and 47 was removed and replaced with clean backfill [IT 1991a, IT 1993a]. Results of soil sampling conducted during the RI [IT 1991a] showed little evidence of fuel components or contaminants remaining in the soil in the study area. Results of soil samples collected from five soil borings (SB-1 through SB-5) and analyzed during the RI [IT 1991a] showed the following:

- Two of five soil borings showed very low levels of organic lead (< 1 ppm). In boring (SB-3) adjacent to the UST northwest of Building 10400, IRP Site 47, (the suspected unleaded gasoline leak site) organic lead was detected in four sampled intervals:

  - 4 to 4.5 ft, 0.8 ppm,
  - 101 to 101.5 ft, 0.9 ppm,
  - 105.5 to 106 ft, 0.8 ppm, and
  - 123.5 to 124 ft, 0.8 ppm.

In boring (SB-4) at Site 25 (the diesel fuel spill site) organic lead was detected in the following sampled intervals:

- 2.5 to 3 ft, 0.8 ppm,
- 60.5 to 61 ft, 0.8 ppm,
- 90.5 to 91 ft, 0.7 ppm,
- 105.5 to 106 ft, 0.8 ppm, and
- 125.5 to 126 ft, 0.8 ppm.

No leaded fuels were known to have been stored at the AC&W Site; and, further investigations of organic lead contamination in surface soils indicated non-detectable concentrations [IT 1991b].

- No petroleum hydrocarbons were detected in laboratory-analyzed samples obtained from those sites.

- At two locations (boring SB-5 at 1.5 and 90.5 feet bls) xylenes were detected. The concentrations, 1 and 2 ppb respectively, are estimated values since these results were less than the quantitation limit. The risk of adverse health effects associated with this level of contamination is insignificant, i.e., less than two in one billion (1.9×10^{-9}) [IT 1991a].

- Trichloroethylene in soils was detected in only two samples collected near the water table at depths of 111 and 121 feet bls in boring SB-5, located near the AC&W septic tank and leach field. Both TCE concentrations are estimated values since the results were less than the sample quantitation limit of 6 ppb.

Concentrations of xylenes and TCE in the soil, each detected twice at levels less than the quantitation limits, indicate that there is no significant soil contamination. This conclusion is also supported by analyses of near surface soil samples, collected 2.0 to 3.0 feet bls, which found no contamination [IT 1991a]. Absence of significant contamination sources renders the following ROD considerations of no consequence:

- Lateral and vertical extent of contaminants;
- Concentration of contaminants;
- Mobility of contaminants;
- Carcinogenicity or noncarcinogenicity of contaminants; and
- Potential surface and subsurface pathways of migration.

2.5.2.2 *Groundwater*

Results of RI/FS groundwater sampling and analysis confirmed a plume of dissolved-phase TCE in groundwater in the SWBZ near the water table. Of the constituents detected, TCE is the only consistently detected contaminant of concern in groundwater in the SWBZ. Other results of this investigation are summarized as follows:

- Only one LWBZ well, MAFB-67, had repeated detections of TCE in past quarterly monitoring rounds from October 1989 through August 1990 (see Table 2.2-2). Trichloroethylene, however has not been detected in Well MAFB-67 in the October 1990 round of sampling nor in the quarterly sampling rounds since. The specific source and/or migratory pathway of TCE into Well MAFB-67 is not known, however, results of the FS aquifer testing indicate little hydraulic communication from the SWBZ and the LWBZ. The vertical extent of contamination by Volatile Organic compounds (VOCs) below the SWBZ is defined by the LWBZ monitoring wells.

- A maximum TCE concentration of 800 ppb was detected during the FS aquifer testing from Well AT-2 [IT 1991b]. One sample, collected by the RWQCB at Well AT-2, showed about 1200 ppb of TCE.

- Organic constituents other than TCE were either not consistently detected or were below concentrations in associated sample Quality Control (QC) blanks with the exception of three wells in the LWBZ. These three wells, MAFB-68, -70, and -71, showed detectable concentrations of toluene, ethylbenzene and xylene in the last three sampling rounds of the RI, which ended in early 1990. However, the maximum concentrations detected were less than 15 ppb and were below the U.S. EPA and California's MCLs or applied action levels (AALs) for those constituents [IT 1991b].

  The U.S. EPA and California MCLs and California AALs are:

Analyte	EPA MCL[a]	CA MCL (1990)[b]	CA AAL (1991)[c]
Toluene	1000 $\mu g/\ell$	2000 $\mu g/\ell$	2000 $\mu g/\ell$
Ethylbenzene	700 $\mu g/\ell$	680 $\mu g/\ell$	2000 $\mu g/\ell$
Xylenes - total	10000 $\mu g/\ell$	1750 $\mu g/\ell$	2000 $\mu g/\ell$

[a] = Federal maximum contaminant level for drinking water, 40 CFR 141.32
[b] = California drinking water primary maximum contaminant level, 1990
[c] = California applied action level, 1991

Trichloroethylene is classified as a probable human carcinogen by the U.S. EPA. The volume of TCE in the SWBZ was estimated in the FS [IT 1991b] to be 13 gallons dissolved

in groundwater and 15 gallons adsorbed on saturated soil. Current estimates of the volumes of TCE in the SWBZ, calculated from PDI data, are 15 gallons dissolved in groundwater and 16 gallons adsorbed on saturated soil [IT 1992e]. Trichloroethylene, as a dissolved phase in SWBZ groundwater, forms a plume that is elliptical in shape and oriented to the southwest, suggesting migration towards the family housing area. The SWBZ plume, defined using monitoring well data obtained during the PDI in October 1991, is shown in Figures 2.5-1 and 2.5-2. Figure 2.5-1 shows the plume at the top of the SWBZ at the water table. Figure 2.5-2 depicts the plume at the base of the SWBZ, 50 feet below the water table. A comparison of current (1993) data to those in Figure 2.5-1 and 2.5-2 has been made and it was determined that the current data corroborates the contours shown in these figures. The 1991 data set used to generate Figures 2.5-1 and 2.5-2 is more complete than later data because the 1991 data set includes screening data at depths that are not sampled by monitoring wells, and because wells MAFB-1, MAFB-2, and occasionally MAFB-3 have become dry or have insufficient water to sample because of water table drop. Groundwater monitoring subsequent to the risk assessment have shown maximum values less than the historical maxima listed.

No completed risk pathways exist for TCE. However, in an unrestricted land use, maximum exposure scenario, a water well could be completed in the SWBZ in the future. If such a well were installed, exposure of the public to contaminated groundwater would be possible through ingestion of drinking water or inhalation of TCE that volatilized during showering, or by absorption through the skin during showering.

2.6 Summary of Site Risks

The RI [IT 1991a] included fate and transport modeling and a baseline risk assessment. The modeling was performed using *AT123D: Analytical Transient one-, two-, and three-Dimensional Simulation of Waste Transport in the Aquifer System* [Yeh 1981, IT 1991a]. The modeling predicted that the TCE plume is not expected to impact down-gradient drinking water wells in the future. Also, the modeling predicted that, as the result of natural attenuation processes, the reasonable maximum exposure (RME) concentration for TCE in the plume may be reduced to 5 ppb within 20 years [IT 1991b]. The computer modeling results were used to aid in comparative analysis during the FS, and not to justify a "no further action" alternative. The data collected and utilized in the RI and FS were of U.S. EPA quality level III, IV, or V, or equivalent. Formal data validation of the RI- and FS-generated data was performed to ensure that data were of the quality commensurate with their intended use.

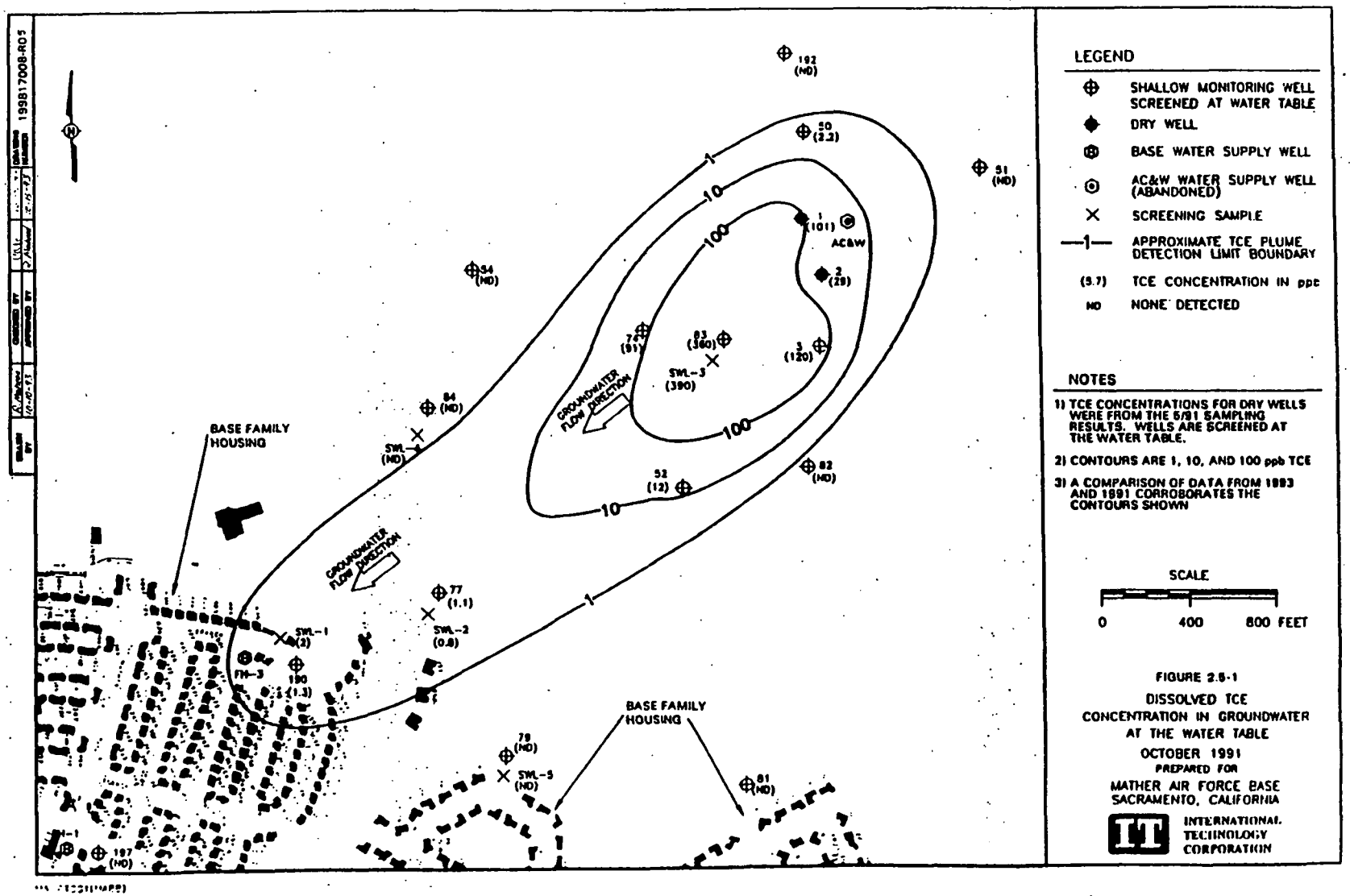
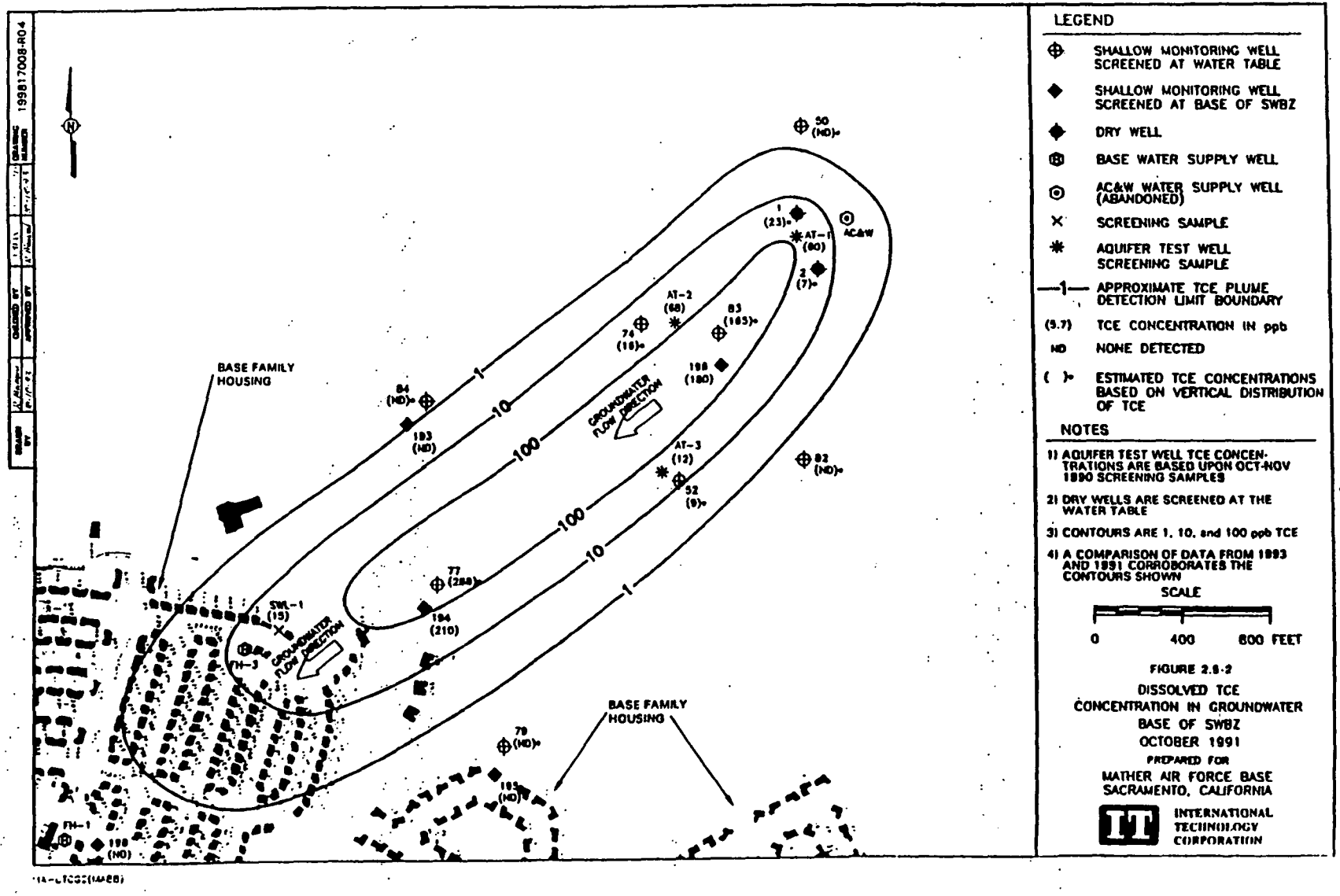


FIGURE 2.5-1
DISSOLVED TCE CONCENTRATION IN GROUNDWATER AT THE WATER TABLE
OCTOBER 1991
PREPARED FOR
MATHER AIR FORCE BASE
SACRAMENTO, CALIFORNIA

INTERNATIONAL TECHNOLOGY CORPORATION


BASE FAMILY HOUSING
BASE FAMILY HOUSING
GROUNDWATER FLOW DIRECTION
GROUNDWATER FLOW DIRECTION
1
10
100
100
10
1
50 (ND)*
1 (23)*
AT-1 (80)
AC&W
2 (7)*
AT-2 (68)
74 (18)*
83 (165)*
198 (180)
84 (ND)*
183 (ND)
AT-3 (12)
82 (ND)*
52 (9)*
77 (288)*
194 (210)
SWL-1 (15)
TH-3
79 (ND)*
183 (ND)
TH-1
198 (ND)
LEGEND
SHALLOW MONITORING WELL SCREENED AT WATER TABLE
SHALLOW MONITORING WELL SCREENED AT BASE OF SWBZ
DRY WELL
BASE WATER SUPPLY WELL
AC&W WATER SUPPLY WELL (ABANDONED)
SCREENING SAMPLE
AQUIFER TEST WELL SCREENING SAMPLE
APPROXIMATE TCE PLUME DETECTION LIMIT BOUNDARY
(9.7) TCE CONCENTRATION IN ppb
ND NONE DETECTED
( )* ESTIMATED TCE CONCENTRATIONS BASED ON VERTICAL DISTRIBUTION OF TCE
NOTES
1) AQUIFER TEST WELL TCE CONCENTRATIONS ARE BASED UPON OCT-NOV 1990 SCREENING SAMPLES
2) DRY WELLS ARE SCREENED AT THE WATER TABLE
3) CONTOURS ARE 1, 10, and 100 ppb TCE
4) A COMPARISON OF DATA FROM 1993 AND 1991 CORROBORATES THE CONTOURS SHOWN
SCALE
0 400 800 FEET
FIGURE 2.8-2
DISSOLVED TCE CONCENTRATION IN GROUNDWATER BASE OF SWBZ OCTOBER 1991
PREPARED FOR
MATHER AIR FORCE BASE SACRAMENTO, CALIFORNIA
INTERNATIONAL TECHNOLOGY CORPORATION

Although the site is currently controlled by the Air Force, Mather AFB was closed on September 30, 1993. Future land use is currently undecided.

