United States Environmental Protection Agency
Office of Emergency and Remedial Response
EPA/ROD/R09-91/066
August 1991

EPA

Superfund Record of Decision:

Advanced Micro Devices #915, CA

50272-101

REPORT DOCUMENTATION PAGE	1. REPORT NO. EPA/ROD/R09-91/066	2.	3. Recipient's Accession No.

4. Title and Subtitle
SUPERFUND RECORD OF DECISION
Advanced Micro Devices #915, CA
First Remedial Action - Final

5. Report Date
08/26/91

6.

7. Author(s)

8. Performing Organization Rept. No.

9. Performing Orgainization Name and Address

10. Project/Task/Work Unit No.

11. Contract(C) or Grant(G) No.
(C)
(G)

12. Sponsoring Organization Name and Address
U.S. Environmental Protection Agency
401 M Street, S.W.
Washington, D.C. 20460

13. Type of Report & Period Covered
800/000

14.

15. Supplementary Notes

16. Abstract (Limit: 200 words)

The Advanced Micro Devices (AMD) #915 site is an active semiconductor manufacturing facility in Santa Clara County, California. The site consists of approximately 5 acres and contains three physical structures, the largest of which is a 116,000-square-feet building known as AMD 915. The site is in the Santa Clara Valley, and the facility lies within an industrial park bordered by residential areas. Ground water from this basin provides up to 50 percent of the municipal drinking water for 1.4 million residents of the Santa Clara Valley. The site overlies three aquifers, one of which is known as the B aquifer, which is approximately 20 to 100 feet below the surface. AMD 915 was built in 1974, and onsite manufacturing processes have involved the use of solvents, caustics, and acids. Eleven chemical storage or treatment areas have been documented at the AMD 915 facility including three underground acid neutralization systems, two above-ground drum storage areas, and six underground tank complexes. Two of the acid neutralization systems remain in operation, as well as one drum storage area, and two tank complexes. Records indicate that solvent wastes and other materials were stored in underground tanks, and as many as 28 separate underground tanks may have been in service at various times. In 1981, site investigations discovered soil

(See Attached Page)

17. Document Analysis a. Descriptors
Record of Decision - Advanced Micro Devices #915, CA
First Remedial Action - Final
Contaminated Medium: gw
Key Contaminants: VOCs (benzene, TCE, toluene, xylenes), other organics, metals (arsenic, chromium)

b. Identifiers/Open-Ended Terms

c. COSATI Field/Group

18. Availability Statement	19. Security Class (This Report) None	21. No. of Pages 58
	20. Security Class (This Page) None	22. Price

(See ANSI-Z39.18) *See Instructions on Reverse* OPTIONAL FORM 272 (4-77) (Formerly NTIS-35) Department of Commerce

Abstract (Continued)

contamination during a planned underground storage tank removal. Two leaking underground tanks were identified, and 7,000 cubic yards of contaminated soil were removed. The majority of these tanks now have been removed from service or replaced. In 1982, ground water contamination also was addressed and found to be limited to the B aquifer. Additional offsite sources of ground water contamination may have a significant effect on the AMD 915 site including commingling of ground water contamination. The most notable of these are Advanced Micro Devices 901/902 facilities, Signetics, and FEI Microwave. Two interim remedial actions for soil were completed during 1981 and 1982, including offsite removal and disposal of a waste solvent tank, and the removal of one acid neutralization system and 5,500 cubic yards of soil. In 1982, ground water pumping and treatment using air stripping and carbon adsorption began onsite using existing building dewatering sumps. This was supplemented with the installation of a series of wells during 1982 and 1988. This Record of Decision (ROD) addresses remediation of onsite contaminated ground water. The primary contaminants of concern affecting the ground water are VOCs including benzene, TCE, toluene, and xylenes; other organics; and metals including arsenic and chromium.

The selected remedial action for this site includes continuing the operation of eight existing ground water extraction wells; and treating contaminated ground water onsite using air stripping and carbon adsorption, followed by discharge of the treated water onsite to surface water. The estimated present worth cost for this remedial action is $2,100,000. This figure represents the O&M costs for 30 years since the system is already in place as an interim measure and no additional capital costs are required.

<u>PERFORMANCE STANDARDS OR GOALS</u>: Ground water clean-up standards are based on the more stringent of Federal or State MCLs for drinking water. Chemical-specific goals for ground water include PCE 5 ug/l (MCL), and TCE 5 ug/l (MCL).

RECORD OF DECISION

ADVANCED MICRO DEVICES #915

SUPERFUND SITE

SUNNYVALE, CALIFORNIA

AUGUST 26, 1991

U.S. ENVIRONMENTAL PROTECTION AGENCY

REGION 9

RECORD OF DECISION

PART I: DECLARATION

PART II: DECISION SUMMARY

PART III: RESPONSIVENESS SUMMARY

ADVANCED MICRODEVICES #915

SUPERFUND SITE

SUNNYVALE, CALIFORNIA

AUGUST 26, 1991

U.S. ENVIRONMENTAL PROTECTION AGENCY

REGION 9

TABLE OF CONTENTS

PART I. DECLARATION 1
- 1.0 SITE NAME AND LOCATION 1
- 2.0 STATEMENT OF BASIS AND PURPOSE 1
- 3.0 ASSESSMENT OF THE SITE 1
- 4.0 DESCRIPTION OF THE REMEDY 1
- 5.0 DECLARATION 2

PART II. DECISION SUMMARY 3
- 1.0 SITE NAME, LOCATION, AND DESCRIPTION 3
  - 1.1 SITE NAME AND LOCATION 3
  - 1.2 REGIONAL TOPOGRAPHY 3
  - 1.3 ADJACENT LAND USE 3
  - 1.4 HISTORICAL LAND USE 6
  - 1.5 HYDROGEOLOGY 6
  - 1.6 WATER USE 8
  - 1.7 SURFACE AND SUBSURFACE STRUCTURES 10
- 2.0 SITE HISTORY AND ENFORCEMENT ACTIVITIES 12
  - 2.1 HISTORY OF SITE ACTIVITIES 12
  - 2.2 HISTORY OF SITE INVESTIGATIONS 13
  - 2.3 HISTORY OF ENFORCEMENT ACTIONS 15
- 3.0 COMMUNITY RELATIONS 15
  - 3.1 COMMUNITY INVOLVEMENT 15
  - 3.2 FACT SHEETS 16
- 4.0 SCOPE AND ROLE OF THE RESPONSE ACTION 16
  - 4.1 SCOPE OF THE RESPONSE ACTION 16
    - 4.1.1 Current Interim Remedial Measure (IRM) 16
    - 4.1.2 Selected Remedy 17
  - 4.2 ROLE OF THE RESPONSE ACTION 17
- 5.0 SUMMARY OF SITE CHARACTERISTICS 20
  - 5.1 SOURCES OF CONTAMINATION 20
    - 5.1.1 Source Investigation 20
  - 5.2 DESCRIPTION OF CONTAMINATION 22
    - 5.2.1 Soil Investigations 22
    - 5.2.2 Groundwater Investigations 22
    - 5.2.3 Air Investigations 23
- 6.0 SUMMARY OF SITE RISKS 24
  - 6.1 TOXICITY ASSESSMENT 24
  - 6.2 RISK CHARACTERIZATION 27
    - 6.2.1 Soil 27
    - 6.2.3 Air 28
    - 6.3.3 Groundwater 29
  - 6.3 PRESENCE OF SENSITIVE HUMAN POPULATIONS 31

6.4 PRESENCE OF SENSITIVE ECOLOGICAL SYSTEMS 31
6.5 CONCLUSION 31
7.0 APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS (ARARS) 31
7.1 TYPES OF ARARS 32
7.2 CONTAMINANT-SPECIFIC ARARS AND TBCS 33
7.3 ACTION SPECIFIC ARARS AND TBCS 34
7.4 LOCATION-SPECIFIC ARARS 35
8.0 DESCRIPTION OF ALTERNATIVES 35
8.1 REMEDIAL ACTION OBJECTIVES 35
8.2 GROUNDWATER CLEANUP STANDARDS 35
8.3 REMEDIAL ACTION ALTERNATIVES 37
9.0 COMPARATIVE ANALYSIS OF ALTERNATIVES 41
9.1 CRITERIA 41
9.2 ANALYSIS OF ALTERNATIVES 43
9.3 THE SELECTED REMEDY 48
9.3.1 Basis of Selection 48
9.3.2 Features of the Remedy 49
9.3.3 Uncertainty in the Remedy 49
10.0 STATUTORY DETERMINATIONS 50
11.0 DOCUMENTATION OF SIGNIFICANT CHANGES 51

PART III. RESPONSIVENESS SUMMARY 51
1.0 INTRODUCTION 51
2.0 REGIONAL WATER QUALITY CONTROL BOARD RESPONSES 52

LIST OF FIGURES

Figure 1 - Regional Location of AMD 915 Facility 4
Figure 2 - General Location Map 5
Figure 3 - Schematic Geologic Log 7
Figure 4 - Historical Waste Storage Locations 11
Figure 5 - Total VOCs In Groundwater 18
Figure 6 - AMD 915 Groundwater Extraction System 19

LIST OF TABLES

TABLE 1 - NPDES DISCHARGE LIMITS, AMD 915 21
TABLE 2 - AMD 915 DATA SUMMARY 26
TABLE 3 - ADULT CARCINOGENIC RISK, AMD 915 30
TABLE 4 - HAZARD INDEX AT CLEANUP STANDARDS 38
TABLE 5 - CANCER RISK AT CLEANUP STANDARDS 39
TABLE 6 - HEALTH INDICES AND CANCER RISK FOR CLEANUP STANDARDS OR CURRENT MAXIMUM CONCENTRATIONS 42

APPENDICES

APPENDIX A - RESPONSIVENESS SUMMARY

APPENDIX B - INDEX TO THE ADMINISTRATIVE RECORD

PART I. DECLARATION

1.0 SITE NAME AND LOCATION

Advanced Micro Devices #915
915 DeGuigne Drive
Sunnyvale, CA 94088

2.0 STATEMENT OF BASIS AND PURPOSE

This Record of Decision ("ROD") presents the selected remedial actions for the Advanced Micro Devices Building 915 (AMD 915) Superfund site in Sunnyvale, California. This document was developed in accordance with the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA) as amended by the Superfund Amendments and Reauthorization Act of 1986 (SARA), 42 U.S.C. Section 9601 et. seq., and, to the extent practicable, the National Oil and Hazardous Substances Pollution Contingency Plan, 40 C.F.R. Section 300 et. seq. ("NCP"). The attached administrative record index (Appendix B) identifies the documents upon which the selection of the remedial action is based. The State of California concurs with the selected remedy.

3.0 ASSESSMENT OF THE SITE

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

4.0 DESCRIPTION OF THE REMEDY

The selected remedy for AMD 915 consists of groundwater extraction, treatment of contaminated water with the existing air stripper, reuse of the treated water, and discharge of a portion of the treated water to a storm drain tributary to surface water under an NPDES permit. The air stripper will include air emissions control in the event that emissions exceed levels permitted by the Bay Area Air Management District (BAAQMD). Contaminated soils and structures were removed as part of interim remedial actions and no further removals are necessary.

These remedial actions address the principal risk remaining at the AMD 915 site by removing the contaminants from ground water, thereby significantly reducing the toxicity, mobility or volume of hazardous substances. These response actions will greatly reduce the possibility of contamination of existing potable water supplies and potential future water supplies.

5.0 DECLARATION

The selected remedy is protective of human health and the environment, complies with federal and State requirements that are legally applicable or relevant and appropriate to the remedial action, and is cost-effective. This remedy utilizes permanent solutions and alternative treatment (or resource recovery) technologies to the maximum extent practicable and satisfies the statutory preference for remedies that employ treatment that reduces toxicity, mobility, or volume as a principal element.

Because the remedy will result in hazardous substances remaining on-site above health-based levels, a five-year review, pursuant to CERCLA Section 121, 42 U.S.C. Section 9621, will be conducted at least once every five years after initiation of the remedial action to ensure that the remedy continues to provide adequate protection of human health and the environment.

John Wise ________________ 8.26.91 ________________

John Wise Date

Deputy Regional Administrator

PART II. DECISION SUMMARY

This Decision Summary provides an overview of the problems posed by the Advanced Micro Devices Superfund building 915 site (AMD 915) the remedial alternatives, and the analysis of the remedial alternatives. This Decision Summary explains the rationale for the remedy selection and how the selected remedy satisfies the statutory requirements.

1.0 SITE NAME, LOCATION, AND DESCRIPTION

1.1 SITE NAME AND LOCATION

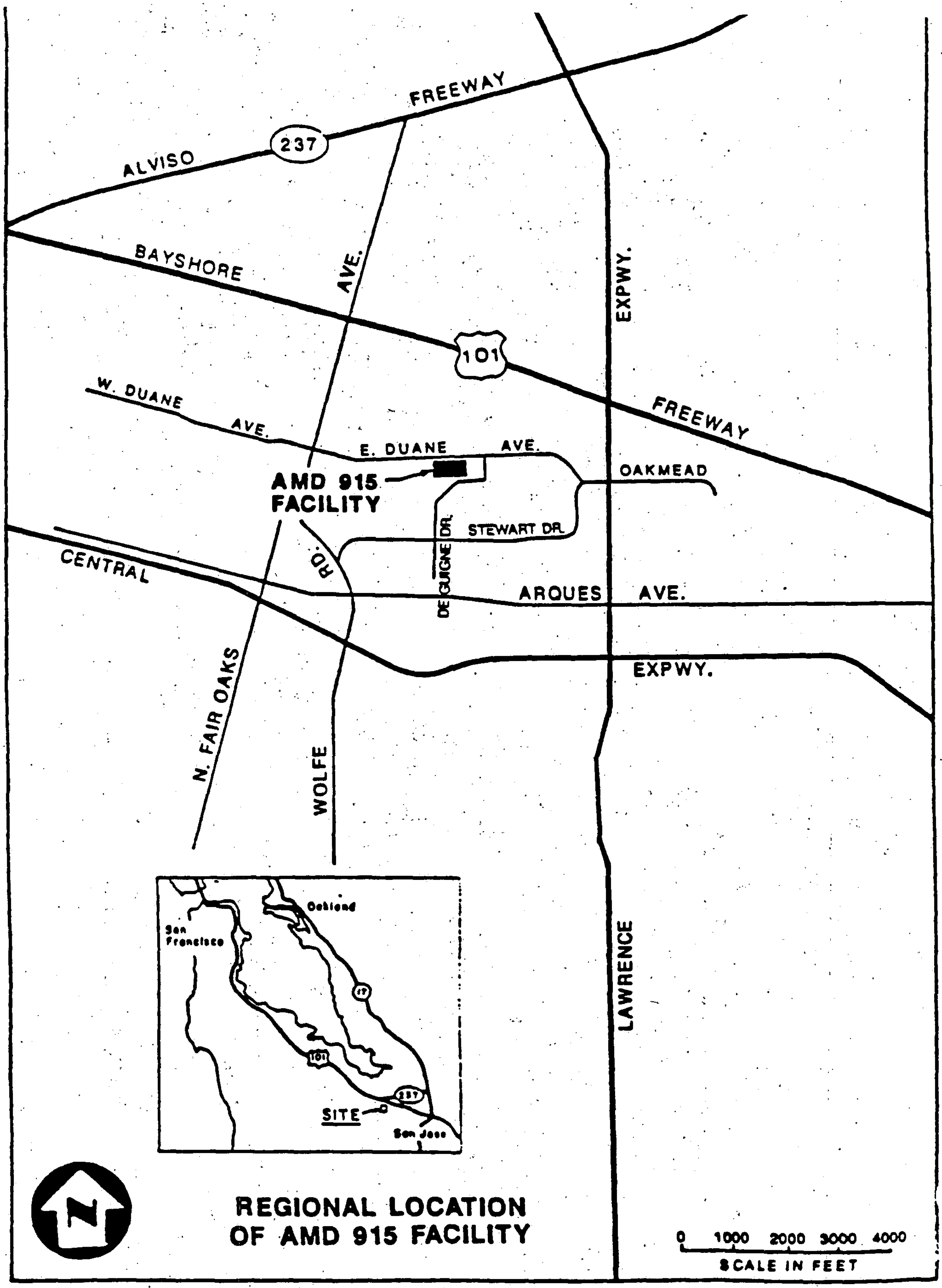
Advanced Micro Devices (AMD) owns and operates a semiconductor manufacturing facility at 915 DeGuigne Drive, Sunnyvale, Santa Clara County (AMD 915). The AMD 915 site is in a broad area bounded by the Bayshore Freeway, Central, and Lawrence Expressways and Fair Oaks Drive (Figure 1). This is approximately four miles south of the southern end of San Francisco Bay. The site has been treated as a single operable unit based on groundwater data indicating that groundwater contamination has been contained within the site boundary (Figure 2). Only AMD property has been impacted by the releases of hazardous substances at the AMD 915 site.

