

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

**Third Five-Year Review**

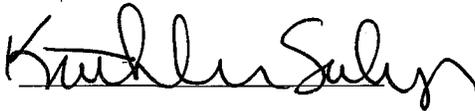
**Teledyne Semiconductor/Spectra-Physics, Inc. Sites  
1300 Terra Bella Avenue and 1250 West Middlefield Road  
Mountain View, Santa Clara County, California**

**September 2009**

**Approved By:**

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9/30/09  
Date

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## ACRONYMS AND ABBREVIATIONS

|                          |  |
|--------------------------|--|
| $\mu\text{g}/\text{m}^3$ | micrograms per cubic meter   |
| ARARs                    | Applicable or Relevant and Appropriate Requirements                                  |
| bgs                      | below ground surface   |
| CV                       | coefficient of variation   |
| DCE                      | dichloroethene   |
| ERD                      | enhanced reductive dechlorination  |
| ESL                      | Environmental Screening Level (San Francisco Bay Region Water Quality Control Board) |
| FFS                      | Focused Feasibility Study  |
| GWET                     | groundwater extraction and treatment   |
| MCL                      | Maximum Contaminant Level  |
| mg/day                   | milligrams per day   |
| MNA                      | monitored natural attenuation  |
| NBES                     | North Bayshore Extraction System   |
| NPDES                    | National Pollutant Discharge Elimination System                                      |
| ORP                      | oxidation-reduction potential  |
| OSWER                    | U.S. EPA's Office of Solid Waste and Emergency Response                              |
| RAOs                     | Remedial Action Objectives   |
| RI/FS                    | Remedial Investigation/Feasibility Study   |
| ROD                      | Record of Decision   |
| Regional Water Board     | San Francisco Bay Regional Water Quality Control Board                               |
| Teledyne                 | Teledyne Semiconductor   |
| Spectra-Physics          | Spectra-Physics Lasers, Inc.   |

|          |   |
|----------|---|
| SSES     | Spring Street Extraction System               |
| SVET     | soil vapor extraction and treatment           |
| TCE      | trichloroethene                               |
| U.S. EPA | United States Environmental Protection Agency |
| VOC      | volatile organic compound                     |

## EXECUTIVE SUMMARY

The former Teledyne Semiconductor (Teledyne) and Spectra-Physics Lasers, Inc. (Spectra-Physics) properties are located in Mountain View, Santa Clara County, California (collectively, the Properties). Although EPA listed them as part of two separate Superfund sites, the Properties are collectively regulated as the Teledyne/Spectra-Physics Site (or Site), which also includes a contaminated groundwater plume and downgradient areas impacted by that plume. As shown in the site map attached as Appendix A, the Site extends from the Properties to the Spring Street Area, also collectively referred to as the North Bayshore Area. The remedy at the Teledyne/Spectra-Physics Site has consisted of:

- Soil-vapor extraction and treatment (SVET) at the Spectra-Physics property.
- Groundwater extraction and treatment (GWET) at the Teledyne property and various portions of the Study Area.
- Groundwater monitoring and institutional controls at the Properties.
- Groundwater monitoring in the Study Area.

This is the third five-year review summary for the Teledyne/Spectra-Physics Site, and it covers activities conducted between July 2004 and September 2009. This five-year review summary is based on the Five Year Status Evaluation Report prepared by the Responsible Parties for the Teledyne (Allegheny Technologies [Allegheny-TDY]) and Spectra-Physics properties (Thermo Electron Corporation [Thermo Electron]).

During the prior five-year review, it was recognized that the ongoing GWET was not likely to achieve the cleanup standards in a reasonable time period in the remnant source area and likely provided no significant remedial benefit in the distal areas of the plume. In 2003, the Regional Board approved Allegheny-TDY and Thermo Electron's plan to implement a monitored natural attenuation (MNA) pilot study in the North Bayshore Area that has documented volatile organic compound (VOC) mass reductions and plume shrinkage under non-pumping conditions.

During the beginning of this five year review, a vapor intrusion evaluation was conducted at the former Teledyne and Spectra-Physics properties. This vapor intrusion evaluation concluded that the remedy is protective at these two properties. However, the Spring Street and North Bayshore Areas were not included in this vapor intrusion evaluation.

Allegheny-TDY and Thermo Electron pilot tested in-situ enhanced reductive dechlorination (ERD) remediation processes at the former Teledyne property in 2005. This pilot test has shown that in-situ ERD is effective at remediating the VOCs and is feasible at the Teledyne/Spectra-Physics Site. Based on the MNA Study, in-situ ERD appears to be more effective than pump and treat at this stage of the cleanup. The pilot study also indicates a stall for cis-1,2-DCE reduction in the shallow water-bearing zone (Shallow Zone), which will

require bioaugmentation. The data indicate there is no cis-1,2-DCE stall in the intermediate water-bearing zone (Intermediate Zone).

Based on the positive results of the two pilot tests, the Regional Board is recommending a full scale Treatability Study that may ultimately result in a proposed change in the final remedy to in-situ ERD/bioaugmentation within the remnant source zone at the former Teledyne property, and MNA across the remaining portions of North Bayshore area. These remedy changes will be documented in an amendment to the Record of Decision (ROD) in 2011.

A protectiveness determination of the remedy at the Teledyne/Spectra-Physics Site cannot be made at this time until after a vapor intrusion assessment is completed at the Spring Street and North Bayshore Areas. There currently is limited information at these two locations to assess the potential for vapor intrusion. All other exposure pathways that could result in unacceptable risks are being controlled, and institutional controls are preventing exposure to, or the ingestion of, contaminated groundwater. In the Spring Street and North Bayshore areas, the vapor intrusion exposure pathway will be reevaluated in approximately one year following the planned vapor intrusion monitoring. In order to make a protectiveness determination, an addendum to the 2009 Five Year Review is required. The FYR addendum should be completed by September 30, 2011.