The RI baseline risk assessment showed the RME to groundwater contamination to occur in a hypothetical residential land use scenario whereby new drinking water wells might be installed in the SWBZ [IT 1991a]. Under these conditions, the RME concentration of TCE would be about 146 ppb resulting in an excess cancer risk of 1.1×10^{-5}, which is within the acceptable risk range of 10^{-4} to 10^{-6}. The calculated RME concentration for the LWBZ is 1.2 ppb, which results in an excess cancer risk well below the 10^{-6} level.

The potential for contaminants to volatilize from groundwater, migrate through the vadose zone, and accumulate in homes in the future is not a threat at the AC&W Site, although it may pose a threat at other Superfund sites. This potential path of contaminant migration and exposure was evaluated in Section 5.2.1 of the RI Report [IT 1991a] and was dismissed for the following reasons:

- The RI soil gas survey indicated that vapor phase transport is occurring but the vapor phase is not reaching the ground surface.
- The large volume of the TCE SWBZ plume relative to its surface area limits the significance of the volatilization as a [TCE] loss mechanism.
- The shape of the TCE plume in the SWBZ is not indicative of a system in which vapor phase transport followed by re-solution [into the groundwater] is an important transport mechanism. Systems that have a large vapor phase component tend to be less directional and more disperse. The TCE plume in the SWBZ is directional, very narrow relative to its length.

Although soil is not an affected media, the RI baseline risk assessment included possible soil contaminants since xylene was found in two samples. The baseline risk assessment indicated the risk of adverse health effects from xylene was 1.9×10^{-9}, less than two in one billion, which is a negligible risk.

2.6.1 Human Health Risks

2.6.1.1 Contaminant Identification

The RI baseline risk assessment identified eight constituents as chemicals of potential concern in groundwater and two constituents as chemicals of potential concern in soils at the AC&W

Site [IT 1991a]. These were benzene, chloroform, chloromethane, cis-1,2-dichloroethylene, ethylbenzene, trichloroethylene, toluene, and xylene in the AC&W Site SWBZ groundwater and organic lead and xylene in AC&W Site soils.

The constituents identified in the RI [IT 1991a], including the chemicals of potential concern, were evaluated during the FS [IT 1991b] to determine the contaminants of concern for the FS analysis of alternatives. These constituents were benzene, bis(2-ethylhexyl) phthalate, carbon tetrachloride, chloroform, chloromethane, cis-1,2-dichloroethylene, trans-1,2-dichloroethylene, ethylbenzene, total lead, methylene chloride, toluene, 1,1,1 trichloroethane, trichloroethylene, and xylenes in the AC&W Site SWBZ groundwater and organic lead and xylene in AC&W Site soils. Most of the constituents were eliminated from the final list of contaminants of concern [IT 1991b]. The evaluation was done to eliminate common laboratory contaminants, constituents with concentrations below applicable or relevant and appropriate requirements (ARARs), constituents which lack environmental prevalence, and constituents which are within the range of background levels. This evaluation process of potential contaminants of concern is in compliance with U.S. EPA guidance documents [EPA 1989b], and was presented and accepted in both the AC&W Remedial Investigation Report [IT 1991a] and the Feasibility Study [IT 1991b]. On the basis of the evaluation, TCE in groundwater is the single remaining contaminant of concern [IT 1991b]. The range of detected TCE concentrations is as follows:

- From 0.3 $\mu g/\ell$ to 790 $\mu g/\ell$ as reported in the RI [IT 1991a].
- The three samples collected from Well AT-2 during the FS aquifer tests contained 560 $\mu g/\ell$, 800 $\mu g/\ell$, and 1200 $\mu g/\ell$ of TCE [IT 1991b]. The sample that contained 1200 $\mu g/\ell$ of TCE was collected by the RWQCB.
- Since the FS aquifer testing performed in November of 1990, the maximum concentration of TCE has been 470 $\mu g/\ell$ in groundwater from well MAFB-83.

The calculated 95% upper confidence limit of the arithmetic average for TCE is 146 $\mu g/\ell$ in the SWBZ and less than 1.2 $\mu g/\ell$ in the LWBZ [IT 1991b]. These estimates were reported in the FS [IT 1991b] and are based on data collected during the RI. The remainder of this section provides additional information on the evaluation of the constituents that were eliminated as contaminants of concern.

Constituents identified as potential contaminants of concern were eliminated from further consideration if they were determined to be indicative of laboratory contamination. The U.S.

EPA guidance [EPA 1989b] states that for common laboratory contaminants (e.g., acetone, methylene chloride, and phthalate esters), sample results should be considered as positive results only if the concentrations in the sample exceed ten times the maximum amount detected in any blank. For constituents other than common laboratory contaminants, sample results should be considered as positive if the concentration of the chemical in the sample exceeds five times the maximum amount detected in any blank.

The following constituents were determined to be artifacts of laboratory contamination:

- Bis(2-ethylhexyl) phthalate [IT 1990a];
- Chloromethane [IT 1991b]; and
- Methylene chloride [IT 1991b].

Constituents were eliminated as contaminants of concern and from further consideration if contaminant levels were below ARARs, or were below discretionary to-be-considered materials (TBC) as defined in 40 Code of Federal Regulations (CFR) 300.400(g)(3) in the absence of chemical-specific ARARs. Commonly used ARARs were the U.S. EPA and/or California (CA) drinking water MCLs. Constituents that do not exceed an ARAR or TBC value [IT 1991b], and therefore are not contaminants of concern in groundwater, include:

- Benzene: below 1 ppb ARAR (CA MCL);
- Carbon tetrachloride: below 0.5 ppb ARAR (CA MCL) and not environmentally prevalent;
- Chloroform: below 100 ppb ARAR (U.S. EPA MCL for total trihalomethanes); below 4.5 ppb TBC (derived Water Quality Criterion based on 22 CCR 12711 exposure level per Regional Water Quality Control Board guidance [RWQCB 1989]);
- Cis-1,2 dichloroethylene: below 6 ppb ARAR (CA MCL);
- Trans-1,2 dichloroethylene: below 10 ppb ARAR (CA MCL) and not environmentally prevalent;
- Ethylbenzene: below 680 ppb ARAR (CA MCL);
- Toluene: below 40 ppb TBC (proposed secondary MCL);
- 1,1,1 Trichloroethane: below 200 ppb ARAR (CA MCL) and not environmentally prevalent, and;

- Xylenes: below 1750 ppb ARAR (CA MCL).

In some cases, U.S. EPA has selected cleanup levels below ARARs when multiple contaminants are present. Therefore, consideration was given to the possibility that contaminants in addition to TCE that may contribute to a "cumulative" unacceptable risk. It was determined that establishing cleanup levels below ARARs to safeguard against "cumulative" effects of contaminants, in addition to TCE, is not relevant to the AC&W Site for the following reasons:

- Absence of environmental prevalence, i.e, < 5% frequency of detection;
- Later sampling events not confirming the presence of the constituent; and
- The very low levels of those constituents when detected.

Total lead in groundwater was eliminated as a contaminant of concern because the concentration present was within the range of background levels [IT 1991a and IT 1991b].

Therefore, TCE is the only contaminant of concern in groundwater.

Organic lead and xylene in AC&W Site soils were also evaluated. During April of 1991, as part of the FS, 16 surface soil samples were collected in the AC&W area and analyzed for organic lead using the method recommended by the CA DTSC. The CA DTSC analytical method has an organic lead detection limit of 0.5 ppm. These analyses were necessary to further assess potential effects from organic lead for the following reasons:

- Previous estimates of organic lead concentrations at the surface were based on soil samples taken at depth from soil borings SB-3 and SB-4, and were therefore not necessarily representative of surface conditions;
- Uncertainties existed with the analytical method used to determine concentrations; and
- The data contradicted the release history, i.e, no leaded fuels were known to have been stored at the AC&W Site.

Of the 16 surface soil samples collected, four were surface samples near the two borings (SB-3 and SB-4). Samples collected at depth from these borings during the RI [IT 1991a] showed low concentrations of organic lead. The 12 other surface samples were collected from locations randomly selected across the AC&W Site. No organic lead was detected in any of the 16 samples. Therefore organic lead is not a contaminant of concern. Xylene was

eliminated as a contaminant of concern in soils at the AC&W Site because it was detected only twice and at concentrations estimated to be less than 2 ppb. The baseline risk assessment indicated that the risk of adverse health effects from ingestion of soil containing 2 ppb of xylene is 1.9×10^{-9}, a negligible risk [IT 1991b].

2.6.1.2 *Exposure Assessment*

Although there are no residents currently in base housing, the area was used to house base workers and their families until September 30, 1993, and is planned to be used again after redevelopment. The water wells that supply the housing area draw water from the LWBZ or deeper in the Mehrten Formation. Aquifer test data support the interpretation of only limited hydraulic connection between the SWBZ and LWBZ [IT 1991b]. Evaluation of monitoring data and mathematical modeling, performed as part of the baseline risk assessment, predicted that the groundwater plume of TCE has not and will not impact the water supply wells in family housing area [IT 1991a]. Therefore, the baseline risk assessment concluded that groundwater at the AC&W Site does not currently present a completed pathway for exposure. However, in an unrestricted land use, maximum exposure scenario, the possibility exists for completion of a well in the SWBZ in the future. In the event a well of this nature is installed, the possibility of exposure to contaminated groundwater could result in exposure from dermal contact, ingestion of drinking water and inhalation of volatilized constituents during showering.

2.6.1.3 *Toxicity Assessment*

The U.S. EPA classifies TCE as a probable human carcinogen (Group B2) [EPA 1990]. A Group B2 carcinogen is known to produce cancer in laboratory animals, and lifetime exposure to TCE by oral ingestion has been documented to produce liver tumors in several strains of mice [EPA 1990]. Cancer Potency Factors (CPF) have been developed by the U.S. EPA's Carcinogenic Assessment Group for estimating excess lifetime cancer risks associated with exposure to potentially carcinogenic chemicals. The U.S. EPA has estimated the TCE oral CPF as 1.1×10^{-2} $(mg/kg\text{-}day)^{-1}$ [EPA 1990]. Cancer potency factors, correction factors, and the estimated intake of the carcinogen, expressed in mg/kg-day, i.e., milligram of chemical for each kilogram weight of an individual per day, are used to calculate an upper-bound estimate of the excess lifetime cancer risk associated with exposure at the estimated intake level. Use of this approach makes underestimation of the actual cancer risk highly unlikely.

The potential for noncarcinogenic adverse health effects caused by exposure to chemical contaminants is estimated through the use of Reference Doses (RfD) developed by the U.S. EPA. Reference doses are estimates, for a specific chemical constituent, of the lifetime human daily exposure level that is likely to be without an appreciable risk of adverse effects. The calculation of a RfD includes methods to ensure that the RfD will not underestimate the potential for adverse noncarcinogenic effects to occur. Reference doses are applicable to the general population, including sensitive individuals. By comparing the RfDs with the estimated intakes of chemicals present in environmental media, e.g., the amount of a chemical ingested from drinking contaminated water, an assessment can be made of the health risks posed by the chemicals present.

As reported in the RI report [IT 1991a], noncarcinogenic effects produced by oral ingestion of TCE are not well characterized, but have been estimated as follows:

- The estimated RfD is based on the U.S. EPA Lowest-Observable-Adverse-Effect-Level (LOAEL). The LOAEL is the lowest exposure level at which there are statistically or biologically significant increases in the number or severity of adverse effects.
- The TCE LOAEL is 55 ppm, which corresponds to an estimated TCE adsorbed dose of 7.34 mg/kg-day [EPA 1987].
- The U.S. EPA then divided the LOAEL dose by 100 to provide a conservative estimate of the RfD, i.e., 7.34×10^{-2} mg/kg-day [IT 1991a].

The estimated TCE RfD is 7.34×10^{-2} mg/kg-day [IT 1991a]. A daily intake of more than 7.34×10^{-2} mg per kg of body weight would be likely to produce adverse, but noncarcinogenic, health effects during an individual's lifetime, i.e., after 70 years of daily TCE intake.

2.6.1.4 Risk Characterization

Excess lifetime cancer risks are calculated using the assumed contaminant intake level, other exposure correction factors, and the CPF. These risks are probabilities that are generally expressed in scientific notation (e.g., 1×10^{-6} or 1E-6). An excess lifetime cancer risk of 1×10^{-6} indicates that, as a plausible upper bound, an individual has a one in one million chance of developing cancer as a result of site-related exposure to a carcinogen over a 70-year lifetime under specific exposure conditions at a site.

Potential concern for noncarcinogenic effects of a single contaminant in a single medium is expressed as the Hazard Quotient (HQ) (or the ratio of the estimated intake derived from the contaminant concentration in a given medium to the contaminant's reference dose). By adding the HQs for all contaminants within a medium or across all media to which a given population may reasonably be exposed, the Hazard Index (HI) can be generated. The HI provides a useful reference point for gauging the potential significance of multiple contaminant exposures within a single medium or across media. The HI provides a numerical indicator of the nearness to acceptable limits of exposure or the degree to which acceptable exposure levels are exceeded. As the HI increases towards unity (i.e., 1), so does concern for the potential hazard posed by the constituent.

For the final AC&W Site baseline risk assessment, a residential unrestricted land use, maximum exposure scenario was assumed. The potential risk posed by exposure to contaminants was estimated by quantifying potential human intake and identifying toxicity characteristics for the contaminants of concern in the exposure pathways. Trichloroethylene is the only contaminant of concern in SWBZ groundwater.

Trichloroethylene is a probable human carcinogen. The excess lifetime cancer risk for TCE is obtained by multiplying the intake of TCE by the TCE CPF. The ingestion intake for TCE is calculated by assuming an ingestion rate of 1.4 liters of water/day containing a contaminant amount equal to the 95% upper confidence limit of the arithmetic average [IT 1991b]. The inhalation intake is calculated as the amount of TCE which would volatilize from the water source during showering. The resulting risk level represents the probability that an individual could contract cancer due to exposure to TCE from SWBZ groundwater if used for drinking or while showering. The calculated risk level for TCE under the residential/unrestricted land use scenario was 1.1×10^{-5}; i.e., the risk level represents the probability of one person in one hundred thousand contracting cancer from the exposure. This calculated risk levels is within the acceptable range of 10^{-4} and 10^{-6}, as defined in 40 CFR 300.430(e)(2)(i)(A)(2).

The results of the risk characterization process for groundwater beneath the AC&W Site are summarized in Table 2.6-1.

Table 2.6-1 Groundwater - Potential Future Residential Exposure

Constituent	Ingestion Intake (mg/kg/day)	Ingestion Toxicity - CPF $(mg/kg/day)^{-1}$	Inhalation Intake (mg/kg/day)	Inhalation Toxicity - CPF $(mg/kg/day)^{-1}$	Total Risk
TCE	8.3×10^{-4}	1.1×10^{-2}	1.2×10^{-4}	1.7×10^{-2}	1.1×10^{-5}

2.6.2 Environmental Risks

There are no environmental risks associated with contaminants at the AC&W Site as reported in the RI/FS Site Inspection report [IT 1990b] and RI/FS reports [IT 1991a, and 1991b] because:

- There are no critical habitats affected by AC&W Site contamination; and
- There are no endangered species or habitats of endangered species affected by contamination at the AC&W Site.

