



UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION IX
75 Hawthorne Street
San Francisco, CA 94105

September 30, 2004

Bruce Wolfe
Executive Officer
California Regional Water Quality Control Board
San Francisco Bay Region
1515 Clay Street, Suite 1400
Oakland, CA 94612

**Re: Five-Year Review Report for the Teledyne and Spectra-Physics Superfund Sites,
Mountain View, CA**

Dear Mr. Wolfe:

The U.S. Environmental Protection Agency, Region 9 (EPA) has reviewed the second Five-Year Review Report for the Teledyne and Spectra-Physics Superfund sites, prepared by the California Regional Water Quality Control Board, San Francisco Bay Region, dated September 27, 2004. A joint Five-Year Review Report has been prepared because the groundwater contamination from these adjacent sites has commingled and is being remediated through a common extraction and treatment system. This Five-Year Review was conducted as a matter of EPA policy because cleanup of the site will take five years or more to complete (see OSWER No. 9355.7-03B-P, *Comprehensive Five-Year Review Guidance*, June 2001). The review addresses remedial actions taken pursuant to the March, 1991 Record of Decision for the site.

EPA concurs that the remedy for the Teledyne and Spectra-Physics sites currently protects human health and the environment because institutional controls are in place that prohibit the use of shallow groundwater. In order for the remedy to be protective in the long term, remedial action objectives for groundwater must be achieved. In addition, EPA recommends that the RWQCB evaluate the need for soil gas and indoor air sampling at additional buildings to verify that the remedy continues to be protective with respect to the vapor intrusion pathway.

The next Five-Year Review for the Teledyne/Spectra-Physics Superfund site will be due on September 30, 2009.

EPA appreciates the opportunity to work with you on this report. If you have any questions, please feel free to contact Debbie Schechter of my staff at 415-972-3230.

Sincerely,

A handwritten signature in black ink that reads "Elizabeth Adams". The signature is written in a cursive style with a large initial "E" and a long, sweeping tail on the "s".

Elizabeth Adams, Chief
Site Cleanup Branch
Superfund Division

**California Regional Water Quality Control Board
San Francisco Bay Region**

Five-Year Review

**Teledyne Semiconductor, 1300 Terra Bella Avenue,
& Spectra-Physics Lasers, 1335 Terra Bella Avenue,
Mountain View, Santa Clara County, California**

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List of Abbreviations

BGS	Below Ground Surface
BPHE	Baseline Public Health Evaluation
DCE	Dichloroethene
ESL	San Francisco Bay Region Water Quality Control Board Environmental Screening Levels
GWET	Groundwater Extraction and Treatment
MSCA	Multi-State Cooperative Agreement
MCL	Maximum Contaminant Level
NBES	North Bayshore Extraction System
NPDES	National Pollutant Discharge Elimination System
NPL	National Priorities List
RI/FS	Remedial Investigation/Feasibility Study
SCR	Site Cleanup Requirement
SSES	Spring Street Extraction System
SVET	Soil Vapor Extraction and Treatment
TCA	1,1,1-trichloroethane
TCE	Trichloroethene
U.S. EPA	United States Environmental Protection Agency
VOC	Volatile Organic Compound
Water Board	San Francisco Bay Region Water Quality Control Board

Executive Summary

The former Teledyne Semiconductor Superfund site and the Spectra-Physics Superfund site are adjacent to each other in Mountain View, Santa Clara County, California. Contaminants from these sites contaminated the shallow groundwater and the resulting plumes of contaminated groundwater became commingled. The contaminant plume extends almost one mile northwards, towards the Bay, and underlies many other properties. Since the plume is so extensive and commingled it is managed as a combined single entity known as the Teledyne and Spectra-Physics site.

The remedy for the contamination, finalized in 1991, included soil vapor extraction and treatment, groundwater extraction and treatment, groundwater monitoring, and institutional controls. This is the second "Five-year" review for the site, and it covers remedial activities conducted between March 1996 and June 2004. The time period covered is eight years to bring the reporting period current. The previous Five-year review was submitted in September, 1999 reviewed activities completed between March 1991 and March 1996.

Remedial actions conducted at the site have already been successful and continue to remove contaminants. Two soil vapor extraction systems were operated on the Spectra-Physics property until 1999 when soil clean up goals were achieved. Three groundwater extraction systems, collecting from different areas of the plume, have continued to operate during this review period. The systems collect groundwater from two aquifers, both at relatively shallow depths, known as the shallow zone and the intermediate zone. Contaminant concentrations in the plume have declined over the review period with some contraction at the perimeters. In order to maintain extraction efficiencies, wells with very low levels of pollutants have been disconnected from the extraction systems.

Studies have been started to determine if natural biological attenuation conditions are present in the area of the plume. These studies will be completed in 2006 and may result in a proposal to change the cleanup remedy.

Recent provisional guidance issued by U.S. EPA regarding the toxicity of trichloroethene (TCE) significantly lowers the levels at which TCE is considered to pose a risk to human health. This required a re-evaluation of the protectiveness of the remedy in terms of exposure to TCE and other chlorinated solvent vapors in indoor air. In early 2004, Teledyne and Spectra-Physics completed soil vapor and indoor air sampling for TCE and other chlorinated solvents and the data showed that there was no significant health risk from these sources.

Until cleanup goals are achieved, the current remedy is protective of human health and the environment in terms of limiting ingestion of contaminated water through institutional controls prohibiting the use of shallow groundwater.

Five-Year Review Summary Form		
SITE IDENTIFICATION		
Site Name (from WasteLAN): Teledyne/Spectra-Physics		
EPA ID (from WasteLAN): Teledyne: CAD009111444 Spectra-Physics CAD009138488		
Region: 9	State: CA	City/County: Mountain View/Santa Clara
SITE STATUS		
NPL status: Final		
Remediation Status: Operating		
Multiple OUs? No	Construction completion date: September 1991	
Has site been put into reuse? The site is in use and remedial operations continue.		
REVIEW STATUS		
Lead agency: State of California		
Author Name: Derek Whitworth		
Author title: Water Resources Control Engineer	Author affiliation: CA Regional Water Quality Control Board (Lead Agency)	
Review period: 6/10/04 – 9/23/04		
Date(s) of site inspection: 6/15/2004		
Type of Review: (in bold) <input type="checkbox"/> Post-Sara <input type="checkbox"/> Pre-Sara <input type="checkbox"/> NPL-Removal only <input type="checkbox"/> Non-NPL Remedial Action Site <input checked="" type="checkbox"/> NPL State/Tribe-lead <input type="checkbox"/> Regional Discretion		
Review number: (in bold) _1 (first) <u>x_2 (second)</u> _3 (third) Other (specify)		
Triggering action: (in bold) <input type="checkbox"/> Actual RA Onsite Construction at OU#__ <input type="checkbox"/> Actual RA Start at OU#__ <input type="checkbox"/> Construction Completion <input checked="" type="checkbox"/> Previous Five-Year Review Report <input type="checkbox"/> Other (specify)		
Triggering action date (from WasteLAN): 9/30/1999		
Due Date (five years after triggering action date): 9/30/2004		

Five-Year Review Summary Form, continued**Issues:**

The declining effectiveness of groundwater extraction and treatment over time is an issue that was identified during the review.

