DECISION SUMMARY

1. Site Name, Location, and Description

APPLIED MATERIALS, INC.
3050 BOWERS AVENUE BUILDING 1 FACILITY
CITY OF SANTA CLARA, SANTA CLARA COUNTY
STATE OF CALIFORNIA

The Applied Materials, Inc. Superfund site (AM or the site), is located at 3050 Bowers Avenue in the City of Santa Clara. Applied Materials manufactures vapor deposition equipment used in the semiconductor industry in its Building 1 plant. Building 1 is located on a nine-acre parcel about 6.4 miles south of San Francisco Bay and within one mile of Calabazas, Saratoga, and San Tomas Aquino Creeks (see figures 1 and 2.)

The population of the City of Santa Clara is about 90,000. The population density in the vicinity of the site is about 4,660 people per square mile. Land use near the site is primarily light industrial, commercial and residential. Agricultural use dominated the area before 1970 but presently represents only a small percentage of land use near the site.

The two primary natural resources in the vicinity of AM are land and water. The potential for agricultural use has been greatly reduced by conversion of land to light industrial, commercial and residential use.

Ground water for human consumption is extracted from wells from about 150 to 500 ft deep in the Santa Clara Valley. The nearest drinking water supply well to the AM site is located 3,500 ft upgradient, to the southwest.

Volatile organic compounds (VOCs) were first detected in groundwater in November 1983, in the vicinity of three underground tanks at the west side of Building 1. The predominant pollutant in 1983 was trichloroethane (1,1,1-TCA) at concentrations up to 12,000 parts per billion (ppb); also detected were trichloroethylene (TCE), dichloroethylene (1,1-DCE), dichloroethane (DCA), Freon 113, and other VOCs.

2. Site History and Enforcement Activities

In 1983, Applied Materials discovered that underground tank leakage and/or spills had resulted in the contamination of soil and shallow groundwater with organic solvents, principally 1,1,1-trichloroethane (TCA), with lower concentrations of 1,1-dichloroethane (DCA) 1,1-dichloroethylene (DCE), and with trace amounts of perchloroethylene (PCE), and Freon 113.

AM has been conducting interim cleanup activities consisting of tank and soil removal and groundwater extraction with treatment by air stripping.

In 1984 and 1985, VOCs were detected at concentrations up to 65 milligrams per liter (mg/l) in soil samples collected in the vicinity of the underground tanks. These data suggested that the VOCs were released from the tanks and/or associated piping. The tanks have been excavated and removed. Above 60 cubic yards of contaminated soil were also removed. The excavation was filled and converted into an extraction pit. About 10,000 gallons of water were extracted to remove sediment and develop the pit. Soil borings indicated that some contaminated soils remain in place in the immediate vicinity of the former tanks. Additional soil was not removed because of a perceived threat to the integrity of the Building 1 structure.

Interim groundwater extraction and treatment began in July 1984. AM has installed and maintains nine onsite monitoring wells, including seven in the A zone and two in the underlying B zone, and three piezometers in the A zone in the vicinity of the extraction pit. The extraction system consists of three wells and the extraction pit and removes from 20,000 to 26,000 gallons of water per day. The extracted groundwater is processed through an air stripping unit which discharges to San Tomas Aquino Creek and ultimately to South San Francisco Bay. This discharge is regulated under a NPDES permit from the California Regional Water Quality Control Board, San Francisco Bay Region (the Board).

Prior to the discovery of subsurface contamination at the site, significant VOC concentrations had been detected at three sites bordering the AM property. However, VOC plumes from the neighboring sites do not appear to extend to the AM site and it is probable that no VOCs were present in the shallow groundwater at Building 1 prior to onsite release.

Lead Agency. Pursuant to the South Bay Multi-Site Cooperative Agreement and the South Bay Ground Water Contamination Enforcement Agreement, entered into on May 2, 1985 (as subsequently amended) by the California Regional Water Quality Control Board, San Francisco Bay Region, EPA, and DHS, the Regional Board has been acting as the lead regulatory agency. The Regional Board will continue to oversee the remediation of the site pursuant to CERCLA, the NCP and applicable state law.

Site Listing History and Enforcement Chronology

The site is on the National Priorities List (NPL) and is regulated under Site Cleanup Requirements of the Regional Board as indicated herein:

October 15, 1984	Site proposed for the NPL.
June 19, 1985	Regional Board adopted NPDES Permit NO. CA0028851, for the discharge of treated water to a storm drain system tributary to San Tomas Aquino Creek and South San Francisco Bay.
September 17, 1986	Regional Board adopted waste discharge requirements for the site.
July 22, 1987	Site added to the final NPL.
December 21, 1988	Regional Board adopted a revised NPDES Permit No. CA9928851
September 20, 1989	Regional Board adopted site cleanup requirements Order No. 89-167.
June 20, 1990	Regional Board adopted permit renewal for NPDES Permit No. CA9928851.
September 19, 1990	September 19, 1990 Regional Board adopted amendments to site cleanup requirements Order No. 90-134.