1.2 REGIONAL TOPOGRAPHY

The Study Area is located in the Santa Clara Valley which is a gently-sloping alluvial plain, flanked by the Diablo Range to the east-southeast and the Santa Cruz Mountains to the west- southwest. The Study Area is located toward the center of the valley. The Santa Cruz Mountains are located several miles southwest of the Study Area. The San Francisco Bay is located approximately 4 miles north of the Study Area.

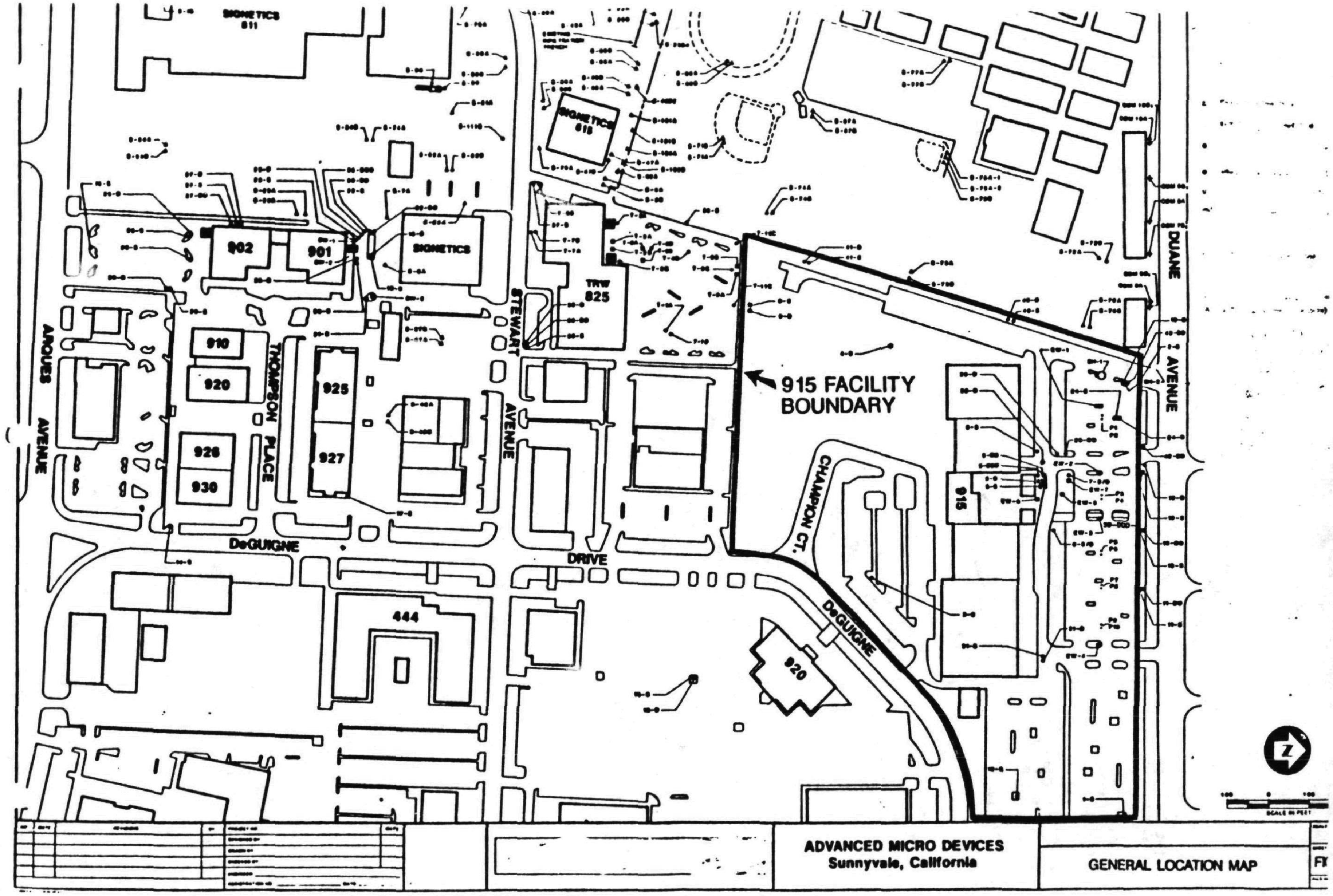
1.3 ADJACENT LAND USE

The AMD 915 site is in a broad area bounded by the Bayshore Freeway, Central and Lawrence Expressways, and Fair Oaks Drive (Figure 1). The facility is located in an industrial park setting bordered by residential areas (Figure 2). The area to the east is predominantly commercial and retail space. The area immediately to the west is a former High School, currently used as a research and development facility. Land to the north of AMD 915 is a mix of multiple and single family residential property.



ALVISO
237
FREEWAY
BAYSHORE
101
FREEWAY
AVE.
EXPWY.
W. DUANE AVE.
E. DUANE AVE.
OAKMEAD
AMD 915 FACILITY
STEWART DR.
DE GUIGNE DR.
RD.
CENTRAL
ARQUES AVE.
EXPWY.
N. FAIR OAKS
WOLFE
LAWRENCE
San Francisco
Oakland
101
237
SITE
San Jose
N
REGIONAL LOCATION OF AMD 915 FACILITY
0 1000 2000 3000 4000
SCALE IN FEET

FIGURE 1



SIGNETICS 811
SIGNETICS 818
SIGNETICS
902
901
TRW 825
STEWART
910
920
925
927
926
930
THOMPSON PLACE
ARQUES AVENUE
AVENUE
915 FACILITY BOUNDARY
CHAMPION CT.
915
DUANE AVENUE
DeGUIGNE
DRIVE
DeGUIGNE
444
920
ADVANCED MICRO DEVICES
Sunnyvale, California
GENERAL LOCATION MAP

FIGURE 2

1.4 HISTORICAL LAND USE

Until the Advanced Micro Devices Building 915 was built in 1974 land use was agricultural, dominantly commercial fruit orchards. AMD 915 was the first commercial construction at this site. This facility was designed and has been used as a semiconductor fabrication facility from 1974 through the present. The manufacturing processes at this site have involved the use of solvents, caustics, and acids. No metal plating has occurred at the AMD 915 facility.

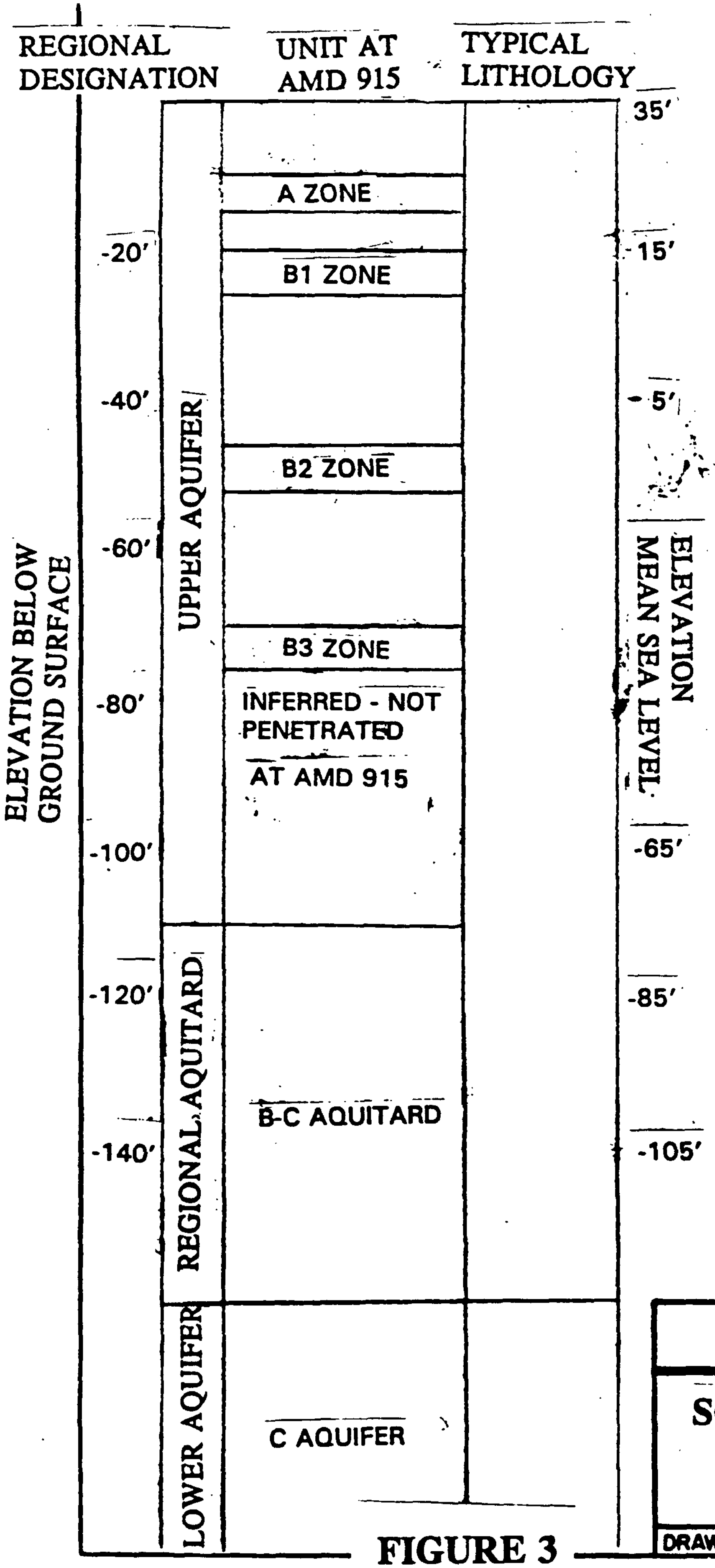
1.5 HYDROGEOLOGY

Stratigraphy in the area surrounding the AMD 915 site is characterized by interbedded and interfingering sands, silts and clays. These sediments were deposited in complex patterns by fluvial-alluvial systems draining the uplands to the south. Sediments were deposited as the streams flowed north toward the Bay.

The nomenclature applied to the water bearing units in the study area is representative of the hydrogeology within the Santa Clara Groundwater Basin. A number of shallow water bearing units are separated from deeper aquifers by a thick persistent aquitard. The shallow units may be subdivided into a variety of zones depending upon depth, lithology and lateral persistence. These zones are frequently labeled as A and B zones. The deeper aquifer is commonly referred to as the C aquifer and the clay layer separating the upper and lower water-bearing zones is commonly referred to as the B-C aquitard. The aquitard has been reported to be between 50 and 100 feet thick in Santa Clara Valley.

Three local aquifers have been identified through the investigation at AMD 915 (Figure 3). The shallowest of these aquifers has been designated the A aquifer and extends from 7 to 20 feet below the ground surface. The permeable portion of this unit is generally from three to five feet thick. The next shallowest unit has been designated as the B1 aquifer which is separated from the A aquifer by a relatively impermeable zone of silty clays. The B1 generally occurs from 20 to 35 feet below the ground surface and appears to be lenticular and discontinuous in nature with highly variable thickness. The next unit has been designated as the B2 aquifer and is separated from the B1 aquifer by 12 to 35 feet of silty clay and clayey silt. Depth to the B2 aquifer at AMD 915 is highly variable ranging from 38 to 65 feet. Permeable units in the B2 range from 2.9 to 12 feet in thickness with an average thickness of 5 feet.

The B3 aquifer is the deepest water bearing zone penetrated at the AMD 915 site. Depth to the B3 aquifer is from 65 to 100 feet below ground surface. The B3 is composed of clayey silt/silty clay, silty very fine to medium sands. The more



SCHEMATIC GEOLOGIC LOG AMD 915

DRAWN BY:	DATE:	DRWG. NO.

FIGURE 3

permeable silty sands vary from 7 to 14 feet in total thickness with an average thickness of about 10 feet. The B3 most likely represents a group of discontinuous sand lens rather than a continuous sand body. Data on the B3 at AMD 915 is limited, however, based on investigations at other sites, this description would be typical of water bearing zones at similar position in the stratigraphic geologic column.

The deeper units have not been investigated at AMD 915 since groundwater contamination has been limited to the B2 aquifer. Both regional geologic studies and investigations at other sites indicate the presence of discontinuous water bearing zones in the intermediate depths down to about 125 feet. A more continuous sand layer may occur near this depth. This water bearing zone, if present, is typically underlain by a regionally continuous clay layer. The clay layer varies in thickness but is usually reported to be tens of feet thick. At varying depths below this clay layer are the thicker sand units that currently provide a large percentage of the local drinking water supply.

The horizontal groundwater gradient in all identified aquifers, in static conditions, is to the north toward San Francisco Bay. Local reversal of gradient is observed in the vicinity of groundwater extraction systems. The vertical hydraulic gradient is generally upward from the deeper aquifers and this has been verified to be the case at the AMD 915 site.

1.6 WATER USE

Currently, groundwater from this basin provides up to 50% of the municipal drinking water for the 1.4 million residents of the Santa Clara Valley. In 1989, groundwater accounted for approximately 128,000 of the 315,000 acre feet of drinking water delivered to Santa Clara Valley Water District customers. This water is produced from the C aquifer. Groundwater contamination is limited to the shallow A and B water bearing zones (see 1.5 above).

Prior to the conversion of agricultural land throughout the Santa Clara Valley to industrial use in the late 1960's and early 1970's water in this area served as irrigation supply and other agricultural purposes. No supply wells completed in the contaminated shallow aquifers have been identified. On March 30, 1989, the Regional Board incorporated the State Board Policy of "Sources of Drinking Water" into the Basin Plan. The policy provides for a Municipal and Domestic Supply designation for all waters of the State with some exceptions. Groundwaters of the State are considered to be suitable or potentially suitable for municipal or domestic supply with the exception of: 1) the total dissolved solids in the groundwater exceed 3000 mg/L, and 2) the water source does not provide sufficient water to supply a single well capable of producing an average, sustained yield of 200 gallons per day. Based on data submitted by AMD, the RWQCB finds that neither of these two exceptions apply to the A and B zones at AMD 915 site. Thus, the A and B zones are considered to be potential sources of drinking water. EPA agrees with this determination.

AMD 915 was listed on the National Priorities List (NPL) primarily because of the potential threat from past chemical releases to the quality of this valuable resource. The major concern at the site stems from the potential migration of contaminants in the Upper Aquifer Zone down to the Lower Aquifer Zone through abandoned or poorly sealed wells or natural conduits through aquitard material. Municipal water supply wells are generally perforated in the Lower Aquifer Zone. All water supply wells located within an approximate one mile radius of the AMD 915 site are perforated from 190 to 390 feet below ground surface.

Currently, the nearest municipal drinking water supply well downgradient of the site is a Santa Clara Valley Water District well, which is located more than 2000 feet north of the site. No pollutants have been found in this well to date. Currently, there are no known users of ground water from the Upper Aquifer Zone. The Regional Water Quality Control Board (RWQCB) has identified potential beneficial uses of the shallow ground water underlying and adjacent to the AMD 915 site. These beneficial uses include industrial process water supply, industrial service water supply, municipal and domestic water supply and agricultural water supply. These are the same as the existing and potential beneficial uses of the ground water in the Lower Aquifer Zone.