## FIVE-YEAR REVIEW SUMMARY FORM

### SITE IDENTIFICATION

**Site Name** (from WasteLAN): Teledyne Semiconductor and Spectra-Physics, Inc.

**EPA ID** (from WasteLAN): Teledyne Semiconductor : CAD009111444 and Spectra-Physics, Inc: 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:** 1984

**Has Site been put into reuse?** 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.

### REVIEW STATUS

**Lead agency:** State of California

**Author Name:** Roger Papler

**Author title:** Engineering Geologist

**Author affiliation:** San Francisco Bay  
Regional Water Quality Control  
Board (Lead Agency)

**Review period:** January to September 2009

**Date(s) of Site inspection:** 3/20/09

|   |
|---|
| <p><b>Type of Review:</b> <input type="checkbox"/> Post-Sara <input type="checkbox"/> Pre-Sara <input type="checkbox"/> NPL-Removal only</p> <p><input type="checkbox"/> Non-NPL Remedial Action Site <input checked="" type="checkbox"/> <b>NPL State/Tribe-lead</b></p> <p><input type="checkbox"/> Regional Discretion</p>                           |
| <p><b>Review number:</b> (in bold) <input type="checkbox"/> 1 (first) <input type="checkbox"/> 2 (second) <input checked="" type="checkbox"/> <b>3 (third)</b> Other (specify)</p>  |
| <p><b>Triggering action:</b> (in bold)</p> <p><input type="checkbox"/> Actual RA Onsite Construction at OU#__ <input type="checkbox"/> Actual RA Start at OU#__</p> <p><input type="checkbox"/> Construction Completion <input checked="" type="checkbox"/> <b>Previous Five-Year Review Report</b></p> <p><input type="checkbox"/> Other (specify)</p> |
| <p><b>Triggering action date</b> (from WasteLAN): 9/30/2004</p>   |
| <p><b>Due Date:</b> 9/30/2009</p>   |

## Five-Year Review Summary Form

### Issues:

The issues identified during this five-year review are:

1. A potential vapor intrusion concern in the Spring Street Area and the North Bayshore Area.
2. A potential vadose zone source under the former Teledyne building.
3. The declining effectiveness of GWET over time.
4. The existing restrictive covenant was recorded prior to adoption of California Civil Code section 1471, which established the legal framework for environmental restriction covenants in California. Also, the ROD does not explicitly include institutional controls (ICs) in the selected remedy.

### Recommendations and Follow-up Actions:

1. To evaluate the potential for vapor intrusion, Allegheny-TDY and Thermo Electron will perform a vapor intrusion assessment in the Spring Street Area and the North Bayshore Area. The necessity of a restrictive covenant for properties in these areas will be determined after the vapor intrusion assessment is completed
2. To evaluate the potential vadose zone source, Allegheny-TDY will perform an additional data gap investigation under the former Teledyne building.
3. To address the declining effectiveness of GWET, Allegheny-TDY and Thermo Electron will implement the alternative remedial technology of ERD and MNA as a full scale Treatability Study. A ROD amendment will be needed to reflect the change in remedy
4. To address the concerns regarding the institutional controls, ICs should be included as part of the remedy and the legal owners of the former Teledyne and Spectra-Physics properties will record new restrictive covenants for those properties consistent with current California law.

### Protectiveness Statement:

A protectiveness determination of the remedy at the Teledyne/Spectra-Physics Site cannot be made at this time until after a vapor intrusion assessment is completed at the Spring Street and North Bayshore Areas. There currently is limited information at these two locations to assess the potential for vapor intrusion. All other exposure pathways that could result in unacceptable risks are being controlled, and institutional controls are preventing exposure to, or the ingestion of, contaminated groundwater. In the Spring Street and North Bayshore

**Five-Year Review Summary Form**

areas, the vapor intrusion exposure pathway will be reevaluated in approximately one year following the planned vapor intrusion monitoring. In order to make a protectiveness determination, an addendum to the 2009 Five Year Review is required. The FYR addendum should be completed by September 30, 2011.

**California Regional Water Quality Control Board**

**San Francisco Bay Region**

**Third Five-Year Review**

**Teledyne/Spectra-Physics Site**

**1300 Terra Bella Avenue and 1250 West Middlefield Road**

**Mountain View, Santa Clara County, California**

**I INTRODUCTION**

The purpose of the five-year review is to determine whether the remedy at a site is protective of human health and the environment. The methods, findings, and conclusions of reviews are documented in Five-Year Review reports. In addition, Five-Year Review reports identify issues found during the review, if any, and identify recommendations to address them.

The Agency is preparing this Five-Year Review report pursuant to CERCLA §121 and the National Contingency Plan (NCP). CERCLA §121 states:

*If the President selects a remedial action that results in any hazardous substances, pollutants, or contaminants remaining at the site, the President shall review such remedial action no less often than each five years after the initiation of such remedial action to assure that human health and the environment are being protected by the remedial action being implemented. In addition, if upon such review it is the judgment of the President that action is appropriate at such site in accordance with section [104] or [106], the President shall take or require such action. The President shall report to the Congress a list of facilities for which such review is required, the results of all such reviews, and any actions taken as a result of such reviews.*

The Agency interpreted this requirement further in the NCP; 40 CFR §300.430(f)(4)(ii) states:

*If a remedial action is selected that results in hazardous substances, pollutants, or contaminants remaining at the site above levels that allow for unlimited use and unrestricted exposure, the lead agency shall review such action no less often than every five years after the initiation of the selected remedial action.*

The California Regional Water Quality Control Board, San Francisco Bay Region, conducted the five-year review of the remedy implemented at the Teledyne/Spectra-Physics Superfund Site (Site) in Mountain View, Santa Clara County, California. This is the third five-year review. The triggering action for this review is the completion of the second five-year

review on September 30, 2004. The five-year review is required due to the fact that hazardous substances, pollutants, or contaminants remain at the Site above levels that allow for unlimited use and unrestricted exposure.

## II SITE CHRONOLOGY

| Activity  | Date               |
|---|--------------------|
| Teledyne and Spectra-Physics installed on-site sumps for acid neutralization and waste collection.  | 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               |
| Teledyne Semiconductor Site is added to NPL   | July 1987          |
| Spectra-Physics starts soil-vapor extraction.   | 1989               |
| Allegheny-TDY and Thermo Electron start the off-site North Bayshore Extraction System.  | 1990               |
| Regional Water Board Order 91-025 (Order) for both sites approves remedies that include soil-vapor extraction and groundwater extraction, treatment, and discharge to sanitary sewer and surface water under National Pollutant Discharge Elimination System (NPDES) permit. The Order defines Final Site Cleanup requirements. | February 21, 1991  |
| Spectra Physics Site added to the NPL   | February 1991      |
| U.S. EPA issues a ROD for the Teledyne/Spectra-Physics Site.  | March 22, 1991     |
| RWQCB and EPA complete first Five Year Review (FYR)   | September 29, 1999 |
| Allegheny-TDY and Thermo Electron submit Ten-Year Review Report to Regional Water Board.  | March 15, 2001     |
| Allegheny-TDY and Thermo Electron submit the MNA proposal for the Study Area.   | September 12, 2003 |
| Regional Water Board approves plan to study natural attenuation.  | November 2003      |
| Allegheny-TDY and Thermo Electron complete soil-gas analyses and vapor intrusion studies and submit reports.  | 2004               |
| Allegheny-TDY and Thermo Electron submit three-year supplemental report to Ten-Year Review.   | June 2004          |

| Activity  | Date               |
|---|--------------------|
| RWQCB and EPA complete the second Five Year Review  | September 30, 2004 |
| Allegheny-TDY and Thermo Electron submit Work Plan for Pilot Study for groundwater injection remediation technology.                        | September 16, 2005 |
| Regional Water Board approves groundwater bioaugmentation injection pilot study.  | October 25, 2005   |
| Allegheny-TDY and Thermo Electron submit interim Natural Attenuation Study report and Final Bioaugmentation Report to Regional Water Board. | February 2007      |