However, actual or threatened releases of TCE in the groundwater, if not addressed by implementing the response action selected in this ROD, may present potential threat to public health, welfare, or the environment.

These conclusions are based on Section 8.4 "FLORA and FAUNA" of the Site Inspection Report [IT 1990b] and Section 6.3.1.2 "Receptor Assessment" of the RI Report [IT 1991a]. Because there are no completed risk pathways at the AC&W Site a site-specific ecological risk assessment has not been performed. However, the Basewide Comprehensive Risk Assessment, will include an ecological risk assessment, and the assessment will be completed before issuance of the final ROD for Mather AFB.

2.7 Description of Alternatives

Seven remedial alternatives (four primary alternatives with respective sub-alternatives) were developed for detailed analysis in the FS Report for the AC&W Site [IT 1991b]. Groundwater, primarily in the SWBZ, is the affected media at the AC&W Site. Soils are not an affected media and are not considered in the remedial alternatives. The remediation goal of each of these alternatives is to reduce the concentration of TCE in groundwater at the AC&W Site to the Safe Drinking Water Act (SDWA) MCL of 5 ppb.

All alternatives include a groundwater monitoring program consistent with ARARs and compatible with the site-wide groundwater monitoring program [IT 1993e], as approved by the Air Force, U.S. EPA, and State of California in accordance with the FFA for Mather AFB.

The seven remedial alternatives are as follows:

- Alternative 1 - No Action
- Alternative 2 - Institutional Controls
  - Alternative 2a - Access Restrictions
  - Alternative 2b - Alternate Water Supply
- Alternative 3 - Extraction/Injection and Treatment
  - Alternative 3a - Extraction/Injection with Ultraviolet/Oxidation (UV/OX) Treatment
  - Alternative 3b - Extraction/Injection with Air Stripping/Vapor Phase Carbon Adsorption Treatment
- Alternative 4 - Extraction/Treatment with Discharge to Mather Lake or Sanitary Sewer
  - Alternative 4a - Extraction/Treatment with UV/OX and Discharge to Mather Lake or Sanitary Sewer
  - Alternative 4b - Extraction/Treatment with Air Stripping/Vapor Phase Carbon Adsorption and Discharge to Mather Lake or Sanitary Sewer

2.7.1 Alternative 1 - No Action

This alternative assumes current site conditions plus implementation of a groundwater monitoring program to assess characteristics of the plume. This alternative considers taking no active cleanup measures, such as groundwater pumping or removal of contamination. The CERCLA/Superfund program requires that the No Action Alternative be evaluated to provide a baseline for comparison purposes. The No Action Alternative relies on natural degradation and dispersion processes to eventually eliminate the contamination. Computer modeling predicted that the RME concentration for TCE may be reduced to 5 ppb within twenty years in this alternative [IT 1991b]. The modeling was performed using GWFL3D code [Walton 1989] and interactive version of the PLASM code [Prickett and Longquist 1971], and the

GWTR3D code [Walton 1989] to simulate transport of TCE in the SWBZ. The modeling also utilized predicted TCE concentrations generated using *AT123D: Analytical Transient one-, two-, and three-Dimensional Simulation of Waste Transport in the Aquifer System* [Yeh 1981, IT 1991a].

The time required to achieve remediation, i.e., to reduce the concentration of TCE to 5 ppb throughout the AC&W Site SWBZ plume, is expected to be greater than 20 years.

2.7.2 Alternative 2 - Institutional Controls

Remedial Alternatives 2a and 2b rely, to the maximum extent possible, on institutional and access restrictions to prevent the possibility of exposure to the contaminated groundwater. Continued groundwater monitoring is applied until the TCE concentration is reduced via natural degradation and dispersion to 5 ppb. Achievement of full remediation is expected to require greater than 20 years, although the RME concentration is predicted to drop to 5 ppb within 20 years [IT 1991a].

In Alternative 2a, two types of restrictions are evaluated, as described below:

- Requirements in the property deed to restrict land use by prohibiting installation of wells in the contaminated portion of the SWBZ; or
- Continued Air Force control of the site to prevent public use of the site, thereby eliminating the possibility of installing a water supply well in the contaminated area.

Alternative 2b provides two possible sources of alternate drinking water supplies which include:

- Connecting the Base to the city water supply; or
- Decommissioning the current Base family housing wells located nearest to the plume and relying on increased production from the other family housing wells which are located even further away from the contaminated zone.

2.7.3 Alternative 3 - Extraction/Injection and Treatment

Remedial Alternatives 3a and 3b rely on active cleanup of the plume. The time required to achieve remediation pursuant to this alternative is estimated by computer modeling to be 10 years [IT 1991b]. The modeling was performed using GWFL3D code [Walton 1989] and

interactive version of the PLASM code [Prickett and Longquist 1971], and the GWTR3D code [Walton 1989] to simulate transport of TCE in the SWBZ. The modeling also utilized predicted TCE concentrations generated using *AT123D: Analytical Transient one-, two-, and three-Dimensional Simulation of Waste Transport in the Aquifer System* [Yeh 1981, IT 1991a]. In these alternatives, water is modeled to be pumped at a total of 200 gpm from specifically located pumping wells, is treated to remove the contamination, and is then injected into an array of injection wells up-gradient of the plume to direct the flow of contamination toward the capture wells. Continued groundwater monitoring is also included in Alternatives 3a and 3b.

For Alternatives 3a and 3b, the goal is to reduce the concentration of the plume to 5 $\mu g/\ell$ (ppb) to meet the MCL ARAR. The treated water will be injected into the SWBZ. Best available control technology (BACT) will be used for the treatment system off-gasses if required to meet Sacramento Metropolitan Air Quality Management District (SMAQMD) air rules ARAR.

Alternative 3a evaluates using UV and ozone or hydrogen peroxide to oxidize and degrade the TCE in the removed groundwater. The end-products of the UV/OX process are chiefly carbon dioxide and water. Alternative 3b evaluates the combination of two industry standard cleanup processes to remove the TCE from the extracted groundwater. Air stripping uses a stream of air to separate the TCE from the water. Once the TCE volatilizes and becomes a part of the air stream, the air stream is filtered with activated carbon to remove the TCE vapor from the air. As the filter becomes saturated with TCE, it is exchanged for a fresh filter. The spent filter is shipped to a carbon regeneration facility where the TCE is thermally destroyed. Alternative 3b, with injection of treated effluent into the SWBZ, is the selected remedy (see Section 2.9) for this ROD.

2.7.4 Alternative 4 - Extraction/Treatment with Discharge to Mather Lake or Sewer

Alternatives 4a and 4b rely on active cleanup of the plume. The time required to achieve remediation pursuant to this alternative is estimated by numerical computer modeling to be more than 10 years [IT 1991b]. The modeling was performed using GWFL3D code [Walton 1989] and interactive version of the PLASM code [Prickett and Longquist 1971], and the GWTR3D code [Walton 1989] to simulate transport of TCE in the SWBZ. The modeling also utilized predicted TCE concentrations generated using *AT123D: Analytical Transient one-, two-, and three-Dimensional Simulation of Waste Transport in the Aquifer System* [Yeh 1981, IT 1991a].

The treatment portion of Alternative 4a is the same as Alternative 3a in that groundwater is extracted via pumping and treated with UV/OX. The difference between Alternatives 3a and 4a is that in Alternative 4a the treated water will either be:

- Discharged to Mather Lake, thereby reducing the need to supply Mather Lake with water from other sources (i.e., Folsom South Canal); or
- Discharged to the sanitary sewer line for disposal by the Sacramento County Sewage Treatment Plant.

The treatment portion of Alternative 4b is the same as Alternative 3b. Groundwater is extracted via pumping and treated with air stripping and a vapor phase carbon adsorption system if necessary. The treated water is discharged via one of the two options described in Alternative 4a above, i.e., to Mather Lake or to the sanitary sewer.

Continued groundwater monitoring is also included in Alternatives 4a and 4b.

2.8 Summary of the Comparative Analysis of Alternatives

The remedial alternatives developed in the Feasibility Study were analyzed in detail using the nine evaluation criteria required by the NCP (Section 300.430(e)(7)). These criteria are classified as threshold criteria, primary balancing criteria, and modifying criteria. Threshold criteria are:

(1) Overall protection of human health and the environment; and
(2) Compliance with ARARs.

Primary balancing criteria are:

(3) Long-term effectiveness and permanence;
(4) Reduction of toxicity, mobility, or volume through treatment;
(5) Short-term effectiveness;
(6) Implementability; and
(7) Cost.

Modifying criteria are:

(8) State/support agency acceptance; and
(9) Community acceptance.

The resulting strengths and weaknesses of the alternatives were then weighed to identify the alternative providing the best balance among the nine criteria. Table 2.8-1 summarizes this comparison.

2.8.1 Overall Protection of Human Health and the Environment

Overall protection of human health and the environment addresses whether a remedy provides adequate protection and describes how risks posed through each pathway are eliminated, reduced, or controlled through treatment, engineering controls, or institutional controls. The RI baseline risk assessment determined the excess cancer risk of the TCE plume to a human receptor as 1.1×10^{-5} [IT 1991a]. Therefore, implementation of the no-action (Alternative 1) or either of the two institutional control alternatives (Alternatives 2a and 2b) would result in risk within the acceptable limits, i.e., between 10^{-4} and 10^{-6}. For these alternatives and using exposure concentrations predicted by the AT123D analytical computer model [Yeh 1981], calculated risk would decrease from 1.1×10^{-5} at present to less than 1.0×10^{-7} by year twenty [IT 1991a].

Implementation of an extraction/treatment system (Alternatives 3a, 3b, 4a, or 4b) decreases risk from the plume at a more rapid rate. The risks presented below are estimated to represent risks due to the remaining TCE, as predicted by computer modeling, at the end of that particular year [IT 1991b]. The modeling was performed using GWFL3D code [Walton 1989] and interactive version of the PLASM code [Prickett and Longquist 1971], and the GWTR3D code [Walton 1989] to simulate transport of TCE in the SWBZ. The modeling also utilized predicted TCE concentrations generated using *AT123D: Analytical Transient one-, two-, and three-Dimensional Simulation of Waste Transport in the Aquifer System* [Yeh 1981, IT 1991a]. The estimates are exceedingly conservative in that they do not allow for any losses due to degradation, dispersion, natural attenuation, etc., over the entire assumed human exposure period of 30 years. The average concentration of the remaining TCE as predicted by the computer fate and transport modeling at one, five, and ten years are assumed to be representative of the long-term exposure contamination [IT 1991a].

The estimated excess cancer risks (using the RME concentration, i.e., the 95% upper confidence arithmetic average of modeling projections [IT 1991b]) from the TCE remaining

Table 2.8-1 Summary of Comparative Analysis

CRITERIA	ALTERNATIVES 1	2a	2b	3a	3b	4a	4b
Overall Protectiveness of Human Health & Environment	Baseline Risk is 1.1E-05	Institutional controls prevent exposure by eliminating pathway		Active remediation reduces risk to 4.0E-07 in year 6.		Active remediation reduces risk to 4.0E-07 in year 7.	
Compliance with ARARs	All alternatives will reduce TCE levels to below 5 ppb. However, the time-frames over which the reduction occurs differ as follows:						
	20 years	20 years	20 years	10 years	10 years	>10 years	>10 years
Long-Term Effectiveness and Permanence	All alternatives offer the same degree of long-term effectiveness. No residual risk will remain to threaten human health and the environment once the cleanup goals have been met.						
Reduction of Toxicity, Mobility, or Volume	No induced reduction. Reduction occurs only via natural attentuation.			TCE levels are reduced below 5 ppb in 10 years.		TCE levels are reduced below 5 ppb 10-20 years.	
Short-Term Effectiveness	All alternatives offer a high degree of short-term effectiveness. No adverse community, worker, or environmental impacts anticipated.						
Implementability	All alternatives are considered to be readily implementable; however, implementability is rated as follows:						
	Highest	Very High	Highest	Very High	Very High	High	High
Cost Present Worth (millions)	$0.4	Deed $0.4 Security $0.7	City Water $3.1 Modify $1.0	$4.5	$3.5	Lake $5.3 Sewer $5.7	Lake $4.3 Sewer $4.8

in the groundwater at 1, 5, and 10 years (assuming an operating life of ten years) are shown in Table 2.8-2.

Table 2.8-2 Estimated Excess Cancer Risks

Alternative	Year 1	Year 5	Year 10
Pumping With Injection	8.0×10^{-6}	4.9×10^{-7}	9.6×10^{-8}
Pumping Only	9.4×10^{-6}	1.3×10^{-6}	1.6×10^{-7}

2.8.2 Compliance with Applicable or Relevant and Appropriate Requirements

Pursuant to section 121(d) (1) of CERCLA [42 USC Section 9621(d)], remedial actions must attain a degree of clean-up which assures protection of human health and the environment. Additionally, remedial actions that leave hazardous substances, pollutants, or contaminants on-site must meet standards, requirements, limitations, or criteria that are ARARs. Federal ARARs for any site may include requirements under any federal environmental laws. State ARARs include promulgated requirements under state environmental or facility-siting laws that are more stringent than any Federal ARARs and that have been identified to the U.S. EPA by the state 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 circumstances at a CERCLA site.

Relevant and appropriate requirements are defined as those cleanup standards of control and other substantive environmental protection requirements, criteria, or limitations promulgated under Federal or State law 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 is well-suited to the particular site. If no ARAR addresses a particular situation, or if an ARAR is insufficient to protect human health or the environment, then non-promulgated standards, criteria, guidance, and TBC advisories may be used to provide a protective remedy.

The regulatory framework associated with the cleanup of groundwater at the AC&W Site is driven by the potential beneficial use of local groundwater. "The goal of EPA's Superfund approach is to return useable groundwater to their beneficial uses within a timeframe that is reasonable" [Federal Register page 51433, December 21, 1988]. Drinking water is considered to be the highest beneficial use and remediation to drinking water standards affords the greatest level of protection and cleanup. As required by the California Porter-Cologne Water Quality Act, the Regional Water Quality Control Board - Central Valley Region defines the beneficial uses of various water bodies for the Sacramento River Basin. Water bodies and their beneficial uses are presented in the Central Valley Basin Plan. The Basin Plan classifies aquifers in the AC&W Site area to have "existing or potential beneficial uses as sources of drinking water". This regional plan has been promulgated and is an ARAR for the AC&W Site.

Section 121(e) of CERCLA, USC Section 9621(e), states that no federal, state or local permit is required for remedial actions conducted entirely on-site. Therefore, action conducted entirely on-site must meet only the substantive, not the administrative, requirement of the ARAR. Any action which takes place off-site is subject to the full requirements of the federal, state, and local regulations.

CERCLA Section 121 states that, at the completion of a remedial action, a level or standard of control required by an ARAR will be attained for wastes that remain on-site. In addition, the NCP, 40 CFR Section 300.435(b)(2) requires compliance with ARARs during the course of the Remedial Design/Remedial Action.

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

- Contaminant-specific requirements are ARARs that set limits on concentrations of specific hazardous substances, pollutants, and contaminants in the environment such as ambient water quality criteria and drinking water standards.

- Action-specific requirements are ARARs that set technology-based restrictions which are triggered by the type of action under consideration. Examples of action-specific ARARs are Resource Conservation and Recovery Act (RCRA) regulations of waste treatment, storage, and disposal.

- Location-specific requirements are ARARs that set restrictions on certain types of activities based on site characteristics such as restrictions on activities in wetlands, floodplains, and historic sites.

The following sections outline the ARARs and other information that U.S. EPA considered for the AC&W Site.

2.8.2.1 *Contaminant-Specific Applicable Relevant or Appropriate Requirements*

The contaminant-specific ARARs for the AC&W Site are federal drinking water standards and promulgated State of California drinking water standards which are more stringent than federal standards. Cleanup levels are set at health-based levels, reflecting current and potential use and exposure. Each is relevant and appropriate to set cleanup standards at the site. For systemic (noncarcinogenic) toxicants, cleanup levels represent that amount to which humans could be exposed on a daily basis without appreciable adverse effects occurring during their lifetime. For carcinogens, cleanup levels must fall within a 10^{-4} to 10^{-6} risk range [NCP, 40 CFR §300.430 (e)(2)(i)(A)(2)].