A well search for abandoned wells in a 3350 acre area encompassing AMD 915 was completed in December 1986. This includes over one mile in all directions and over three miles in the downgradient direction. The focus of the well search was to identify wells that potentially may form migration pathways to the deeper aquifer. The search identified 177 possible well locations. Of these wells 76 are identified as destroyed. Only four wells that might act as potential migration conduits to deeper aquifers were identified. Only one of these wells is downgradient of the AMD 915 site. This well is a Santa Clara Valley Water District (SCVWD) well more than 2000 feet downgradient of the site. Testing of the well has shown no evidence of contamination. Of the remaining three wells, two wells are listed as destroyed in SCVWD records. The remaining well is a cathodic protection well maintained by PG&E. This type of well is frequently installed to inhibit rust in underground pipelines. These wells are typically shallow (i.e. pipeline depth) and cased with steel. No additional data was available on the other well and attempts to field check the well location were unsuccessful.

Two municipal supply wells were identified by the potential conduit study. Well ID number 1845 is a City of Sunnyvale water supply well. This well is over 3000 feet upgradient of the known groundwater contamination plume. Well ID number T6SR1WS29N2 T6SR1WS29 is also upgradient of the groundwater pollution plume and is shown in Santa Clara Valley Water District records as destroyed.

The potential conduit survey was updated in 1989 with a new search of Santa Clara

Valley Water District records to locate any wells that might have been installed since the completion of the potential conduit search in 1986. This second search found eight wells, four of which had been destroyed. The remaining four wells are active monitor wells slotted in the shallow aquifer between 5 and 20 feet below ground surface. These four wells, due to the shallow depth of completion, do not represent potential conduits for migration of contaminants to deeper aquifers.

1.7 SURFACE AND SUBSURFACE STRUCTURES

The physical site consists of approximately five acres. Three physical structures exist at the surface. The largest of these, designated as AMD 915, covers about 116,000 square feet. The remaining buildings are smaller each covering less than 10,000 square feet. The remainder of the surface is paved for use as parking or is covered by concrete utilized in facility support structures. Plants or other forms of landscaping are minimal.

Eleven chemical storage or treatment areas have been documented at the AMD 915 facility (Figure 4). This has included three underground acid neutralization systems, two above ground drum storage areas, and six underground tank complexes. Two of the acid neutralization systems (ANS) remain in place and in operation, one of the drum storage areas is still active, and two of the underground tank complexes are still in use. The remainder of the subsurface structures have been removed.

Two tanks have been removed from the Pad III area. A 1,500 gallon steel tank installed in 1973 for waste solvent storage, was removed in 1987. Soil samples and tank integrity testing both indicate that the tank had not leaked. A 400 gallon tank was installed in 1980 for photo resist stripper waste and was removed in 1983. Soil samples were taken from the excavation and no contamination was indicated. The tank was visually inspected and no damage or leaks were noted.

The tanks in the Pad IV area were installed in 1976 and removed in 1981 (see 2.1 below). Pad IV had two 1,400 gallon, single wall steel tanks, one for waste solvent and one for waste photo resist. Additional detail regarding tank integrity and the removal of these tanks is provided in Section 2.2 below.

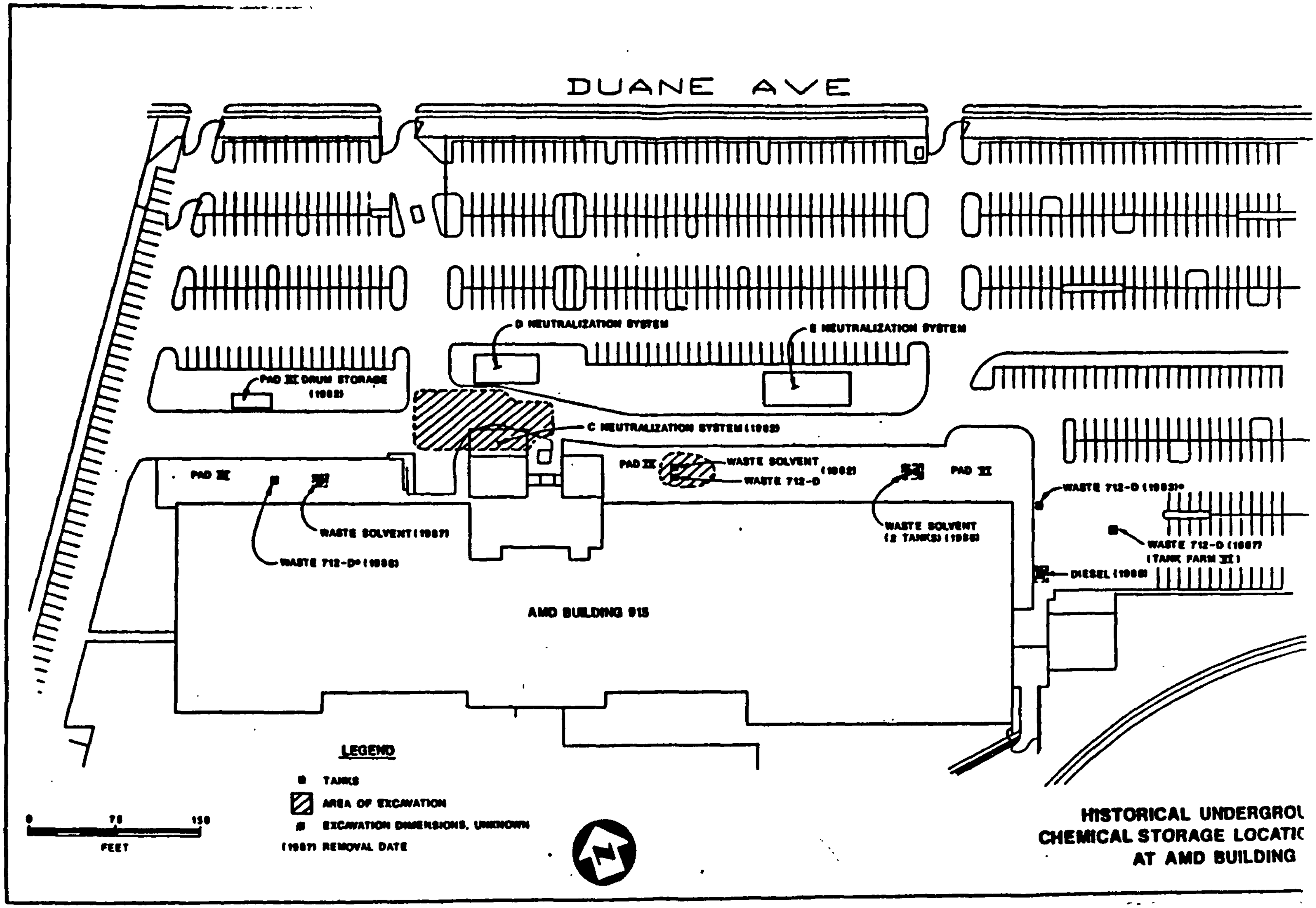

DUANE AVE
D NEUTRALIZATION SYSTEM
E NEUTRALIZATION SYSTEM
C NEUTRALIZATION SYSTEM (1982)
WASTE SOLVENT
WASTE 712-D
WASTE SOLVENT (1987)
PAD XI
AMD BUILDING 915
LEGEND
TANKS
AREA OF EXCAVATION
EXCAVATION DIMENSIONS, UNKNOWN
(1987) REMOVAL DATE
FEET
HISTORICAL UNDERGROU
CHEMICAL STORAGE LOCATIC
AT AMD BUILDING

FIGURE 4

Three single wall steel tanks were installed at the Pad VI area in 1980 and an additional vaulted polyethylene tank was installed in 1982. Two 2000 gallon steel tanks were used for waste solvent storage. The remaining steel tank, 1,000 gallon, capacity was used for storage of diesel fuel. The tank installed in 1982 of 500 gallon capacity was used for storage of waste photo resist. The 2,000 gallon tanks were removed in 1986 and the 1,000 gallon tank was removed in 1988. The polyethylene tank was removed in 1983. The condition of all tanks was reported to be good upon removal with no evidence of damage or leaks. All three of the steel tanks passed a tank pressure test for integrity after removal.

Three underground tanks were installed at Tank Farm VI in 1982. Two vaulted steel tanks, one of 1,000 gallon and one of 1,200 gallon capacity, were used for waste solvent storage. The third tank was a vaulted polyethylene tank used for waste photo resist storage. The waste photo resist tank was removed in 1987. The two waste solvent tanks were removed in 1990. All tanks were reported to be in good condition upon removal.

The three underground acid neutralization systems were installed sequentially. The C system was installed in 1974 and consisted of three steel-lined single wall tanks with a total capacity of 4,200 gallons. The excavation and removal of the C system is covered in greater detail in Section 2.2 below.

The remaining drum storage area is an enclosed concrete, contained area (Chemical Storage III) that was installed in 1982. The two remaining acid neutralization systems, D system and E system were installed in 1977 and 1979 respectively. Both systems consist of multiple underground vaulted fiberglass tanks. The D system has a capacity of 3,600 gallons in a three tank system. The E system has a capacity of 24,000 gallons in a five tank system. The remaining underground tank areas are Tank Farm III and Tank Farm IV. Both areas are used for the temporary storage of waste solvent. Tank Farm III, installed in 1983, contains two vaulted steel tanks one with 2,400 gallon capacity and one with 1,200 gallon capacity. Tank Farm IV, installed in 1982, contains three vaulted steel tanks one with 2,500 gallon capacity, one with 1,200 gallon capacity, and one with 1,000 gallon capacity.

2.0 SITE HISTORY AND ENFORCEMENT ACTIVITIES

2.1 HISTORY OF SITE ACTIVITIES

Advanced Micro Devices Building 915 (AMD 915) was built in 1974, and was the first commercial construction at this site.. This facility was designed and has been used as a semiconductor fabrication facility from 1974 through the present. The recent trend has been an increased focus on research and development activity with a decline in the importance of production activities. The manufacturing processes at this site have involved the use of solvents, caustics, and acids. No metal plating has occurred at the AMD 915 facility.

The earliest records of waste storage and handling practices at the AMD 915 facility are from 1980. These records are not always clear since they include quantities of some chemicals in use or storage at several AMD facilities. In general, solvent wastes at AMD 915 were stored in underground tanks; Freon waste, waste oil, sirtyl-etch, and sorb-all were containerized in 55 gallon drums for offsite disposal. Corrosives other than chromic acid were neutralized in the on-site acid neutralization system which discharged to the sanitary sewer system. Process gas was wet scrubbed and the scrubber effluent was also directed to the acid neutralization system.

The waste solvent and containerized materials were removed from the site by a licensed carrier for offsite disposal. As handling and storage practices changed the storage areas for containerized waste has been continually upgraded and underground tanks have either been replaced with above ground facilities or doubly contained underground units. Additional detail of past and present storage facilities is presented in Section 2.2 below.

2.2 HISTORY OF SITE INVESTIGATIONS

Initial investigation at this site began voluntarily in 1981 as the result of soil contamination discovered during an underground tank excavation and removal. The removal was due to a change in facility operations. Additional investigations were driven by ongoing investigations at other AMD facilities. As many as 28 separate underground tanks may have been in service at various times at the AMD 915 site. The majority of these tanks have been removed from service or replaced with doubly contained above or below ground units.

Five potential source areas of soil and/or groundwater contamination were investigated at AMD 915 (Figure 4). These include the Pad IV photoresist stripper tank removed in 1981, the Pad "C" ANS removed in 1981, solvent tanks at Pad VI removed in 1986, Pad III waste solvent tank removed in 1987, and the East End diesel tanks investigated in 1988.

Of the five areas investigated two have been identified as possible sources of soil and groundwater contamination at the AMD 915 facility. These include an acid neutralization system north of the AMD 915 building at Pad "C" and the Pad IV photoresist stripper tank also north of the AMD 915 building. No other signs of leaking tanks were identified in the removal of tanks from the other three areas. Soil samples confirm the absence of contaminated soil in the vicinity of the other tanks.

The tank removal at the Pad IV area apparently removed contaminated soil containing greater than 100 mg/Kg of trichloroethylene (TCE). However, documentation of the depth of excavation and lateral extent of soil contamination was unavailable. Additional data collection to investigate remaining potential source soil contamination was completed in July 1990 as part of the final RI study. The only EPA 8240 compounds identified during this investigation were 1,2,4-Trichlorobenzene (1,2,4-TCB) and 1,2,3-Trichlorobenzene (1,2,3-TCB) at concentrations less than 1 mg/Kg (1 ppm in soil).

During tank removals two leaking underground tanks have been identified. The first of these occurred during the removal of two, 1500 hundred gallon tanks from the Pad IV area. The tanks were used for storage of photoresist solution and waste solvent. Holes in the photoresist tank was observed during the removal of the tanks in 1981. Based on soil samples from the excavation this was verified as a source of contaminants. It was not possible to determine the duration of the leak or volume/ mass of contaminants released.

The second leaking underground tank was one of three in an underground acid neutralization system (ANS). The leak in this tank from the ANS, located at pad "C", was documented when a hole was noted in one tank during removal in late 1981. These two areas have been identified as potential point sources of contamination. Based on soil sampling in the excavation and groundwater monitoring data, the "C" ANS was probably the dominant source of groundwater contamination at the AMD 915 site.

Groundwater investigation also began in 1982 as part of the investigation of the leaking underground tanks previously documented. Ongoing extraction of groundwater through existing building dewatering sumps was supplemented in 1982 with the addition of the first in a series of groundwater extraction wells. Monitoring of groundwater quality has been ongoing, at least quarterly, since 1982.

Additional offsite sources of groundwater contamination may have a significant affect on the AMD 915 site. The most notable of these are Advanced Micro Devices 901/902 Thompson Drive facilities, Signetics 811 East Arques site, and the FEI Microwave facility at 825 Stewart Drive. These three facilities have documented point sources of groundwater contamination which has commingled in the subsurface and may be commingling with groundwater contamination from the AMD 915 site. Control of this commingled groundwater contamination plume and cleanup activities are being addressed under other RWQCB Orders and a separate Record of Decision.

While investigation and interim remedial actions had been ongoing since 1982 the formal Remedial Investigation/Feasibility Study (RI/FS) process began with the request for an RI/FS workplan in 1988. A well survey to locate wells in six areas that might act as potential conduits for the spread of groundwater contamination was commissioned by an industry group in 1986. This survey included the area surrounding the AMD 915 site and was as updated for the AMD 915 RI in 1990.

For purposes of these reports and the proposed final cleanup plan, AMD 915 Deguigne Drive has been designated as a single Operable Unit (see Figure 2). It was determined that the RI would focus on groundwater data from 1987 to 1989 as a result of changes in analytical accuracy and sampling protocols. Several draft RI/FS reports have been submitted on behalf of AMD including the draft final RI/FS submitted in January 1991. Final corrections were added in March 1991. The RWQCB adopted an Order June 19, 1991 approving the RI/FS and a final cleanup plan that encompassed cleanup at the AMD 915 facility. While all available data was considered in the FS and the risk assessment, risk management decisions included groundwater data that was collected after the completion of the FS.

2.3 HISTORY OF ENFORCEMENT ACTIONS

The site has been included on the National Priorities List (NPL) and has been regulated by Regional Board Orders, as indicated herein:

A.	April 1985	Order #85-034, Waste Discharge Requirements Adopted for NPDES Permit CA0028797
B.	June 1988	AMD 915 Proposed for Inclusion on the NPL
C.	May 1989	Order #89-043, Administrative Civil Liability for Late Submittal of RI/FS Workplan
D.	May 1989	Order #89-080 Site Cleanup Requirements Adopted, Approving RI/FS workplan
E.	September 1990	AMD added to the NPL
F.	December 1990	Order #90-156, Reissuance of Waste Discharge Requirements Adopted for issuance and revision of NPDES Permit CA0028797
G.	June 1991	Order #91-101, Site Cleanup Requirements Adopted, Approval of Final Cleanup Plan and Cleanup Standards

3.0 COMMUNITY RELATIONS

3.1 COMMUNITY INVOLVEMENT

An aggressive Community Relations program has been ongoing for all Santa Clara Valley Superfund sites, including AMD 915. The Board published a notice in the San Jose Mercu , News on March 13, 20, and 27, 1991, announcing the proposed final cleanup plan and opportunity for public comment at the Board Hearing of March 20, 1991 in Oakland, and announcing the opportunity for public comment at an evening public meeting to be held at the Westinghouse Auditorium, Britton at East Duane Avenue, in the City of Sunnyvale on Thursday March 28, 1991. Based on community response the 30 day comment period from March 20, 1991 through April 19, 1991 was extended for an additional 30 days through May 20, 1991. Several informal meetings were held with c mmunity members during the extended public comment period.