Recommendations and Follow-up Actions:

The limits to the effectiveness of the present remedy are recognized but no clear alternatives are available. The concentrations of contaminants in soils close to the source have reduced significantly but there have been no measurable reductions in concentrations at the fringes of the plume. There are three groundwater extraction systems operating but it is not clear if these systems are causing a reduction in contaminants significantly greater than would be achieved by natural attenuation. Studies are underway to determine if the conditions for natural biological attenuation exist at the site. If affirmative, changes to the remedial program may be proposed.

Protectiveness Statement:

Remedial actions conducted at the site are functioning as designed; however, it is doubtful that groundwater cleanup goals will be achieved in any measurable time. In the interim, until another approach is considered, the remedy is protective of human health and the environment in terms of limiting ingestion of contaminated water through the use of institutional controls prohibiting the use of shallow groundwater.

Recent changes in the methodology for assessing the toxicity of TCE significantly lowers the levels at which TCE are considered to pose a risk to human health. This and other recent changes in the methodology of assessing risk from chlorinated solvent required a re-evaluation of the protectiveness of the remedy as regards exposure to contaminant vapors in indoor air. Contaminants in soil gas under, and in indoor air in, buildings on both properties were measured and shown not pose a health risk.

**California Regional Water Quality Control Board
San Francisco Bay Region**

Five-Year Review

**Teledyne Semiconductor 1300 Terra Bella Avenue
& Spectra-Physics Lasers 1335 Terra Bella Avenue
Mountain View, Santa Clara County, California**

I. Introduction

This report is the second five-year review (and covers eight years) for the Teledyne Semiconductor and Spectra-Physics Lasers Superfund sites in Mountain View. Contaminants from these sites contaminated the shallow groundwater and the resulting plumes of contaminated groundwater became commingled. The contaminant plume extends almost one mile northwards, towards the Bay, and underlies many other properties. Since the plume is so extensive and commingled it is managed as a combined single entity known as the Teledyne and Spectra-Physics site. This report reviews the activities at both the sites.

The California Regional Water Quality Control Board, San Francisco Bay Region (Water Board), conducted this review pursuant to the Multi-Site Cooperative Agreement (MSCA) between the U.S. EPA Region IX and the Water Board. The purpose of a five-year review is to ensure that a remedial action remains protective of public health and the environment and is functioning as designed. This five-year review is conducted as a matter of EPA policy because the remedial action requires more than five years to complete cleanup of the groundwater.

II. Site Chronology

Below grade sumps installed at the sites.	1962-1977
Teledyne used sumps for acid neutralization and waste collection.	Before 1980
Spectra-Physics used sumps for collecting rinse waters.	Before 1987
Teledyne starts remediation investigations.	1982
Spectra-Physics starts remedial investigations.	1984
Teledyne starts interim remedial actions.	1986
Start soil vapor extraction at the Spectra-Physics site.	1989
Teledyne & Spectra-Physics start the off-site North Bayshore Extraction System.	1990
Regional Water Board Order (SCR) 91-025 for both sites approves remedies that include soil vapor extraction and groundwater extraction, treatment and discharge to sanitary sewer and surface water under NPDES permit.	Feb 21, 1991

Regional Board Orders No. 91-025 defines the Final Site Cleanup Requirements.	Feb 21, 1991
USEPA issues Record of Decision (ROD) for Teledyne and Spectra-Physics sites.	Mar 22, 1991
Teledyne & Spectra-Physics submit first Five-Year Review Report to Regional Board.	1996
Regional Water Board / U.S. EPA complete first Five-Year review.	Sept 29, 1999
Teledyne & Spectra-Physics submit Ten-Year Review Report to Regional Board UTC facility.	Mar 15, 2001
Regional Board approves plan to study natural attenuation parameters	Nov 2003
Teledyne and Spectra-Physics complete soil gas analyses and vapor intrusion studies and submit reports.	2004
Teledyne & Spectra-Physics submit three-year supplemental report to Ten-Year Review.	June 2004
Final Natural attenuation study due.	Jan 2006

III. Background

Physical Characteristics

The Teledyne Semiconductor and Spectra-Physics Laser Superfund sites are located on Terra Bella Avenue that is off West Middlefield Road in Mountain View. This is located immediately south of Highway 101 and is reached by taking the south Shoreline Boulevard exit. The groundwater contaminant plume that has a commingled source at the site extends downgradient, in a northerly direction towards the Bay, for almost one mile. It goes under Highway 101. Amphitheatre Parkway forms the northern boundary of the plume area. Just north of the Parkway is a dewatering trench for the Mountain View Landfill.

The groundwater plume originating from the two sites is managed as one commingled plume by the successors to Teledyne Semiconductor and by Spectra-Physics. In the downgradient area of the plume there are two other locations that are additional sources of chlorinated solvent contaminants. One location is known as the Montwood site at 1615 and 1625 Plymouth Street, approximately one half mile north of the source area. The second location, known as the Peery/Arrillaga site at 1028 Alta Avenue, is approximately three quarters of a mile north of the source area on Terra Bella Avenue. Both sites are under Water Board Orders for cleanup (SCR 01-010 and SCR 00-002) and the data indicates they are not contributing to the Teledyne Spectra-Physics plume. At these two sites the contaminated groundwater is captured by on site groundwater extraction systems. The Montwood site water is discharged into the sanitary sewer system. At the Peery Arrillaga site the water is treated and discharged into Permanente Creek under an NPDES permit.