3. Community Participation

May 1989:	Fact Sheet No.1
	RI/FS completed
June 1989:	Fact Sheet No. 2, Proposed Final Cleanup
June 15, 1989:	Notice of public meeting published in Santa Clara American
June 21, 1989 -	July 21, 1989: Public Comment Period
	Documents available at the Santa Clara
----------	Public Library and the Regional Board
June 21, 1989:	Public Hearing on Proposed Plan
June 22, 1989:	Notice of public meeting published in the Santa Clara American

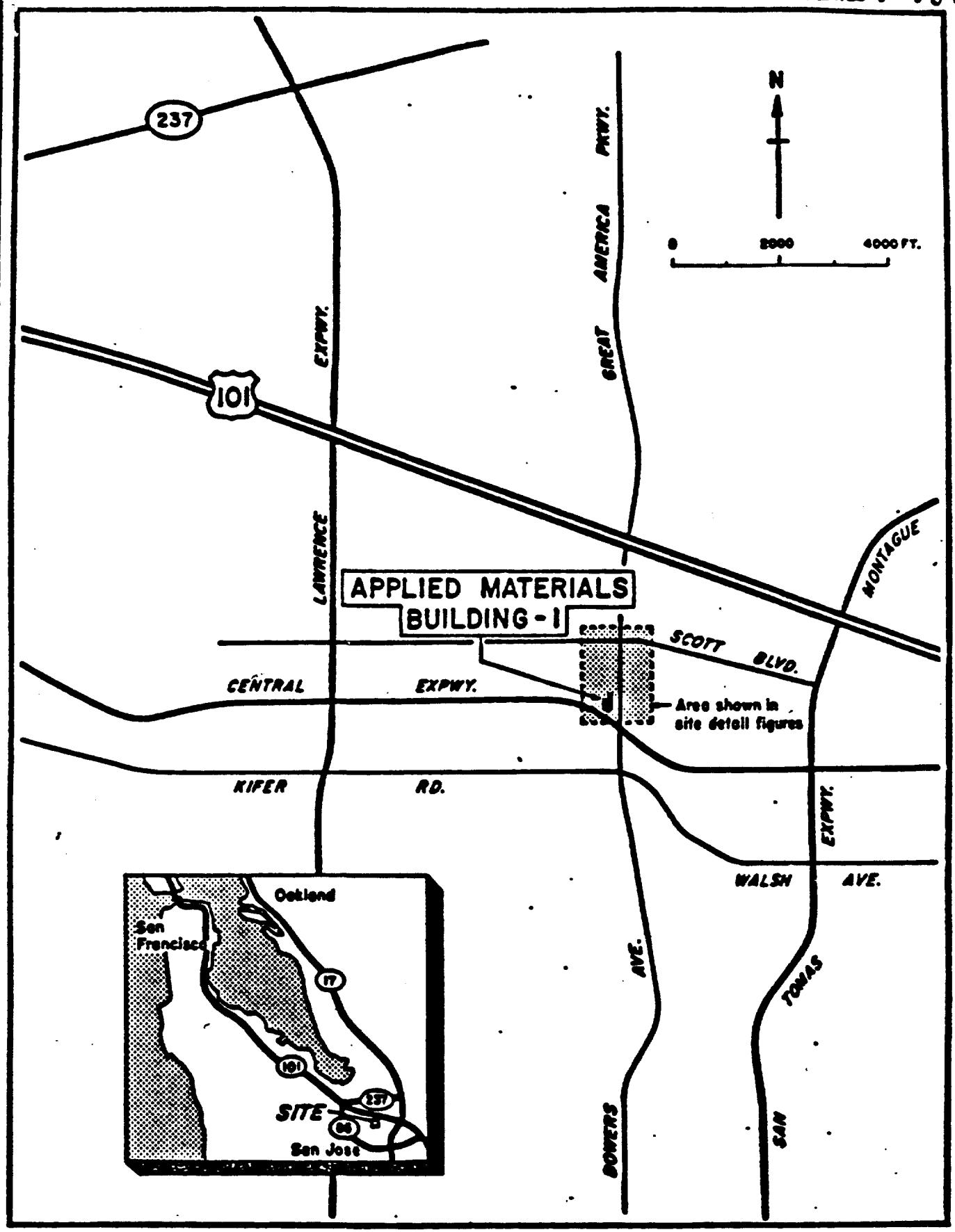

Figure 1. Location of Applied Materials Building 1

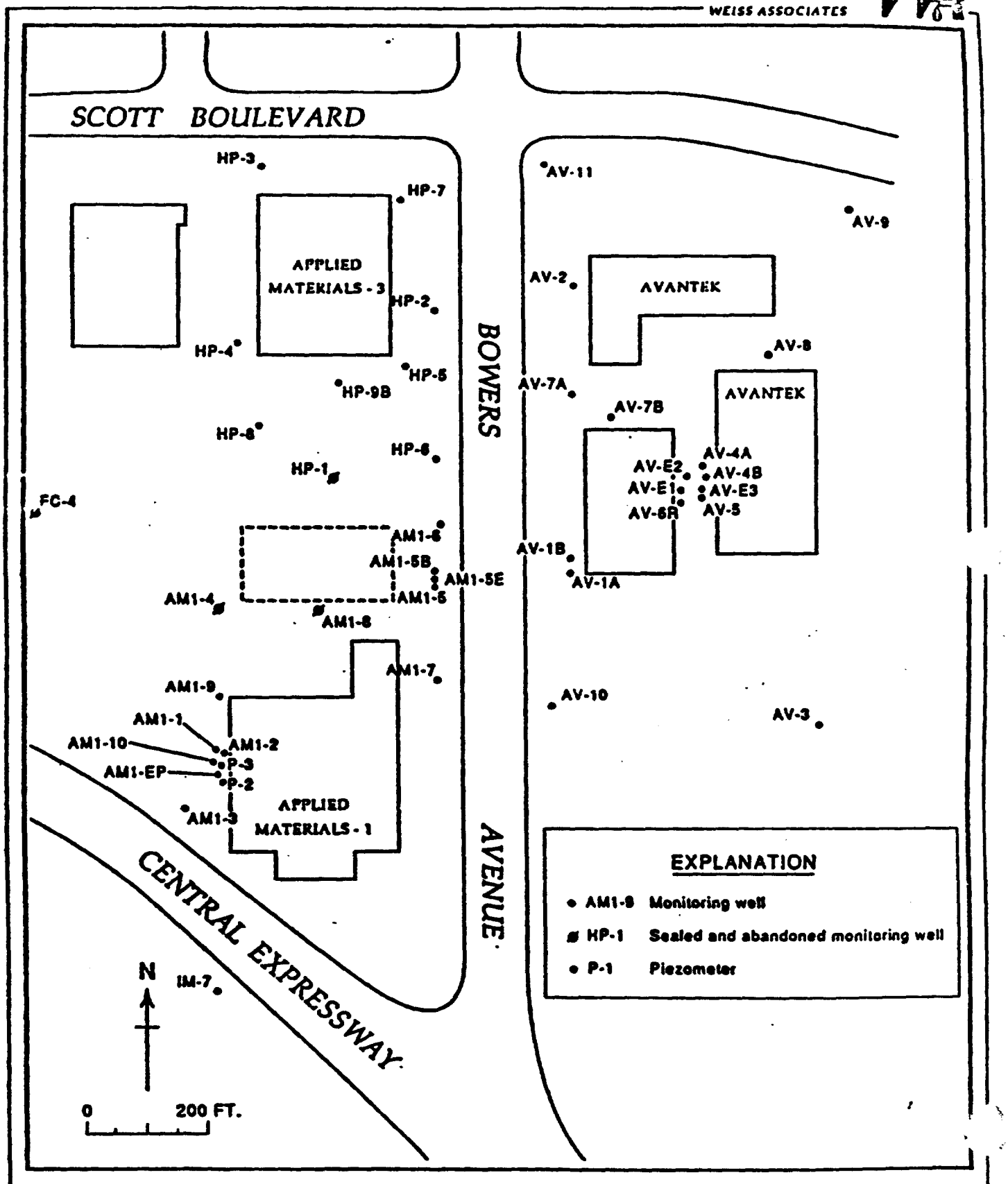

Figure 2. Wells in the Vicinity of Applied Materials Building 1

June 29, 1989: Public Meeting on Proposed Plan
Sept. 20, 1989: Public Hearing to Adopt Proposed Plan and Regional Board Site Cleanup Orders

Aug. 1990: Fact Sheet No. 3, Revised Final Cleanup Plan
Aug. 15, 1990: Public Hearing on Proposed Plan
Aug. 15, 1990 - Sept. 15, 1990: Public Comment Period
Documents available at the Santa Clara
----------Public Library and the Regional Board
Sept. 19, 1990: Public Hearing to Adopt Proposed Plan and Regional Board site cleanup orders

The comments received during the public comment period and at the public hearings are addressed in the Responsiveness Summary which is attached to this ROD.

4. Scope and Role of the Operable Unit Within the Site Strategy

The principal threat posed by the site is from contaminated groundwater that may be used as drinking water or may migrate to contaminate a drinking water aquifer. The selected remedy is for an operable unit that will address the principle threat by capturing and removing contaminated groundwater and treating it to health-based levels. The remedial action will prevent any further migration of contaminants in the groundwater, prevent any future exposure of the public to