3.2 FACT SHEETS

Fact Sheets were mailed to interested residents, local government officials, and media representatives. Fact Sheet 1, mailed in December 1989, summarized the pollution problem, the results of investigations to date, and the interim remedial actions. Fact Sheet 2, mailed in March 1991, described the cleanup alternatives evaluated, explained the proposed final cleanup plan; announced opportunities for public comment at the Board Hearing of March 20, 1991 in Oakland and the Public Meeting of March 28, 1991 in Sunnyvale and described the availability of further information at the City of Sunnyvale Library and the Regional Board offices. An additional Fact Sheet was mailed to the interested public in July describing the final plan and summarizing the response to comments regarding AMD 915.

4.0 SCOPE AND ROLE OF THE RESPONSE ACTION

4.1 SCOPE OF THE RESPONSE ACTION

The remedy selected and described in this ROD includes the existing interim remedial measures. The interim remedial measures have included the removal of leaking underground tanks and acid neutralization systems, containment and extraction of contaminated groundwater, and treatment of extracted groundwater.

4.1.1 Current Interim Remedial Measure (IRM)

Two interim remedial actions for soil were completed in 1981. The first of these was the removal of a waste solvent tank and Burmar vault in the Pad IV area in June 1981. This excavation resulted in the removal of approximately 1500 cubic yards of soil. Analysis of soil for VOCs was not completed at the time of excavation. Additional investigation of the Pad IV area in July 1990 indicated that this action was successful and no soil with greater than 1 ppm of VOCs remain in place.

The second action was completed in September 1981 with the removal of the acid neutralization system from the Pad "C" area north of the AMD 915 facility. The acid neutralization system and approximately 5500 cubic yards of soil were removed between December 21, 1981 and January 4, 1982. These materials were disposed of at an offsite commercial disposal facility.

Remediation of the groundwater began with extraction of groundwater from four building dewatering sumps which were in place from the completion of the 915 building. These sumps only extract water from the shallow or A aquifer and three of the sumps are still operating at present. In 1982 five groundwater extraction wells were installed, with four wells extracting water from the A and B1 aquifers and one well extracting water from the A, B1 and B2 aquifers. In 1984 four additional extraction wells were completed. These wells were combined with the two best producing wells that had been installed in 1982 for a total of six extraction wells. The intent of these changes to the system was to improve control of offsite contaminant migration. An additional extraction well completed in the B2 aquifer was added in 1985. An eighth extraction well, again in the B2 aquifer, was added in 1988 (Figure 5). The layout of the existing groundwater extraction system is shown in Figure 6.

The extracted groundwater is piped to a groundwater treatment system, consisting of two airstripping towers, one active, one reserve, and an aqueous phase activated carbon filtration unit. This treatment system was completed in January of 1984. The system has consistently removed from 90 to 99% of the VOCs from the groundwater. Approximately 30% of the extracted treated groundwater is reused as industrial process or cooling water, prior to release to the sanitary sewer. The remaining treated water is discharged to a storm sewer tributary of Calabazas Creek under NPDES Permit Number CA0028797. The discharge permit was revised in December 1990. The current permits includes limits for all chemicals of concern in addition to limits for selected inorganics identified by the RWQCB Basin Plan. These limits generally are set at the more stringent of the drinking water standards (MCLs) or aquatic toxicity values (see Table 1).

4.1.2 Selected Remedy

Following completion of the RI it was determined that the IRM for soil had been successful. No further remedial action for soil is included. The selected remedy for groundwater is the continued operation of the eight existing groundwater extraction wells. Treatment by air-stripper with final polish by aqueous phase carbon filtration will also continue. Onsite reuse of the groundwater is expected to increase in the future with attendant decreases in discharge to surface water.
The air stripper will include emissions controls if emissions exceed levels permitted by BAAQMD.

The discharge to surface water is controlled by NPDES Permit No. CA0028797. The limits for this discharge includes instantaneous maximum limits for specific contaminants and limits for receiving waters including pH, nitrogen and dissolved oxygen. The discharge limits were established following EPA guidance and represent the best available technology. A complete list of discharge limits is included as Table 1.

4.2 ROLE OF THE RESPONSE ACTION

The purpose of the actions at AMD 915 is to control the migration of polluted groundwater from the site and to capture and remediate existing contaminated groundwater. The intent of these actions is to expedite cleanup of groundwater at this site and to prevent movement of contaminated groundwater from the onsite area to offsite and to prevent potential vertical migration into aquifers that currently serve as drinking water sources.

GROUNDWATER TOTAL VOCS CONCSNTRATION CONTOURS
B2-AQUIFER ZONE, APRIL 1991

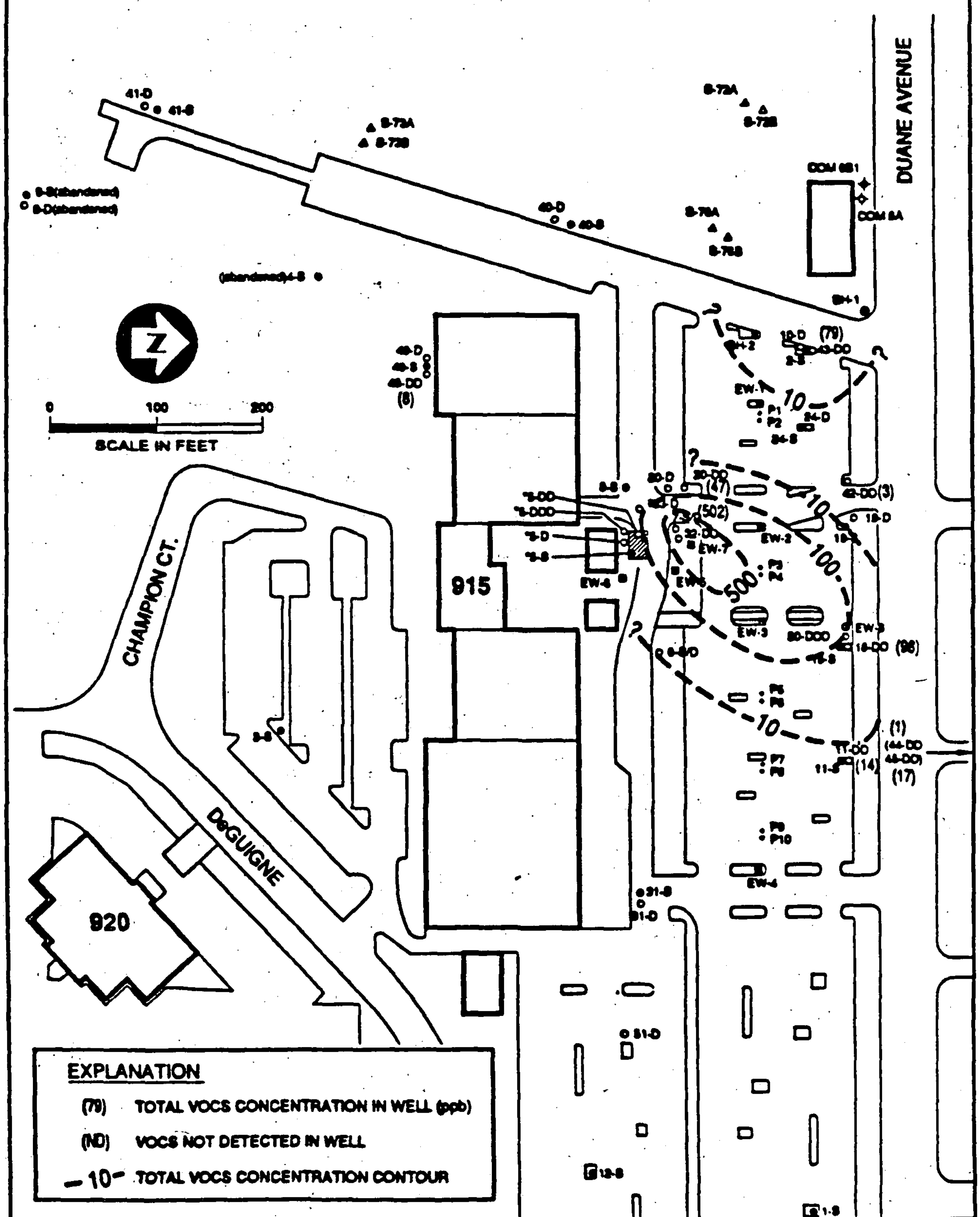


FIGURE 5

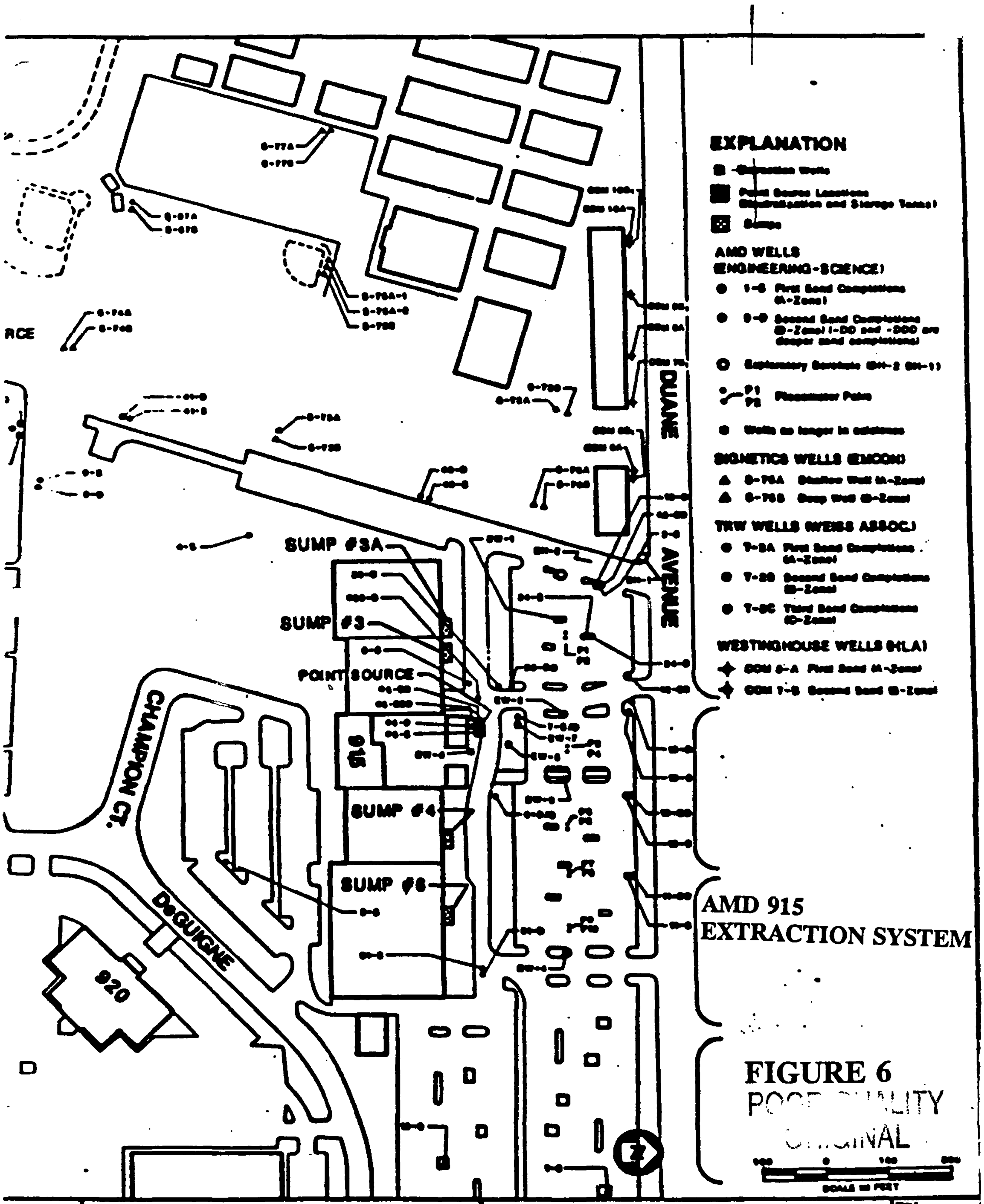


FIGURE 6

ADVANCED MICRO DEVICES
Sunnyvale, California

PROJECT SITE

The IRM for groundwater has contained the groundwater contamination plume to the site. Vertical migration has been limited and the toxicity, mobility, and volume of contaminants has been reduced. The final goal of this response action is to allow the future use of the shallow groundwater as a possible source of drinking water.

5.0 SUMMARY OF SITE CHARACTERISTICS

5.1 SOURCES OF CONTAMINATION

5.1.1 Source Investigation

Five potential source areas of soil and/or groundwater contamination were investigated at AMD 915. These include the Pad IV photoresist stripper tank removed in 1981, The Pad "C" ANS removed in 1981, solvent tanks at Pad VI removed in 1986, Pad III waste solvent tank removed in 1987, and the East End diesel tanks investigated in 1988.

Of the five areas investigated two have been identified as possible sources of soil and groundwater contamination at the AMD 915 facility. These include an acid neutralization system north of the AMD 915 building at Pad "C" and the Pad IV photoresist stripper tank also north of the AMD 915 building. No other signs of leaking tanks were identified in the removal of tanks from the other three areas. Soil samples confirm the absence of contaminated soil in the vicinity of the other tanks.

The tank removal at the Pad IV area apparently removed contaminated soil containing greater than 100 mg/Kg of trichloroethylene (TCE). However, documentation of the depth of excavation and lateral extent of soil contamination was unavailable. Additional data collection to investigate remaining potential source soil contamination was completed in July 1990 as part of the final RI study. The only EPA 8240 compounds identified during this investigation were 1,2,4-Trichlorobenzene (1,2,4-TCB) and 1,2,3-Trichlorobenzene (1,2,3-TCB) at concentrations less than 1 mg/Kg (1 ppm in soil).

Additional offsite sources of groundwater contamination may have a significant affect on the AMD 915 site. The most notable of these are Advanced Micro Devices 901/902 Thompson Drive facilities, Signetics 811 East Arques site, and the FEI Microwave facility at 825 Stewart Drive. These three facilities have documented point sources of groundwater contamination which has commingled in the subsurface and may be impinging upon AMD 915 groundwater. Control of this commingled groundwater contamination plume and cleanup activities are being addressed by separate actions.

TABLE 1

NPDES DISCHARGE LIMITS, AMD 915

Constituent	Instantaneous Maximum Limit (μg/l)
VOC's	
Trichlorofluoromethane	5.0
1,1,1-trichloroethane	5.0
Tetrachloroethylene	5.0
Trichloroethylene	5.0
1,1 Dichloroethylene	5.0
Vinyl Chloride	0.5
cis-1,2-Dichloroethylene	5.0
trans-1,2-Dichloroethylene	5.0
Methylene Chloride	5.0
Total VOC's	10.0[1]
AROMATICS	
Ethylbenzene	5.0
Dichlorobenzene	5.0
Trichlorobenzene	5.0
Xylenes	5.0
Total Petroleum Hydrocarbons	50.0
INORGANICS	
Arsenic	20.0
Cadmium	10.0
Chromium (VI)	11.0
Copper	20.0
Cyanide	25.0
Lead	5.6
Mercury	1.0
Nickel	7.1
Silver	2.3
Zinc	58.0

[1]Total of constituents for EPA 601 analytes

5.2 DESCRIPTION OF CONTAMINATION

5.2.1 Soil Investigations

Soil pollution was the most concentrated near the AMD 915 acid neutralization system, located just north of the AMD 915 facility. Soil concentrations up to 280,000 ppb of TCE were detected below the western-most tank in the three-tank acid neutralization system. Concentrations as great as 330,000 ppb of TCB have been detected in soil borings.