### III BACKGROUND

#### Physical Characteristics

The former Teledyne facility was located at 1300 Terra Bella Avenue and Spectra-Physics was located at 1250 Middlefield Road, in Mountain View, California (Appendix A – Site Map). Mountain View has a population of 65,000 and is located towards the northwest end of Silicon Valley in Santa Clara County and is part of the San Francisco Bay Metropolitan Region. Teledyne is presently located at 1274 Terra Bella Avenue and Spectra-Physics is presently located at 1277 Terra Bella Avenue. The Teledyne Semiconductor and Spectra-Physics Laser Superfund properties are located immediately south of Highway 101.

The groundwater plume originating from the two sites is managed as one commingled plume by the successors to Teledyne Semiconductor and by Spectra-Physics. The comingled groundwater contaminant plume extends downgradient, in a northerly direction towards the Bay, for almost one mile. The plume passes under Highway 101, past Amphitheatre Parkway, to the former dewatering trench for the Mountain View Landfill.

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 located on the hydrogeologically upgradient side of the original buildings.

Northwest of and adjacent to the former Teledyne property, the western lateral portion of the plume underlies the residences in the Spring Street Area.

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.

## **Hydrogeology**

The Teledyne/Spectra-Physics Site is situated in the northern portion of the Santa Clara Valley, California, along the western edge of San Francisco Bay. The Santa Clara Valley is a gently northward sloping alluvial plain, flanked by the Diablo Range to the east-northeast, and the Santa Cruz Mountains to the west-southwest. The alluvium comprises a complex sequence of clay, silt, sand, and gravel. Within the Santa Clara Valley, two significant water-bearing zones have been identified as the Upper and Deep Aquifers.

The Upper Aquifer consists of approximately 70 feet of silty clay and clayey silt interbedded with sand and gravel. The Deep Aquifer exists at depths greater than 100 feet below ground surface (bgs) and is reported to extend to a depth of approximately 700 feet bgs. The Deep Aquifer is the primary source of water 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 three zones as follows:

- A shallow Zone extending from approximately 20 to 35 feet bgs;
- An upper Intermediate Zone extending from approximately 35 to 50 feet bgs; and
- A lower Intermediate Zone extending from approximately 50 to 70 feet bgs.

The Shallow, Upper Intermediate, and Lower Intermediate Zones consist of interconnected permeable lenses that are separated by mostly continuous aquitards of variable thickness. The estimated depth to shallowest groundwater beneath the Teledyne/Spectra-Physics Site, and the site vicinity, is approximately 12 to 15 feet bgs. Groundwater flow in the three zones is to the north. The groundwater flow direction has been generally consistent since project inception and has been influenced by the operation of Allegheny-TDY and Thermo Electron's and other parties' groundwater extraction systems.

## **History of Contamination**

Site investigations began at Teledyne in 1982 and at Spectra-Physics in 1984. Soil samples taken from the Teledyne property indicated that releases of VOCs had occurred and had impacted soil and groundwater, but residual VOC soil concentrations were within cleanup standards 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 concentrations that required remediation. The groundwater at both the Teledyne and Spectra-Physics sites has been impacted, with the impact limited to the Upper Aquifer in the Shallow and Intermediate zones. Groundwater samples collected from the Deep Aquifer, used as a source of drinking water, indicated that it had not been impacted.

The plume is comingled with three identified sources of VOCs within the downgradient Study Area:

- 1615 and 1625 Plymouth Street (known as the Montwood site)
- 1098 Alta Avenue (known as the Peery/Arrillaga site).
- Southeast corner of Space Park Way and N. Shoreline Boulevard (known as the Space Park Way site).

The Peery/Arrillaga and Montwood sites are respectively regulated under Regional Water Board Orders 01-010 and 00-002, and have localized GWET systems in operation to address on-site VOCs. The Montwood site shut down its GWET system to conduct a temporary MNA study in preparation for a probable ERD pilot study. A third site, Space Park Way, is located at the southeast corner of Space Park Way and N. Shoreline Boulevard. Allegheny-TDY and Thermo Electron operate groundwater extraction well E-13 at the Space Park Way site solely to control the higher concentrations emanating from that area.

### **Initial Response**

To address the impacted soil on the Spectra-Physics property, soil vapor extraction and treatment (SVET) systems were installed in 1989 and in 1992. Both systems treated the extracted vapors with granular activated carbon.

Interim remedial actions began at Teledyne in October 1986 with the startup of an on-site GWET system to provide hydraulic control and remediation of the impacted groundwater. This system extracted groundwater from both the shallow zone (RA-1) and intermediate zone (T-32I) in the upper aquifer. The groundwater extracted from this system was treated by an air stripper and then discharged to Permanente Creek under a NPDES permit.

Two additional groundwater extraction systems were also installed in separate off-site areas. In 1990, Allegheny-TDY and Thermo Electron started operating the North Bayshore Extraction System (NBES) that consisted of 11 shallow wells and six intermediate-zone wells. The water from this system is discharged into the sanitary sewer system under a City of Mountain View permit. In 1991, Allegheny-TDY and Thermo Electron started the second off-site system that is located on Spring Street (SSES), a residential area northwest of and adjacent to the Teledyne site. This system consists of three shallow-zone and two intermediate-zone wells. Although relatively close to the on-site system, access limitations required that groundwater extracted from the SSES would be discharged to the sanitary sewer, also under a City of Mountain View permit.

### **Summary of Basis for Taking Action**

The Teledyne/Spectra-Physics Site lies within the Santa Clara Valley Groundwater Basin. USEPA designated the Teledyne and Spectra-Physics properties and the Spring Street and North Bayshore areas as a Superfund site primarily because of the potential threat to the deeper, underlying groundwater found within the Basin currently being used for potable water supply.