The buildings at the source area on Terra Bella Avenue are still in use for light industrial activities. BD Biosciences Clontech and Microchip Technology Inc. now occupy the

single building that was used by Teledyne Semiconductor. Most of the buildings formerly used by Spectra-Physics are still in use although at least one is vacant and another, on West Middlefield Road, was vacated and is being used as a church. That building is on the hydrogeological upgradient side of the original buildings.

Buildings above the plume in the downgradient area, to the north of Highway 101, are almost exclusively commercial offices. Residences used to exist in this area but, with city-zoned development, these gave way to relatively new office buildings occupied primarily by companies engaged in computer hardware and software development. Mountain View, towards the northwest end of Silicon Valley, has a population of 65,000 and is located in Santa Clara County and is part of the San Francisco Bay Metropolitan Region.

This five-year review covers remedial activities conducted by the successor to Teledyne Semiconductor and by Spectra-Physics Lasers over the last eight years.

Hydrogeology

The Teledyne and Spectra-Physics sites are situated in the northern portion of the Santa Clara Valley, California, along the edge of San Francisco Bay. The Santa Clara Valley is a gently, northward sloping alluvial plain, flanked by the Diablo Range to the east-southeast, and the Santa Cruz Mountain to the west-southwest. The alluvium is composed of a complex sequence of clay, silt, sand, and gravel up to 1,500 feet thick. Within the Santa Clara Valley, two significant water-bearing zones have been identified: the Upper Aquifer and the Deep Aquifer. The Upper Aquifer consists of approximately 70 feet of silty clay and clayey silt interbedded with variable thicknesses of sand and gravel. The Deep Aquifer exists at depths greater than 150 feet below ground surface (BGS) and is reported to extend to a depth of approximately 700 feet bgs. The Deep Aquifer is the primary groundwater source in the Santa Clara Valley. The Upper and Deep Aquifers are separated by a regional aquitard of low-permeability, fine grained sediments approximately 50 to 150 feet thick.

The Upper Aquifer is divided into a shallow zone and an intermediate zone. The shallow zone, consisting of a mixture of generally well-sorted, permeable sands and gravels, exists from approximately 10 to 30 ft bgs. An aquitard of relatively impermeable fine-grained materials exists from approximately 25 to 35 ft bgs. The intermediate zone, consisting of well-sorted, permeable sands and gravels, exists from 35 to 70 ft bgs.

History of Contamination

Site investigations were started at Teledyne in 1982 and at Spectra-Physics in 1984. Soil samples taken from the Teledyne site indicated that releases of VOCs (mainly chlorinated solvents TCE and derivatives such as 1,2 DCE) had occurred and had impacted soil and groundwater but that residual concentrations of VOCs in the soils were low, within cleanup goals, and no soil remediation was required.

Soil samples collected from the Spectra-Physics site showed that releases of the same VOCs had occurred and were still present in the soil at levels that required remediation.

The groundwater under the Spectra-Physics site was also contaminated. Contamination was limited to the upper aquifer both in the shallow and intermediate zone. Groundwater samples collected from the deep aquifer, used as a source of drinking water, indicated that it had not been impacted.

Initial Response

Interim remedial actions began at Teledyne in 1986 with the start-up of an onsite groundwater extraction system to provide hydraulic control and remediation of the impacted groundwater. To address the soil contamination on the Spectra-Physics property, one soil vapor extraction system was installed in 1989 and a second one in 1992. Both systems treated the extracted vapors with granular activated carbon.

Hydraulic control and remediation of the VOC-impacted groundwater coming from both sites was started with the activation of the onsite groundwater extraction system in October 1986. This extracted water from both the shallow zone and intermediate zone in the upper aquifer. The ground water extracted from this system was treated by an air stripper and then discharged to Permanente Creek under an NPDES permit.

In addition to the on-site extraction and treatment system, two other groundwater extraction systems were also installed in separate offsite areas. One, started in 1990, was the North Bayshore Extraction System (NBES) consisting originally of 11 shallow wells and six intermediate zone wells located in the downgradient area north of highway 101. The water is discharged into the sanitary sewer system. The second, located on Spring Street, a residential area northwest of the Teledyne site, is known as the Spring Street Extraction System (SSES). This originally had three shallow zone and two intermediate zone wells and became operational in 1991. Although relatively close to the onsite system, access limitations determined that the extracted water would be discharged to the sanitary sewer also.

Summary of Basis for Taking Action

The site overlies the Santa Clara Valley groundwater basin. Groundwater from this basin provides up to 50% of the municipal drinking water for over 1.4 million residents of the Santa Clara Valley. The Teledyne Semiconductor and Spectra-Physics Laser sites were made Superfund sites primarily because of the past chemical releases' potential threat to this valuable resource.

IV. Remedial Actions

Remedy Selection

A Baseline Public Health Evaluation for both sites was prepared along with a Remedial Investigation/Feasibility Study (RI/FS). These documents form the basis of the remedial action plan. The Regional Water Board adopted Final Site Cleanup Requirements (SCRs), Order No. 91-025 in February 1991 and the U.S. EPA adopted a Record of Decision on March 22, 1991. The final site cleanup remedy selected in the SCR for the two sites consisted of the following elements:

- 1) Soil vapor extraction and treatment
- 2) Groundwater extraction and discharge to the sanitary sewer for off-site systems
- 3) Groundwater extraction and treatment by air stripping for the on site system.
- 4) Discharge of treated water for the on site system under NPDES permit
- 5) Deed restriction prohibiting the use of shallow groundwater for drinking water.

The SCRs set cleanup standards for both soil and groundwater. The soil cleanup standard was 2.5 ppm total VOCs for soil between 0-10 ft bgs and 0.5 ppb total VOCs for soils 10-14 ft bgs. For groundwater at California proposed or adopted Maximum Contaminant Levels (MCLs), EPA MCLs, California Action Levels, or levels based on a risk assessment were used. These cleanup levels were set at:

Chemical	Cleanup Standard (ug/l)
1,1-Dichloroethane (1,1-DCA)	5
cis-1,2-Dichloroethene (cis-1,2-DCE)	6
trans-1,2-Dichloroethene (trans-1,2-DCE)	10
1,1-dichloroethene (1,1-DCE)	6
Tetrachloroethene (PCE)	5
Toluene	100
1,1,1-Trichloroethane (1,1,1-TCA)	200
Trichloroethene (TCE)	5
Trichlorobenzene (1,2,4-TCB)	40
Vinyl Chloride	0.5

Remedy Implementation

Groundwater extraction and treatment systems, at both sites, and a soil vapor extraction and treatment (SVET) system, at the Spectra-Physics site, were in place at the time the final SCR was adopted in February 1991. After adoption of the final SCR, a second SVET was installed on the Spectra-Physics property.