Potential drinking water regulations include MCLs for specific contaminants [Section 1412 of the SDWA, 42 USC §300g-1 "National Drinking Water Regulations"; National Primary Drinking Water Regulations, 40 CFR Part 141]. Maximum contaminant levels are enforceable standards which apply to specified contaminants which U.S. EPA has determined have an adverse effect on human health. The MCL for TCE is 5 ppb. Maximum contaminant levels are set at level that are protective of human health and set close to Maximum Contaminant Levels Goals (MCLGs).

Under the authority of the NCP [40 CFR §300.430(f)(5)], MCLGs set at levels above zero must be attained by remedial actions for ground or surface water that is currently or potentially a source of drinking water, where the MCLGs are relevant and appropriate under the circumstances based on the factors in the NCP [40 CFR §300.400(g)(2)]. The MCLGs are applicable to the site if the MCLGs are less stringent than or equal to the federal MCL.

California has promulgated MCL for primary volatile organic compounds, however, the U.S. EPA has chosen the Federal MCL for TCE, i.e., 5 ppb ($\mu g/\ell$), as the groundwater cleanup standard for the AC&W Site because the California MCL for TCE, i.e., 0.005 mg/ℓ (5 $\mu g/\ell$) [22 CCR Section 64444.5] is equal to the Federal MCL.

2.8.2.2 *Action-Specific Applicable or Relevant and Appropriate Requirements*

2.8.2.2.1 Air Stripping - Alternatives 3b and 4b. Alternatives 3b and 4b utilize air stripping to remove TCE from the groundwater followed by vapor phase carbon adsorption to

remove TCE from the air stream. The SMAQMD requires that new source that emits toxic chemicals to the atmosphere must have authorization for construction and operation. Although on-site treatment facilities are exempted by CERCLA from administrative requirements of the permit, emission limits and monitoring requirements imposed by the SMAQMD permit must be met. These requirements include SMAQMD Rule 202 Section 301, and Rule 402 Section 301, et seq.:

- SMAQMD Rule 202, Section 301, "Best Available Control Technology" (BACT)

  Section 301 is considered to be relevant and appropriate to the air emissions from the air stripper. BACT is required for emissions of reactive organic compounds. The SMAQMD requires that a risk assessment for air emissions be performed to support the remedial design phase. System-specific requirements include ability of the carbon adsorption system to perform at a minimum control efficiency of 90%, and that daily emissions will be quantified and not exceed SMAQMD limitations.

- SMAQMD Rule 402, Section 301, "Nuisance"

  Section 301 is considered to applicable to the remedial action. Discharges of air contaminants will not be in such quantities as to cause injury, detriment, nuisance or annoyance to any considerable number of persons or the public, or endanger the comfort, repose, health or safety of any such persons or the public, or cause injury or damage to business or property.

The OSWER Directive 9355.0-28, "Control of Air Emissions from Air Strippers at Superfund Groundwater Sites" will be considered. This TBC covers all Superfund sites with potential air stripper emissions.

2.8.2.2.2 Off-Site Thermal Regeneration of Spent Activated Carbon - Alternatives 3b and 4b. Use of activated carbon for remediation of VOCs under Alternatives 3b and 4b could trigger requirements associated with regeneration or disposal of the spent carbon. If the spent carbon is a listed waste or a characteristic waste then it is regulated as a hazardous waste under RCRA [42 USC §9601, et seq.] and California's Hazardous Waste Management (HWM) regulations [22 CCR 66262.10 - 66262.57].

Movement of contaminants to new locations and placement in or on land will trigger land disposal restrictions for the waste [RCRA 40 CFR §263 Subpart D]. Additionally, closure for units which store hazardous waste for more than 90 days must be met [RCRA 40 CFR §264.110 - 264.120].

Containers used for storage of contaminated carbon that is classified as a listed or characteristic waste must comply with California HWM regulations [22 CCR 66262.30 - 66262.33]. Accumulation of hazardous waste on-site for more than 90 days may trigger the requirements set forth in RCRA [40 CFR Part 264] and California HWM regulations [22 CCR 66264].

On-site storage of contaminated carbon can trigger state requirements such as California HWM regulations [22 CCR 66262.10 - 66262.43, and 66264] and municipal or county hazardous material ordinances. If the spent carbon is a hazardous waste, construction and monitoring requirements for storage facilities may also apply.

Disposal of contaminants can trigger RCRA land disposal restrictions for disposal. If land disposal restrictions are triggered, spent carbon would need to meet treatment standards and RCRA off-site Subtitle C disposal restrictions would also apply.

The selected remedy will utilize, if necessary, the off-site thermal regeneration of the spent carbon. Regeneration of activated carbon, using high-temperature thermal process, is considered "recycling" under both Federal RCRA regulations, and California hazardous waste regulations. Transportation, storage, and generation of hazardous waste for recycling must comply with requirements of RCRA and California HWM regulations [22 CCR Sections 66262.10 - 66262.57]. Performance standards for hazardous waste incinerators can also be requirements for on-site carbon reactivation.

2.8.2.2.3 Discharge to Surface Waters - Alternatives 4a-1 and 4b-1. Substantive National Pollutant Discharge Elimination System (NPDES) permit requirements [NPDES, Clean Water Act §402; 40 CFR Parts 122-125] would apply under Alternatives 4a-1 and 4b-1 to discharge of treated effluent to surface waters. These requirements would primarily be effluent limitations and monitoring requirements. Ambient Water Quality Criteria are used by the State of California to set Water Quality Standards in the California Inland Surface Waters Plan. Standards in the plan are used by the RWQCB to set NPDES effluent discharge limitations.

2.8.2.2.4 Underground Injection - Alternatives 3a and 3b. Alternatives 3a and 3b include groundwater extraction, treatment of the groundwater, and injection of treated effluent into the SWBZ. Effluent from the groundwater treatment system that is injected into the aquifer at the AC&W Site, i.e., the SWBZ, must meet the following ARARs:

- "The Water Quality Control Plan (Basin Plan) for the Central Valley Regional Water Quality Control Board (Region 5): The Sacramento River Basin (Basin 5A), The Sacramento-San Joaquin Delta Basin (Basin 5B), and the San Joaquin River Basin (Basin 5C)" [RWQCB 1990];
- The State Water Resources Control Board Resolution No. 68-16 (Antidegradation Policy) "Statement of Policy with Respect to Maintaining High Quality of Waters in California,";
- The State Water Resources Control Board Resolution No. 88-63 (Policy on Sources of Drinking Water),";
- Section 3020 of RCRA; and
- The federal Underground Injection Control (UIC) Program for class V wells set forth in 40 CFR Part 144.

The SWRCB Resolution 68-16 requires maintenance of existing State water quality unless it is demonstrated that a change will benefit the people of California, will not unreasonably affect present or potential uses, and will not result in water quality less than that prescribed by other State policies.

According to the decision of the U.S. EPA Administrator, Resolution 68-16, the water anti-degradation policy, is a State ARAR for the establishment of numerical limits for the reinjection of treated ground water into clean areas (i.e., high quality waters) of the aquifer, i.e., outside of the contaminated plume. The numerical limits established on a monthly median and on a daily maximum basis to meet the requirements of Resolution 68-16 are set forth in Table 2.8-3 With respect to the reinjection of treated ground water within the contaminated plume, treatment shall be at most the concentration level of the trichloroethylene (TCE) in the ground water at the point of reinjection measured on a monthly median basis, but not greater than 5 μg/l, the Federal and State primary MCL. With respect to reinjection of treated groundwater outside the contaminated plume, the effluent is required to attain a discharge level for TCE of 0.5 μg/l measured on a monthly median basis, with the maximum inforceable discharge standard not to exceed 5.0 μg/l. To meet the requirement that the selected remedy be protective of human

Table 2.8-3 Groundwater Discharge Treatment Standards

Groundwater Discharge Treatment Standards			
Constituent	Standards for Injection into Non-Contaminated Portions of the Aquifer Based on State Board Resolution 68-16 (Concentrations in µg/ℓ)		Standards for Injection in the Contaminated Portions of the Aquifer Based on the more stringent of (a) MCLs (State or Federal which ever is more stringent) as a Daily Maximum (see below) or (b) In Situ Groundwater Concentrations at the Point of Injection as 30 Day Median (Concentrations in µg/ℓ)
	30 Day Median[1]	Daily Maximum[1]	State or Federal MCLs Daily Maximum
Trichloroethylene (TCE)[2]	0.5	5.0	5.0
Total Volatile Organic Constituents (VOCs)[3]	1.0	5.0	---
pH	6.5 < pH < 8.5		

1. EPA method 601 and 602 with a detection limit of 0.5 µg/ℓ or less. If the daily maximum is exceeded an additional sample(s) must be collected and analyzed within the same month to demonstrate that the monthly median has not been exceeded.
2. Carcinogens.
3. Total VOCs will be the sum of all EPA Method 601 and 602 analysis constituents including TCE.

health and the environment, the U.S. Air Force shall maintain hydraulic control of the plume while extracting contaminated ground water, and reinjecting treated ground water into the contaminant plume or the clean portion of the aquifer.

Section 3020 of RCRA prohibits disposal of hazardous waste above or into a formation which contains a source of drinking water. This prohibition does not apply to injection of treated contaminated groundwater into an aquifer if:

- Such injection is part of a response action under Section 104 or 106 of CERCLA;
- The contaminated groundwater is treated to substantially reduce hazardous substances prior to such injection; and
- The response action will, upon completion, be adequate to protect human health and the environment.

The federal UIC Program requires that injection wells such as those that would be located at the Site:

- Not cause a violation of the primary MCL in the receiving aquifer, and
- Not adversely affect the health of persons [40 CFR Section 144.12].

The effluent reinjected outside of the contaminated plume and into clean groundwater will have a discharge median monthly TCE concentration level of 0.5 micrograms per liter ($\mu g/\ell$ or ppb). Reinjection of the effluent within the contaminated plume will have a median monthly TCE concentration level not exceeding the concentration of TCE in the groundwater at the point of reinjection. However, in no case will the maximum discharge concentration level exceed 5.0 $\mu g/\ell$ (ppb), the federal and state MCL drinking water standard.

2.8.2.3 Location-Specific Applicable or Relevant and Appropriate Requirements

The Air Force has not identified any location-specific ARARs for the AC&W Site.

2.8.2.4 Compliance With Applicable or Relevant and Appropriate Requirements

All of the alternatives considered in the FS [IT 1991b] will comply with the ARARs. None of the proposed alternatives will require waivers to be issued. The point in time at which ARARs are satisfied, however, differs significantly among the alternatives. Alternatives 3a and 3b are predicted to achieve ARARs about 10 years after start-up by increasing capture efficiency as a result of injecting the treated effluent. Alternatives 4a and 4b, which rely on extraction only to

capture and contain the plume, are predicted to require more than 10 years of operation to achieve ARARs.

Alternatives 1, 2a, and 2b; however, rely on natural attenuation and degradation processes to reduce contaminant levels. For these alternatives, the fate and transport modeling effort predicted natural phenomena will require at least 20 years to adequately reduce TCE and achieve the MCL of 5 ppb [IT 1991a]. The modeling was performed using *AT123D: Analytical Transient one-, two-, and three-Dimensional Simulation of Waste Transport in the Aquifer System* [Yeh 1981, IT 1991a].

2.8.3 Long-Term Effectiveness and Permanence

Long-term effectiveness and permanence refers to the ability of a remedy to maintain reliable protection of human health and the environment over time. The criterion includes the consideration of residual risk and the adequacy and reliability of controls. Long-term effectiveness and permanence is essentially the same for all seven of the alternatives. The only long-term activity is groundwater monitoring, and this activity is common to all alternatives, including no-action.

However, the transition point from short-term to long-term, i.e., the end of the remedial action implementation period, varies between the alternatives. Long-term is considered to begin when ARARs are achieved: at least year 20 for Alternatives 1, 2a, and 2b; in about 10 years for Alternatives 3a and 3b; and in excess of 10 years for Alternatives 4a and 4b.

2.8.4 Reduction of Toxicity, Mobility, or Volume

Reduction of toxicity, mobility, or volume through treatment refers to the preference for a remedy that uses treatment to reduce health hazards, contaminant migration, or quantity of contaminants at the site. Alternatives 3a, 3b, 4a, and 4b (pump and treat alternatives) offer significant advantages in reduction of toxicity, mobility, and volume relative to Alternatives 1 and 2, i.e., alternatives which do not employ active treatment. In addition, the pump and treat alternatives fully meet the statutory preference for treatment technologies that permanently destroy the principal hazardous constituents: Alternatives 3b and 4b resulting in the on-site destruction of TCE via UV/OX reactions; and Alternatives 3a and 4a resulting in the off-site destruction of TCE during carbon regeneration. Alternatives 3a and 4a will not meet the statutory preference for treatment technologies that permanently destroy the principal hazardous constituents if vapor-phase carbon adsorption is not required to comply with SMAQMD ARARs.

The time required to reduce the absolute concentration of TCE to a maximum of 5 ppb throughout the AC&W Site groundwater plume has not been established definitively, but will be modeled as part of the remedial design. Modeling results presented in the FS (see Appendix E, Table E-6 [IT 1991b]) indicate that Alternatives 3a and 3b may reduce TCE concentration to maximum of 4 ppb after 10 years of operation while Alternatives 4a and 4b may reduce TCE concentration to a maximum of 6 ppb in 10 years [IT 1991b]. The modeling was performed using GWFL3D code [Walton 1989] and interactive version of the PLASM code [Prickett and Longquist 1971], and the GWTR3D code [Walton 1989] to simulate transport of TCE in the SWBZ. The modeling also utilized predicted TCE concentrations generated using *AT123D: Analytical Transient one-, two-, and three-Dimensional Simulation of Waste Transport in the Aquifer System* [Yeh 1981, IT 1991a]. Thus Alternatives 4a and 4b will probably require more than 10 years to reduce the AC&W Site SWBZ plume TCE concentration to 5 ppb.

Alternatives 1, 2a, and 2b contribute no induced reduction of toxicity, mobility, or volume and rely solely on natural attenuation to reduce the TCE plume to the 5 ppb level over a period predicted by the baseline fate and transport modeling to be at least 20 years.

2.8.5 Short-term Effectiveness

Short-term effectiveness refers to the period of time needed to complete the remedy and to any adverse impacts on human health and the environment that may be posed during the construction and implementation of the remedy. All of the alternatives are judged to offer a high degree of short-term effectiveness because of the lack of risk posed to the community and/or workers during the construction and implementation phase.

The pump and treat alternatives (Alternatives 3a, 3b, 4a, and 4b) are the only alternatives which could potentially expose the community/workers by bringing TCE to the surface for treatment. However, any potential threat can be readily controlled. The treated groundwater effluent will be sampled on a regular basis and the off-gas emissions will be continuously monitored. The pump and treat system would be de-activated in the event that unacceptable discharges occur.

No adverse environmental impacts are anticipated from the construction and implementation of any of the pump and treat alternatives. Alternatives 3a and 3b return the treated effluent to the SWBZ so that the aquifer will not be depleted by extraction of the groundwater.

2.8.6 Implementability

Implementability refers to the technical and administrative feasibility of a remedy, including availability of materials and services needed to implement the selected remedy. It also includes coordination of federal, state, and local governments in cleanup of the site. Although all of the alternatives considered in the detailed analysis are readily implementable, Alternatives 1 and 2b offer the highest degree of implementability. For obvious reasons, Alternative 1 (no action) is easily implementable, requiring only monitoring of the groundwater; and Alternative 2b (alternate water supply) requires only the abandonment of wells, such as Well FH-3, or the extension of the city water supply.

Alternative 2a (deed restrictions/continued Air Force control) also presents minimal implementability problems; however, specific actions proposed for this alternative are sensitive to the future land use. If this alternative were ultimately chosen for implementation, the possibility exists that at some time into the institutional action (if the AC&W Site were allowed public access), a change from continued Air Force security to deed restrictions and/or other site security would be necessary. Therefore, base closure would not preclude implementation of this alternative.

Of the pump and treat alternatives, Alternatives 3a and 3b are judged more implementable than Alternatives 4a and 4b because it may be easier to mitigate potential injection well plugging by biologic growths, metallic precipitants, silt particles, or by other effects than to meet the requirements governing the discharge of effluent to Mather Lake.