Additional excavation and removal of tanks was carried out at the Pad IV area also north of the AMD 915 building (Figure 4). Soil samples from this excavation were analyzed only for TCB, xylene, toluene, and benzene. The depth of the excavation and lateral extent of soil contamination was poorly documented, in addition to the absence of analysis for VOCs. Therefore this was identified as a data gap in early drafts of the RI/FS and additional sampling was completed in July 1990. The only analytes detected in the soil samples from the additional soil borings were 1,2,4-TCB and 1,2,3-TCB. These analytes were present at levels below 1 mg/Kg and are not considered to represent significant soil contamination.

5.2.2 Groundwater Investigations

Groundwater investigation has included the installation of 42 monitoring wells. Groundwater sampling of selected wells has occurred on a quarterly basis for at least the last four years. Groundwater monitor data on a less systematic basis is available for up to 10 years. The characterizations of risk are based on data collected from 1987 through 1989.

Based on this data the lateral extent of groundwater contamination is limited to the AMD 915 site. Vertically, VOC contamination has been confirmed down to the B2 aquifer at depths up to 68 feet. Groundwater contamination has not been detected in the B3 zone. The majority of onsite, A zone monitoring wells are dry, therefore the lateral extent of contamination in the A zone is difficult to estimate. The lateral extent of contamination in the recent past has been limited to 250 feet downgradient of the source area. The spread of the groundwater contamination from the AMD 915 facility, perpendicular to the groundwater flow direction, can not be determined due the contaminant contribution from upgradient sources.

The rate of groundwater flow in the shallow aquifers at the AMD 915 site, without considering the cone of depression resulting from the groundwater extraction system, is estimated to vary from 50 to 200 feet per year. Modeling results presented in the RI/FS indicate that, with the eight extraction wells operating, capture of the groundwater contamination plume in the shallow aquifers is complete.

TCE is the most prevalent groundwater contaminant and has been utilized as a indicator chemical for the AMD 915 site (see section 6.1 below). Highest initial levels of TCE contamination were recorded in 1892 in monitor wells 9-S in the A aquifer and 9-D in the B1 aquifer. The maximum concentration of TCE in well 9-S was 4800 µg/l. The maximum concentration of TCE in well 9-D was 6600 µg/l. These wells were abandoned in 1988. The last sampling event prior to abandonment for well 9-S was in October 1987. At this time, 800 µg/l of TCE was detected in well 9-S. The last sampling event prior to abandonment for well 9-D was in June 1988 and 1100 µg/l TCE was detected in well 9-D. The maximum concentration of TCE in July 1990 was in well 41-D at 990 µg/l. This well is near the upgradient property boundary and is not necessarily representative of groundwater contamination related to onsite point sources.

5.2.3 Air Investigations

Volatilization of groundwater contaminants from the subsurface was not investigated since the groundwater plume is restricted to subject property. Therefore no current residential property exists above or adjacent to the plume. The site is completely paved or covered by structures with active ventilation systems. The paving may limit the migration of contaminants and the active ventilation systems will limit the concentration of contaminants in indoor air.

Emissions from the onsite air stripper that is currently part of the interim remedial action are regulated by the BAAQMD. The air stripper systems at AMD were permitted by the BAAQMD in 1986. The BAAQMD permit process would usually result in the request for data and the renewal of the permits on an annual basis. The permits for the air strippers were inexplicably dropped by the BAAQMD. AMD filed applications for new permits in May of 1990. Discussions with BAAQMD staff indicates that additional information was requested from AMD. The permit to operate for the AMD 915 air strippers was re-issued by the BAAQMD in August 1991. The permit was not revised since this was not a new or modified system. No risk screening was required.

The air stripper at AMD 915 releases approximately 1.5 pounds of contaminants, dominantly TCE, per day. The BAAQMD has not required control of the air stri, er offgas. The potential health risk from the uncontrolled air strippers has been evaluated by the BAAQMD. Since the air stripper had been previously permitted and is not a new or modified system the air strippers do meet the requirements of BAAQMD Rule 47. While they release more than one pound per day of volatile organic chemicals (VOCs) they were permitted in 1986 prior to enactment of newer regulations and are therefore considered to be in compliance with Rule 47 by a "grandfather" clause.

Air emissions for the AMD facility at 915 DeGuigne Drive (AMD 915) facility have been evaluated as a whole by BAAQMD as required by Assembly Bill 2508. The levels of emissions were not considered a great enough health risk by the BAAQMD to warrant further screening or modeling. An evaluation of the emissions from the air strippers was submitted by AMD in September 1991. Estimated emissions have declined to a current level of about 300 pounds per year or 0.82 pounds per day. Emissions controls will be added to the air stripper at AMD #915 if required by

BAAQMD.

6.0 SUMMARY OF SITE RISKS

6.1 TOXICITY ASSESSMENT

Using very protective assumptions regarding concentration, distribution, toxicity, and potential routes of exposure, the Baseline Public Health Evaluation (BPHE) identified certain "chemicals of potential concern." The initial list of chemicals of concern included all chemicals that were detected in the chemical database for the period from 1987 through 1989 plus additional data for inorganic analysis from 1990 (see Table 2). This list included twenty organic chemicals and two inorganic chemicals. Twenty-three analytes are listed since Chromium is included in two valence states.

This list was reduced through consideration of toxicity, occurrence, and the availability of toxicological data. The revised list consists of 16 organic chemicals and 2 inorganic chemicals for a total of nineteen chemicals, since Chromium is again included in two valence states. These chemicals include (see Table 2) Arsenic, Benzene, Chloroform, Chromium (III), Chromium (VI), Dichlorodifluoromethane (Freon 12), 1,1-Dichloroethane (1,1-DCA), 1,1-Dichloroethylene (1,1-DCE), cis-1,2-Dichloroethylene (cis-1,2-DCE), trans-1,2-Dichloroethylene (trans-1,2-DCE), Ethylbenzene, Freon 113, Tetrachloroethylene (PCE), Toluene, 1,2,4-TCB, 1,1,1-Trichloroethane (1,1,1-TCA), TCE, Trichlorofluromethane (Freon 11), and xylenes.

Arsenic was used in the process at the AMD 915 facility in the form of arsine gas. The gas was collected by hoods within the facility and sent to scrubbers for removal from the air prior to release. The scrubber effluent was in turn sent to the acid neutralization system for treatment prior to discharge to the sanitary sewer system. Based on this history of site usage and detection in some groundwater samples arsenic was included as a chemical of concern included in the FS. Further review of the occurrence of arsenic was included in an addendum to the FS submitted in March 1991.

The maximum concentration of arsenic detected was 14 μg/l. This is well below the MCL of 50 μg/l. Background concentration of arsenic in groundwater in the South Bay is highly variable, however background in the area near AMD 915 is estimated to be 10 μg/l. The background is well within the range established for groundwater in the South Bay. This background concentration was exceeded in only a single sample at 14 μg/l. Since the difference between 10 and 14 μg/l was not considered to be a significant variation from background and since a small number of samples exceeded background it was assumed that the occurrence of arsenic is representative of local background levels in shallow groundwater and not site contamination. Therefore arsenic was eliminated as a chemical of concern.

The rational for selecting the remaining chemicals as chemicals of concern is as follows:

1. Chloroform, Chromium (VI), 1,1-Dichloroethane (1,1-DCA), 1,1-

Dichloroethylene (1,1-DCE), Tetrachloroethylene (PCE), and TCE are known or possible human carcinogens.

2. All of the chemicals of concern are detected in groundwater at a greater than 10% frequency.

3. Chloroform, Dichlorodifluoromethane (Freon 12), 1,1-Dichloroethane (1,1-DCA), 1,1-Dichloroethylene (1,1-DCE), cis-1,2-Dichloroethylene (cis-1,2-DCE), trans-1,2-Dichloroethylene (trans-1,2-DCE), Ethylbenzene, Freon 113, tetrachloroethylene (PCE), Toluene, 1,1,1-Trichloroethane (1,1,1-TCA), TCE, Trichlorofluromethane (Freon 11), and xylenes possess physicochemical properties (relatively high water solubility and relatively low soil sorption) which promote their dispersion in groundwater. In addition all of these chemicals are volatile and can easily be dispersed into soil gas and possibly the atmosphere.

4. Chromium, Dichlorodifluoromethane (Freon 12), Ethylbenzene, Freon 113, Tetrachloroethylene (PCE), Toluene, 1,2,4-TCB, 1,1,1-Trichloroethane (1,1,1-TCA), TCE, Trichlorofluromethane (Freon 11), and xylenes have been used on site as part of the manufacturing process. Soil sampling has documented the presence of most of these chemicals as contaminants in soil from source area excavations.

5. TCE has been used as an indicator chemical for the site. This is based on the reasons stated above. TCE is also the chemical most frequently detected in soil and groundwater. TCE has been detected in groundwater at the greatest concentration of any of the chemicals of concern, has the most widespread occurrence and has the highest representative or average concentration in groundwater samples.

6. Vinyl Chloride has been added as a chemical of concern because it is a known human carcinogen and a breakdown product of PCE, TCE, and DCE. Vinyl Chloride has not currently been detected in groundwater or soil at the AMD 915 site.

TABLE 2
AMD 915 DATA SUMMARY

		GROUNDWATER (μg/L)			SOIL (μg/L)		
Chemical	CRAVE	Rep Value	Max Value	#Det/#Anal	Rep Value	Max Value	#Det/#Anal
Arsenic	A	10.97	14.1	6/21	ND	ND	0/14
Benzene	A	ND	ND	0/9	104.89	460	12/18
Chloroform	B2	1.54	4.3	17/126	ND	ND	0/14
Chromium(III)	D	93.63	653	16/21	ND	ND	0/14
Chromium(VI)	A	93.63	653	16/21	ND	ND	0/14
Dibromochloromethane[a]	B2	0.90	1.80	1/126	ND	ND	0/14
Dichlorodifluoromethane	D	23	37	2/126	ND	ND	0/14
1,1-Dichloroethane	B2	1.93	4.5	17/126	ND	ND	0/14
1,1-Dichloroethene	C	7.90	50	36/126	ND	ND	0/14
cis-1,2-Dichloroethene	D	85.04	450	79/126	ND	ND	0/14
trans-1,2-Dichloroethene	D	1.27	2.1	7/126	ND	ND	0/14
cis-1,3-Dichloropropane[a]	D	375	750	1/126	ND	ND	0/14
Ethylbenzene	D	ND	ND	0/9	50	100	1/4
Freon 113	D	24.8	280	73/126	1,634.69	9600	32/45
Tetrachlorethane	B2	0.95	1.9	1/126	19.00	38	1/14
Toluene	D	2.00	4	1/9	24.5	110	11/18
Total Trichlorobenzenes[a]	D	NA	NA	NA	8258.82	96,000	43/75
Trichlorobenzenes[a] (specified as not 1,2,4-isomer)	D	NA	NA	NA	3512.50	36,000	9/16
1,2,4-Trichlorobenzene	D	1.8	3.6	1/5	7,433.04	60,000	44/83
1,1,1-Trichloroethane	D	13.33	44	41/126	0.70	0.7	2/49
Trichloroethene	B2	252.67	3,800	105/126	643.97	2,800	39/49
Trichlorofluoromethane	D	0.88	1.2	4/126	ND	ND	0/14
Xylene	D	ND	ND	0/9	92.31	310	14/17

6.2 RISK CHARACTERIZATION

Using protective assumptions, the BPHE developed current and future exposure scenarios. This consideration included soil, air and groundwater as potential sources, transport media, and human exposure points. Risks were characterized for pathways involving these media in the following subsections. As described in the National Contingency Plan, the EPA acceptable excess cancer risk range is 1×10^{-4} to 1×10^{-6} for exposure to known or expected carcinogens at concentration levels that represent an excess upper bound lifetime cancer risk to an individual. For noncarcinogenic effects, the Hazard Index (HI) provides a useful reference point for gauging the potential significance of multiple contaminant exposures within a single media or across media. EPA considers an HI less than 1.0 to be acceptable.

At the AMD 915 site no probable current exposure scenarios have been identified. For the hypothetical future exposure scenarios, it was assumed that the AMD 915 site would be developed for residential use and that the groundwater in the shallow aquifer would be used as the sole source of drinking and domestic water at this site. According to the BPHE, potential future exposure routes at the AMD 915 site may include ingestion of groundwater, inhalation of VOC vapors during showering or other domestic uses, and ingestion of soil during construction of this hypothetical residential development.

Surface water was not evaluated as a potential exposure pathway since it is improbable that the contaminated groundwater would reach any body of surface water. The nearest surface water bodies are the Sunnyvale East Drainage Channel and Calabazas Creek. The Sunnyvale Drainage channel, approximately 2500 feet west of the site, is lined. Infiltration of contaminated groundwater from the AMD 915 site into this channel is unlikely due to the lining and the groundwater flow direction. Calabazas Creek is approximately 5000 feet east of the site. This section of the creek has been straightened and lined for flood control purposes. Infiltration of contaminated groundwater from the AMD 915 site into Calabazas Creek is unlikely due to the lining and the groundwater flow direction. The nearest surface water body in the downgradient direction is Guadelupe Slough, more than 10,000 feet north of the AMD 915 contaminant plume. Contaminant migration to Guadelupe Slough would probably require more than 50 years if groundwater extraction were to cease.

6.2.1 Soil

No shallow contaminated soil remains since the interim remedial actions for soil were effective. The exposure to contaminated soil through the dermal contact route was not evaluated since it is unlikely that the chemicals of concern at AMD 915, metals or VOCs, would be adsorbed through the skin since the VOCs would volatilize into the air prior to significant subcutaneous adsorption and metals are poorly adsorbed through the skin.

Incidental ingestion of soil by a construction worker during hypothetical future construction on the site was evaluated. The hazard index for exposure to the chemicals of concern by this pathway is 0.01 for the maximum case indicating that adverse non-carcinogenic health affects are unlikely to occur. The cancer risk resulting from exposure through this pathway is estimated to be 1.5×10^{-9}. In consideration of the small population of construction workers that would be exposed the cancer risk would be statistically insignificant.

6.2.3 Air

The risk from overall air emissions from AMD 915 was evaluated by the BAAQMD as part of an evaluation required by California Assembly Bill 2508 (AB 2508). This evaluation ranked the air emissions from AMD 915 as a medium risk which required no further modeling or evaluation. It should be stressed that this evaluation is for all air emissions from the AMD 915 facility to which the air stripper offgas contributes a small percentage.

The potential for volatilization of chemicals from groundwater to the surface was also evaluated. Investigations at a neighboring site and at a site in Massachusetts have indicated that this pathway is probably only of concern in the circumstance where the vapors enter structures and become concentrated in indoor air. Since the groundwater contaminant plume is currently contained onsite no residences overlay the plume. The manufacturing facilities that overlay the plume all utilize active ventilation systems which would act in two ways to reduce this potential risk. First the ventilation system, by pumping air into the structure, creates positive pressure thus reducing the rate of infiltration of contaminants into the structure and second the continued influx of air dilutes any contaminants that do enter the structure.

In the hypothetical future case that the site would be re-developed as residential property this exposure pathway would have a minor contribution (less than 1%) to the total risk related to using the contaminated groundwater as a domestic water supply. Therefore this pathway was not evaluated further.

The emissions and risk related to the releases to ambient air from the air stripper at AMD 915 were re-evaluated by AMD in September 1991. Both the flow rate and influent concentration have declined in the last year. This results in reductions in both mass emission and air effluent concentration. Risk estimates based on this revised data using a model developed by California Air Pollution Control Officers Association would predict a risk of less than 1×10^{-5} from this emission. Air effluent control, in the form of vapor phase activated carbon, will be added to the air stripper in the future if required by changes in BAAQMD regulations.

6.3.3 Groundwater

Possible exposure to contaminated groundwater as a result of using this groundwater as a source of domestic water supply was evaluated. This evaluation considered both direct ingestion of the groundwater and exposure to contaminants through the inhalation pathway as a result of showering and other domestic use. According to the BPHE, if no further cleanup action were taken, and if current cleanup actions were halted, no average exposure scenarios were shown to present a non-carcinogenic or carcinogenic risk greater than the EPA allowable risk range. Based on average groundwater contaminant concentration data, the carcinogenic risk from groundwater ingestion is estimated to be 6 per 100,000 (Table 3). The majority of this risk is related to the ingestion of arsenic at concentrations well below the Federal and State maximum contaminant levels (MCLs). The noncarcinogenic hazard index for the average case is less than 1 indicating that toxic health affects would not be expected from the domestic use of this groundwater.