Soil Vapor Extraction

The SVET System 1 began operation in February 1989 in the area of sump # 1 at Building 3 (1250 West Middlefield Road) on the Spectra-Physics site. In January 1992 the SVET System 2 was initiated in the building 2 (1245 Terra Bella Avenue) and Building 3 to address the VOC impacted soil at that location. In both systems the extracted vapors were treated using vapor phase granular activated carbon. System 1 removed 85 pounds of VOCs before it was taken out of service in January 1995. System

2 removed 443 pounds of VOCs from impacted soils before being taken out of service in April 1999. The SVET systems were closed down after recovery had reached asymptotic levels and soil cleanup goals had been achieved. Currently there are no SVET systems in operation.

Groundwater Extraction

Groundwater extraction and treatment has been conducted continuously at the on site properties since October 1986. The North Bay Extraction System was installed in March 1990 and Spring Street system in August 1991. Only the effluent from the on-site system discharges into Permanente Creek that is located to the west and north of the impacted area. All three systems were operational during the eight years covered by this review.

Institutional constraints, restricting the use of groundwater on the two properties had been established in 1992 and 1994. Teledyne, Inc. recorded its deed restriction with the Santa Clara County Recorder on March 5, 1992 (No. 11260055) and Spectra-Physics Lasers, Inc. recorded its deed restriction on September 7, 1994 (No. 12640287). The deeds both prevent the boring of groundwater wells and interference with groundwater remediation equipment.

Systems Operation/O&M

Groundwater extraction has been conducted continuously since 1986. The successors to Teledyne and Spectra-Physics routinely submit quarterly progress reports to the Water Board. Progress reports indicated that the extraction systems operated as designed during the eight-year period covered by this review. The second SVET System was taken out of service in April 1999 and no SVET systems have operated since then.

Actual costs associated with operation and maintenance of the SVET systems from January 1996 through April 1999 was \$85,000, significantly less than the projected sum of \$320,000. The reported costs for operating the three groundwater extraction systems was \$3,030,000 for the period January 1996 through December 2000 and \$5,010,000 for the eight year period through December 2003.

V. Progress Since Last Review

The last 5-year review was completed in September 1999. The previous 5-year review indicated that a study would be completed to improve the efficiency of the North Bayshore Extraction System. This study was to observe the effects of shutting down two extraction wells, E-17 and E-9. E-9 was closed and well E-17 had to be abandoned due to changes in land use by the city of Mountain View that control the property to the north of Amphitheater Parkway where the wells were located. E-9 was not subsequently reconnected.

VOC concentrations in former source areas and throughout the downgradient plume continue to decline. VOC concentrations in shallow zone and intermediate zone

monitoring wells located at the furthest downgradient locations have remained relatively stable at low levels with TCE between 15 and 26 ppb in 1995 to between 15 and 18 ppb in 2003. . These data indicate that hydraulic control of the VOC plume has been achieved.

Between 1996 and 2000, 653 million gallons of groundwater were extracted, from which 3,000 pounds of VOCs were removed. For three years between January 2001 and December 2003 336 million gallons of water were extracted and 1,123 pounds of VOCs removed. Mass removal efficiency has declined from about 4.4 pounds of VOCs per million gallons of water extracted (lbs/MG) in 1996 to 3.6 lbs/MG in 2003.

VI. Five-Year Review Process

Document Review

This 5-year review (actually covering eight years) consists of a review of relevant documents including Teledyne Spectra-Physics Ten-Year status report (submitted to the Water Board on March 15, 2001), groundwater monitoring reports, and annual reports. Applicable groundwater cleanup standards contained in the Final Site Cleanup Requirements were reviewed. There have been no changes in the cleanup standards contained in the Cleanup Requirements.

Data Review

Groundwater monitoring data collected from 1991 to 2003 were reviewed to evaluate progress in remediating the groundwater pollutant plume. The combination of SVET and GWET has been successful in removing VOC mass from unsaturated and saturated soils, in controlling migration of the plume, and reducing concentrations of VOCs in groundwater.

In the eight years from 1996 and 2003 the following actions were noted. From the On-Site Extractions System, 170 million gallons were extracted with the removal of 1,250 lbs of VOCs. From the Spring Street Extraction System 224 million gallons were extracted with the removal of 686 lbs of VOCs. From the North Bayshore Extraction System 595 million gallons were extracted with the removal of 2,186 lbs of VOCs.

After almost 20 years of groundwater extraction, however, the amount of VOC mass being removed has declined considerably and concentrations in groundwater may be stabilizing at levels significantly above the cleanup goals. The mass removal efficiency for the three sites over the eight year period has declined as follows: for the on-site system from 6.7 to 5.1 lbs per million gallons (lbs/MG); for the SSES from 3.3 to 2.5 lbs/MG; and for the NBES from 3.3 to 3.1 lbs/MG. This observation of a leveling off in the reduction rate following initial significant reduction in VOC concentrations has been found to occur at many other sites in the area and around the country.

A review of the monitoring well data and contaminant iso-concentration maps shows that the groundwater pollutant plume is generally stable with concentrations decreasing in the

source areas. At the perimeter of the plume, there has been little regression of the VOC iso-concentration contours. Wells at the furthest downgradient area of the monitoring area close to of the plume have remained at around 20 µg/l TCE since 1990. Contour maps completed in 2000 for the shallow and intermediate zones and compared with contour maps completed in 1993/94 indicate that there has been some regression of the plume edge. Contamination remains confined to the shallow and intermediate zones in the upper aquifer. Monitoring well VW-1, screened at a depth of 91 to 96 ft bgs (in the deeper aquifer), has not detected any VOCs since 1988.

Remedial efforts have reduced VOC concentrations in source areas and across the plume. Concentrations in on-site groundwater at the source areas are declining and now do not exceed 1,500 µg/l and typically are less than 1,000 µg/l. That VOC concentrations in the groundwater remain significantly above cleanup goals is probably due to the predominance of low permeability soils causing a low rate of desorption of the VOCs from the soil matrix to the groundwater.

No potentially toxic or mobile transformation products have been identified during sampling that was not already present at the time of the Record of Decision, and therefore cleanup standards specified in the Site Cleanup Requirements still apply.