contaminated groundwater and restore the groundwater to drinking water quality. This operable unit does not address cleanup of soils. Contaminated soils known to exist under Building 1 and the utility pad and dock will be addressed in the future in another operable unit or as part of a final site-wide ROD.

5. Summary of Site Characteristics

This ROD addresses groundwater contamination from all known or suspected sources.

Chemicals Detected. VOCs were first detected in groundwater in November 1983, in the vicinity of three underground tanks at the west side of Building 1. The predominant pollutant in 1983 was trichloroethane (1,1,1-TCA) at concentrations up to 12,000 parts per billion (ppb); also detected were trichloroethylene (TCE), dichloroethylene (1,1-DCE), dichloroethane (1,1-DCA), Freon 113, and other VOCs.

Analytical results from January through June 1989 indicate the presence of the following VOCs in groundwater onsite: 1,1,1-TCA at 1,100 ppb; 1,1-DCA at 120 ppb; 1,1-DCE at 50 ppb; TCE at 20 ppb; PCE at 9 ppb; 1,2,-DCA at 2.3 ppb; 1,2-DCE at 0.6 ppb; 1,1,2-TCA at 1.0 ppb; Freon 113 at 170 ppb; and Freon 11 at 48 ppb.

VOCs are identified as either carcinogenic (cancer-causing) or noncarcinogenic (not cancer-causing). The VOCs found in the subsurface at this site include several which have been categorized by the EPA as capable of causing cancer in humans: (1) possible human carcinogen - 1,1-DCE, and 1,1,2-TCA; (2) probable human carcinogen - TCE, PCE, 1,1-DCA and 1,2-DCA (EDC). Chloroform, a probable human carcinogen, was detected in onsite samples collected from 1983 through 1986 and in 1988. Vinyl chloride, a known human carcinogen, was detected twice, once in 1983 and once in 1985, in samples from two different source-area wells; and more recently (1990) in samples from a newly installed extraction well.