## 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 provided the basis of the remedial action plan. The Regional Water Board adopted Final Site Cleanup Requirements Order No. 91-025 (Order) in February 1991 and the U.S. EPA adopted a Record of Decision (ROD) on March 22, 1991. The final site cleanup remedy selected in the ROD for the two sites consisted of the following elements:

- Groundwater extraction and treatment for groundwater;
- Soil vapor extraction and treatment for soil cleanup; and
- Shallow zone, intermediate zone, and deep aquifer groundwater monitoring and vadose zone monitoring.

The Order set cleanup standards for both soil and groundwater. The soil cleanup standard was 2.5 parts per million total VOCs for soil between 0 and 10 ft bgs and 0.5 part per million total VOCs for soil between 10 and 14 ft bgs. The groundwater cleanup standards were set at the EPA Maximum Contaminant Levels (MCLs) and are summarized in Table 1.

**Table 1 - Groundwater Cleanup Standards**

| <b>Chemical</b>                          | <b>Cleanup Standard<br/>(micrograms/Liter)</b> |
|--|--|
| Vinyl Chloride                           | 0.5  |
| Trichloroethene (TCE)                    | 5  |
| Tetrachloroethene (PCE)                  | 5  |
| 1,1-dichloroethane (1,1-DCA)             | 5  |
| 1,1-dichloroethene (1,1-DCE)             | 6  |
| cis-1,2-dichloroethene (cis-1,2-DCE)     | 6  |
| trans-1,2-dichloroethene (trans-1,2-DCE) | 10   |
| 1,1,1-Trichloroethane (1,1,1-TCA)        | 200  |
| Toluene                                  | 100  |
| 1,2,4-trichlorobenzene                   | 40   |

## **Remedy Implementation**

Groundwater extraction and treatment systems, at both sites, and a SVET system at the Spectra-Physics site, were in place by the time the final Board Order was adopted in February 1991. After adoption of the final Order, a second SVET was installed in 1992 on the Spectra-Physics property.

### Soil-Vapor Extraction and Treatment

In 1989, SVET System 1 began operation in the area of sump #1 at Building 3 (1250 West Middlefield Road) on the Spectra-Physics property. In 1992, SVET System 2 began operation in the vicinity of Building 2 (1245 Terra Bella Avenue) and Building 3 to address the VOC-impacted soil at those locations. In both systems, the extracted vapors were treated using vapor-phase granular activated carbon. Collectively, the two systems have removed 1165 pounds of VOCs. The SVETs were curtailed after recovery had reached asymptotic levels and soil cleanup standards had been achieved. Currently there are no SVET systems in operation.

### Groundwater Extraction

The GWET system at the former Teledyne property began operation in October 1986. The NBES was installed in March 1990 and the SSES was installed in August 1991. The effluent from the NBES and SSES is discharged under permit to the City of Mountain View sanitary sewer system. The effluent from the on-site system was treated under NPDES permit and discharged into Permanente Creek, which is located to the west and north of the impacted area. All three systems were fully operational until December 2003 when the majority of the SSES and NBES systems were turned off for an MNA Pilot Study in the Study Area. Only two extraction wells (E-8 and E-13) are currently operating in the NBES area.

In January 2007, the SSES was restarted to capture relatively higher VOC concentrations that were detected in that area. In the SSES area, the VOC concentrations increased substantially after the GWET at the adjacent former Teledyne property was turned off in November 2005 and enhanced reductive dechlorination (ERD) injections began a few months later.

### Restrictive Covenants

Regional Water Board Order 91-025 required the parties to record restrictive covenants (or “deed restrictions”). Accordingly, Allegheny-TDY and Thermo Electron respectively recorded restrictive covenants prohibiting the use of groundwater on the Teledyne and Spectra-Physics Lasers with the Santa Clara County Recorder on March 5, 1992 (No. 11260055) and September 7, 1994 (No. 12640287). The covenants also prevent the installation of groundwater wells and interference with groundwater remediation equipment. Note, however, that the ROD did not explicitly select institutional controls; amendment of the ROD to incorporate restrictive covenants is needed.

A title search performed on January 16, 2009, indicates the existence of the restrictive covenants recorded by Spectra-Physics in 1994. The Title Search performed on April 27, 2009, however, did not indicate the existence of the Teledyne covenant. If new restrictive covenants have not been recorded at the time that the protectiveness determination is made for this review, a new title report should be prepared to determine whether a prospective future owner will find the Teledyne covenant in the title record.

**Systems Operation/Operations and Maintenance**

Allegheny-TDY operates the GWET system located at the SSES and NBES areas. The effluent is discharged to the sanitary sewer and treated at the local publicly owned treatment works. PES Environmental conducts routine operation and maintenance, and LFR, Inc. on behalf of Allegheny-TDY conducts quarterly sampling and monitoring of the remaining operational extraction wells.

Semi- annual groundwater monitoring reports for the Site are submitted to the Regional Water Board. Costs associated with operation and maintenance of the GWET system and associated reporting are summarized below in Table 2. The main costs associated with the operation and maintenance of the GWET system are sampling, analytical laboratory fees, electricity, parts, and discharge and consulting fees.

**Table 2 - System Operations/O&M Costs**

| <b>From</b> | <b>To</b>  | <b>Total Cost</b> |
|-------------|------------|-------------------|
| 1/1/1996    | 12/31/2003 | \$5,010,000       |
| 1/1/2004    | 12/31/2008 | \$1,461,000       |

**V PROGRESS SINCE LAST REVIEW**

The 2<sup>nd</sup> five year review, completed in 2004, concluded that:

*“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*

*buildings and in building indoor air on both properties were measured and shown not to pose a health risk.”*

The issue identified and the actions taken since the last five-year review are summarized below in Table 3.

**Table 3: Actions Taken Since the Last Five-Year Review**

| Issues from Previous Review            | Recommendations Follow-up Actions | Action Taken and Outcome                              |
|--|-----------------------------------|---|
| Declining effectiveness of GWET system | Evaluate ERD and MNA              | The pilot studies show that ERD and MNA are effective |

**Monitored Natural Attenuation**

Data collected and evaluated as part of the last five year review indicated hydraulic control of the VOC-impacted groundwater plume, and the pilot MNA study indicated that the groundwater plume was shrinking. Based on these findings, that five year review recommended continuing the MNA pilot study and using the results of the MNA pilot study to determine the feasibility of implementing an MNA remedy. The results of the MNA study are documented in the February 23, 2007, *Interim Report Monitored Natural Attenuation Study at the North Bayshore and Spring Street Extraction Systems* (MNA Report).

The MNA Report concluded that natural attenuation is occurring and is essentially maintaining or decreasing the size and concentrations of the VOC-impacted groundwater plume in the North Bayshore Area. The four lines of evidence include:

- TCE mass removal;
- Presence of TCE breakdown products;
- Plume stability; and
- TCE plume size reduction.