Site Inspection

Water Board staff conducted a site inspection on June 15, 2004. No activities that could interfere with cleanup of the site were observed. The institutional controls that are in place include prohibitions on the use of groundwater until cleanup levels are achieved. No activities were observed that would have violated the institutional controls. VOC contamination is confined to groundwater.

VII. Technical Assessment

Question A: Is the remedy functioning as intended by the decision documents?

The current groundwater-monitoring program is sufficient to track the plume, as well as track the effectiveness of remedial actions. The remedy selected in the Final Remedial Action Plan (GWET, SVET, and institutional controls) was implemented as planned and achieved some success by removing VOCs from vadose zone soil and soil vapor, maintaining plume control, and reducing VOC concentrations in groundwater. The contamination is confined to the shallow and intermediate zones of the upper aquifer and has not impacted the deeper aquifer that is a drinking water resource.

In 2003, because of declining efficiency of the selected remedy, the successor to Teledyne Semiconductor and Spectra-Physics Lasers requested and received Water Board approval to curtail the extraction from wells supplying the NBES and the SSES that had low concentrations of contaminants or were not yielding significant quantities of contaminant, typically less than 5% of the total contaminant and as little as 0.4%. Specifically in the NBES wells in the shallow zone E-1, E-2, E-3, E-4, E-5, E-6, E-7, E-8 were closed. Well E-9 remained closed. In the intermediate zone, wells E-11, E-12, E-

15, E-16 and E-19 were closed. In the SSES four of the five original wells, ES-15, ES-25, ES-3I and ES-5S were closed, with ES-4I remaining. This well was contributing most of the mass of contaminant. Both wells in the on-site system remain in operation.

The plume is overlain by two identified sources of contamination in the downgradient offsite area. One from a site at 1615 and 1625 Plymouth Street, known as the Montwood site, and another at 1098 Alta Ave. known as the Peery/Arrillaga site. Both sites are under Water Board Orders (SCR 01-010 and SCR 00-002) and have localized groundwater extraction systems in operation that contain the localized contamination. Contaminants from these sites do not significantly contribute to the Teledyne Spectra-Physics plume.

The goal of the remedy, described in 1991, was to reduce the contamination in the groundwater to drinking water standards within a reasonable period of time. That time was estimated to be 20 to 90 years. The groundwater data collected since 1990 indicates that with the current remedy the time required for cleanup cannot be projected and will be significantly in excess of 20 years.

The institutional controls in place include prohibitions on the use of groundwater until cleanup levels are achieved. No activities were observed that would have violated the institutional controls.

Question B: Are the exposure assumptions, toxicity data, cleanup levels, and remedial action objectives used at the time of the remedy selection still valid?

In an effort to determine whether the remedy at the former Teledyne Spectra-Physics site remains protective of human health and the environment, this section discusses changes in site conditions, changes in exposure pathways, changes in toxicity values, changes in remedial action objectives, and changes in ARARs since selection of the Site remedy.

Changes in Site Conditions

The building and site occupied by Teledyne and Spectra-Physics continue, with some exceptions, to be occupied by light industrial activities. One building at the Spectra-Physics site has been converted to a church. At least one other is vacant. Spectra-Physics Lasers still has its operations there but the Teledyne operations no longer exist. Two companies--BD Biosciences Clontech and Microchip--now occupy the former Teledyne building.

The use of the downgradient area under which the groundwater plume has migrated remains commercial office space and light industrial. Many of the office buildings are new and were built to accommodate software companies of the computer industry. There are no residences above the off site plume.

Changes in Exposure Pathways

A baseline human health risk assessment for the Teledyne and Spectra-Physics site was completed in 1990. This risk assessment was incorporated into the RI/FS Report and Final Remedial Action Plan, and was used in evaluating and selecting remedial options

for the site. The risk assessment focused on the potential for future exposure to contamination if the groundwater and its contaminant sources were left untreated, and if that water was used for domestic purposes (e.g., drinking, showering, washing). Exposure to contamination through these pathways contributes the greatest risk to human health where those pathways are complete. At the former Teledyne Spectra-Physics site, however, the groundwater currently is not used for domestic purposes; thus, those exposure scenarios were considered unlikely. Additionally, because the contamination at the site is primarily in the groundwater, the 1990 risk assessment concluded that potential exposure to site contaminants through the inhalation pathway presented negligible risks.

Since 1990, however, the understanding of the fate and transport of chemicals in the subsurface has evolved. We now understand that, under certain conditions, VOCs in the soil and/or groundwater emit vapors that can migrate upward through subsurface soils and enter overlying buildings through cracks in floors or through piping conduits. In September 2002, U.S. EPA's Office of Solid Waste and Emergency Response (OSWER) released an external review draft "Evaluating the Vapor Intrusion to Indoor Air Pathway from Groundwater and Soils" (2002) that focuses specifically on this pathway. Given the relatively shallow water table at the former Teledyne Spectra-Physics site (approximately 10 feet bgs), coupled with the high TCE concentrations that were originally measured in media beneath the buildings (up to 18,000 $\mu\text{g}/\text{kg}$ soil), USEPA identified the Teledyne Spectra-Physics site as one requiring evaluation of the potential for groundwater contamination to impact indoor air.

Samples were collected from outside and inside the buildings and from the soil close to buildings on the Spectra-Physics and Teledyne sites in February and April 2004. On the Spectra-Physics site samples were collected from the vacant building at 1305 Terra Bella Avenue. Five samples (including one duplicate) of soil gas were collected from below an asphalt seal just outside all four walls of the building. Four samples (including one duplicate) of indoor air were collected from inside the building and one sample of outdoor air was collected from the roof. At the former Teledyne building a similar approach was taken with five samples of soil gas and, in this case, six samples of indoor air (with one duplicate) and one outdoor air sample.

At the Spectra-Physics site the highest level of TCE detected in the soil gas was 4.1 $\mu\text{g}/\text{m}^3$ and in the indoor air 0.34 $\mu\text{g}/\text{m}^3$. At the Teledyne site the highest level of TCE in soil gas was 1,300 $\mu\text{g}/\text{m}^3$ and for indoor air 0.41 $\mu\text{g}/\text{m}^3$. These indoor air concentrations of TCE are below U. S. EPA's draft long-term health-protective risk range and the California EPA health-based screening levels. The data was reported to the Water Board in March and May 2004 and, based on this data, no further sampling was requested or conducted.