Hydrogeology. The site is in the Santa Clara Valley, a sedimentary basin filled with unconsolidated heterogeneous alluvial material, sometimes interspersed with layers of marine clay. The alluvium is a mixture of permeable water-bearing sands and gravels interbedded with less permeable silts and clays. The soils are extremely variable over short distances, both horizontally and vertically.

Water-bearing deposits in the Santa Clara Valley and at the Building 1 site are generally divided into three laterally traceable units, beginning with the near-surface A zone and progressing with depth through the B zone and into the C zone. The top of the A zone is found at depths between 9 and 15 feet below the surface; the B zone at between 42 and 47 feet. The A and B zones are separated by a layer of silty clay at least 5 feet thick.

Groundwater is found at a depth of about eight feet in the A zone and is confined or semi-confined. Groundwater flow is to the northeast, at a calculated velocity of about two feet per day. Water level measurements indicate an upward hydraulic gradient between the A and B zones. Water in the A and B zones at this site is not withdrawn for any current use other than the interim remedial actions presently underway.

The C zone is located from 150 to more than 500 feet below the surface, and contains aquifers which produce water for domestic and other uses. The C zone aquifers are separated from the shallow A and B aquifers by clay layers ranging from 50 to 150 feet. These clay layers can provide an effective natural barrier to vertical groundwater movement, but are not universally present. The integrity of clay barriers that are present may be compromised at specific locations by abandoned wells that are improperly sealed and act as conduits for the vertical migration of pollutants.

VOCs at this site are found in fine-grained silts and clays in the depth interval of 8 to 19 feet, and in the groundwater and soils of the underlying gravelly sand of the A zone aquifer which is five or more feet thick. VOCs have also been found in the B zone, to a limited extent. By 1983, the AM plume had migrated a

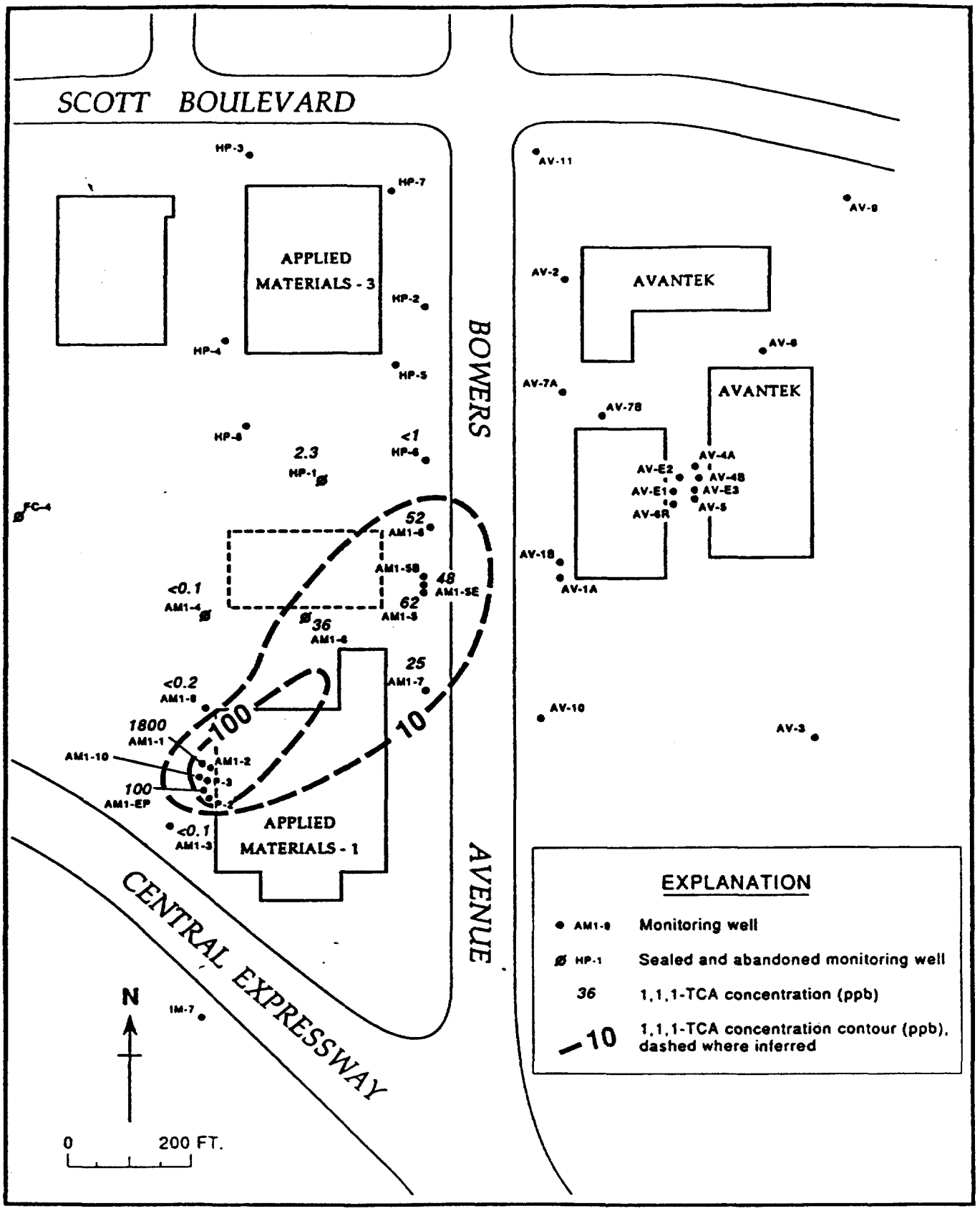

Figure 3. Applied Materials Building 1 and Vicinity - Distribution of 1,1,1-TCA (ppb) in the A1 Water-Bearing Zone - May 3, 1990