Additional evidence of natural attenuation included VOC plume reduction and measured decreases in mass flux across a large transect through the widest portion of the North Bayshore Study Area. To check the progress of the ongoing MNA pilot test, LFR assessed additional data between January 2006 and December 2008 and utilized the same methodologies that are referenced within the Interim MNA Report. The results of the ongoing MNA study confirmed the conclusions of the MNA report.

Overall, the analytical results of the MNA monitoring indicate that natural attenuation is actively occurring within the North Bayshore Study Area and that the plume is stable or shrinking. Based on these findings, the majority of the NBES remains shut down.

## **ERD Pilot Study**

In November 2005, Allegheny-TDY and Thermo Electron implemented the *Pilot Study Work Plan for Groundwater Injection Remediation Technology* (ERD Workplan) and documented the results of the ERD Workplan in the February 23, 2007, *Final Report for the Bioaugmentation Pilot Study* (ERD Report). The Report concluded that:

- VOC degradation was occurring in the Shallow- and Intermediate-Zone groundwater and that the subsurface environment was sufficiently enhanced for reductive dechlorination of VOCs in groundwater.
- The transformation of cis-1,2-DCE to vinyl chloride was stalling within Shallow Zone. During full-scale ERD activities, Allegheny-TDY and Thermo Electron plan to address the cis-1,2-DCE stall by bioaugmenting the Shallow Zone with *dehallicoides* bacteria.
- Intermediate Zone groundwater did not stall at cis-1,2-DCE and TCE transformed completely to ethene and ethane.
- Preferential flow pathways exist in the Shallow and Upper Intermediate Zones. During full-scale ERD activities, Allegheny-TDY and Thermo Electron plan to address the presence of preferential pathway by using a durable emulsified oil product. Allegheny-TDY and Thermo Electron concluded that subsurface diffusion and dispersion will overcome any preferential pathway issues.

## **Draft Focused Feasibility Study**

Allegheny-TDY and Thermo Electron conducted a Focused Feasibility Study (FFS) for the Site. The Draft FFS also contains the on-site Data Gap Investigation (DGI) results and additional ERD data that are described below. Based on the DGI results and additional ERD data, the Draft FFS proposes implementing a full-scale ERD at the former Teledyne property and MNA in the off-property NBES areas. The Draft FFS proposes ERD injection point spacing every 30 feet with a presumed radius of influence of 15 feet around each injection point. The SSES in the adjacent residential area would continue operating until VOC levels decline considerably. The NBES would be shut down with the exception of well E-13 in the Space Park Way area.

### Data Gap Investigation

To identify source areas and focus the ERD remedy at the former Teledyne property, the ERD Report recommended additional DGI of the groundwater near and within the former Teledyne building. The DGI results indicate that:

- An elevated TCE source exists in the Lower Intermediate Zone near the former sump area located west of the former Teledyne building.
- There could be a vadose zone source beneath the building, which may be contributing VOCs to groundwater.

- Boundaries of relatively higher VOCs in groundwater are isolated to the former Teledyne property. The DGI is included as an appendix within the FFS.

#### Assessment of Additional ERD Data

Since the issuance of the ERD Report, Allegheny-TDY and Thermo Electron have performed additional carbon substrate injections and groundwater monitoring within the pilot study area. The results show that the overall VOC concentration trends are decreasing with strongly reducing conditions that are highly conducive for reductive dechlorination.

The data collected during the two-year period from 2006 to 2008, since the ERD Pilot Study Report was submitted, confirms the prior assessment and conclusions. Overall, the more recent data confirm that VOCs in groundwater at the site can be biologically degraded by ERD.

Overall, the VOC and geochemical groundwater monitoring data collected during the pilot study have provided sufficient information to determine remediation design parameters, such as injection point spacing, electron donor solution volume, and injection frequency, for the proposed full-scale implementation of ERD treatment at the Teledyne/Spectra-Physics Site. The FFS presents the DGI and proposed ERD injection points.

## **VI FIVE-YEAR REVIEW PROCESS**

### **Community Notification**

The Regional Water Board published a public notice in the Mountain View Voice on May 22, 2009. The public notice announced the beginning of the five year review process.

### **Document Review**

This five-year review included a review of relevant documents including the Five Year Status Review (submitted to the Water Board on February 2, 2009), FFS, and groundwater monitoring 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 Site Cleanup Requirements.

### **Data Review**

#### Groundwater Data

Groundwater monitoring data collected from 2004 to 2009 were summarized in Tables 4 and 5 and reviewed to evaluate progress in remediating the groundwater pollutant plume. The data review generally shows that the VOC concentrations in groundwater in the former source areas and across the plume continue to decline. Temporary VOC increases in the

SSES well ES4I - located near the former Teledyne property - occurred after the ERD pilot study began. Due to the probable surfactant release of groundwater-VOCs from the substrate injections, the VOCs may have been displaced to well ES4I through the same preferential pathway that contaminated the SSES area before remediation began. VOC concentrations in monitoring wells located along the down-gradient and perimeter edges of the Study Area have remained stable at low concentrations demonstrating that stability of the VOC plume has been achieved.

**Table 4 - TCE Concentrations in ug/L in Off-property Down-gradient Wells**

|                         | <b>12/2004</b> | <b>11/2005</b> | <b>12/2006</b> | <b>11/2007</b> | <b>11/2008</b> |
|-------------------------|----------------|----------------|----------------|----------------|----------------|
| <b>NBES</b>             |                |                |                |                |                |
| E-2 (Shallow)           | 370            | 330            | 310            | 260            | 280            |
| E-9 (Shallow)           | 16             | 13             | 4.4            | 2.7            | 3.3            |
| NC-<br>IS(Intermediate) | 11             | 11             | 10             | 8.7            | 9.6            |
| E-11(Intermediate)      | 120            | 80             | 94             | 82             | 86             |
| E-15(Intermediate)      | 68             | 51             | 45             | 30             | 31             |
| NC-2I<br>(Intermediate) | 11             | 13             | 14             | 11             | 14             |
| <b>SSES</b>             |                |                |                |                |                |
| ES1S (Shallow)          | 65             | 70             | 56             | 50             | 53             |
| ES2S (Shallow)          | 35             | 43             | 37             | 45             | 40             |
| ES5S (Shallow)          | 24             | 22             | 45             | 74             | 82             |
| MS9S (Shallow)          | 2.8            | 2.3            | 2.8            | 1.0            | 2.6            |
| ES3I (Shallow)          | 220            | 230            | 230            | 210            | 220            |
| ES4I (Intermediate)     | 370            | 340            | 1,800          | 880            | 850            |