2.8.7 Cost

This criteria examines the estimated cost for each remedial alternative. For comparison, capital costs and annual O&M costs are used to calculate a present-worth cost for each alternative. A detailed cost analysis was performed for each of the alternatives proposed in the FS Report (and sub-options where applicable) [IT 1991b]. These cost estimates, presented in the FS Report [IT 1991b] and Proposed Plan, were calculated assuming a clean up standard of a 5 ppb TCE RME concentration, however, based on guidance from regulatory agencies, this assumption has been changed to an absolute TCE concentration of 5 ppb. The revised present worth cost estimates of each alternative, assuming zero equipment salvage value, zero percent inflation, and a five percent discount rate, are shown for comparison in Table 2.8-4 in order of least expensive (Alternative 1) to most expensive (Alternative 4a-2).

Table 2.8-4 Present Worth Costs for All Alternatives

Alternative	Present Worth Costs
1 No-action	$0.4 million
2a-1 Deed Restrictions	$0.4 million
2a-2 Continue Site Security	$0.7 million
2b-2 Modify Well Field	$1.0 million
2b-1 City Water Supply	$3.1 million
3b Air Stripping/Vapor Phase Carbon Adsorption and Injection	$3.5 million
4b-1 Air Stripping/Vapor Phase Carbon Adsorption and Discharge to Mather Lake	$4.3 million
3a Ultraviolet Light/Oxidation and Injection	$4.5 million
4b-2 Air Stripping/Vapor Phase Carbon Adsorption and Discharge to Sanitary Sewer	$4.8 million
4a-1 Ultraviolet Light/Oxidation and Discharge to Mather Lake	$5.3 million
4a-2 Ultraviolet Light/Oxidation and Discharge to Sanitary Sewer	$5.7 million

2.8.8 State/Support Agency Acceptance

State acceptance indicates whether, based on its review of the RI, FS, and Proposed Plan, the state in which the site resides agrees with the preferred alternative. The Air Force, as the lead agency, has involved the State of California Department of Toxic Substances Control, and the State of California Regional Water Quality Control Board. The Air Force has responded to all state regulatory agency comments received during their reviews of the Feasibility Study Report and the Proposed Plans. The state regulators support the selection of Alternative 3b as the preferred remedy.

2.8.9 Community Acceptance

Community acceptance indicates the public support of a given alternative. Section 3.0 of this Record of Decision documents the community acceptance of the selected remedy, as presented in the Proposed Plan.

2.9 *The Selected Remedy*

The U.S. EPA has selected Alternative 3b as the remedy for the AC&W Site. The selected remedy for contaminated groundwater at the AC&W Site consists of groundwater extraction, treatment via air stripping and injection of treated effluent into the SWBZ. If necessary to meet ARARs, the treatment system off-gasses will be collected by activated carbon adsorption. The effluent limit for TCE (see Table 2.8-3) is 0.5 $\mu g/\ell$ as a monthly median for reinjection outside of the contaminant plume, and variable up to the lesser of 5 $\mu g/\ell$ or the concentration in groundwater at the point of injection, and in both cases will have a daily maximum concentration of 5 $\mu g/\ell$. The remedial action is intended to restore the AC&W Site groundwater to its beneficial use, which is a potential source of drinking water. The remediation will be achieved when the TCE concentration throughout groundwater of the AC&W Site has been reduced to the ARAR-based SDWA MCL of 5 $\mu g/\ell$ (ppb). As discussed in Section 2.8.1 above, the TCE concentration in the groundwater at the conclusion of the remediation will be within or below the cancer risk range considered to be acceptable, i.e., within the range of 10^{-4} to 10^{-6}.

Based on information obtained during the remedial investigation and on a careful analysis of all remedial alternatives, the U.S. EPA and the State of California believe that the selected remedy will achieve this objective.

Moreover, the selected remedy (1) does not contemplate discharge to surface waters, and such discharge is prohibited, (2) prohibits the bypass or overflow of untreated or partially treated waste, (3) requires that the discharge shall be limited to approved on-site land disposal using injection wells, and (4) that the pH of the treated ground water shall be between a pH of 6.5 and 8.5 or equivalent to the pH of the receiving water. The Remedial Design (RD) and the Remedial Action (RA) Work Plan will provide for alternative discharge options in the event the reinjection capacity becomes insufficient to handle the treated effluent. These alternative discharge options will be used only on a temporary basis.

The selection of this remedy is based on a comparative analysis of the alternatives presented above and provides the best of trade-offs with respect to the nine evaluation criteria. The selected remedy provides the best route towards achieving the cleanup standards and restoring the groundwater to full beneficial use.

This section is a description of the conceptual engineering features and operation of the selected remedy. The initial conceptual design parameters listed below were developed from RI/FS modeling [IT 1991a, IT 1991b, and IT 1992e]. The current design parameters being used for

initial modeling during the remedial design are more reflective of current conditions at the site, and are indicated in parentheses below the RI/FS model parameters. These parameters are provided for indication purposes. The specific design details will be determined during the remedial design phase in order to meet the performance objective of complete capture of the contaminant plume to the aquifer cleanup level, and therefore may be different than those listed and discussed below:

- Influent TCE Concentration = variable, possibly as much as 500 ppb at start-up (Current design estimates predict an average of about 100 ppb with a maximum of about 200 ppb.)
- Effluent TCE Concentration = 5 ppb (maximum)
- Groundwater Flow Rate (combined) = 200 gpm
  (Current design estimates a combined flow of about 270 gpm)
- Air Flow Rate = 670 cubic feet per minute (cfm)
  (Current design estimates 900 cfm)
- Volumetric Air/Water Ratio = 25:1.

The detailed implementation of the selected remedial action will be performed by the U.S. Air Force in consultation with the regulatory agencies during the RD/RA phase, at which time the U.S. Air Force will develop reporting, notification and monitoring programs. The monitoring program shall include sufficient monitoring (both in terms of frequency and test methods employed) to evaluate the effectiveness of the RA and ensure that the effluent reinjection standards adopted herein are being met. The U.S. Air Force shall, at a minimum, include the following in the RD/RA phase: Locations of the extraction, injection, and performance monitoring wells, estimated extraction and injection rates, proposed operational procedures, proposed contingency plan for the extraction, treatment and injection system in the event of power outage and/or mechanical failure, geologic well logs and well development data sheets for all newly installed extraction, injection and performance monitoring wells proposed for the AC&W Site ground water treatment system. The operational procedures shall reflect that the ground water treatment system will not be operated in excess of its design capacity without the prior approval of the regulatory agencies.

Since the selected remedy does not contemplate on-site disposal of hazardous or remedial action derived wastes, no such action specific ARARs were selected. Hazardous and remedial action derived wastes could consist of wastewater, screenings, sludges and other solids generated during

construction, operation and maintenance of the treatment system. Off-site disposal of such wastes will be performed in accordance with applicable federal, state and local laws, regulations and ordinances. However, these requirements would not be considered ARARs under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), as ARARs apply only to on-site activities.

2.9.1 Extraction Wells

The contaminated groundwater would be pumped from the SWBZ from production wells using down-hole submersible pumps. It is estimated that these wells would have a combined production rate of 270 gpm. The influent water would flow through buried polyvinyl chloride (PVC) piping to a pre-treatment filtration unit.

Initial background concentration of all potential pollutants shall be determined for each water-bearing zone in which reinjection will occur.

The U.S. Air Force will perform metals and minerals monitoring before and during the remedial action. If the results necessitate the establishment of reinjection standards for additional constituents in order to meet Applicable or Relevant and Appropriate Requirements (ARARs), an amendment to the ROD, inclusion in the Groundwater/Comprehensive OU ROD, or other appropriate procedural mechanisms will be considered by the U.S. Air Force, U.S. EPA, and Cal EPA.

2.9.1.1 Pre-Treatment Unit

The pre-treatment unit would consist of a bag-type filter. The filter bag would be capable of removing particles from the influent water that are as small as 1 micron. Actual specifications for the pre-treatment unit will be developed during the remedial design phase. Because heavy solid loads are not anticipated, it should be only necessary to change the filter bag once or twice per year. Actual maintenance intervals would be dictated by field conditions.

After passing through the pre-treatment unit, the influent would be pumped to the top of the air stripping tower(s). A description of the major components of the air stripping treatment unit is presented below.

2.9.1.2 *Air Stripping Tower and Blower*

The air stripping tower(s) would be of a cylindrical, vertical design which will allow air flow countercurrent to the liquid flow through packing. Components of a typical air stripping tower include:

Spray Nozzles

Spray nozzles are used to uniformly distribute the liquid influent over the packing to avoid channelling and dry spots.

Mist Eliminator

The mist eliminator is a relatively thin bed of packing or wire mesh material. It is situated above the main packing and spray nozzles and is used to remove entrained water droplets from the exiting air stream.

Packing System

Within the column of polypropylene packing material, the liquid and countercurrent air contact each other, stripping contaminants from the liquid. In time, the packing material can become encrusted with solids precipitated from the liquid influent or can be fouled with biological growth, necessitating removal and disposal. This fouling would cause gradual reduced efficiency in the removal of contaminants, as well as increasing the pressure drop through the packing resulting in decreased air flow from the blower. It is anticipated that the removal and refill of the packing material would need to be carried out only once per year. The used packing would be classified as non-hazardous waste and could be disposed in a sanitary landfill. The treated water would exit the tower and be forced by an effluent pump along the effluent line to the post-treatment filtration unit.

Blower

The supply air for the air stripping tower is provided by a blower. After contacting the liquid, the air flows out the top of the stripping tower. Here the off-gas is warmed by a heater. The heater is used to reduce the relative humidity in the air stream which increases the effectiveness of the vapor phase carbon adsorption process and reduces carbon consumption. A heater will not be necessary if activated carbon adsorption of the vapor phase is not required to comply with SMAQMD ARARs.

2.9.1.3 *Post-Treatment Unit*

Specifications of any post-treatment unit (PTU) will be developed during the remedial design phase. Purposes of the PTU will be to remove any particulates which may have formed in the treatment process, and to maintain effluent chemical properties to mitigate potential chemical, physical, or biological fouling of the aquifer and injection wells. The effluent will be pumped from the PTU to the injection wells through buried PVC pipelines.

2.9.1.4 *Vapor Phase Carbon Adsorption System*

Vapor-phase carbon-adsorption treatment will be used if required to meet SMAQMD ARARs. The vapor phase carbon adsorption is included as part of the selected remedy to prevent negative cross-media impacts and maintain 90% capture efficiency. There are two main types of vapor phase carbon adsorption systems which may be used in conjunction with the air stripper to remove contaminants from the off-gas stream. The first type consists of self-contained, portable activated carbon canisters. These canisters are filled with regenerated granular carbon which removes impurities from the stripper off-gas. Approximately 2000 to 3000 lbs of activated carbon would be needed for the anticipated TCE concentrations and air flow rates. These units are designed for installation on a concrete pad. The only installation needed is to connect the inlet from the stripper tower and outlet ports. The canisters can be connected in a series lead-lag configuration for increased contact times, or parallel configuration for high flow rates. The useful life of the carbon is dependent upon the concentration of the organic compounds in the gas stream, flow rate, and temperature. With the AC&W Site treatment system, it is estimated that the carbon would initially require replacement once per month, with less frequent replacement as influent TCE concentration decreases. When the carbon becomes saturated with contaminants, the canister is detached, sealed, and shipped for regeneration. The carbon vendor would provide shipping and regeneration as a service.

The second type of carbon system is a permanent skid-mounted structure in which single or dual beds of granular activated carbon are arranged. The system employs the same principles as the carbon canisters, however, maintenance is more involved. Maintenance consists of removal and transport of the spent carbon to a regeneration facility, cleaning the vessel and filling the vessel with regenerated carbon. The shipping and regeneration service would be provided by the carbon vendor.

After carbon treatment, the treated vapor would be discharged to the atmosphere. The off-gas would be analyzed continuously with an in-line monitor to prevent unacceptable releases of organic gases to the atmosphere.

Selection of the type of carbon system will be made after further analysis in the design phase.

2.9.1.5 Injection Wells

Detailed specifications for the injection wells will be developed during the remedial design phase. The location of the injection wells and selection of injection well screen intervals will be established during the remedial design phase. The treated effluent will be injected into the SWBZ using wells screened in the SWBZ. These wells will have a combined injection rate of about 270 gpm, or equal to the extraction rate.

2.9.2 Performance Evaluations

In addition to operational monitoring of influent, effluent, and air emissions, routine sampling of the site groundwater (both SWBZ and LWBZ) will be conducted to monitor the migration of the TCE plume and the decrease in the concentration. Specific sampling, analysis, and monitoring requirements will be established during the remedial design. This data will be utilized both as a part of institutional control and as part of periodic performance evaluations of the remedial system.

Periodic performance evaluation reports will present groundwater monitoring data. The evaluation report shall demonstrate that the capture zones of the extraction wells are adequate to provide complete capture of the plume exceeding the aquifer cleanup standard of 5 $\mu g/\ell$ (ppb) TCE, and shall demonstrate that the injection of treated groundwater does not degrade the receiving water quality.

Five-Year Site Reviews and periodic performance evaluations, as recommended by the U.S. EPA, are to be included as a component of the selected remedy. The specific schedule for periodic performance evaluations will be determined during the remedial design phase. However, the U.S. EPA recommends an initial evaluation be conducted one to two years after the remedy is operational and functional, in order to determine whether modifications to the restoration action are necessary. The U.S. EPA also recommends that more extensive performance evaluations be conducted at least every five years [55 FR 8740]. The purpose of

the evaluations is to determine whether cleanup levels have been, or will be, achieved in the desired timeframe. After the evaluations are completed, the following options should be considered:

- Discontinue operation;
- Upgrade or replace the remedial action to achieve the original remedial action objectives or modified remedial action objectives; and/or
- Modify the remedial action objectives and continue remediation, if appropriate [55 FR 8740].

2.9.3 Estimated Costs

Major costs associated with the selected remedy were estimated during the FS [IT 1991b]. The cost estimates have been revised to incorporate the longer period of remediation (10 years versus 6 years) and are summarized in Tables 2.9-1, 2.9-2 and 2.9-3, below. Cost estimates will be refined and finalized during the remedial design phase.

Table 2.9-1 Selected Remedy Costs - Alternative 3b

Cost Component	Total Dollars x 1000	Present Worth[a] x 1000
Capital	$1605	$1602
Operation and Maintenance[a]	$2521	$2032
Total Costs	$4126	$3634

[a] Calculated over a 10 year life, 5% discount rate

Table 2.9-2 Estimated Cost Summary, Present Worth Calculation

Selected Remedy: Alternative 3b
Extraction / Injection
Air Stripper with Vapor Phase Carbon Adsorption (200 gpm)

Annual Discount Rate 5%

Cost / Year (x1000)

1. Year	0	1	2	3	4	5	6	7	8	9	10	11	Totals
2. Capital Costs	#######		$2.3		$2.3		$2.3		$2.3		$2.3		$1,604.9
3. O & M Costs	$0	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	####	$2,521.2
4. Discount Factor	1.000	0.952	0.907	0.864	0.823	0.784	0.746	0.711	0.677	0.645	0.614	0.585	
5. Annual Expenditures	#######	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	####	$4,126.1
6. Present Worth	#######	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	####	$3,549.0
												Total Cost	$3,634

O & M = Operations and Maintenance

Table 2.9-3 Estimated Cost Summary, Capital and O & M Cost Breakdowns

Selected Remedy: Alternative 3b
Extraction / Injection
Air Stripper with Vapor Phase Carbon Adsorption (200 gpm)

Capital Costs		FS Report Appendix G Element No.
Construction Costs:		
Extraction Wells	$127,020	- 3, 167% of 4, 10, 40% of 11
Treatment Plant	$363,660	, 13, 14, 15, 16
Auxillary Components	$5,604	5, 6, 7
Injection Wells	$117,000	8, 9, 60% of 11
Sub-Total Construction Costs	$613,284	
Bid Contingency of 15%	$91,993	
Scope Contingency of 15%	$91,993	
Regulatory Negotiations and Submittals	$23,355	
Total Construction Costs	$820,624	
Management and Engineering Costs:		FS Report Appendix C1 Element No.
CERCLA Documentation	$256,209	1, 2, 3
Remedial Design	$198,783	4
Construction Management and System Start-Up	$317,810	5
Total Management and Engineering Cost	$772,802	
Total Capital Cost	**$1,593,426**	

O & M = Operations and Maintenance

Table 2.9-3 Estimated Cost Summary, Capital and O & M Cost Breakdowns (continued)

O & M Costs: Cost / Year	
1. Sampling	
Year 1	$70,110
Year 2-10	$39,840
Year 11	$7,568
2. Labor	
Year 1	$108,312
Year 2-10	$90,712
Year 11	$38,096
3. Air Stripper / Carbon Adsorption O & M	
Year 1-10	$83,053
4. Miscellaneous O & M	
Year 1-10	$30,081
Year 11	$3,249
Total O & M Costs / Year	
Year 1	**$291,556**
Year 2 - 10	**$243,686**
Year 11	**$48,913**
Total O & M Cost	**$2,533,643**

O & M = Operations and Maintenance

2.10 Statutory Determinations

The selected remedy satisfies the statutory requirements of Section 121 of CERCLA, as amended by SARA, in that the following four mandates are attained:

- The selected remedy is protective of human health and the environment, will decrease site risks, and will not create short term risks nor have cross-media consequences;
- The selected remedy complies with federal and state requirements that are applicable or relevant and appropriate to the remedial action such as chemical-specific ARARs, chemical-specific cleanup standards, and action-specific ARARs for discharge of treated effluent by underground injection;
- The selected remedy is cost-effective in its fulfillment of the nine CERCLA evaluation criteria through remediation of the contaminated groundwater in a reasonable period of time; and
- The selected remedy utilizes permanent solutions and alternative treatment technologies or resource recovery technologies, to the maximum extent practicable while concurrently satisfying the statutory preference for remedies that employ treatments which reduce toxicity, mobility, and/or volume.