distance of 700 feet or more downgradient, 500 feet cross-gradient, and vertically downward to a depth of about 50 feet below the surface. The current (1990) areal extent of the plume is similar to what it was in 1983, but the concentration of 1,1,1-TCA has decreased from a range of 4,000 to 12,000 ppb in 1983, to 25 to 1,800 ppb at present (Figure 3.)

The primary migration pathway is through the aquifers. There are no surface migration pathways. No water supply wells, active or abandoned, are located within the plume. The nearest former water supply well, more than 500 feet deep in the C zone, was located east of Building 1 and just beyond the eastern margin of the plume. This well was closed in April 1986 under supervision of the Santa Clara Valley Water District. The nearest public water supply well is 3500 feet upgradient to the southwest. No contaminents have been detected in this well. It is beyond the capture zone of the extraction wells at this site.

Several thousand people in the city of Santa Clara would be exposed to contamination from the AM site if it were allowed to migrate to public or private water wells. Groundwater contamination could eventually migrate into San Francisco Bay.

6. Summary of Site Risks

The primary exposure route is through the ingestion (drinking) of contaminated groundwater. Another exposure route is through inhalation. Potential human health effects resulting from the presence of VOCs in the groundwater have been evaluated by (1) calculating exposure point concentrations for indicator VOCs, then comparing these to Applicable or Relevant and Appropriate Requirements (ARARs); and (2) calculating exposure risks for a Maximally Exposed Individual (MEI) at the location of highest estimated exposure.

The shallow groundwater in the A and B zones is designated a potential source of drinking water. Cleanup standards are derived which provide an acceptable residual risk to an individual drinking the water and inhaling VOCs emitted during indoor uses. In addition to achieving the cleanup standard for each chemical, the total upperbound cancer risk for the summed oral and inhalation (and dermal if appropriate pathways must be below the accepted risk level (1×10^{-4} in this case), and the sum of the non-carcinogenic Hazard Indices for all pathways must be less than 1.0.

Cleanup standards for this site, as revised herein, are shown in Table 1. The table also shows the type of carcinogen, as determined by the EPA, grouped according to the weight of evidence from epidemiological studies and animal studies:

Group A - Human Carcinogen (sufficient evidence of carcinogenicity in humans)

Group B - Probable Human Carcinogen (B1-limited evidence of carcinogencicity in humans; B2-sufficient evidence of carcinogencity in animals with inadequate or lack of evidence in humans)

Group C - Possible Human Carcinogen (limited evidence of carcinogenicity in animals and inadequate or lack of human data)

TABLE 1
Cleanup Standards

Chemical	Group	Cleanup Standard (mg/l)
Vinyl Chloride	A	0.0005 (1)
Chloroform	B2	0.006 (2)
1,2-Dichloroethane (1,2-DCA)	B2	0.0005 (1)
Tetrachloroethylene (PCE)	B2	0.005 (1)
Trichloroethylene (TCE)	B2	0.005 (1)
1,1-Dichloroethane (1,1-DCA)	B2/C	0.005 (1)
1,1,2-Trichloroethane (1,1,2-TCA)	C	0.032 (1)
1,1-Dichloroethylene (1,1-DCE)	C	0.006 (1)
1,1,1-Trichloroethane (1,1,1-TCA)	NC	0.200 (1)
1,2-Dichloroethylene (1,2-DCE)		
cis (c-)	NC	0.006 (1)
trans (t-)	NC	0.010 (1)
Freon 11 (F 11)	NC	0.150 (1)
Freon 113 (F 113)	NC	1.200 (1)

NC Non-carcinogen
(1) DHS Maximum Contaminant Level - MCL
(2) DHS Applied Action Level - AL

Table 2 gives the cancer potency factors (CPFs) and reference doses (RfDs) for each VOC identified. Table 3 shows the calculated risk for identified carcinogens; Table 4 shows the calculated non-carcinogenic risks.

TABLE 2
Cancer Potency Factors (CPFs) for Cancinogens
and
Risk Reference Doses (RfDs) for Non-carcinogens

Chemical	CPF oral	CPF inhal	RfD oral	RfD inhal
Vinyl Chloride	2.3	0.295	---	---
Chloroform	0.0061	0.081	0.01	ND
1,2-DCA	0.091	0.091	---	---
PCE	0.051	0.0033	0.01	ND
TCE*	0.011	0.017	0.007	---
1,1-DCA	0.091	0.091**	0.1	0.1
1,1,2-TCA	0.057	0.057	0.004	ND
1,1-DCE	0.6	1.2	0.009	ND
1,1,1-TCA	---	---	0.09	0.3
c-1,2-DCE	---	---	0.01	
t-1,2-DCE	---	---	0.02	ND
F 11	---	---	0.3	0.2
F 113	---	---	30	ND

ND = No Data; oral = ingestion; inhal = inhalation.

* TCE is under review by the EPA; the given CPFs and RfDs may change.