Notes:

J = Estimated value, value below reporting limit

ND = Not detected

NS = Not sampled

**Table 5 - TCE Concentrations in ug/L in Source Area Wells**

| <b>Well No.</b>            | <b>12/2004</b> | <b>11/2005</b> | <b>12/2006</b> | <b>8/2007</b> | <b>10/2007</b> |
|----------------------------|----------------|----------------|----------------|---------------|----------------|
| <b>Teledyne</b>            |                |                |                |               |                |
| PZ-2S (Shallow)            | NS             | NS             | NS             | NS            | 130            |
| PZ-5S (Shallow)            | 600            | 350            | 810            | NS            | 1,900          |
| T-4 (Upper Intermediate)   | 47             | NS             | 38             | NS            | 27             |
| T-6 (Shallow)              | NS             | NS             | NS             | 98            | NS             |
| T-11(Shallow)              | NS             | NS             | NS             | NS            | 41             |
| T-13 (Lower Intermediate)  | 2.1            | 2.3            | 2.0            | NS            | <0.5           |
| T-20 (Shallow)             | ND             | ND             | <0.5           | NS            | <0.5           |
| PZI-1 (Upper Intermediate) | NS             | NS             | NS             | 430           | NS             |
| <b>Spectra-Physics</b>     |                |                |                |               |                |
| S-3 (Shallow)              | 2.9J           | 8.6            | 2.1J           | NS            | <2.5           |
| S-9 (Shallow)              | ND             | ND             | <0.5           | NS            | <0.5           |
| S-12 (Shallow)             | ND             | ND             | <0.5           | NS            | <0.5           |
| S-15I (Upper Intermediate) | 18             | 16             | 15             | NS            | 14             |
| S-16I (Upper Intermediate) | ND             | ND             | 0.3J           | NS            | <0.5           |
| S-18 (Shallow)             | 47             | 35             | NS             | NS            | NS             |

Notes:

J = Estimated value, value below reporting limit

ND = Not detected

NS = Not sampled

Table 6 shows the contaminant mass removed from the Site for the current and two prior evaluation periods.

**Table 6 - Mass Removal Efficiency**

| From     | To         | Volume Extracted (gal) | VOC Mass Removed (lbs) | Mass Removal Efficiency (lbs per million gal) |
|----------|------------|------------------------|------------------------|---|
| 1/1/1994 | 12/31/1999 | 672,222,500            | 2,831                  | 4.2   |
| 1/1/2000 | 12/31/2003 | 572,197,052            | 2,362                  | 4.1   |
| 1/1/2003 | 12/31/2008 | NA                     | 1,756                  | NA  |

The GWET has been successful in controlling migration of the plume and reducing concentrations of VOCs in groundwater. After almost 20 years of groundwater extraction, however, the amount of VOC mass being removed has declined considerably and VOC concentrations in groundwater have stabilized. This observation of an initial significant reduction in VOC concentrations followed by a leveling off of the reduction in VOC concentrations has been found to occur at many other sites in the area and around the country.

Based on observations made of groundwater data collected from between 2003 and 2008, the areal extent of the VOC contaminant plume appears to have decreased by an average of 7 percent per year. Remedial efforts have reduced VOC concentrations in groundwater in source areas and across the plume. Maximum VOC-groundwater concentrations in on-site source areas have been reduced from over 8,600 ug/L (well T-6) to approximately 1,000 ug/L (well T-32I). However, several groundwater-VOCs remain above cleanup standards due to the historical lack of source delineation at the former Teledyne property, complexity of site hydrogeology, recalcitrance of the chlorinated solvents, and limitations in current cleanup technology. Because on-site sources at Teledyne had not been delineated by prior investigations, Allegheny-TDY and Thermo Electron conducted the Data Gap Investigation that revealed the presence of elevated VOCs in the upper part of the Lower-Intermediate zone. The Deeper Zone is not impacted.

No potentially toxic or mobile transformation products have been identified during sampling conducted during this evaluation period that were not already identified to be present at the time of the Record of Decision.

Soil Vapor and Indoor Air Data

In 2004, Allegheny-TDY and Thermo Electron collected soil vapor and indoor air samples to evaluate the indoor air vapor intrusion pathway at the former Teledyne and Spectra-Physics

buildings. The soil vapor samples were collected from outside the buildings. At the former Teledyne property, the detected VOCs included PCE and TCE with maximum concentrations of 160 and 1,300 ug/m<sup>3</sup>, respectively. At the former Spectra-Physics property, the detected VOCs included PCE, TCE and cis-1,2-DCE, Freon 113, and vinyl chloride that were detected at 1.2, 4.1, 120, 1 and 0.42 ug/m<sup>3</sup>, respectively. At both properties, VOC concentrations in soil gas did not exceed their respective commercial San Francisco Bay Region Water Quality Control Board Environmental Board Screening Level (ESLs) for evaluation of potential vapor intrusion concerns of 4,100 ug/m<sup>3</sup> and 1,400 ug/m<sup>3</sup>.

During that vapor intrusion study, Allegheny-TDY and Thermo Electron also collected indoor and ambient air samples to further evaluate the indoor air vapor intrusion pathway at the former Teledyne and Spectra-Physics buildings. At the former Teledyne building, the respective maximum PCE and TCE detections were 0.31 and 0.41 ug/m<sup>3</sup>, concentrations that were similar to ambient air levels. VOC concentrations in indoor air for the Teledyne building did not exceed the target excess cancer risk set at 10<sup>-6</sup> for carcinogenic effects, and the target hazard quotient set at 0.2 for non-carcinogenic effects. In 2004, indoor air sampling indicated that indoor air levels that were below RWQCB's indoor air ESLs, and the Regional Water Board approved the 2004 vapor intrusion report.

At the former Spectra-Physics building, the respective maximum PCE, TCE, cis-1,2-DCE, Freon 113, detections were 12, 3, 3.5, and 0.87 ug/m<sup>3</sup>, respectively. The other indoor air results indicated non-detectable or trace levels of these compounds. Although, the maximum PCE and TCE concentrations exceeded RWQCB ESLs, the maximum detections indicated anomalous and un-representative indoor air levels. This conclusion was based on the following lines of evidence; (a) PCE is not a constituent of concern for the Site, (b) the duplicate quality assurance sample indicated non-detectable levels, and (c) the soil gas concentration beneath the Spectra-Physics building was ten times less than the indoor air concentration.

The results of this 2004 indoor air sampling indicated that the indoor air concentrations were significantly lower than expected given the high soil gas concentrations found beneath the buildings. This was attributed to the "tight" clays at 4 feet bgs found at most of the sampling locations.