The following sections describe how the selected remedy satisfies each of the statutory requirements and the preference for treatment.

2.10.1 Protection of Human Health and the Environment

As reported in the RI Report [IT 1991a], current on-site health risks are calculated to be within the range considered to be acceptable by the U.S. EPA (i.e., within the 10^{-4} to 10^{-6} carcinogenic risk range [55 FR 8716]). Active treatment of the groundwater will further reduce the risk, as indicated in Section 2.8.1. Five-Year Site Reviews will apply to the selected remedy [55 FR 8730] since during the period of remediation, hazardous substances will remain on-site possibly in concentrations above health-based levels.

Section 2.8.5 discussed the short-term effectiveness of the evaluated alternatives. The selected remedy will not pose unacceptable short-term risks to human health or to environment during implementation. Section 2.6.2 discussed the current on-site risks to the environment. Control measures have been incorporated into the conceptual design of the remedy, including off-gas monitoring, treatment unit security (e.g., fencing), effluent monitoring, and possibly the implementation of BACT for the air emissions.

2.10.2 *Compliance with Applicable or Relevant and Appropriate Requirements*

The selected remedy, when complete, will have reduced the concentrations of contaminants in groundwater to clean up standards thereby satisfying the chemical-specific ARARs (Federal or State MCL, whichever is more stringent for the site). In addition, during remediation, this remedy will meet action-specific ARARs for discharge of treated groundwater into the aquifer by injection. For any waste carbon that is generated during treatment, the applicable RCRA and more stringent California HWCA requirements will be met. No waiver will be necessary.

2.10.3 *Cost Effectiveness*

As discussed previously, all alternatives evaluated in the FS were equally effective as all will eventually achieve the SDWA MCL. Alternatives 3a and 4a, however, satisfy the regulatory preference for active treatment, when practicable (see 40 CFR 300.430 (a)(1)(iii)(D)). Alternatives 3b and 4b also satisfy the required preference for active treatment, when practicable, only if vapor phase carbon adsorption is required. As shown in Section 2.8.7, the selected remedy is less costly than a similar alternative involving the use of UV/OX for treatment (Alternative 3a).

2.10.4 *Utilization of Permanent Solutions and Alternative Treatment (or Resource Recovery) Technologies to the Maximum Extent Practicable*

Table 2.8-1 summarizes the detailed analysis of the alternatives with respect to the CERCLA mandated evaluation criteria and identifies the major trade-offs of the selected remedy. The selected remedy, Alternative 3b, by actively treating the groundwater, satisfies the statutory preference to utilize permanent solutions and treatment technologies to the maximum extent practicable. The trade-offs in the evaluation criteria of the selected remedy, as compared to the other alternatives, is as follows. The selected remedy offers potentially greater implementability than Alternative 4a by avoiding discharge of treated effluent to Mather Lake. It also offers the advantage that the extraction and treatment of the groundwater will not deplete the SWBZ. Air stripping/vapor phase carbon adsorption is preferred over UV/OX because the technology is:

- More developed and proven in similar applications;
- More capable of handling variable flow rates and/or TCE concentration;
- Considered more reliable, less complex, and subject to less complicated operation and maintenance requirements; and
- More cost-effective.

2.10.5 *Preference for Treatment as a Principal Element*

The primary risk potentially posed by the AC&W Site is from a hypothetical exposure to TCE contaminated groundwater. The hypothetical exposure scenario requires a drinking water supply well to be installed in the plume. The selected remedy employs active treatment of the groundwater, via air stripping, to mitigate the potential threat to human health. Therefore, the CERCLA preference for treatment is satisfied by the selected remedy.

2.11 *Documentation of Significant Changes*

The Proposed Plan for the AC&W Site was released for public comment in October 1991. The Proposed Plan identified Alternative 4b (i.e., extraction, treatment by air stripping and vapor phase carbon adsorption, and discharge to Mather Lake) as the preferred alternative. The Air Force, as lead agency, reviewed all written and verbal comments submitted during the public comment period.

However, after finalization of ARARs by the regulatory agencies, it was determined that Alternative 3b (i.e., extraction, treatment by air stripping and vapor phase carbon adsorption, and injection of treated effluent into the SWBZ) is more cost effective than Alternative 4b. The Air Force released a Revised Proposed Plan for public comment in March 1992, which identified Alternative 3b as the preferred alternative. The Air Force, as lead agency, reviewed all written and verbal comments submitted during the public comment period. After comment review, it was determined that no significant changes to the remedy outlined in the Revised Proposed Plan were necessary.

2.12 *References*

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IT 1990b U.S. Air Force Installation Restoration Program, RI/FS Activities for Mather Air Force Base, California, Final Site Inspection Report, August 1990, Prepared by IT Corporation for HAZWRAP.

IT 1991a U.S. Air Force Installation Restoration Program, Final Remedial Investigation Report of the AC&W Site for Mather Air Force Base, California, March 1991, Prepared by IT Corporation for HAZWRAP.

IT 1991b U.S. Air Force Installation Restoration Program, Feasibility Study for Mather Air Force Base, California, AC&W Site, Final Report, August 1991, Prepared by IT Corporation for Battelle Environmental Management Operations (EMO).

IT 1991c U.S. Air Force Installation Restoration Program, Quarterly Groundwater Monitoring Report, June 1991, Mather Air Force Base, California, July 1991, Prepared by IT Corporation for Battelle Environmental Management Operations (EMO).

IT 1991d U.S. Air Force Installation Restoration Program, Quarterly Groundwater Monitoring Report, Third Quarter 1991, Mather Air Force Base, California, September 1991, Prepared by IT Corporation for Battelle Environmental Management Operations (EMO).

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IT 1992b U.S. Air Force Installation Restoration Program, Quarterly Groundwater Monitoring Report, First Quarter 1991, Mather Air Force Base, California, June 1991. Prepared by IT Corporation for Battelle Environmental Management Operations (EMO).

IT 1992c U.S. Air Force Installation Restoration Program, Quarterly Groundwater Monitoring Report, Second Quarter 1992, Mather Air Force Base, California, August 1992. Prepared by IT Corporation for Battelle Environmental Management Operations (EMO).

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IT 1992e U.S. Air Force Installation Restoration Program, Preliminary Design Investigation, Mather Air Force Base, California, AC&W Site, Final Report, June 1992, Prepared by IT Corporation for Battelle Environmental Management Operations (EMO).

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IT 1993c U.S. Air Force Installation Restoration Program, Quarterly Groundwater Monitoring Report, First Quarter 1993, Mather Air Force Base, California, June 1993. Prepared by IT Corporation for Battelle Environmental Management Operations (EMO).

IT 1993d U.S. Air Force Installation Restoration Program, Quarterly Groundwater Monitoring Report, Second Quarter 1993, Mather Air Force Base, California, August 1993. Prepared by IT Corporation for the Air Force Center for Environmental Excellence (AFCEE).

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22 CCR 66262.10 - 66262.57 Standards Applicable to Generators of Hazardous Waste. California Code of Regulations, Title 22, Sections 66262.10 - 66262.57.

22 CCR 66262.30 - 66262.33 Pre-Transport Requirements. California Code of Regulations, Title 22, Sections 66262.30 - 66262.33.

22 CCR 66264 Standards for Owners and Operators of Hazardous Waste Transfer, Treatment, Storage, and Disposal Facilities. California Code of Regulations, Title 22, Section 66264.

40 CFR 122 EPA Administered Permit Programs: The National Pollutant Discharge Elimination System. Code of Federal Regulations, Title 40, Part 122, U.S. Environmental Protection Agency, Government Printing Office, Washington, D.C.

40 CFR 136 Guidelines for Establishing Test Procedures for the Analysis of Pollutants Code of Federal Regulations, Title 40, Part 136, U.S. Environmental Protection Agency, Government Printing Office, Washington, D.C.

40 CFR 300 National Oil and Hazardous Substances Pollution Contingency Plan. Code of Federal Regulations, Title 40, Part 300, U.S. Environmental Protection Agency, Government Printing Office, Washington, D.C.

53 FR 53194 Federal Register. Volume 53, December 21, 1988, page 51394 et seq., EPA's et seq. Preamble to the Proposed Rule of the "National Oil and Hazardous Substances Pollution Contingency Plan", 40 CFR Part 300, U.S. Environmental Protection Agency, Government Printing Office, Washington D.C.

55 FR 8666 Federal Register, Volume 55, March 8, 1990, page 8666 et seq., EPA's et seq. Preamble to the Final Rule of the "National Oil and Hazardous Substances Pollution Contingency Plan", 40 CFR Part 300, U.S. Environmental Protection Agency, Government Printing Office, Washington, D.C.

3.0 Responsiveness Summary

The public comment period for the Proposed Plan at the AC&W Site, Mather AFB, began on October 1, 1991 and expired on October 31, 1991 without any comments being received by the base or regulatory agencies. The public meeting presenting the Proposed Plan occurred on October 1, 1991. The transcript from the public meeting is included in the Administrative Record. While one comment was made during the October 1, 1991 public meeting presenting the Proposed Plan, it related more to base closure than the AC&W Site remediation. The comment is found on page 16 of the transcript from the October 1, 1991 meeting. Note that on page 10 line 10 of the transcript Lt. Col. Blank used the word "below" when he meant "above". His statement should have been, "None of the wells in the current round of sampling show any contamination above detection limits in that deeper water bearing zone."

The public comment period for the Revised Proposed Plan at the AC&W Site, Mather AFB, began on March 16, 1992 and expired on April 15, 1992 without any comments being received by the base or regulatory agencies. The public meeting presenting the Revised Proposed Plan occurred on April 1, 1992. The transcript from the public meeting is included in the Administrative Record. The transcript contains all public comments and responses from representatives from Mather Air Force Base, EPA, and California regulatory agencies. The public made 18 comments during the public meeting on April 1, 1992. Twelve comments were directly applicable to the selected remedy in the Revised Proposed Plan. These comments and the U.S. Air Force Air Training Command responses are provided below. The other comments were of a more general nature.

1. Why are we concerned with TCE (trichloroethylene)? What are the real effects? Why are we so concerned? (Mr. Flaming)

   Trichloroethylene (TCE) is a suspected human carcinogen, for which a Safe Drinking Water Act maximum contaminant level (MCL) of five parts per billion has been established. The MCL is set at that level to ensure no more than one person in one million who consistently consumes water containing that amount of TCE will contract cancer from that exposure. Because the groundwater underlying Mather AFB is classified by the State of California as a potential drinking water source, the water must be treated to a level that meets the MCL of five parts per billion.

2. Has any of the water on the (AC&W) site been treated yet? (Ms. Rogers)

No permanent treatment has been initiated at the AC&W Site. An aquifer pumping test was performed in 1990; this test removed sufficient contaminated groundwater to reduce the maximum TCE level in the groundwater, but the water was not treated on site. Untreated groundwater was discharged to the regional sewer where it was treated by Sacramento County.

3. How long would that treatment take before you got it to the five parts per billion? (Ms. Rogers)

Reducing the TCE concentration in the plume to an average of five parts per billion has been projected to take six years of operation of the groundwater extraction, treatment and reinjection system. The Air Force has not calculated the time required to reduce the TCE concentration to a maximum of five parts per billion everywhere in the plume. This calculation will be performed during design of the treatment system.

4. Do you know that (the treatment system proposed for the AC&W Site) to be effective from other locations? (Mr. Flaming)

Groundwater extraction, treatment and reinjection systems have been shown to be effective for reduction of total mass of contaminants in groundwater systems and for capture and containment of contaminated groundwater. Experience with these systems has shown that reducing contamination to acceptable limits can take longer than predicted through groundwater modelling. However, since groundwater extraction is effective at containment and mass reduction, it is the method of remediation most often chosen for sites with contaminated groundwater.

5. "Are (civilians) going to be allowed to go onto the (AC&W) Site? Is there a risk to the civilian tenant coming on-base within the six-year time frame (calculated for treatment system operation)? (Mr. Flaming)

Civilian use of the AC&W Site is a possibility. Reuse options for base property are still being pursued.

The calculated risk from the AC&W Site is to persons drinking contaminated groundwater from the shallow aquifer. If someone drilled a well into the most contaminated portion of the shallow aquifer within the six-year time the groundwater is being treated, the water from that well would contain TCE in concentrations above the maximum contaminant level (MCL). The MCL is calculated based on a lifetime (70-year) excess cancer risk of one in a million.

6. Is Mather Air Force Base responsible for the original contamination? (Ms. Rogers)

Yes, it is most probable the contamination at the AC&W Site originated from Air Force operations at that site.

7. Is that (source of contamination) the pipe that they can't find? Is that where they think the contamination is coming from? (Ms. Rogers)

   Yes. The disposal pipe that was referenced in the Installation Restoration Program Phase I Report (Preliminary Assessment) is still thought to be the likely source of contamination at the AC&W Site.

8. What year do you think (Lt Col Blank) (that) there was dumping into the pipe? (Ms. Rogers)

   Records indicate the pipe was used from about 1958 to 1966.

9. Was it (dumping into the pipe) just forgotten about until 1979? (Ms. Rogers)

   The disposal into the pipe was standard practice at the time. It was not until 1979, when TCE contamination was discovered in groundwater at other locations in the Central Valley, that anyone thought further about this disposal activity.

10. What's TCE used for? Is it a by-product of some sort? (Mr. Gray)

    TCE is a chlorinated solvent used widely in the 1950s through 1970s for cleaning and degreasing. It was brought onto the base as a primary product, not a by-product.

11. (Are) federal monies being used to do this clean-up? (Ms. Rogers)

    Yes. Monies used for environmental clean-ups at Mather AFB come from a special account within the Department of Defense budget (the Base Realignment and Closure Account).

12. Is there an estimate how much (the remediation will cost) for this six-year period? (Ms. Rogers)

    The current estimate for construction of the remediation system at the AC&W Site is $2.9 million.