Changes in Toxicity Values

Since the 1990 risk assessment, there have been a number of changes to the toxicity values for certain contaminants of concern at the Teledyne and Spectra-Physics sites. Revisions to the toxicity values for 1,1-DCE and VC indicate a lower risk from exposure to these chemicals than previously considered. On the other hand, recent studies of the

toxicity values for PCE and TCE may indicate higher risks from exposure than previously considered.

The greatest uncertainty with toxicological changes for the Teledyne and Spectra-Physics sites is associated with TCE. In August 2001, U.S. EPA's Office of Research and Development (ORD) released "Trichloroethylene Health Risk Assessment: Synthesis and Characterization" (TCE Health Risk Assessment) for external peer review. The draft TCE Health Risk Assessment takes into account recent scientific studies of the health risks posed by TCE. According to the draft TCE Health Risk Assessment, for those who have increased susceptibility and/or higher background exposures, TCE could pose a higher risk through inhalation than previously considered. The Draft TCE Health Risk Assessment is available online at:
<http://cfpub.epa.gov/ncea/cfm/recordisplay.cfm?deid=23249>.

The Science Advisory Board, a team of outside experts convened by U.S. EPA, reviewed the draft TCE Health Risk Assessment in 2002. The Science Advisory Board's review of the draft TCE Health Risk Assessment is available at:
<http://www.epa.gov/sab/pdf/ehc03002.pdf>.

U. S. EPA's ORD and OSWER have requested additional external peer review of the draft TCE Health Risk Assessment by the National Academy of Sciences. Consequently, review of the toxicity value for TCE may continue for a number of years. In the interim, because of the uncertainties associated with the draft TCE Health Risk Assessment, USEPA Region 9 is considering both the draft TCE Health Risk Assessment toxicity values, as well as the California TCE toxicity value (similar to U.S. EPA's previously listed TCE toxicity value from 1987), in evaluating potential health risks from exposure, and in making protectiveness determinations. The toxicity criteria that have been used to evaluate the remedy's protectiveness are based on long-term exposures (24 hours, 350 days, 30 years) for residential settings and (10 hours, 250 days, 25 years) for commercial/industrial settings. To date, none of the immediate or short-term health criteria for air have been exceeded in any buildings.

Changes in Remedial Action Objectives

The Final Remedial Action Plan for the Teledyne and Spectra-Physics sites were approved by the Water Board and U.S. EPA in 1991 (Site Cleanup Requirements, Order No. 91-025) focused on reducing both levels of contaminants in groundwater and the concentration of contaminants in the soil source area. The goal was that the groundwater could ultimately be used for domestic purposes. At that time, plans to mitigate the subsurface vapor intrusion pathway were not considered.

Changes in ARARs

Applicable or Relevant and Appropriate Requirements (ARARs) and cleanup levels for soil contamination at these sites have been met in accordance with the Final Site Cleanup Requirements. There have been no changes in ARARs that would affect operations or the protectiveness of the remedy.

The Water Board has developed risk-based Environmental Screening Levels (ESLs) for a variety of exposure routes including vapor intrusion into buildings from underlying groundwater contamination. The current levels of TCE and cis-1,2-DCE in groundwater beneath the building are below the Water Board's residential screening levels for potential indoor air risk.

One of the action-specific ARARs from the ROD cites the NPDES discharge standards in accordance with the Water Board's Water Quality Control Plan, San Francisco Bay Region, Region 2 (1995). The Basin Plan references standards that were adopted from U.S. EPA's Ambient Water Quality Criteria, as adopted by the Water Board in 1986. In 2000, U. S. EPA promulgated the California Toxics Rule, which updates and adds standards for discharges to surface waters. The California Toxics Rule standards for VOCs are not lower than those in the NPDES permits for the groundwater treatment systems; therefore, these new standards do not affect the NPDES discharge standards for the treated effluent, and they do not affect the protectiveness of the remedy.

Question C: Has any other information come to light that could call into question the protectiveness of the remedy?

At the time of this review there is no information available that would question the effectiveness of the remedy.

Technical Assessment Summary

According to the data reviewed and the site inspection, the remedy is functioning as intended by the Record of Decision in the short term. There have no been changes in the physical condition or land use of the site that would reduce the protectiveness of the remedy.

VIII. Issues

The one issue identified during the review was the recognition that the present remedy was not likely to achieve the cleanup goals in any predictable time period. The dischargers are questioning if the groundwater extraction system is achieving significantly more than would be accomplished by not extracting groundwater and allowing natural biological effects take their course.

In situ remediation processes have not be considered by the dischargers but in situ oxidation has been tried at the Montwood site on Plymouth Street in the downgradient area of the commingled plume. Specifically both potassium permanganate and sodium persulfate ($\text{Na}_2\text{S}_2\text{O}_8$) were injected into the shallow groundwater aquifer in an attempt to oxidize and degrade the chlorinated solvents. Although initial impacts were noted there was no significant overall reduction in the levels of groundwater contamination and the potential effectiveness of this approach is doubted. Based on this information it does not appear to be practical to consider in situ chemical oxidation as a way to significantly reduce contaminant concentrations across the area of the plume.

There is an on going study to determine if conditions for biological natural attenuation exist across the plume. If the data confirm these conditions then enhanced natural attenuation could be an option to accelerate the cleanup process. This can be considered over the next five years.

IX. Recommendations and Follow-up Actions

Teledyne and Spectra-Physics will continue to monitor groundwater quality for several years. They will also complete their investigations to determine if conditions for natural attenuation exist in the area of the commingled plume. If the results from this investigation indicate that conditions conducive to natural attenuation do exist, then a limited shutdown of the groundwater extraction system should be considered in order to test this proposition. This will probably occur within the next five years.

Issue	Recommendation	Affects Protectiveness
Groundwater extraction and treatment is not likely to achieve cleanup goals. Natural biological attenuation could be just as effective as groundwater extraction in remediating the groundwater. If natural attenuation conditions are shown to exist in the area of the plume, enhancing the conditions could accelerate the cleanup process and achieve cleanup goals.	The natural attenuation study will be completed in January 2006. If the study confirms that conditions exist then the use of enhancements to promote biological attenuation should be considered.	Yes.