A slightly elevated carcinogenic risk and an elevated hazard index is shown for the maximum exposure scenario. The difference between the two exposure scenarios is that the average case assumes that an adult consumes 1.4 liters of contaminated groundwater water every day for nine years and the maximum case assumes that an adult consumes 2.0 liters of contaminated groundwater water every day for 30 years. Nine years is the 50th percentile residence time and 30 years is the 90th percentile residence time at one location based on recent census data. The risk for the maximum scenario, including both ingestion and inhalation exposures, is 1.25×10^{-3} (Table 3) with a hazard index of 5. The risk without the inclusion of arsenic or the inclusion of 1,1-DCE as a carcinogen for all pathways would be 5.40×10^{-4} with a hazard index of about 6. The hazard index increases as a result of the use of a modified reference dose for 1,1-DCE as specified by EPA Region IX staff toxicologist.

It should be emphasized that there are currently no known plans to use the on-site area for residential purposes. Nor is shallow groundwater currently used for local drinking water; local ordinances require the installation of a sanitary seal through at least the upper 50 feet of the shallow water bearing zones. This would limit use of the most contaminated groundwater for drinking water. In addition, the assumption that all cleanup actions will be discontinued is intended only to provide a baseline for comparison, and does not reflect the current situation or future plans for the AMD 915 site.

TABLE 3
ADULT CARCINOGENIC RISK
AMD 915

CHEMICAL	REPRESENTATIVE EXPOSURE			MAXIMUM EXPOSURE		
	INGESTION	INHALATION	TOTAL	INGESTION	INHALATION	TOTAL
ARSENIC	4.61 X 10^{-5}	NA	4.61 X 10^{-5}	2.82 X 10^{-4}	NA	2.82 X 10^{-4}
CHLOROFORM	2.25 X 10^{-8}	4.36 X 10^{-9}	2.69 X 10^{-8}	3.00 X 10^{-7}	9.36 X 10^{-8}	3.93 X 10^{-7}
CHROMIUM VI	0.00 X 10^{-0}	NA	0.00 X 10^{-0}	0.00 X 10^{-0}	NA	0.00 X 10^{-0}
1,1-DCA	4.22 X 10^{-7}	0.00 X 10^{-0}	4.22 X 10^{-7}	4.68 X 10^{-6}	0.00 X 10^{-0}	4.68 X 10^{-6}
1,1-DCE	1.14 X 10^{-5}	1.76 X 10^{-6}	1.32 X 10^{-5}	3.43 X 10^{-4}	8.52 X 10^{-5}	4.28 X 10^{-4}
PCE	1.16 X 10^{-7}	5.79 X 10^{-10}	1.17 X 10^{-7}	1.11 X 10^{-6}	8.90 X 10^{-9}	1.12 X 10^{-6}
TCE	6.67 X 10^{-6}	4.76 X 10^{-7}	7.15 X 10^{-6}	4.78 X 10^{-4}	5.50 X 10^{-5}	5.33 X 10^{-4}
TOTAL	6.47 X 10^{-5}	2.24 X 10^{-6}	6.70 X 10^{-5}	1.11 X 10^{-3}	1.40 X 10^{-4}	1.25 X 10^{-3}
W/O ARSENIC	1.86 X 10^{-5}	2.24 X 10^{-6}	2.08 X 10^{-5}	8.28 X 10^{-4}	1.40 X 10^{-4}	9.68 X 10^{-4}
W/O ARSENIC OR 1,1-DCE	7.20 X 10^{-6}	4.80 X 10^{-7}	7.68 X 10^{-6}	4.85 X 10^{-4}	5.48 X 10^{-5}	5.40 X 10^{-4}

6.3 PRESENCE OF SENSITIVE HUMAN POPULATIONS

AMD 915 is located in an industrial area and the groundwater contamination plume has been contained onsite. There are no residences above the groundwater plume. The San Miguel School, which currently houses a daycare center and a Headstart Program, is approximately 2000 feet north of the plume boundary. The nearest residences are more than 500 feet from the site boundary. There are also no public parks, hospitals, or convalescent homes within or near the plume boundaries.

6.4 PRESENCE OF SENSITIVE ECOLOGICAL SYSTEMS

Two endangered species are reported to use South San Francisco Bay, located approximately three miles north of the Study Area. The California clapper rail and the salt marsh harvest mouse are reported to exist in the tidal marshes of the Bay and bayshore. The endangered California brown pelican is occasionally seen in the Bay Area, but does not nest in the South Bay. Ranges of the endangered American peregrine falcon and southern bald eagle include the Bay Area. The southern bald eagle does not use bay and bayshore habitats. The peregrine falcon is making a strong recovery and may be downgraded from endangered to threatened status in specific areas including California in the near future. Nesting peregrines have been noted in the northern bay area, including the Golden Gate Bridge and Bay Bridge, however nesting peregrine falcons have not been reported in the South Bay.

The AMD site Study Area does not constitute critical habitat for endangered species nor does it include or impact any "wetlands". The closest wetlands are about two miles to the north.

6.5 CONCLUSION

Actual or threatened releases of hazardous substances from the Advanced Micro Devices, 915 DeGuigne Drive Superfund site, if not addressed by implementing the response action selected in this ROD may present an imminent and substantial endangerment to the public health, welfare or environment. Based on the fact that a variety of the VOCs detected in the Study Area pose significant health risks as carcinogens or as noncarcinogens and complete exposure pathways exist, EPA has determined that remediation is warranted.

7.0 APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS (ARARS)

Under Section 121(d)(1) of CERCLA, § 9621, remedial actions must attain a degree of clean-up which assures protection of human health and the environment. Additionally, remedial actions that leave any hazardous substance, pollutant, or contaminant on-site must meet a level or standard of control that at least attains standards, requirements, limitations, or criteria that are "applicable or relevant and appropriate" under the circumstances of the release. These requirements, known as "ARARs", may be waived in certain instances, as stated in Section 121(d)(4) of CERCLA, 42 U.S.C. § 9621(d)(4).

"Applicable" requirements are those clean-up standards, standards of control and other substantive environmental protection requirements, criteria, or limitations promulgated under federal or state law that specifically address a hazardous substance, pollutant or contaminant, remedial action, location, or other circumstance at a CERCLA site. "Relevant and appropriate" requirements are clean-up standards, 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, address problems or situations sufficiently similar to those encountered at the CERCLA site that their use is well-suited to the particular site. For example, requirements may be relevant and appropriate if they would be "applicable" but for jurisdictional restrictions associated with the requirement. (See the National Contingency Plan, 40 C.F.R. Section 300.6, 1986).

The determination of which requirements are "relevant and appropriate" is somewhat flexible. EPA and the State may look to the type of remedial actions contemplated, the hazardous substances present, the waste characteristics, the physical characteristics of the site, and other appropriate factors. It is possible for only part of a requirement to be considered relevant and appropriate. Additionally, only substantive requirements need be followed. If no ARAR covers a particular situation, or if an ARAR is not sufficient to protect human health or the environment, then non-promulgated standards, criteria, guidance, and advisories must be used to provide a protective remedy.

7.1 TYPES OF ARARS

There are three types of ARARs. The first type includes "contaminant specific" requirements. These ARARs set limits on concentrations of specific hazardous substance, pollutants, and contaminants in the environment. Examples of this type of ARAR are ambient water quality criteria and drinking water standards. The second type of ARAR includes location-specific requirements that set restrictions on certain types of activities based on site characteristics. These include restriction on activities in wetlands, floodplains, and historic sites. The third type of ARAR includes action-specific requirements. These are 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 for waste treatment, storage, and disposal.

ARARs must be identified on a site-specific basis from information about specific chemicals at the site, specific features of the site location, and actions that are being considered as remedies.

7.2 CONTAMINANT-SPECIFIC ARARS AND TBCS

Section 1412 of the Safe Drinking Water Act, 42 U.S.C. Section 300G-1

Under the authority of Section 1412 of the Safe Drinking Water Act, Maximum Contaminant Levels Goals (MCLGs) that are set at levels above zero, shall be attained by remedial actions for ground or surface water that are current or potential sources of drinking water, where the MCLGs are relevant and appropriate under the circumstances of the release based on the factors in §300.400 (g)(2).

The appropriate remedial goal for each indicator chemical in ground water is the MCLG (if not equal to zero), the federal MCL, or the State MCL, whichever is most stringent.

California's Resolution 68-16

California's "Statement of Policy With Respect to Maintaining High Quality of Waters in California," Resolution 68-16, affects remedial standards. The policy requires maintenance of existing water quality unless it is demonstrated that a change will benefit the people of the State, will not unreasonably affect present or potential uses, and will not result in water quality less than that prescribed by other State policies.

The FS evaluated groundwater cleanup to background or non-detect levels. Cleanup to non-detect levels would increase estimated groundwater cleanup times by over 50% and add significantly to cost. The FS also evaluated cleanup levels necessary to achieve a 1 in 1,000,000 excess cancer risk from future ingestion of the groundwater. This is highly impractical due to the presence of arsenic. The arsenic concentration would have to be reduced to 1.5 μg/l to approach the 1 in a 1,000,000 excess cancer risk. This is far below the current MCL for arsenic of 50 μg/l and is probably below the naturally occurring background of arsenic in groundwater in Santa Clara County.

In addition, cleanup of groundwater to below the MCL for the chemicals of concern may not be achievable due to the technical difficulties in restoring aquifers by the removal of low concentrations of any VOC. This is due to the slow desorption of VOCs adsorbed to the inner pore spaces of soil particles which make up the aquifer material and VOCs adsorbed to clays and organic matter in the aquitard. Cleanup to MCL levels would protect the primary beneficial use of the groundwater as a potential source of drinking water. For these reasons, MCLs were accepted as concentrations that meet the intent of Resolution No. 68-16.

7.3 ACTION SPECIFIC ARARS AND TBCS

National Pollutant Discharge Elimination System (NPDES)

NPDES substantive permit requirements and/or RWQCB Waste Discharge Requirements (WDRs) are potential ARARs for effluent discharges. The effluent limitations and monitoring requirements of an NPDES permit or WDRs legally apply to point source discharges such as those from a treatment system with an outfall to surface water or storm drains. The RWQCB established effluent discharge limitations and permit requirements based on Water Quality Standards set forth in the San Francisco Bay Regional Basin Plan or best available technology standards.

EPA Office of Solid Waste and Emergency Response (OSWER) Directive 9355.0-28

OSWER Directive 9355.0-28 "Control of Air Emissions from Superfund Groundwater Air Strippers at Superfund Groundwater Sites" applies to future remedial decisions at Superfund sites in ozone non-attainment areas. Future remedial decisions include Records of Decisions (RODs), Significant Differences to a ROD and Consent Decrees. AMD 915 is in an ozone non-attainment area. This directive requires such sites to control total volatile organic compound emissions from air strippers and soil vapor extractors to fifteen pounds per day per facility. This directive is not an ARAR, but is a TBC. ARARs with more stringent requirements take precedence over the directive.

Bay Area Air Quality Management District (BAAQMD) Regulation 8, Rule 47

Bay Area Air Quality Management District Board of Directors adopted Regulation 8, Rule 47. This rule is entitled "Air Stripping and Soil Vapor Extraction Operations" and applies to new and modified operations. The rule consists of two standards:

- Individual air stripping and soil vapor extraction operations emitting benzene, vinyl chloride, perchloroethylene, methylene chloride and/or trichloroethylene are required to control emissions by at least ninety percent by weight. Operations emitting less than one pound per day of these compounds are exempt from this requirement if they pass a District risk screen.

- Individual air stripping and soil vapor extraction operations emitting greater than fifteen pounds per day of organic compounds other than those listed above are required to control emissions by at least ninety percent by weight.

Regulation 8, Rule 47 is an ARAR for the implementation of the remedy at AMD 915.

7.4 LOCATION-SPECIFIC ARARS

Fish and Wildlife Coordination Act

The Fish and Wildlife Coordination Act is an applicable requirement for the locations adjacent to Calabazas Creek, Guadelupe Slough and other tributary streams and marshes.

8.0 DESCRIPTION OF ALTERNATIVES

8.1 REMEDIAL ACTION OBJECTIVES

Cleanup of groundwater contamination at the AMD 915 Superfund site focuses on the following remedial objectives:

1. Prevention of the near-term and future exposure of human receptors to contaminated groundwater;

2. Restoration of the contaminated groundwater for future use as a potential source of drinking water;

3. Control of contaminant migration;

4. Monitoring of contaminant concentrations in groundwater to observe the control of contaminant migration and the progress of cleanup.

8.2 GROUNDWATER CLEANUP STANDARDS

The cleanup standards must meet all applicable, relevant and appropriate requirements (ARARs) and be protective of human health and the environment. Based on the results of the RI no further soil remediation is anticipated.

After further review it was determined that arsenic was not present at concentrations or in frequency of occurrence that could be considered to be significantly different from background levels of arsenic. Therefore no cleanup standard for arsenic is included. Cleanup standards for groundwater are shown in Tables 4 and 5. The standards for chemicals of concern identified at AMD 915 except for dichlorodifluoromethane (Freon 12) shall be the more stringent of the Federal or California maximum contaminant level (MCLs) for drinking water. The cleanup standard for Freon 12 is based on Federal ambient water quality criteria (WQC). Since groundwater cleanup levels are based on Federal or State MCLs or Federal WQC, this will satisfy all ARARs for groundwater cleanup.

Tables 4 and 5 show the hazard indices and risk calculations for the chemicals of concern at the cleanup standards. These tables include vinyl chloride even though it has not currently been detected at the site since it is a known human carcinogen and is a breakdown product of other chemicals detected in groundwater at the AMD 915 site. As an extra measure of protection, the potential risk and hazard related to use of water as a domestic supply after the cleanup standards have been met has been evaluated assuming a 70 year lifetime exposure. The noncarcinogenic hazard index for the sixteen chemicals of concern assuming that all sixteen chemicals are present at the cleanup standards set for the AMD 915 Superfund site is 1. The excess cancer risk predicted as a result of inhalation and ingestion of groundwater containing the six chemicals of concern that are known or suspected carcinogens is 6.19×10^{-4}. While Chromium VI is a chemical of concern and is a known human carcinogen it is not included in the calculation of carcinogenic risk since it is not a carcinogen through the ingestion pathway. Since Chromium VI is not volatile it would not result in an exposure through the inhalation route in a domestic use scenario.

The health hazard and risk estimates above include 1,1-DCE which is classified by the EPA only as a possible human carcinogen. This classification is currently under review and the California Department of Health Services (DOHS) does not recommend including 1,1-DCE in risk calculations as a carcinogen. Based on the recommendation of DOHS and with guidance from EPA Region IX the risk after cleanup has also been evaluated without the inclusion of 1,1-DCE as a carcinogen. Under EPA Region IX guidance 1,1-DCE is summed in the hazard index with a more protective reference dose to provide additional consideration of possible carcinogenic effects.At AMD 915 the carcinogenic risk after cleanup for all chemical of concern associated with the potential future use scenario of 70 years of groundwater ingestion and inhalation of VOCs is 3.1×10^{-4}. The adjusted hazard index would be greater than 1, which indicates that it is more appropriate to include 1,1-DCE as a carcinogen for this case and to consider the risk and hazard figures cited above as representative for the AMD 915 site.

In cleaning up TCE and 1,1-DCE, the dominant chemicals in mass and concentration, to their respective MCLs of 5.0 μg/l and 6.0 μg/l, it is quite likely that the concentrations of other VOCs will be reduced to levels below the cleanup criteria. Therefore an additional risk estimate, based on cleanup to MCL levels or current maximum concentration when these maximum concentrations are less than MCLs has been developed (Table 6). This is an attempt to provide a more realistic estimate of the residual risk after cleanup is achieved.

The noncarcinogenic hazard index associated with the cleanup standards at AMD 915 for the representative or average case is 0.25 and 0.36 for the maximum case. This is indicative that no toxic effects would be expected from the domestic use of groundwater after cleanup at the AMD 915 facility.