Administrative Record Index, Aircraft Control and Warning Site

Mather, California

ID	DATE	TITLE	AUTHOR	RECIPIENT
82001	6/1/82	Installation Restoration Program Records Search for Mather Air Force Base, Phase I, Stage I	CH2M Hill, Gainesville, FL	HQ ATC, Randolf AFB, TX
82002	10/4/82	Letter Comment on Installation Restoration Program Records Search for Mather AFB	CA Central Valley Regional Water Quality Control Board	Deputy Regional Civil Engineer, Department of the Air Force
82003	10/20/82	Letter Report: Interim Status Inspection Report for Mather AFB	CA Dept. of Health Services, Toxics Substances Control Division	Mr. Jerry Oberheimen, 323 CES/DEV, Mather AFB
83001	1/18/83	Presurvey Report - Installation Restoration Program Phase IIA, Mather AFB	Engineering - Science, Arcadia, CA	Occupational & Environmental Health Laboratory, Brooks AFB
83002	9/2/83	Letter Summary of Meeting Regarding Phase IIB Statement of Work.	Capt. Dennis Korycinski, Bioenv. Engr, Mather AFB	Col. Markland, USAF HQATC/SGPB
83003	10/3/83	Letter Comment on IRP Phase IIB Statement of Work		Col Slaughter, Base Commander, Mather AFB
83004	12/6/83	MFR: IRP Coordination Meeting (Discussion of Phase II field activities)	Capt. Dennis Korycinski, Bioenv. Engr, Mather AFB	Memo for Record
83005	12/20/83	Letter Comment on Phase II Statement of Work	CA Central Valley Regional Water Quality Control Board	Col Slaughter, Base Commander, Mather AFB
84001	8/17/84	Minutes of MAFB IRP Meeting 2 Aug 84	Capt James Curran, Bioenv Engr, Mather AFB	Members and Attendees
84002	9/1/84	Minutes of IRP Technical Working Group Meeting, 20 Aug 84	MSgt Patricia Sparks, BES/SGPB, Mather AFB	Members and Attendees
84003	10/24/84	Minutes of IRP Technical Working Group Meeting, 1 Oct 84	MSgt Patricia Sparks, BES/SGPB, Mather AFB	Members and Attendees
84004	12/4/84	Letter Comment Phase I Report, Phase IIA Presurvey Report & Phase IIB SOW	US Environmental Protection Agency, Region IX	Col Slaughter, Base Commander, Mather AFB
84005	12/5/84	Minutes of IRP Technical Working Group Meeting, 26 Oct 84	MSgt Patricia Sparks, BES/SGPB, Mather AFB	Members and Attendees
85001	2/15/85	Minutes of IRP Presurvey Meeting for Phase II, Stage 2, 22 Jan 85.	Mather AFB Hospital/SGPB	Members and Attendees
85002	4/18/85	Minutes of IRP Working Group Meeting, 18 Apr 85	Mather AFB Hospital/SGPB	Members and Attendees
85006	10/1/85	Letter Comment on IRP, phase II, Stage 3 Scope of Work for Mather AFB	CA Central Valley Regional Water Quality Control Board	Capt James Curran, USAF HOSP Mather/SGPB
85008	12/19/85	Letter Comment on IRP, phase II, Stage 3 Scope of Work for Mather AFB	CA Dept of Health Services, Toxic Substances Control Division	Col Bruce Johnson, Base Commander, Mather AFB
86001	2/5/86	Letter Comment on IRP, Phase II, Stage 1 Confirmation/Quantification Draft Report	CA Central Valley Regional Water Quality Control Board	Capt James Curran, USAF HOSP Mather/SGPB
86002	3/5/86	Letter Comment on IRP, Phase II, Stage 1 Confirmation/Quantification Draft Report	CA Dept of Health Services, Toxic Substances Control Division	Col Bruce Johnson, Base Commander, Mather AFB
86003	3/13/86	Letter Comment on IRP, Phase II, Stage 1 Confirmation/Quantification Draft Report	US Environmental Protection Agency, Region IX	Col Bruce Johnson, Base Commander, Mather AFB
86004	3/26/86	Letter Comment on IRP, Phase II, Stage 1 Confirmation/Quantification Draft Report	Co. of Sacramento Health Dept, Environmental Health Branch	Capt James Curran, USAF HOSP Mather/SGPB
86005	9/1/86	IRP, Phase II, Stage 1 Confirmation/Quantification Final Report, Vol 1 & 2	Roy F. Weston, Inc, West Chester, PA	Occupational & Environmental Health Laboratory, Brooks AFB
87007	9/12/87	Letter Comment on IRP, Phase II, Stage 3 Confirmation/Quantification Draft Report, June 87	CA Dept of Health Services, Toxic Substances Control Division	Capt James Curran, USAF HOSP Mather/SGPB
87009	9/27/87	Letter Comment IRP, Phase II, Stage 3 Confirmation/Quantification Draft Report Jun 87	CA Central Valley Regional Water Quality Control Board	Col Bruce Johnson, Base Commander, Mather AFB
87010	9/28/87	Letter Comment IRP, Phase II, Stage 3 Confirmation/Quantification Draft Report Jun 87	US Environmental Protection Agency, Region IX	Capt James Curran, USAF HOSP Mather/SGPB
87011	9/2/87	Letter Comment IRP, Phase II, Stage 3 Confirmation/Quantification Draft Report, Jun 87	CA Dept of Health Services, Public Water Supply Branch	Capt James Curran, USAF HOSP Mather/SGPB
87013	12/22/87	Minutes of Technical Review Committee Meeting 15 Dec 87	Col Don Kosovac, 323 FTW/EM, Mather AFB	Members and Attendees
88001	1/1/88	IRP, Phase II, Confirmation/Quantification Stage 3, Final Report	Aerovironment Inc, Monrovia, CA	HQ ATC/SGPB, Randolph, AFB< TX
88004	2/9/88	Minutes of Technical Review Committee Meeting on 27 Jan 88	Col Don Kosovac, 323 FTW/EM, Mather AFB	Members and Attendees
88006	4/11/88	Notice (Proof of Publication) of Meeting to Discuss Phase II., Stage 3 Results	323 FTW/PA, Mather AFB	Published in Sacto Union Apr 7, 8, & 9, 1988
88007	4/14/88	Minutes of Technical Review Committee Meeting, 22 Mar 88	Col Don Kosovac, 323 FTW/EM, Mather AFB	Members and Attendees
88011	9/11/88	Minutes of Technical Review Committee Meeting, 30 Jun 88	Lt Col Richard Blank, 323 FTW/EM, Mather AFB	Members and Attendees
88012	9/15/88	Letter Comment on Draft Well Redevelopment and Sampling Plan for Mather AFB	CA Central Valley Regional Water Quality Control Board	323 FTW/EM, Mather AFB
88013	9/15/88	Letter Comment on Draft Well Redevelopment and Sampling Plan for Mather AFB	US Environmental Protection Agency, Region IX	US Air Force
88014	9/17/88	Letter Comment on Draft Well Redevelopment and Sampling Plan for Mather AFB	CA Dept of Health Services, Toxic Substances Control Division	Lt Col Richard Blank, 323 FTW/EM, Mather AFB
88015	9/18/88	Letter Comment on Draft Well Redevelopment and Sampling Plan for Mather AFB	US Environmental Protection Agency, Region IX	Lt Col Jose Saenz, HQ ATC/DEEV
88016	10/14/88	IRP Phase IV-A Activities - Well Redevelopment and Sampling Plan for MAFB	International Technology Corporation	HQ ATC, Randolph AFB, TX
88017	11/30/88	Minutes of Technical Review Committee Meeting, 6 Oct 88	Lt Col Richard Blank, 323 FTW/EM, Mather AFB	Members and Attendees
88018	12/7/88	Letter Comment on Draft AC&W Site Remedial Investigation/Feasibility Work Plan	CA Central Valley Regional Water Quality Control Board	Lt Col Jose Saenz, HQ ATC/DEEV, Randolph AFB, TX
88019	12/8/88	Letter Comment on Draft AC&W Site Remedial Investigation/Feasibility Work Plan	US Environmental Protection Agency, Region IX	Lt Col Jose Saenz, HQ ATC/DEEV, Randolph AFB, TX
88020	12/29/88	Letter Comment on Draft AC&W Site Remedial Investigation/Feasibility Work Plan	CA Dept of Health Services, Toxic Substances Control Division	Lt Col Richard Blank, 323 FTW/EM, Mather AFB
89001	3/6/89	Minutes of the Technical Review Committee, 12 Jan 89	Lt Col Richard Blank, 323 FTW/EM, Mather AFB	Members and Attendees
89002	5/1/89	ATSDR Preliminary Health Assessment for Mather AFB	US Environmental Protection Agency, Region IX	Lt Col Jose Saenz, HQ ATC/DEEV, Randolph AFB, TX
89003	7/20/89	Minutes of Technical Review Committee Meeting, 10 Jul 89	Lt Col Richard Blank, 323 FTW/EM, Mather AFB	TRC Members & Attendees
89004	5/1/89	Minutes of Technical Review Committee Meeting 6 Apr 89	Lt Col Richard Blank, 323 FTW/EM, Mather AFB	Members and Attendees
89005	7/21/89	Interagency Agreement for Mather AFB		Signatories

16

ID	DATE	TITLE	AUTHOR	RECIPIENT
89006	8/10/89	Letter Comment on (Draft) IRP Community Relations Plan for Mather AFB dated 11 Apr 89.	CA Dept of Health Services, Toxic Substances Control Division	Lt Col Richard Blank, 323 FTW/EM, Mather AFB
89007	8/8/89	Letter Comment on (Draft) IRP Community Relations Plan for Mather AFB dated 11 Apr 89	US Environmental Protection Agency, Region IX	Lt Col Richard Blank, 323 FTW/EM, Mather AFB
89008	10/1/89	Final AC&W Site RI/FS Work Plan (Vol I), Mather AFB	International Technology Corporation	HQ ATC, Randolph AFB, TX
89009	10/1/89	Final AC&W Site RI/FS Sampling & Analysis Plan (Vol II), Mather AFB	International Technology Corporation	HQ ATC, Randolph AFB, TX
89010	10/1/89	Final AC&W Site RI/FS Quality Assurance Project Plan (Vol III), Mather AFB	International Technology Corporation	HQ ATC, Randolph AFB, TX
89011	10/1/89	Final AC&W Site RI/FS Final Health & Safety Plan (Vol IV), Mather AFB	International Technology Corporation	HQ ATC, Randolph AFB, TX
89013	11/13/89	Minutes of Technical Review Committee Meeting, 13 Nov 89	Lt Col Richard Blank, 323 FTW/EM, Mather AFB	Members and Attendees
89014	11/29/89	Letter Comment on Draft Final AC&W Site RI/FS Work Plan	CA Dept of Health Services, Toxic Substances Control Division	Lt Col Richard Blank, 323 FTW/EM, Mather AFB
89015	11/29/89	Letter Comment on Draft Final AC&W Site RI/FS Work Plan	US Environmental Protection Agency, Region IX	Lt Col Joe Sears, HQ ATC/DEEV, Randolph AFB, TX
89016	12/1/89	IRP Community Relations Plan for Mather AFB	323 FTW/Public Affairs Office	Public
90001	2/14/90	Letter Comment on IRP Community Relations Plan for Mather AFB, Dec 89	US Environmental Protection Agency, Region IX	Lt Col Richard Blank, 323 FTW/EM, Mather AFB
90002	2/20/90	Sampling & Analysis Report for Site Monitor Wells, Oct/Nov 89	International Technology Corporation	HQ ATC/DEEV, Randolph AFB, TX
90003	3/7/90	Minutes of Technical Review Committee Meeting, 30 Jan 90	Lt Col Richard Blank, 323 FTW/EM, Mather AFB	Members and Attendees
90004	4/1/90	Draft Sampling and Analysis Plan for Quarterly Groundwater Sampling	EA Engineering, Science, & Technology	Air Force Systems Command, Wright Patterson AFB, OH
90009	5/1/90	Draft Quality Assurance Plan for Quarterly Groundwater Sampling	EA Engineering, Science, & Technology	HQ ATC/DEEV, Randolph AFB, TX
90012	5/25/90	Minutes of Technical Review Committee Meeting, 10 May 90	Lt Col Richard Blank, 323 FTW/EM, Mather AFB	Members and Attendees
90014	7/1/90	Quarterly Groundwater Sampling, Mather AFB, May/June 90, Vol I, II, & III	EA Engineering, Science, & Technology	Occupational & Environmental Health Laboratory, Brooks AFB
90016	7/25/90	RI/FS for MAFB, Group 2 & AC&W Sites Quality Assurance Project Plan Addendum	International Technology Corporation	HQ ATC/DEEV, Randolph AFB, TX
90017	8/1/90	RI/FS for MAFB - Site Inspection Report	International Technology Corporation	HQ ATC/DEEV, Randolph AFB, TX
90018	9/3/90	Validated AC&W Data Summary Report	International Technology Corporation	Martin Marietta Energy Systems Inc., HAZWRAP
90019	9/6/90	Minutes of Technical Review Committee Meeting, 2 Aug 90	Lt Col Richard Blank, 323 FTW/EM, Mather AFB	Members and Attendees
90020	9/13/90	Validated Data Summary Report - Fourth Quarter 1989 Wells	International Technology Corporation	Martin Marietta Energy Systems Inc., HAZWRAP
90021	9/19/90	Validated Data Summary Report Addendum - Fourth Quarter 1989 Wells	International Technology Corporation	Martin Marietta Energy Systems Inc., HAZWRAP
90022	10/1/90	Quarterly Groundwater Sampling, MAFB, Aug 1990, Vol I, II, and III	EA Engineering, Science, & Technology	Occupational & Environmental Health Laboratory, Brooks AFB
90023	10/5/90	Validated Data Summary Report - First Qtr 1990	International Technology Corp, Knoxville, TN	Martin Marietta Energy Systems Inc., HAZWRAP
90025	11/1/90	Feasibility Study for MAFB, AC&W Site- Final Work Plan	International Technology Corporation	HQ ATC/DEEV, Randolph AFB, TX
90026	11/19/90	Minutes of the Project Manager's Meeting, 23 Oct 90	Lt Col Richard Blank, 323 FTW/EM, Mather AFB	Members and Attendees
90027	11/26/90	Letter Comments on Draft Final Site Inspection Report and AC&W Site FS Work Plan	CA Dept of Health Services, Toxic Substances Control Division	Lt Col Richard Blank, 323 FTW/EM, Mather AFB
90028	11/29/90	Minutes of the TRC Meeting 15 Nov 90	Lt Col Richard Blank, 323 FTW/EM, Mather AFB	Members and Attendees
90029	3/8/90	Minutes of RPM Meeting 8 Mar 90	Lt Col Richard Blank, 323 FTW/EM, Mather AFB	Members and Attendees
91001	2/1/91	Quarterly Groundwater Sampling, MAFB, Nov-Dec 1990, Vol I, II, and III	EA Engineering, Science, & Technology	Occupational & Environmental Health Laboratory, Brooks AFB
91002	2/1/91	Routine Groundwater Monitoring Program Project Plans	International Technology Corporation	HQ ATC/DEEV
91003	2/14/91	Minutes of the Project Manager's Meeting 30 Jan 91	Lt Col Richard Blank, 323 FTW/EM, Mather AFB	Members and Attendees
91004	3/1/91	Final Remedial Investigation Report of the Aircraft Control & Warning Site	International Technology Corporation	HQ ATC/DEEV, Randolph AFB, TX
91005	4/15/91	Minutes of the Technical Review Committee Meeting, 26 Mar 91	Lt Col Richard Blank, 323 FTW/EM, Mather AFB	Members and Attendees
91006	5/1/91	Quarterly Groundwater Monitoring Report for March 1991	International Technology Corporation	HQ ATC/DEEV, Randolph AFB, TX
91007	5/15/91	Letter Comment on Routine Ground Water Monitoring Program Project Plans	CA Dept of Health Services, Toxic Substances Control Division	Lt Col Richard Blank, 323 FTW/EM, Mather AFB
91008	5/15/91	Letter Comment on Routine Ground Water Monitoring Program Project Plans	US Environmental Protection Agency, Region IX	Lt Col Richard Blank, 323 FTW/EM, Mather AFB
91009	5/23/91	Letter Comment on Routine Ground Water Monitoring Program Project Plans	CA Central Valley Regional Water Quality Control Board	Lt Col Richard Blank, 323 FTW/EM, Mather AFB
91010	6/18/91	Minutes of Technical Review Committee, 21 May 1991	Lt Col Richard Blank, 323 FTW/EM, Mather AFB	TRC Members & Attendees
91011	7/1/91	Quarterly Ground Water Monitoring Report for May 1991	International Technology Corporation	HQ ATC/DEEV, Randolph AFB, TX
91012	7/2/91	Letter Comment on Quarterly Groundwater Monitoring Report for Mar 1991	US Environmental Protection Agency, Region IX	Lt Col Richard Blank, 323 FTW/EM, Mather AFB
91013	7/25/91	Minutes of the Project Manager's Meeting 25 Jul 91	Lt Col Richard Blank, 323 FTW/EM, Mather AFB	Members and Attendees
91014	7/31/91	Letter Request for Applicable or Relevant and Appropriate Requirements	CA Department of Toxic Substance Control	Various State & Local Agencies
91015	8/1/91	Feasibility Study for MAFB, AC&W Site - Final Report	International Technology Corporation	HQ ATC/DEEV, Randolph AFB, TX
91016	8/1/91	Final Proposed Plan for Groundwater Cleanup of the Aircraft Control and Warning Site	International Technology Corporation	HQ ATC/DEEV, Randolph AFB, TX