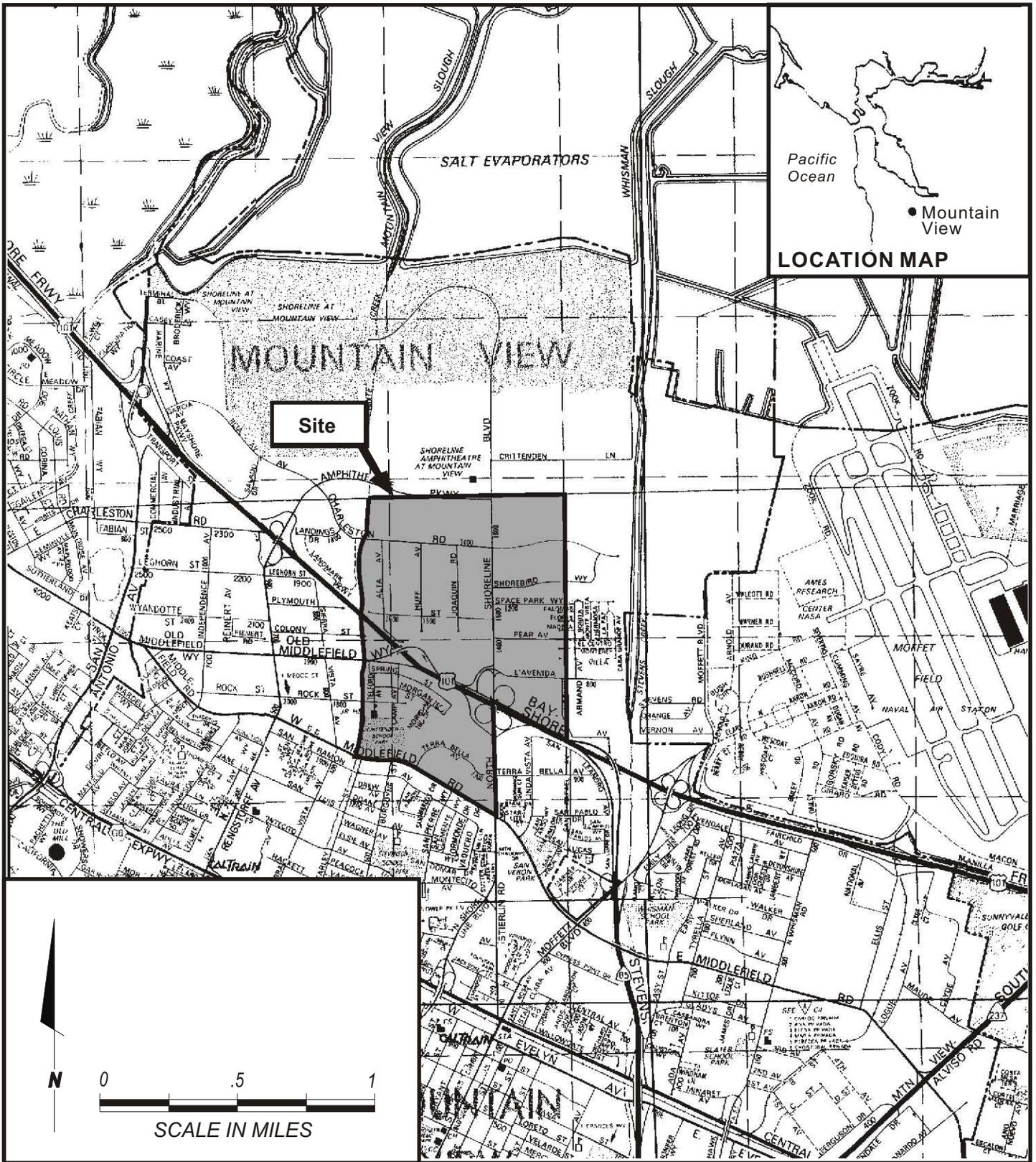
X. Protectiveness Statement

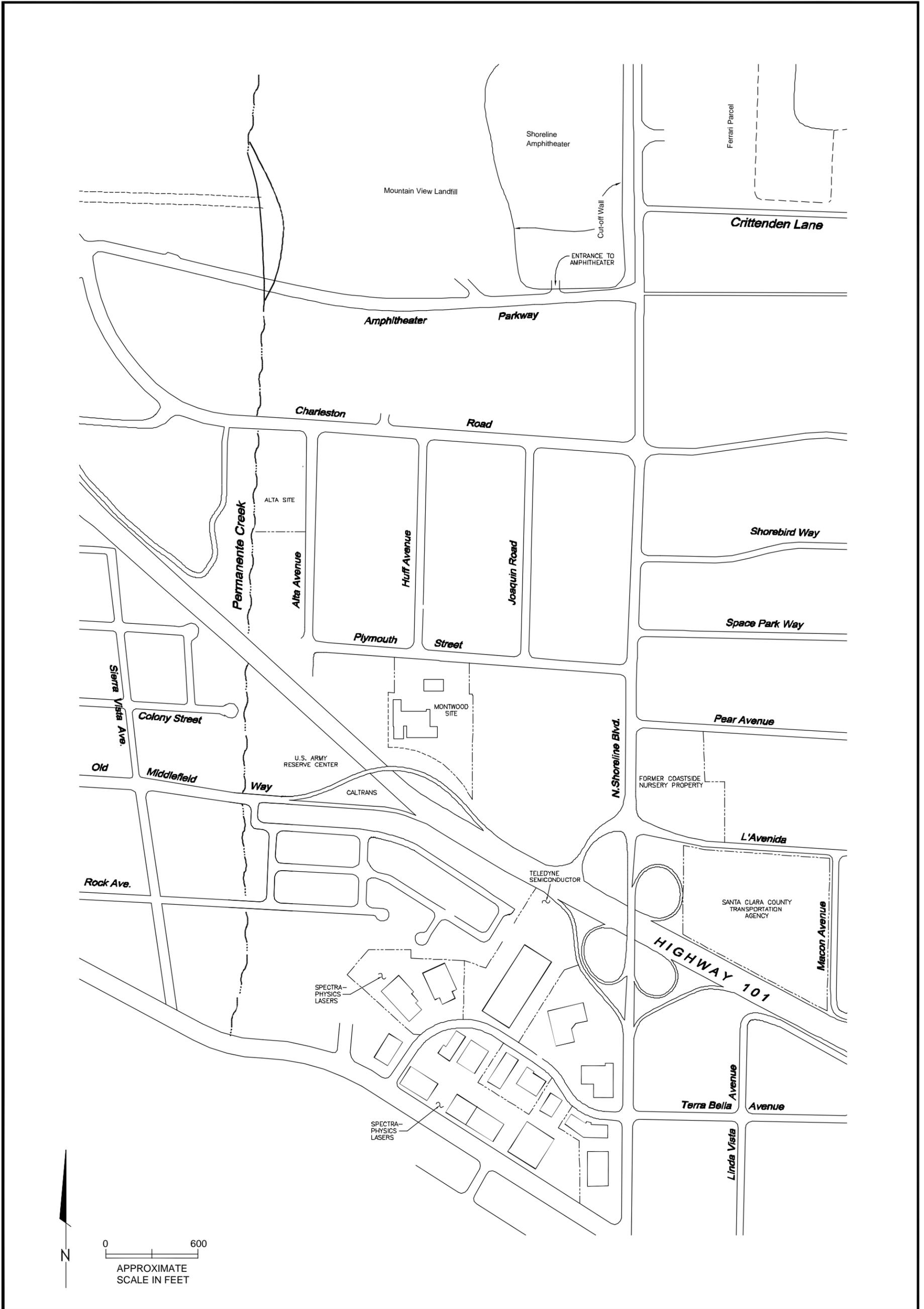
Remedial actions conducted at the site until 2003 under the Final Site Cleanup Requirements Order functioned as designed and achieved positive results by reaching soil cleanup goals, maintaining hydraulic control of plume migration and reducing VOC concentrations in groundwater throughout the plume. Groundwater cleanup goals (MCLs) have not yet been achieved and are not expected to be achieved in the