** An inhalation factor is not given for 1,1-DCA, but the EPA believes that the laboratory data are sufficient to apply the oral factor as an inhalation factor.

TABLE 3
Carcinogenic Risk

Carcinogen/Group	Risk due to Ingestion	Risk due to Inhalation	Risk Total
Vinyl Chloride/A	13.8×10^{-6}	1.8×10^{-6}	15.6×10^{-6}
Chloroform/B2	0.4×10^{-6}	5.8×10^{-6}	6.2×10^{-6}
1,2-DCA/B2	0.55×10^{-6}	0.55×10^{-6}	1.1×10^{-6}
PCE/B2	3.1×10^{-6}	0.2×10^{-6}	3.3×10^{-6}
TCE/B2	0.7×10^{-6}	1×10^{-6}	1.7×10^{-6}
1,1-DCA/B2-C	5.5×10^{-6}	5.5×10^{-6}	11×10^{-6}
1,1,2-TCA/C	2.2×10^{-5}	2.2×10^{-5}	4.4×10^{-5}
			8.3×10^{-5}

Risk = $(C_w) \times (CPF) \times (HIF)$
C_w = MCL or AL
HIF = 0.012 for carcinogen

1,1-DCE is classified as a Group C carcinogen by the EPA, but is evaluated using the modified RfD approach so that the risk is considered independently and is not added to the carcinogenic risk calculated for the other listed carcinogens. Using the modified RfD approach, which is applied only to the ingestion route of exposure, the carcinogenic risk for 1,1-DCE is determined by comparing the CDI exposure to the RfD/10. This comparison shows that the exposure would be less than the RfD/10, and therefore we assume there is no significant risk due to 1,1-DCE.

TABLE 4

Non-carcinogenic Risk

Chemical	Ingestion HQ	Inhalation HQ
Chloroform	0.0174	NA
1,1-DCA	0.00145	0.00145
PCE	0.0145	NA
1,1,2-TCA	0.232	NA
1,1-DCE	0.0193	NA
1,1,1-TCA	0.064	0.0193
t-1,2-DCE	0.0145	NA
F 11	0.0145	0.0218
F 113	0.0012	NA
Hazard Index	0.37885 = 0.38	0.04255 = 0.04

HQ = Hazard Quotient
NA = Not Applicable

$$HQ = \frac{CDI}{RfD}$$

$$CDI = (C_W) \times (HIF)$$

C_W = MCL or AL

HIF = 0.029 for non-carcinogen

The total excess cancer risk number shown in Table 3, (excluding risk due to exposure to 1,1-DCE), is 8.3 X 10^{-5}; and the risk due to 1,1-DCE at its DHS drinking water MCL of 0.006 mg/l is considered insignificant. The Hazard Index calculations show an HI of 0.38 for the ingestion pathway and an HI of 0.04 for the inhalation pathway (Table 4).

The risk due to non-carcinogens at this site was also assessed. The Hazard Index (HI) for each potential exposure route, summed from calculated Hazard Quotients (HQs), was less than 1.0.

The total carcinogenic risk, as now determined, is within the accepted EPA range when based on an evaluation of DHS MCLs, and the non-carcinogenic risk derived from these MCLs is less than 1.0 for each pathway. As a consequence of these determinations none of the cleanup standards must be reduced to less than the DHS MCL or AL, or the non-zero MCLG.

7. Description of Alternatives

EPA and the Regional Board evaluated five remedial action alternatives for the site in accordance with CERCLA Section 121, the National Contingency Plan ("NCP"), and the Interim Guidance on Superfund Selection of Remedy, December 24, 1986 (OSWER Directive No. 9355.0-19).

The Feasibility Study initially screened the following five groundwater remedial action technologies: (a) active containment of the groundwater plume and removal of VOCs by groundwater extraction and treatment; (b) passive containment of the groundwater plume using a slurry wall system and groundwater extraction and treatment; (c) bioremediation with down gradient groundwater extraction and treatment; (d) steam and/or hot air injection with groundwater extraction and treatment; and (e) no further action with monitoring. The two remedial alternatives that passed the initial screening and were evaluated utilizing the nine criteria. The two alternatives are listed below:

Remedial Alternative 1

Remedial Alternative 1 is a "no further action" alternative, retained for base-line comparison purposes in accordance with EPA guidance. The use of remedial technologies is not proposed at the site under this alternative. The existing groundwater recovery, treatment and discharge operations would be discontinued, but groundwater monitoring would continue for at least 100 years. The total present worth cost of this alternative is $655,000.

Remedial Alternative 2

Remedial Alternative 2 consists of the following:

- Institutional constraints on on-site activities and use of groundwater
- Groundwater monitoring
- Pumping from existing extraction wells until cleanup standards are met (an estimated 50 years)
- Treatment using the existing air stripping system
- Discharge of treated water to surface water under existing RWQCB NPDES permit

Total present worth cost = $715,000

The Proposed Plan identified several additional cleanup alternatives that included soils. Since this ROD is for the groundwater operable unit, the soils alternatives are not described in this ROD.

8. Summary of Comparative Analysis of Alternatives

Threshold Criteria

Overall protection of human health and the environment:

Alternative 2, would be protective of human health and the environment. Alternative 1, the "no action" alternative is not protective of human health and the environment, because it is expected that the groundwater plume would continue to migrate, further degrading the aquifer.