The health hazard and risk estimates above include 1,1-DCE which is classified by the

EPA only as a possible human carcinogen. Based on the recommendation of DOHS and with guidance from EPA Region IX as detailed above the risk after cleanup has also been evaluated without the inclusion of 1,1-DCE as a carcinogen. The carcinogenic risk without 1,1-DCE is 4 x 10^{-6} for the average or representative case and 2 x 10^{-5} for the maximum plausible case. The revised hazard indices are 0.37 for the average case and 0.53 for the maximum case. The maximum case was considered in setting cleanup standards.

The compliance boundary includes all groundwater within the plume boundaries as indicated in Figure 5, all groundwater monitored in existing wells, and any contaminated groundwater identified by additional monitoring wells installed upon RWQCB or EPA request for the purpose of monitoring potential vertical or horizontal migration of groundwater contaminant plumes currently located in the A and B aquifer zones.

8.3 REMEDIAL ACTION ALTERNATIVES

Initially, a large number of cleanup methods (technologies) were screened with respect to their effectiveness, implementability, and order-of-magnitude cost. The methods which passed this initial screening were then combined into cleanup alternatives most applicable to the AMD 915 site and evaluated in detail. As listed below these include cessation of remedial action, monitoring, and institutional controls for the onsite area, groundwater extraction with treatment of the extracted water by air stripping with polish by carbon adsorption, groundwater extraction with treatment of the extracted water by carbon adsorption, and groundwater extraction with treatment of the extracted water by UV/H_2O_2 Oxidation.

Alternative 1: No Action - Monitoring The no action alternative includes completely stopping operation of the existing groundwater treatment system which has been operating for the last 6 years and imposes site restrictions on future use of the property. Contaminant concentration would be reduced by the natural processes of physical and chemical degradation and dispersion as the plume continued to migrate north toward San Francisco Bay. Since it is uncertain when the groundwater would return to background levels groundwater monitoring would continue.

Alternative 2: Extraction - Air Stripping and Liquid Phase Carbon Adsorption This alternative comprises the current interim remedial system for the groundwater (extraction wells, air stripper and liquid phase carbon adsorption). Air stripping as a stand-alone technology is very effective in removing VOCs from groundwater at the AMD 915 site. Further polishing of the air stripper effluent by carbon adsorption provides additional treatment. The treatment, reuse, and discharge of the treated groundwater will continue to be regulated by the RWQCB under an NPDES permit. Air emissions will continue to be regulated by the BAAQMD. Deed restrictions would be included to prevent use of A and B zone groundwater while remediation is underway.

TABLE 4, HAZARD INDEX AT CLEANUP STANDARDS

	AMD 915 HAZARD INDEX, CONCENTRATION (Cw) SET AT ARARs								
	HAZARD INDEX = CDI/RfD			CDI = Chronic Daily Intake			RfD = Reference Dose		
	Cw = ARARs, TBCs, or cleanup goals								
No.	CHEMICAL	Cw µg/l	WOE	ORAL RfD	CDI	HI	Inhalation RfD	Inhalation HI	TOTAL HI
1	CHLOROFORM	0.100	MCL\B2	0.01	2.86e-03	2.86e-01	NA	0.00	2.86e-01
2	CHROMIUM III	0.050	MCL\D	1	1.43e-03	1.43e-03	NA	0.00	1.43e-03
3	CHROMIUM VI	0.050	MCL\D	0.005	1.43e-03	2.86e-01	NA	0.00	2.86e-01
4	DICHLORODIFLUOROMETHANE	0.00019	WQC\D	0.200	5.43e-06	2.71e-05	0.05	1.09e-04	1.36e-04
5	1,1-DCA	0.005	CA MCL\B2	0.100	1.43e-04	1.43e-03	0.1	1.43e-03	2.86e-03
6	1,1-DCE	0.006	CA MCL\C	0.009	1.71e-04	1.90e-02	NA	0.00	1.90e-02
7	cis-1,2-DCE	0.006	CA MCL\D	0.02	1.71e-04	8.57e-03	NA	0.00	8.57e-03
8	trans-1,2-DCE	0.010	CA MCL\D	0.02	2.86e-04	1.43e-02	NA	0.00	1.43e-02
9	FREON 113	1.200	CA MCL\D	3	3.43e-02	1.14e-02	NA	0.00	1.14e-02
10	PCE	0.005	MCL\B2	0.01	1.43e-04	1.43e-02	NA	0.00	1.43e-02
11	TOLUENE	2.000	MCL\D	0.3	5.71e-02	1.90e-01	0.6	9.52e-02	2.86e-01
12	1,2,4-TCB	0.009	MCL\D	0.02	2.57e-04	1.29e-02	0.003	8.57e-02	9.86e-02
13	1,1,1-TCA	0.200	MCL\D	0.09	5.71e-03	6.35e-02	0.3	1.90e-02	8.25e-02
14	TCE	0.005	MCL\B2	NA	1.43e-04	0.00	NA	0.00	0.00
15	TRICHLOROFLOUROMETHANE	0.150	CA MCL\NA	0.3	4.29e-03	1.43e-02	0.01	2.14e-02	3.57e-02
16	VINYL CHLORIDE	0.0005	CA MCL\A	NA	1.43e-05	0.00	NA	0.00	0.00
				TOTAL HAZARD INDEX =		.92e00		2.23e-01	1e+00
	IRIS = IRIS ORAL REFERENCE DOSE								
	DWHA = DRINKING WATER HEALTH ADVISORY								
	WQC = NATIONAL AMBIENT WATER QUALITY CRITERIA FOR PUBLIC HEALTH								

	MCL = FEDERAL MCL
	CA MCL = CALIFORNIA MCL
	WOE = WEIGHT OF EVIDENCE = SOURCE OF DATA
	A = KNOWN HUMAN CARCINOGENS
	B1 = PROBABLE HUMAN CARCINOGEN (limited human evidence, adequate evidence from animals)
	B2 = PROBABLE HUMAN CARCINOGEN (inadequate human evidence, adequate evidence from animals)
	C = POSSIBLE HUMAN CARCINOGEN (limited evidence of carcinogenity, animal studies only)

TABLE 5, CANCER RISK AT CLEANUP STANDARDS

AMD 915		CHEMICAL CONCENTRATION SET TO CLEANUP STANDARDS						
DETERMINATION OF EXCESS LIFETIME CANCER RISK FOR CARCINOGENS								
EXCESS LIFETIME CANCER RISK = CDI x q*								
q* = CANCER POTENCY FACTOR (MG/KG/DAY)-1			CDI = Chronic Daily Intake (MG/KG)					
Cw = ARARs, TBCs, or cleanup goals								
CHEMICAL	Cw MG/L	WOE\CLASS OF CARCINOGEN	ORAL q*	CDI	RISK	INHALATION q*	INHALATION RISK	TOTAL RISK
CHLOROFORM	0.100	IRIS\B2	6.10e-03	2.86e-03	1.74e-05	8.10e-02	2.31e-04	2.49e-04
1,1-DCA	0.005	CA MCL\B2	9.10e-02	1.43e-04	1.30e-05	NA	0.00	1.30e-05
1,1-DCE	0.006	CA MCL\C	6.00e-01	1.71e-04	1.03e-04	1.20e+00	2.06e-04	3.09e-04
PCE	0.005	MCL\B2	5.10e-02	1.43e-04	7.29e-06	3.30e-03	4.71e-07	7.76e-06
TCE	0.005	MCL\B2	1.10e-02	1.43e-04	1.57e-06	1.70e-02	2.43e-06	4.00e-06
VINYL CHLORIDE	0.0005	CA MCL\A	2.30[illegible]	1.43e-05	3.29e-05	2.95e-01	4.21e-06	3.71e-05
			EXCESS CANCER RISK		1.75e-04		4.44e-04	6.19e-04
		EXCESS CANCER RISK W/O 1,1-DCE			7.20e-05		2.38e-04	3.10e-04
WOE = WEIGHT OF EVIDENCE = SOURCE OF DATA								

MCL = FEDERAL DRINKING WATER MAXIMUM CONTAMINANT LEVEL							
CAMCL = CALIFORNIA DRINKING WATER MAXIMUM CONTAMINANT LEVEL							
A = KNOWN HUMAN CARCINOGENS							
B1 = PROBABLE HUMAN CARCINOGEN (limited human evidence, adequate evidence from animals)							
B2 = PROBABLE HUMAN CARCINOGEN (inadequate human evidence, adequate evidence from animals)							
C = POSSIBLE HUMAN CARCINOGEN (limited evidence of carcinogenity, animal studies only)							

Alternative 3: Extraction - Carbon Adsorption Alternative This alternative consists of extraction of groundwater using the current well system. The extracted groundwater could then be passed directly through granular activated carbon designed for liquid phase adsorption of VOCs. Use of the air stripper would be discontinued. The treatment, reuse, and discharge of the treated groundwater will continue to be regulated by the RWQCB under an NPDES permit. Deed restrictions would be included to prevent use of A and B zone groundwater while remediation is underway.

Alternative 4: Extraction - UV/H_2O_2 Oxidation This alternative consists of extraction of groundwater using the current network of wells. Oxidation enhancers such as hydrogen peroxide (H_2O_2) would be mixed with the groundwater which is then exposed to ultraviolet light in the reactor. The reactor offgas would be treated by a catalytic oxidizer to ensure compliance. The treated groundwater would be recycled into onsite operations and the excess disposed of to the storm drain. The treatment, reuse, and discharge of the treated groundwater would continue to be regulated by the RWQCB under an NPDES permit. Air emissions will continue to be regulated by the BAAQMD. Deed restrictions would be included to prevent use of A and B zone groundwater while remediation is underway.

9.0 COMPARATIVE ANALYSIS OF ALTERNATIVES

This section provides an explanation of the criteria used to select the remedy, and an analysis of the remedial action alternatives in light of those criteria, highlighting the advantages and disadvantages of each of the alternatives.

9.1 CRITERIA

The alternatives were evaluated using nine component criteria. These criteria, which are listed below, are derived from requirements contained in the National Contingency Plan (NCP) and CERCLA Sections 121(b) and 121(c).

1. Overall protection of human health and the environment.

2. Short term effectiveness in protecting human health and the environment.

3. Long-term effectiveness and permanence in protecting human health and the environment.

4. Compliance with ARARs (ARARs are detailed in Section 7.0).

5. Use of treatment to achieve a reduction in the toxicity, mobility or volume of the contaminants.

TABLE 6

HEALTH INDICES AND CANCER RISK FOR CLEANUP STANDARDS OR CURRENT MAXIMUM CONCENTRATIONS

CHEMICAL	CONCENTRATION µg/l	REFERENCE	EPA MCL/MCLG (PROPOSED)	CANCER RISK	HAZARD INDEX
CHLOROFORM	4.3	CURRENT MAX	100.0	3.94×10^{-7}	0.01
CHROMIUM (III)	50	MCL	50.0	0.0	0.001
CHROMIUM (VI)	50	MCL	50.0	NA	0.3
FREON 12	0.19	EPA WQC	NA	NA	0.00003
1,1-DICHLOROETHANE	4.5	CURRENT MAX	5.0	4.68×10^{-6}	0.001
1,1-DICHLOROETHENE	6.0	CA MCL	7.0	5.13×10^{-5}	0.02
cis-1,2-DICHLOROETHENE	6.0	CA MCL	(70.0)	NA	0.009
trans-1,2-DICHLOROETHENE	2.1	CURRENT MAX	(100.0)	NA	0.003
FREON 113	260	CURRENT MAX	1200	NA	0.0003
TETRACHLORETHANE	1.9	CURRENT MAX	5	1.12×10^{-6}	0.005
TOLUENE	4.0	CURRENT MAX	(1000)	NA	0.0004
1,2,4-TRICHLOROBENZENE	3.6	CURRENT MAX	(100)	NA	0.006
1,1,1-TRICHLOROETHANE	44	CURRENT MAX	200	NA	0.02
TRICHLOROETHENE	5.0	MCL	5.0	7.01×10^{-7}	NA
TRICHLOROFLUOROMETHANE	1.2	CURRENT MAX	150	NA	0.0001
VINYL CHLORIDE	0.5	CA MCL	2.0	1.34×10^{-5}	NA
TOTAL				5.8×10^{-5}	0.36
TOTAL WITH MODIFIED 1,1-DCE Rfd				6.7×10^{-6}	0.53

6. Implementability.

7. State acceptance/Support Agency acceptance.

8. Community acceptance.

9. Cost.

9.2 ANALYSIS OF ALTERNATIVES

PROTECTION OF HUMAN HEALTH AND THE ENVIRONMENT

Alternatives 2, 3 and 4 basically provide equal protection of human health and the environment because they all extract ground water that contains contaminants at concentrations above drinking water standards. Extraction prevents further migration of the plume. Deed restrictions protect against use of the aquifers before cleanup is completed. After cleanup using Alternatives 2, 3 and 4, the predicted carcinogenic risk without 1,1-DCE would be 6 x 10^{-6} for the maximum plausible case. This is a reduction of over 95% from the projected carcinogenic risk whether arsenic and 1,1-DCE are considered as carcinogens or arsenic is deleted and 1,1-DCE is evaluated as noncarcinogen with a modified reference dose. Water discharged following treatment would meet NPDES requirements which are protective of human health and the environment.

Alternative 3 and 4 could be considered slightly more protective than Alternative 2 since they would not involve the transfer of groundwater contaminants to the air. Alternatives 2 and 3 both involve the destruction of some contaminants by regeneration of the granular activated carbon. Alternative 4 would result in the destruction of most contaminants as part of the treatment process. Air emissions from Alternative 2 are considered sufficiently protective, however, since they fall within the EPA acceptable cancer risk range at 1 X 10^{-5} and meet BAAQMD permit requirements.

Alternative 1 is less protective than Alternatives 2, 3 and 4 because it would allow the contaminated ground water to continue migrating. Deed restrictions and well permit restrictions would need to be imposed for a significantly greater amount of time than those of Alternatives 2, 3 and 4, since natural attenuation of groundwater contaminant concentrations would require an undetermined amount of time probably greater than 100 years as compared to the approximately 12 year cleanup time for Alternatives 2, 3 and 4.

Alternative 1 provides no reduction in risk. While future use of the contaminated ground water may be unlikely, a future user of the contaminated ground water would be exposed to a cancer risk of 1.25 X 10^{-3} and an HI of 5. Alternative 1 is least protective of human health and the environment. Because it does not include deed restrictions, Alternative 1 greatly increases the chances that an individual will install a well into a migrating plume.

COMPLIANCE WITH ARARS

Alternatives 2, 3 and 4 would attain all pertinent ARARS identified in Section 7. The Safe Drinking Water Act MCLs and California Department of Health Services DWALs would be achieved by extracting ground water contaminated above these levels. NPDES permit requirements would be met by proper design and operation of either treatment system. The Fish and Wildlife Coordination Act would not be an ARAR for Alternatives 2, 3 or 4 because the groundwater extraction system would prevent the plume from reaching surface waters or wet lands and the treatment system would ensure that discharged water was protective of human health and the environment.

The RCRA land disposal restrictions would apply to the spent carbon from Alternatives 2 and 3 and would additionally apply to Alternative 2 in the event that it became necessary to implement air stripper emissions control involving gas-phase activated carbon. The spent carbon would be treated before reuse or disposal by an incineration process.

Only Alternative 2 would need to comply with OSWER Directive 9355.0-28 and BAAQMD Regulation 8, Rule 47 because of the air stripper emissions. These ARARs are addressed by the BAAQMD permitting process. If air stripper operational modifications become necessary, emissions would be captured and destroyed by available technology.

The drinking water ARARS would not be attained by Alternative 1 since contamination would be left in place. The Fish and Wildlife Coordination Act would become an ARAR if the plume migrated to Calabazas Creek and other tributary streams and marshes. California's resolution 68-16 would not be achieved since the groundwater contaminants would unreasonably affect the present and potential uses of the upper aquifers. RCRA land disposal restrictions, NPDES requirements, BAAQMD Regulation 8, and OSWER Directive 9355.0-28 would not apply to Alternative 1 since no treatment is included.