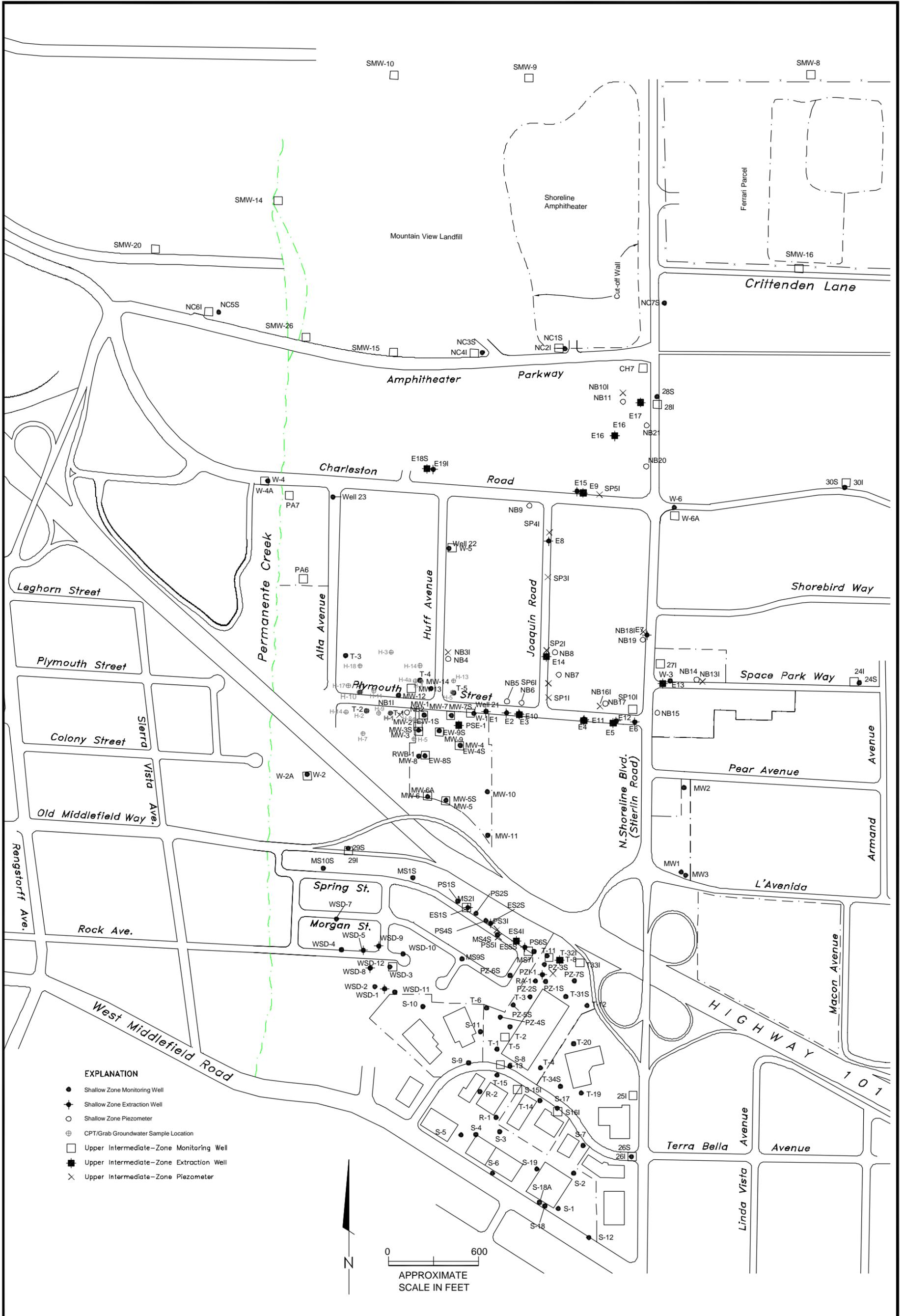
foreseeable future with the current remedy. The remedy at the site is currently protective of human health and the environment because exposure pathways that could result in unacceptable risks are being controlled.

XI. Next Review

The next five-year review for the Teledyne and Spectra-Physics Superfund site is required by September 30, 2009. In order to re-synchronize the five-year reporting schedule between the Water Board and U.S. EPA, the successor to Teledyne and Spectra-Physics Lasers have been asked to submit their next Five-Year Summary Report to the Water Board by March 15, 2009 rather than by March 15, 2006.







- EXPLANATION**
- Shallow Zone Monitoring Well
 - ◆ Shallow Zone Extraction Well
 - Shallow Zone Piezometer
 - ⊕ CPT/Grab Groundwater Sample Location
 - Upper Intermediate-Zone Monitoring Well
 - Upper Intermediate-Zone Extraction Well
 - × Upper Intermediate-Zone Piezometer