Compliance with applicable or relevant and appropriate requirements (ARARs)

Cleanup standards for this site are determined by the DHS action levels, State and federal Maximum Contaminant Levels, and California Resolution 68-16. Alternative 2 would meet these ARARs. Alternative 1 does not meet these ARARs.

Primary Balancing Criteria

Long-term effectiveness and permanence:

Alternative 2 would mitigate potential future risks by preventing the migration of VOCs in groundwater and restoring the groundwater quality of the A zone to drinking water standards. Long-term monitoring and operation and maintenance would be required. Alternative 1 is not effective or permanent.

Reduction of toxicity, mobility, or volume through treatment;

Alternative 2 would reduce contaminants at the site through extraction and treatment of contaminated groundwater. Alternative 1 would not result in a reduction of toxicity, mobility or volume since it relies on natural attenuation mechanisms, such as dispersion, sorption, diffusion and degradation.

Short-term effectiveness;

Implementation of Alternative 2 will provide short-term effectiveness. Risks associated with groundwater monitoring, recovery, treatment and discharge are mitigated by the health and safety measures to be implemented at the site although no direct exposure to contaminants is anticipated.

Alternative 1 will not be effective in containing the contaminant plume and in the short term will allow further migration of contaminants.

Implementability;

Alternative 2 utilizes proven and readily available technology; the existing recovery and treatment systems are already implemented at the site.

Alternative 1, "no action", can be readily implemented at the site as it involves discontinuing the current remedial actions.

Cost

The cost to implement Alternative 1 would be lower compared to the other remedial alternative for the site. Monitoring wells would need to be maintained for many years. Long term monitoring of contamination would be required for at least 100 years. The existing extraction wells would need to be plugged and abandoned and the treatment system could be disassembled and removed from the site. The present worth value is $655,000.

The cost to implement Alternative 2 would be higher. The groundwater recovery, treatment, and discharge systems are already built and operating at the site. The system would require maintenance to remain operable. The present worth value is $715,000 for Alternative 2.

Modifying Criteria

State/support agency acceptance;

The State of California has no objections to the technical elements of the remedial action selected in this ROD.

Community acceptance

The community is supportive of the preferred alternative. Applied Materials indicated a preference for Alternative 2 for groundwater.

9.0 Applicable and Relevant and Appropriate Requirements (ARARS) and To Be Considered Criteria

Remedial actions selected under CERCLA must attain levels of cleanup of hazardous substances released into the environment and control of further release which assure protection of human health and the environment. CERCLA requires the selection remedial actions that achieve a level or standard of cleanup that meets legally applicable or relevant and appropriate requirements, standards, criteria, or limitations (ARARs).

ARARs are generally separated into three categories: (1) chemical specific requirements that set health or risk-based concentration limits or ranges for particular activities; (2) action-specific requirements; and (3) location-specific requirements.

The regulatory framework for setting remedial objectives for the cleanup of groundwater at the site and for the selection of ARARs is based on the beneficial (current or potential) use of local ground water as a drinking water supply.

9.1 Chemical-Specific ARARs

Chemical-specific ARARs for the site are federal and State of California drinking water standards. Applicable federal and State drinking water standards are presented in the first column of Table 5.

9.1.1 Federal Drinking Water Standards

Potential ARARs for the site include Maximum Contaminant Levels (MCLs), and Maximum Contaminant Level Goals (MCLGs) when set at a level above zero.

Table 5

Chemical Specific ARARs

Chemical	EPA MCLs	EPA IRIS[a]	CA DHS MCLs	CA ACTION LEVELS
	level (ppb or ug/1)			
1,1-dichloroethane (1,1-DCA)	-	-	5	5
1,2-dichloroethane (1,2-DCA)	5	0.4	0.5	-
1,1-dichloroethylene (1,1-DCE)[e]	7	0.06	6	-
1,2-dichloroethylene (1,2-DCE)[e]				
cis	70[b]	-	6	6
trans	100[b]	-	10	10
tetrachloroethylene (PCE)	5[b]	-	5	-
1,1,1-trichloroethane(1,1,1-TCA)[e]	200	-	200	-
1,1,2-trichloroethane(1,1,2-TCA)	5b	0.06	32	-
trichloroethylene (TCE)	5	3	5	-
freon 113	-	-	1200	1200
freon 11	-	-		150
chloroform	100[c]	6		6[d]
vinyl chloride	2	-		0.5

a. EPA's Integrated Risk Information System (10^{-6} risk level)
b. Proposed MCL
c. Total trihalomethanes
d. California DHS applied action level
e. Chemicals for which the MCL and the non-zero MCLG are the same.

The relevant and appropriate standards to establish groundwater cleanup levels at the site are the federal and State Maximum Contaminant Level (MCLs), as established under the Safe Drinking Water Act.

9.1.2 State Drinking Water Standards

California Drinking Water Standards establish enforceable limits for substances that may affect health or aesthetic qualities of water and apply to water delivered to customers. The State's Primary Standards are based on federal National Interim Primary Drinking Water Regulations. Currently, for contaminants found at this site, California has promulgated MCLs for those contaminants at the site as listed on Table 5.

9.1.3 Discharge of Treated Effluent to Surface Water

Substantive National Pollutant Discharge Elimination System (NPDES) permit requirements would apply to treated effluent discharged to surface waters. These requirements would primarily be effluent limitations and monitoring requirements. The California Regional Water Quality Control Board (RWQCB) regulates NPDES discharges. Ambient Water Quality Criteria and technology-based standards are used by the RWQCB to set NPDES effluent discharge limitations.