REDUCTION OF TOXICITY, MOBILITY, OR VOLUME THROUGH TREATMENT

Alternatives 2, 3 and 4 reduce the toxicity, mobility, and volume of groundwater contaminants by removing greater than 99% of the contaminants from the extracted ground water. Alternative 2 transfers part of the contaminants to ambient air where their toxicity, mobility, and volume as air contaminants actually increases. In addition, some of the VOCs are ozone precursors. The current air stripper is operating under a BAAQMD permit that does not require emissions control. The remaining contaminants are concentrated onto granular activated carbon, which would then be regenerated or properly disposed at a landfill. Contaminants would potentially be destroyed during carbon regeneration, making any future release of the removed contaminants impossible. The levels of contaminants that remain in the treated water will be regulated by an NPDES permit.

Alternative 3 would concentrate up to 99% of the contaminants onto granular activated carbon, which would then be regenerated or properly disposed at a landfill. Contaminants would potentially be destroyed during carbon regeneration, making any future release of the removed contaminants impossible. Contaminants that remain in the treated groundwater would be discharged to surface water under the regulations of an NPDES permit.

Alternative 4 would mix oxidizing chemicals with contaminated groundwater prior to exposure to ultraviolet light sources. This process results in the breakdown of many halogenated chemicals with rates of reduction that vary by chemical species. The rate of destruction has varied from 90 to 99% for the halogenated solvents that are the primary chemicals of concern at the AMD 915 facility. A pilot test of this technology was completed at a neighboring facility with similar chemicals. The rates of destruction were highly variable and some chemicals required multiple treatments to achieve standards. The air effluent would be treated by a catalytic convertor and regulated by BAAQMD regulations. If successful the technology would result in the immediate destruction of 90 to 99% of the contaminants. Contaminants that remain in the treated groundwater would be discharged to surface water under the regulations of an NPDES permit.

Alternative 1 would not result in any reduction of toxicity, mobility, or volume.

LONG-TERM EFFECTIVENESS AND PERMANENCE

Alternatives 2, 3, and 4 include groundwater extraction which is intended to reduce the level of contamination in the A and B Aquifer Zones to the cleanup standards indicated in Section 8.2. Thus, potential risks to the community currently posed by the site in its present condition are minimized. To ensure that the magnitude of residual risks are minimized, the performance of the groundwater extraction system will be carefully monitored on a regular basis and adjusted as warranted by the performance data collected during operation.

The potential future risk from long-term exposure to volatilized contaminants that are emitted from the soil and accumulate inside residences is addressed by the groundwater extraction system in Alternatives 2, 3, and 4. Groundwater extraction reduces the amounts of contaminants that could volatilize into the soil gas and eventually into surface air. Furthermore, deed restrictions will prevent the use of the most

Alternative 4 may have some technical limitations. Several pilot scale studies of UV/oxidation technology have been completed in Santa Clara County with varied results. The initial study at Lorentz Barrel and Drum indicated that a similar technology was not successful in destroying over 90% of the chemicals of concern especially some halogenated solvents. A similar result was also noted from a pilot scale test completed at the TRW Microwave facility. An additional study was completed at the Lorentz Barrel and Drum site with more promising results. This may be indicative that as this innovative technology matures results will improve, however the reliable destruction of highly halogenated compounds is questionable.

There are no technical concerns regarding the implementability of Alternative 1. Institutional controls required in Alternatives 2, 3, and 4 are administratively feasible.

COST

All costs estimates are based on present calculations. The time for operation is assumed to be 30 years for the no action alternative and the length of time estimated to achieve cleanup for the active alternatives. The cost for Alternative 1 is $1.5 million. This cost is the result of ongoing monitoring.

The present net worth cost for Alternative 2 is estimated to be $2.1 million. Since the system is in place as an interim remedial action no additional capital costs are included in this estimate. Extraction system operation and treatment testing and evaluation make up approximately 58% of this cost with the remaining 42% as a result of groundwater monitoring. The estimated time to achieve background levels of chemicals is 18 years at an estimated present net worth cost $2.8 million.

The present net worth cost of for Alternative 3 is estimated to be $5.1 million. It is estimated that this alternative could reach MCLs in 12 years. The estimates to achieve background levels of chemicals is 18 years at an estimated present net worth cost $6.7 million. The additional capital cost for this alternative has a present worth of $0.08 million. The majority of the increased cost as compared to Alternative 2 is the cost of carbon replacement/regeneration.

The present net worth cost of Alternative 4 is estimated to be $4.0 million. It is estimated that this alternative could reach MCLs in 12 years. The estimates to achieve background levels of chemicals is 18 years at an estimated present net worth cost $5.1 million. The additional capital cost for this alternative has a present worth of $0.6 million. The major cost factor for this alternative is increased operation cost. The increased operation cost is the result of increased operator time and cost and the large increase in electrical power consumption.

most contaminated groundwater prohibiting well drilling into any of the aquifers below the site. Due to current zoning, there are no residences above or in close proximity to the overall plume. Consideration should be given to re-evaluating the risk to residents from the exposures specified above in the future. If necessary, based on future evaluation, fans or other ventilation aids could be provided to any affected buildings, and other precautions would be taken to protect potential future residents.

Treatment by air stripping provided by Alternative 2 is reliable for the long-term removal of VOCs from the ground water. Treatment residuals are expected to be negligible based on the high volatility of the compounds present in the ground water.

Treatment by aqueous phase granular activated carbon provided by Alternatives 2 and 3 is reliable for the removal of VOCs from the ground water. Treatment residuals are expected to be negligible since they will be concentrated on a relatively small amount of carbon that will either be properly disposed in a landfill or regenerated by a destructive technology.

Alternative 1 provides no long-term effectiveness.

SHORT-TERM EFFECTIVENESS

The short-term impact to the health of workers and the community will be very minimal for Alternatives 2, 3, and 4 because the groundwater extraction system is already in place as the interim remedial action at the site. There would be no current additional risks since the plume is already contained and the treatments are protective. Groundwater cleanup time is estimated to require about 12 years. Uncontrolled air emissions from Alternative 2 make it slightly less effective in protecting health and the environment than Alternatives 3 and 4 in the short-term.

Alternative 1 does not include the implementation of treatment remedies; therefore, there are no additional risks to the community. Risks associated with the contaminant plume would remain at the site for over 100 years until natural attenuation reduces the contaminant concentrations down to the cleanup standards.

IMPLEMENTABILITY

Alternatives 2, 3, and 4 include the same extraction system which is already in place. Both alternatives provide groundwater treatment with either an air stripper or carbon adsorption. Both methods are proven technologies, however due to the large treatment volumes at the AMD 915 facility it is unclear that the size or number of carbon vessels required is not a technical problem due to onsite space limitations. In addition, both alternatives are administratively feasible using existing permits for discharge or air emissions.

SUPPORT AGENCY ACCEPTANCE

The Feasibility Study and the Proposed Plan Fact Sheet were reviewed by the RWQCB and they concur with EPA's preferred alternative.

COMMUNITY ACCEPTANCE

The Proposed Plan was presented to the community of Sunnyvale in a public meeting on March 27, 1991 and in a fact sheet. A single technical comment was received regarding the efficacy of groundwater extraction under the current drought conditions. The drought condition is considered to be a temporary condition that will not effect the long term operation of the groundwater extraction system. Other comments received are addressed in the Responsiveness Summary (Appendix A).

9.3 THE SELECTED REMEDY

9.3.1 Basis of Selection

Maintaining the existing groundwater extraction system with the existing treatment system of an air stripper followed by carbon adsorbtion (Alternative 2) is the selected remedy for the AMD 915 Superfund site. This remedy addresses only the contaminated ground water since all contaminated soils and structures were removed during the interim remedial action.

Alternatives 2, 3, and 4 were the only alternatives that met all of the nine criteria and adequately addressed the remedial action objectives. The only difference between the three alternatives is the type of treatment. Air stripping and carbon adsorption are equally effective at treating the groundwater contaminants, and only differ in the area of treatment residuals. Under a current BAAQMD permit, residual contaminants from the air stripper are discharged directly to the air. Residual contaminants adsorbed to the liquid-phase granular activated carbon would be destroyed during regeneration as treatment prior to confinement as a small concentrated volume in a proper landfill.

Despite slight advantages of carbon adsorption and UV/H_2O_2 oxidation in dealing with treatment residuals resulting in better reduction of toxicity, mobility, and volume, the existing treatment system provides several advantages. These advantages include the fact that the air stripper with carbon polish costs two to four times less than either carbon adsorption or UV/H_2O_2 oxidation and the existing system and carbon adsorption are both proven technologies, however it is uncertain that carbon adsorbtion with the high flow volumes at AMD 915 would be reliable or practical since it would require very large treatment units or frequent carbon regeneration. The air stripper and small carbon polish unit are already installed and operating in accordance with current permits. In addition, residuals from the air stripper could potentially be captured and destroyed by available emissions control technology if permit modifications become necessary. Therefore, Alternative 2 was selected as the groundwater remedy for AMD 915.

9.3.2 Features of the Remedy

Alternative 2 maintains the existing groundwater extraction system with the existing air stripper for a present worth cost of 1.5 million dollars. It is already implemented and operating with acceptance from the community and federal, state, and local agencies. Alternative 2 consists of the following features:

- Groundwater extraction from eight on-site wells, four A Aquifer wells 2 B1 aquifer wells and 2 B2 aquifer wells. These wells send a combined flow of approximately 50 gpm to the air stripper. The well locations and pumping rate contain the plume and prevent further migration of VOC-contaminated ground water. The theoretical cancer risk of 2×10^{-3} for a future use of drinking water contaminated with vinyl chloride, 1,1 DCA, PCE, and TCE will be continually reduced over an estimated 12 year period to a risk for a 70 year lifetime exposure of 6.7×10^{-6}. Thus, groundwater extraction until drinking water standards are achieved will attain ARARs and permanently restore the contaminated aquifers to their maximum beneficial uses.

- Air stripping will remove more than 99% of the VOCs from the extracted ground water allowing the treated effluent to be discharged under an existing NPDES permit to a storm tributary to Calabazas Creek without degrading this surface water or presenting a significant risk to human health and the environment. The stripped VOCs are emitted directly to the air under an existing BAAQMD permit. The air stripper will include air emissions control if emissions exceed levels permitted by the BAAQMD.

- Periodic groundwater monitoring will verify plume containment, determine current plume boundaries, and follow the decrease in VOC concentrations as the cleanup progresses.

- Institutional controls in the form of a deed restriction filed by the discharger will be required to limit access to site groundwater until the cleanup standards have been met.

- Reuse of 100% of the treated effluent is the required goal for the extraction and treatment system.

9.3.3 Uncertainty in the Remedy

The goal of this remedial action is to restore groundwater to its beneficial uses, which at this site include a potential source of drinking water. Based on information obtained during the RI and on a careful analysis of all remedial alternatives, EPA and the RWQCB believe that the selected remedy will achieve this goal. It may become apparent, during implementation or operation of the system and its modifications, that contaminant levels have ceased to decline and are remaining constant at levels higher than the cleanup standards over some portion of the plume. In such a case, the system performance standards and/or the remedy may be reevaluated by EPA.

The selected remedy will include groundwater extraction for an estimated period of 12 years at AMD 915, during which the system performance will be carefully monitored on a regular basis and adjusted as warranted by the performance data collected during operation. Modifications may include any or all of the following:

a) at individual wells where cleanup standards have been attained, pumping may be discontinued;

b) alternating pumping at wells to eliminate stagnation points;

c) pulse pumping to allow aquifer equilibration and allow adsorbed contaminants to partition into groundwater; and

d) installation of additional extraction wells to facilitate or accelerate cleanup of the contaminant plume.

To ensure that cleanup standards continue to be maintained, the aquifer will be monitored at those wells where pumping has ceased on an occurrence of every five years following discontinuation of groundwater extraction.

10.0 STATUTORY DETERMINATIONS

The selected remedy protects human health and the environment through extraction and treatment of VOC-contaminated groundwater. The selected remedy will comply with Section 121 of CERCLA. This remedy addresses only the contaminated groundwater since all contaminated soil and structures were removed during the interim remedial actions. The reductions in risk are summarized for groundwater extraction and treatment in Section 9.3.2 of this ROD. There are no long-term or short-term threats associated with the selected remedy that cannot be readily controlled. In addition, no adverse cross-media affects are expected from the remedy.

The selected remedy will comply with all of the identified chemical, action, and location specific ARARs that are described in Section 7 of this ROD. In the event that it becomes apparent that the drinking water ARARs may not be achievable as described in Section 9.3.3 of this ROD, the system performance standards and/or the remedy may be reevaluated.

The present worth cost of the selected remedy is $2.1 million. It is the least costly of three alternatives that provide equal protection of human health and the environment. The selected remedy is already installed and operating in accordance with current permit requirements for discharge of treated groundwater and for air emissions.

The selected remedy uses permanent solutions and alternative treatment (or resource recovery) technologies to the maximum extent practicable and satisfies the statutory preference for remedies that employ treatment that reduces toxicity, mobility, or volume as a principal element. Section 9.3.2 of this ROD summarizes the key features of the selected remedy. The remaining toxicity, mobility, and volume of contaminants emitted from the air stripper could potentially be captured and destroyed by available emissions control technology if permit modifications become necessary.

Because the remedies will result in hazardous substances remaining on-site above health-based levels, a five-year review, pursuant to CERCLA Section 121, 42 U.S.C. Section 9621, will be conducted at least once every five years after initiation of the remedial action to ensure that the remedy continues to provide adequate protection of human health and the environment.

11.0 DOCUMENTATION OF SIGNIFICANT CHANGES

There were no significant changes between the preferred alternative and this Record of Decision.

PART III. RESPONSIVENESS SUMMARY

1.0 INTRODUCTION

This responsiveness summary reviews comments and questions regarding the Remedial Investigation/Feasibility Study (RI/FS) and Proposed Final Cleanup Plan (proposed plan) for Advanced Micro Devices facilities at 901/902 Thompson Place (AMD 901/902) and 915 DeGuigne Drive (AMD 915), the former TRW Microwave at 825 Stewart Drive (TRW) the Signetics facility at 811 E. Arques, all in Sunnyvale. A single responsiveness summary was prepared for this group of Superfund sites because actions at all sites potentially impact the same local community. The study area that encompasses AMD 901/902, Signetics, and TRW has been divided into four area-specific operable units. Separate proposed plans have been developed for each of these four operable units and for AMD 915.

This summary includes comments received during the 60 day period from the opening of public comment at the Board meeting of March 20, 1991 through the close of public comment on May 20, 1991. All comments during this period were received by the RWQCB. Additional opportunity for comment was given to the public at the RWQCB meeting on June 19, 1991. This Record of Decision does not include any significant changes to the proposed plan presented at the community meeting of March 27, 1991 and does not differ significantly from the plan adopted by the RWQCB.

2.0 REGIONAL WATER QUALITY CONTROL BOARD RESPONSES

Since RWQCB is the lead agency for AMD 915 and received all comments, RWQCB prepared the Responsiveness Summary (Attachment A). EPA, as the support agency, has reviewed and concurs with the RWQCB responses.

Written comments were received from Santa Clara Valley Water District (SCVWD); Supervisor Ron Gonzales, Santa Clara County Board of Supervisors; Santa Clara County Office of Education; Silicon Valley Toxics Coalition (SVTC); San Miguel Homeowners Association; California Department of Health Services, Environmental Epidemiology and Toxicology Branch (EETB); and two community members, Gary Holton and John Schwartz. Specific comments received at the community meeting held at the Westinghouse Auditorium in Sunnyvale, March 28, 1991, general comments from an informal meeting held May 7, 1991 at the San Miguel School site in Sunnyvale and verbal comments received by telephone during the comment period and two meetings with the San Miguel Homeowners Association, May 23 and May 30, 1991, will also be outlined and addressed separately. The comments by SCVWD and Gary Holton were supportive of the proposed plan, as outlined above, and as such will not require a specific response.

The attached Responsiveness Summary is divided into two parts; Part I provides a summary of the major issues raised by commentors and focuses on the concerns of the local community; Part II is a more technical response to all significant comments.