ID	DATE	TITLE	AUTHOR	RECIPIENT
91017	8/20/91	Letter Comment on the Final Proposed Plan for Groundwater Cleanup at the AC&W Site	CA Central Valley Regional Water Quality Control Board	Lt Col Richard Blank, 323 FTW/EM, Mather AFB
91018	9/1/91	Quarterly Groundwater Monitoring Report for Third Quater, dated Sept 1991	International Technology Corporation	HQ ATC/DEEV, Randolph AFB, TX
91019	9/9/91	Preliminary Design Investigation for the AC&W Site, Final Work Plan	International Technology Corporation	HQ ATC.DEEV, Randolph AFB, TX
91020	9/17/91	Summary of State & Local ARARS	CA Department of Toxic Substance Control	Lt Col Richard Blank, 323 FTW/EM, Mather AFB
91021	9/17/91	Minutes of Technical Review Committee Meeting , 20 Aug 91	Lt Col Richard Blank, 323 FTW/EM, Mather AFB	Members and Attendees
91022	9/23/91	Notice of Availability of Proposed Plan and Notice of Intent to Adopt a Negative Declaration	CA Department of Toxic Substance Control	To Whom it May Concern
91023	10/1/91	Letter Comment on Preliminary Design Investigation for the AC&W Site, Draft Final Work Plan	CA Department of Toxic Substance Control	Lt Col Richard Blank, 323 FTW/EM, Mather AFB
91024	10/1/91	Public Meeting Minutes on Proposed Plan for Ground Water Treatment at the AC&W Site	Peter's Shorthand Reporting Corporation	Administrative Record for AC&W, MAFB
91025	10/16/91	Letter Comment on Quarterly Groundwater Monitoring Report for May 1991	US Environmental Protection Agency, Region IX	Lt Col Richard Blank, 323 FTW/EM, Mather AFB
91026	10/24/91	Minutes of the Project Manager's Meeting 25-26 September, 1991	Lt Col Richard Blank, 323 FTW/EM, Mather AFB	Members and Attendees
91028	12/2/91	Notice of Determination - Approval of Negative Declaration for 'Proposed Plan for Groundwater C	CA Department of Toxic Substance Control	CA Office of Planning & Research
91029	12/3/91	Minutes of Technical Review Committee Meeting, 21 November 1992	Lt Col Richard Blank, 323 FTW/EM, Mather AFB	Members and Attendees
91030	12/3/91	Letter Comment on Third Quarter 1991 Groundwater Monitoring Report for May 1991	US Environmental Protection Agency, Region IX	Lt Col Richard Blank, 323 FTW/EM, Mather AFB
92005	1/1/92	Draft Final Installation Restoration Program Community Plan for Mather AFB, Jan 1992	International Technology Corporation	HQ ATC/DEEV, Randolph AFB, TX
92006	1/1/92	Quarterly Groundwater Monitoring Report for Fourth Quarter 1991, Mather AFB	International Technology Corporation	HQ ATC/DEEV, Randolph AFB, TX
92007	1/14/92	Letter Comment on Draft Record of Decision for the AC&W Site, Mather AFB	Sacramento Metropolitan Air Quality Management District	Lt Col Richard Blank, 323 FTW/EM, Mather AFB
92008	2/11/92	Letter Resolicitating a Request for ARARS for the AC&W Site	CA Department of Toxic Substance Control	Lt Col Richard Blank, 323 FTW/EM, Mather AFB
92010	2/25/92	Letter Comment on Draft Record of Decision for the AC&W Site	US Environmental Protection Agency, Region IX	Lt Col Richard Blank, 323 FTW/EM, Mather AFB
92010	2/25/92	Letter Comment on Draft Record of Decision for the AC&W Site	CA Department of Toxic Substance Control	Lt Col Richard Blank, 323 FTW/EM, Mather AFB
92013	3/1/92	Revised Proposed Plan for Groundwater Cleanup at the AC&W Site	HQ ATC/DEVR, Randolph AFB, TX	Public
92014	1/23/92	Minutes of the Remedial Project Manager's Meeting, 9 Jan 92	Lt Col Richard Blank, 323 FTW/EM, Mather AFB	Members and Attendees
92017	3/3/92	Letter Comment on Draft Record of Decision for AC&W Site	CA Central Valley Regional Water Quality Control Board	Lt Col Richard Blank, 323 FTW/EM, Mather AFB
92020	3/18/92	ARARS for AC&W Groundwater Treatment System	CA Central Valley Regional Water Quality Control Board	CA Department of Toxic Substance Control
92021	3/27/92	Minutes of the Project Manager's Meeting, 11 Mar 92	Lt Col Richard Blank, 323 FTW/EM, Mather AFB	Members and Attendees
92022	3/27/92	Minutes of Technical Review Committee Meeting, 11 Mar 92	Lt Col Richard Blank, 323 FTW/EM, Mather AFB	Members and Attendees
92023	4/1/92	Public Meeting Minutes on the Revised Proposed Plan for the AC&W Site	Certified Shorthand Reporter	Administrative Record for the AC&W Site
92024	5/1/92	Groundwater Monitoring Project Plans for 1992	International Technology Corporation	HQ ATC/DEEV, Randolph AFB, TX
92025	5/22/92	Letter Comment on Superfund Record of Decision for the AC&W Site and Discharge Requiremer	CA Central Valley Regional Water Quality Control Board	Lt Col Richard Blank, 323 FTW/EM, Mather AFB
92026	5/28/92	Letter Comment on Superfund Record of Decision for the AC&W Site	CA Department of Toxic Substance Control	Lt Col Richard Blank, 323 FTW/EM, Mather AFB
92027	5/28/92	Letter Comment on Superfund Record of Decision, AC&W Site	US Environmental Protection Agency, Region IX	Lt Col Richard Blank, 323 FTW/EM, Mather AFB
92028	6/12/92	Superfund Record of Decision: Aircraft Control & Warning Site (First Issue)		Administrative Record File for Mather AFB
92030	6/1/92	Draft Final Preliminary Design Investigation Report for the AC&W Site	International Technology Corporation	HQ ATC/DEEV, Randolph AFB, TX
92031	6/3/92	Letter Comments on the Superfund Record of Decision for the AC&W Site.	US Environmental Protection Agency, Region IX	Lt Col Richard Blank, 323 FTW/EM, Mather AFB
92032	6/4/92	Quarterly Groundwater Monitoring Report - First Quarter 1992	International Technology Corporation	HQ ATC/DEEV, Randolph AFB, TX
92033	7/8/92	Minutes of Technical Review Committee Meeting, 3 Jun 92	Lt Col Richard Blank, 323 FTW/EM, Mather AFB	Members and Attendees
92034	7/13/92	Letter Comment on Draft Final AC&W Site Preliminary Design Investigation Report	CA Department of Toxic Substance Control	Lt Col Richard Blank, 323 FTW/EM, Mather AFB
92035	7/20/92	Letter Comment on 1992 Groundwater Monitoring Program Project Plans	US Environmental Protection Agency, Region IX	Lt Col Richard Blank, 323 FTW/EM, Mather AFB
92036	7/20/92	Letter Comment on First Quarter 1992 Groundwater Monitoring Report	US Environmental Protection Agency, Region IX	Lt Col Richard Blank, 323 FTW/EM, Mather AFB
92037	7/27/92	Letter Comment on 1992 Groundwater Monitoring Program Project Plans	CA Department of Toxic Substance Control	Lt Col Richard Blank, 323 FTW/EM, Mather AFB
92038	8/7/92	Quarterly Groundwater Monitoring Report - Second Quarter 1992	International Technology Corporation	HQ ATC/DEEV, Randolph AFB, TX
92041	9/30/92	Letter Comment on Second Quarter 1992 Groundwater Monitoring Report	US Environmental Protection Agency, Region IX	Lt Col Richard Blank, 323 FTW/EM, Mather AFB
92047	11/6/92	Quarterly Groundwater Monitoring Report - Third Quarter 1992	International Technology Corporation	HQ ATC/DEEV, Randolph AFB, TX
92057	12/18/92	Letter Comment on Third Quarter 1992 Groundwater Monitoring Report	US Environmental Protection Agency, Region IX	Lt Col Richard Blank, 323 FTW/EM, Mather AFB
92061	1/17/92	Reevaluating Alternatives for Disposal of Treated Water at AC&W Site	William Phelivanian, HQ ATC/DEEV, Randolph AFB, TX	Ms Tracie Billington, CA EPA, DTSC
92062	4/20/92	Comments of Draft Waste Discharge Requirements for AC&W Sites	HQ ATC/DEEV, Randolph AFB, TX	Mr Michael Mosbacher, CA Water Quality Control Board
92063	6/4/92	Letter Comment on Effluent Discharge for ARARS at AC&W Site	Ms Katherine Moore, US EPA, Region IX	HQ ATC/DEEV, Randolph AFB, TX

ID	DATE	TITLE	AUTHOR	RECIPIENT
92064	6/10/92	Letter Comments on Draft ROD AC&W Sites	Ms Antonia Vorster, CA Regional Water Quality Control Board	Lt Col Blank, 323 FTW/EM, MAFB
92065	6/11/92	Letter Response to Ms Vorster's Ltr, ROD AC&W Sites dtd 6/10/92	AFCEE, Regional Council, Lt Col Swenson, S.F., CA	Ms Antonia Vorster, CA Regional Water Quality Control Board
92066	6/11/92	Letter Comments on Revised ROD for AC&W Sites	Capt Miles, HQ ATC/DEEV, Randolph AFB, TX	Ms Katherine Moore, US EPA, Region IX
92067	6/11/92	Letter Comments on Revised ROD for AC&W Sites	Capt Miles, HQ ATC/DEEV, Randolph AFB, TX	Mr Michael Mosbacher, CA Water Quality Control Board
92068	6/11/92	Letter Comments on Revised ROD for AC&W Sites	Capt Miles, HQ ATC/DEEV, Randolph AFB, TX	Ms Tracie Billington, CAA EPA, Dept Toxic Substance Control
92069	6/12/92	Dispute Resolution Letter, AC&W Sites	CA EPA, Dept of Toxic Substance Control	Col Powers, HQ ATC, Randolph AFB, TX & US EPA, Region IX
92070	6/14/92	Dispute Resolution Authority, AC&W Sites (Federal)	US EPA, Region IX	Col Powers, HQ ATC, Randolph AFB, TX & CA EPA, DTSC
92071	6/19/92	Mather AFB Dispute Concerning Application of State Water Board Resolution	CA Water Resources Control Board, Chief Council	Memo to CVRWQCB, Larry Pearson
92072	6/19/92	Mather Dispute Resolution - AC&W Site	Col Powers, HQ ATC/DEEV, Randolph AFB, TX	Mr Anthony Landis, CA EPA, Dept of Toxic Substance Control
92073	6/19/92	Mather Dispute Resolution - AC&W Site	Col Powers, HQ ATC/DEEV, Randolph AFB, TX	Mr Keith Takata, US EPA, Region IX
92074	7/2/92	Dispute Resolution Authority (State)	CA EPA, Dept of Toxic Substance Control	Mr Keith Takata, US EPA, Region IX
92075	7/6/92	Dispute Resolution Committee Meeting Report	US EPA, Region IX	HQ ATC, Randolph AFB, TX & David Wang, CA EPA, DTSC
92076	7/13/92	Elevation of Dispute to Senior Executive Committee	CA EPA, Dept Toxic Substance Control	Mr Vest,SAF/MIQ;Mr McGovern,US EPA; Mr Soo Hoo,CA EPA
92077	8/21/92	Dispute Follow-Up, TCE Removal at Various Sites	CA Regional Water Quality Control Board	Mr Vest,SAF/MIQ;Mr McGovern,US EPA; Mr Soo Hoo,CA EPA
92078	9/3/92	Letter Response to Dispute for AC&W Site	Mr Gary Vest, SAF/MIQ	Mr McGovern, US EPA; Mr Soo Hoo, CA EPA
92079	9/11/92	Response to Dispute Letter From Air Force	CA State Water Resources Board	Mr Vest,SAF/MIQ;Mr McGovern,US EPA; Mr Soo Hoo,CA EPA
93003	2/22/93	Superfund Record of Decision, AC&W Site, Draft Final	US Air Force	Administrative Record File for Mather AFB
93004	2/8/93	Quarterly Groundwater Monitoring Report - Fourth Quarter 1992	International Technology Corporation	HQ ATC/DEEV, Randolph AFB, TX
93005	2/12/93	Letter Response to EPA Region IX & AC&W Dispute Decision	Mr Gary Vest, SAF/MIQ	US EPA Region IX Administrator and Director CA DTSC
93006	2/16/93	Letter Requesting AC&W Dispute Elevation to the Administrator of the US EPA	CA Department of Toxic Substance Control	Ms Carol Browner, US EPA, Administrator
93011	3/8/93	Letter Comment on the Fourth Quarter 1992 Groundwater Monitoring Report	US Environmental Protection Agency, Region IX	Lt Col Richard Blank, 323 FTW/EM, Mather AFB
93012	3/15/93	Letter Comment on AC&W Site Record of Decision	CA Central Valley Regional Water Quality Control Board	Lt Col Richard Blank, 323 FTW/EM, Mather AFB
93013	3/19/93	Letter Comment on AC&W Site Record of Decision	CA Department of Toxic Substance Control	Lt Col Richard Blank, 323 FTW/EM, Mather AFB
93014	3/19/93	Letter Comment on Fourth Quarter 1992 Groundwater Monitoring Report	CA Central Valley Regional Water Quality Control Board	Lt Col Richard Blank, 323 FTW/EM, Mather AFB
93016	4/2/93	Minutes of Remedial Projects Managers Meeting 25 February 1993	Lt Col Richard Blank, 323 FTW/EM, Mather AFB	Members and Attendees
93017	4/22/93	Letter of Final Decision on the AC&W Dispute	Ms Carol Browner, US EPA Administrator	Dep. Sec. of the AF for Env., Safety, & Occupational Health
93018	4/22/93	Minutes of the Technical Review Committee Meeting 26 Mar 93	Lt Col Richard Blank, 323 FTW/EM, Mather AFB	Members and Attendees
93019	5/21/93	Letter Comment on 1993 Groundwater Monitoring Program Project Plans for Mather AFB	CA Department of Toxic Substance Control	Dr Charles Smith, AFBDA/OL-D (EM) Mather
93020	5/24/93	Letter Comment on 1993 Groundwater Monitoring Program Project Plans for Mather AFB	CA Central Valley Regional Water Quality Control Board	Dr Charles Smith, AFBDA/OL-D (EM) Mather
93021	6/2/93	Quarterly Groundwater Monitoring Report - First Quarter 1993	International Technology Corporation	HQ ATC/DEEV, Randolph AFB, TX
93024	6/15/93	Minutes of Remedial Project Manager Meeting 21 May 93	Dr Charles Smith, AFBDA/OL-D(EM)	Members and Attendees
93028	7/9/93	US EPA Region IX Decision for the AC&W Site Dispute	Mr John Wise, US EPA Administrator, Region IX	Dr Charles Smith, AFBDA/OL-D (EM) Mather
93029	7/9/93	Letter Comment on First Quarter 1993 Groundwater Monitoring Report for MAFB	US Environmental Protection Agency, Region IX	Dr Charles Smith, AFBDA/OL-D (EM) Mather
93033	8/20/93	Letter Comment on AC&W Site February 1993 Record of Decision	CA Central Valley Regional Water Quality Control Board	Dr Charles Smith, AFBDA/OL-D (EM) Mather
93034	8/20/93	Minutes of Remedial Project Manager's Meeting, 27 July 1993	Dr Charles Smith, AFBDA/OL-D(EM), Mather	Members and Attendees
93055	2/22/93	Revised ROD for AC&W Site	HQ ATC/DEEV, Randolph AFB, TX	US EPA, CA DTSC, CA RQCB
93056	5/13/93	Cost Estimate for Dispute	SAF/MIQ,	US EPA, Region IX
93057	5/13/93	CA Response to EPA Final Decision	State Water Control Board	US EPA Region IX