EPA has also developed screening levels in various media to address the potential for vapor intrusion. Both agencies use similar conceptual models that incorporate important variables such as depth to the contaminant source and the physical properties of the chemicals of concern. The Water Board's ESLs are derived using generalized soil physical properties that may be applicable for the San Francisco Bay Area. EPA's screening values are derived from empirical data collected in the process of numerous, national vapor intrusion investigations. EPA's screening values are 210 ug/m<sup>3</sup> for PCE and 610 ug/m<sup>3</sup> for TCE in soil gas at industrial sites. However, the actual indoor air concentrations at the Teledyne building were below EPA's indoor air screening numbers of 2.1 ug/m<sup>3</sup> and 6.1 ug/m<sup>3</sup> for PCE and TCE, respectively.

In 2008, soil vapor samples were collected beneath the former Teledyne property building. Sample collection was difficult at the 5 foot bgs depth, which indicated mostly “no air flow” conditions. The highest concentration detected was 36,000 ug/m<sup>3</sup> for TCE that was collected from a soil vapor sample at 10’ bgs. The TCE and PCE concentrations exceed their respective RWQCB commercial ESLs of 4,100 ug/m<sup>3</sup> and 1,400 ug/m<sup>3</sup> and EPA’s industrial levels of 210 ug/m<sup>3</sup> for PCE and 610 ug/ m<sup>3</sup> for TCE for evaluation of potential vapor intrusion concerns. However, the results of the 2004 indoor air sampling indicated that the indoor air concentrations were significantly lower than expected given the high soil gas concentration beneath the buildings, which was attributed to the no air flow conditions observed under the building. The 2008 sub-slab sampling indicated tight clays at 4 feet bgs in most of the sampling locations. Due to these clays and historically low levels of VOCs in the indoor air, no further vapor intrusion sampling is needed at the former Teledyne property building.

**Table 7 - TCE/PCE Concentrations in ug/m<sup>3</sup> in Indoor Air and Soil Gas Samples**

| Sample Type       | Sample Location | Sample Date | Teledyne Concentration | Sample Location | Sample Date | Spectra-Physics Concentration |
|-------------------|-----------------|-------------|------------------------|-----------------|-------------|-------------------------------|
| <b>Indoor air</b> | IA-1            | 4/14/04     | ND <0.19               | I-1             | 2/18/04     | 0.34                          |
|                   | IA-2            | 4/14/04     | 0.41                   | I-2             | 2/18/04     | ND <0.19                      |
|                   | IA-3            | 4/14/04     | 0.19                   | I-3             | 2/18/04     | 3.0/12*                       |
|                   | IA-3 (Dup)      | 4/14/04     | ND <0.19               | I-3 (Dup)       | 2/18/04     | ND <0.19                      |
|                   | IA-4            | 4/14/04     | ND <0.19               |                 |             |                               |
|                   | IA-5            | 4/14/04     | ND <0.19               |                 |             |                               |
| <b>Soil gas</b>   | SG-1            | 4/13/04     | 1,300                  | SG-1            | 2/13/04     | 0.86                          |
|                   | SG-2            | 4/13/04     | 140                    | SG-2            | 2/13/04     | 4.1                           |
|                   | SG-3            | 4/13/04     | 11                     | SG-2 (Dup)      | 2/13/04     | 3.6                           |
|                   | SG-3 (Dup)      | 4/13/04     | 11                     | SG-3            | 2/13/04     | 1.4                           |
|                   |                 |             |                        |                 |             |                               |

| Sample Type | Sample Location | Sample Date | Teledyne Concentration | Sample Location | Sample Date | Spectra-Physics Concentration |
|-------------|-----------------|-------------|------------------------|-----------------|-------------|-------------------------------|
|             | SG-4            | 4/13/04     | 4.1                    |                 |             |                               |
|             | SG-5            | 4/13/04     | 0.26                   |                 |             |                               |
|             | SG-6            | 12/14/08    | <100                   |                 |             |                               |
|             | SG-7            | 12/13/08    | 7,200                  |                 |             |                               |
|             | SG-8            | 12/13/08    | 20,000                 |                 |             |                               |
|             | SG-10           | 12/14/08    | 200                    |                 |             |                               |
|             | SG-11           | 12/14/08    | 900                    |                 |             |                               |
|             | SG-12           | 12/13/08    | 1,200                  |                 |             |                               |
|             | SG-13           | 12/13/08    | 8,200                  |                 |             |                               |
|             | SG-14           | 12/14/08    | 36,000                 |                 |             |                               |
|             | SG-15           | 12/14/08    | 4,100                  |                 |             |                               |
|             | SG-16           | 12/14/08    | <100                   |                 |             |                               |
|             | SG-17           | 12/14/08    | 9,600                  |                 |             |                               |

ESL = Environmental Screening Level / ND = Not Detected / 2.0/0.7\* = TCE/PCE ESLs

Current TCE groundwater concentrations in the Spring Street area in the shallow zone range from 2.6 to 82 ug/L. EPA's Regional Screening Level (RSLs) to assess for the potential of TCE vapor intrusion in residential areas is 3 ug/L. If the concentration of a contaminant is below its respective RSL, there is no potential for exposure. If groundwater levels exceed the RSLs, as here in the Spring Street area, additional sampling data needs to be collected to determine if vapor intrusion is occurring. The probability of vapor intrusion is site specific, and many factors such as geologic features, building construction, layout of utilities could affect vapor pathways and whether there is a risk of indoor air being contaminated by chemical contaminant off-gassing from groundwater.

There has been no soil gas sampling at the NBES area. The current groundwater concentrations in the shallow zone for TCE range from non-detect to 280 ug/L, which exceeds EPA's industrial RSL of 15.3 ug/L, indicating the need for further assessment for the potential for vapor intrusion.

## **Site Inspection**

The Regional Water Board and USEPA conducted a site inspection on May 20, 2009. 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 soil and groundwater. However, the vapor intrusion potential in the SSES area needs to be evaluated based on prior soil vapor data; and follow-up vapor intrusion potential needs to be re-evaluated at Spectra-Physics based on current vapor intrusion guidance indicating the need for follow-up indoor air sampling when indoor air sampling indicates indoor air levels exceed our ESLs.