9.1.4 Air Emissions Standards

Any new source that emits toxic chemicals to the atmosphere at levels determined by the Bay Area Air Quality Management District (BAAQMD) to be appropriate for review must have authorization to construct and a permit to operate from the BAAQMD. Although on-site treatment facilities are exempted by CERCLA from the administrative requirements of the permitting process, emission limits and monitoring requirements imposed by the BAAQMD must be met.

Vapor phase GAC units for air-stripping towers must be used if required by EPA OSWER Directive 9355.0-28 Control of Air Emissions from Superfund Air Strippers at Superfund Groundwater Sites.

9.2 Location-Specific ARARS

9.2.1 Fault Zone

The Applied Materials site is not located within 61 meters (200 feet) of a fault. Therefore, the fault zone requirements of 40 CFR Section 264.18(a) is satisfied.

9.2.2 Floodplain

A hazardous waste treatment facility located in a 100-year floodplain must be designed, constructed, operated, and maintained to prevent washout of any hazardous waste by a 100-year flood. This facility is located in the 100-year floodplain of the San Tomas Aquino Creek drainage system.

9.2.3 California Resolution 68-16

Resolution 68-16 is California's "Statement of Policy With Respect to Maintaining High Quality of Waters in California". EPA regards Resolution 68-16 as criteria to establish ground water cleanup levels. 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 beneficial uses of the water, and will not result in water quality less than prescribed by other state policies.

A beneficial use of the ground water in the aquifer system is drinking water. Establishing a cleanup level which maintains this beneficial use would attain the requirements of Resolution 68-16.

9.3 Action-Specific ARARs

No action-specific ARARs have been identified for this site.

9.4 To Be Considered Criteria

In establishing selected remedial alternatives, EPA considers various procedures, criteria, advisories, and resolutions. These "to be considered" criteria (TBCs) do not carry the weight of ARARs, but are relevant to the cleanup of the site. The following discussion presents selected criteria relevant to the selection of remedial alternatives.

9.4.1 State Criteria for Groundwater Cleanup

California's criteria for evaluating drinking water quality and ground water cleanup are advisory Drinking Water Action Levels and advisory Applied Action Levels respectively. These criteria are presented in Table 5.

Drinking Water Action Levels are health-based concentration limits set by the Department of Health Services (DHS) to limit public exposure to substances not yet regulated by promulgated standards.

Applied Action Levels (AALs) were developed by DHS for use with the California guidance in the "Site Mitigation Decision Tree". AALs are guidelines that DHS uses to evaluate the risk a

site poses. While the DHS Applied Action Levels are not promulgated standards and are not, therefore, ARARs, they have been taken into consideration in developing cleanup standards for the site pursuant to the National Contingency Plan (NCP).

10. The Selected Remedy

Based upon consideration of the requirements of CERCLA, the selected remedy is Alternative 2 which includes the following components: 1) institutional constraints, 2) groundwater monitoring, 3) pumping from existing extraction wells and 4) treatment with existing air stripping systems and 5) discharge of treated water to surface water under existing NPDES permit.

The goal of this remedial action is to restore groundwater to its beneficial use. Based on information obtained during the remedial investigation and on a careful analysis of all remedial alternatives, EPA and the State of California believe that the selected remedy will achieve this goal. It may become apparent, during implementation or operation of the system, that contaminant levels have ceased to decline and are remaining constant at levels higher than the remediation goal, that goal and/or the remedy may be reevaluated.

The selected remedy will include groundwater extraction and treatment. The system's performance will be carefully monitored on a regular basis and adjusted as warranted by the performance data collected during operation. Modifications may include:

a) at individual wells where cleanup standards have been attained, pumping may be discontinued;
d) alternative pumping at wells to eliminate stagnation points
c) pulse pumping to allow aquifer equilibration and to allow adsorbed contaminants to partition into ground water; and
d) installation of additional extraction wells to facilitate or accelerate cleanup of the contaminant plume.

The final cleanup levels (Table 6) are calculated to result in a total excess cancer risk of 8.3×10^{-5} and a total toxic risk of less than 1.0 (Hazard Index).

Table 6

FINAL CLEANUP LEVELS

APPLIED MATERIALS, INC.
3050 BOWERS AVENUE BUILDING 1 facility
SANTA CLARA

Chemical	Level (ppb or ug/l)
1,1-DCA	5
1,2-DCA	0.5
1,1-DCE	6
1,2-DCE	
cis	6
trans	10
PCE	5
1,1,1-TCA	200
1,1,2-TCA	32
TCE	5
Freon 113	1,200
Freon 11	150
Chloroform	6
Vinyl chloride	0.5

11. Statutary Determinations

The selected remedy is protective of human health and the environment in that contaminated groundwater will be treated to at least maximum contaminant levels (MCLs), which fall within EPA's acceptable carcinogenic risk range of one-in-a-million (10^{-6}) to one-in-ten-thousand (10^{-4}) individual lifetime excess cancers that may develop in a population. In addition, the remedy complies with all federal and state ARARs. The selected remedy is cost effective. The overall effectiveness of the remedial action is proportional to its cost, in that it represents a reasonable value for the cost. The selected remedy will permanently and significantly reduce the toxicity, mobility, or volume of the hazardous substances in the groundwater and will utilize treatment of groundwater as a principal element.

IRENE, 12/4/90

I checked w/
The RPM and
there is NO
page 1.
This is correct
as is.
Deborra.