## **VII TECHNICAL ASSESSMENT**

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

For well over a decade, the remedy functioned as intended by reducing overall VOC levels to below 1,000 ppb. However, MNA, at least for the North Bayshore Area, has been shown to be more efficient than groundwater extraction at this stage of cleanup because the mass removal efficiency of the GWET system has declined considerably since implementation. The GWET system is shut down except for the SSES area and two groundwater extraction wells in the NBES area where these wells are still needed to reduce localized areas of contamination. The current groundwater monitoring program is sufficient to track the plume and detect any migration beyond the current plume boundaries, as well as track the effectiveness of remedial actions. Down-gradient monitoring wells have remained near or below the cleanup standards. Based on groundwater analytical from deep aquifer wells C1 and C2, contaminated groundwater 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. Thus, the plume has not expanded in size and has not migrated vertically. Contamination remains confined to the Shallow and Intermediate Zones.

The positive ERD pilot study results and focus provided by the DGI data will optimize the full-scale ERD effort.

The institutional controls in place include prohibitions on the use of groundwater until cleanup standards are achieved. No activities were observed that would have violated the institutional controls. However, in 1995, California passed California Civil Code Section 1471, which creates a framework for environmental restriction covenants and specifies how they are to be recorded and made applicable to successors. If ICs in the form of restrictive covenants are selected in a new decision document, the legal owners of the former Teledyne and Spectra-Physics properties should record new restrictive covenants for those properties that are consistent with current California law.

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

There have been no changes to the physical conditions of the Site that would affect protectiveness of the remedy. With the exception of residential land use in the adjacent SSES area, the use of the Site and the down-gradient area under which the groundwater plume has migrated remains commercial, light industrial, and office space. Institutional controls prohibit the use of groundwater, and groundwater is not currently used at the Site.

Changes in Cleanup Standards

There have been no changes to Applicable, Relevant, and Appropriate Requirements (ARARs) for the site and no new standards that would affect the protectiveness of the remedy. TCE and cis-1,2-DCE are the primary chemicals whose concentrations still routinely exceed the cleanup standards. Groundwater cleanup standards for these chemicals have not changed since the ROD was issued.

Changes in Toxicity

There have been a number of changes to the toxicity values for specific constituents of concern since the 1991 Record of Decision. The majority of the chemical contaminants currently have toxicity values that are higher than in 1991 and, therefore; the original risk assessment for those are more conservative than originally calculated. However, four chemical contaminants, PCE, TCE, Vinyl Chloride and 1,1-DCA, have had their toxicity values lowered since the 1991 BPHE. Although there have been changes to the toxicity values, these changes do not increase the site risk to unacceptable levels as illustrated below in Table 8 - Recalculated Risk Using 2009 Toxicity Values

**Table 8 - Recalculated Risk Using 2009 Toxicity Values for Groundwater Cleanup Levels.**

|                                   | Clean up Level<br>in 1991 ROD<br>(mg/L) | 2009 ESL<br>corresponding<br>to 10 <sup>-6</sup> risk | New risk for<br>clean-up level |
|-----------------------------------|---|---|--------------------------------|
| 1,1-Dichloroethane (1,1-DCA)      | 5                                       | 2.4   | 2.08E-06                       |
| 1,1,1-Trichloroethane (1,1,1-TCA) | 200                                     | 9100  | 2.20E-08                       |
| 1,2-Dichloroethylene              | 6                                       | N/A   |                                |
| Cis-1,2-Dichloroethylene          | 6                                       | 370   | 1.62E-08                       |
| Trans-1,2-Dichloroethylene        | 10                                      | 110   | 9.09E-08                       |

|                              | Clean up Level<br>in 1991 ROD<br>(mg/L) | 2009 ESL<br>corresponding<br>to 10 <sup>-6</sup> risk | New risk for<br>clean-up level |
|------------------------------|---|---|--------------------------------|
| Trichloroethene (TCE)        | 5                                       | 1.7   | 2.94E-06                       |
| Tetrachloroethene (PCE)      | 5                                       | 0.11  | 4.55E-05                       |
| Vinyl Chloride               | 0.5                                     | 0.016   | 3.13E-05                       |
| 1,1-Dichloroethane (1,1-DCA) | 5                                       | 2.4   | 2.08E-06                       |
| Toluene                      | 100                                     | 2300  | 4.35E-08                       |

### Changes in Exposure Assessment

The exposure assumptions used to develop the Human Health Risk Assessment were for potential future exposure if untreated groundwater were to be used for drinking water and if residential uses were to occur on the site. These assumptions are considered to be conservative in evaluating risk and developing risk-based cleanup levels.

However, the original exposure assumptions at the time of remedy selection did not account for all exposure pathways. Since 1990, the understanding of the fate and transport of chemicals in the subsurface has evolved, raising concerns over potential indoor air vapor intrusion. In 2004, a vapor intrusion assessment at the Teledyne and Spectra-Physics properties indicated the highest respective TCE levels in:

- Soil gas at 1,300 µg/m<sup>3</sup> and 4.1 µg/m<sup>3</sup>; and
- Indoor air at 0.41 µg/m<sup>3</sup> and 0.34 µg/m<sup>3</sup>.

The Data Gap Investigation (DGI) included additional soil gas testing to focus and optimize the ERD remediation. In 2008, the DGI documented elevated TCE levels in sub-slab soil gas beneath the former Teledyne building up to 36,000 µg/m<sup>3</sup>. The DGI report recommended additional investigation to evaluate a potential vadose zone source of the elevated VOCs in soil vapor.

The vapor intrusion potential in the SSES and the NBES area needs to be evaluated. The Regional Water Board will be issuing a workplan requirement for Teledyne to complete additional vapor intrusion assessment.

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

There is no other information that calls into question the protectiveness of the remedy.

**Technical Assessment Summary**

According to the data reviewed and the site inspection, the remedy is continuing to control the groundwater contamination. There have been no changes in the physical condition or land use at the Site that would affect the protectiveness of the remedy. Allegheny-TDY and Thermo Electron will be required to conduct additional soil gas and possibly indoor air sampling to further assess the potential vapor intrusion pathway. There is no other information that calls into question the protectiveness of the remedy.

**VIII ISSUES**

The issues identified during this five-year review are:

1. A potential vapor intrusion concern in the Spring Street Area and North Bayshore Area;
2. A potential vadose zone source under the former Teledyne building;
3. The declining effectiveness of GWET over time; and
4. The existing restrictive covenant was recorded prior to adoption of California Civil Code section 1471, which established the legal framework for environmental restriction covenants in California. Also, the ROD does not explicitly include institutional controls (ICs) in the selected remedy.

**IX RECOMMENDATIONS AND FOLLOW-UP ACTIONS**

1. To evaluate the potential for vapor intrusion, Allegheny-TDY and Thermo Electron will perform a vapor intrusion assessment in the Spring Street Area and North Bayshore Area. The necessity of a restrictive covenant for properties in these areas will be determined after the vapor intrusion assessment is completed.
2. To evaluate the potential vadose zone source, Allegheny-TDY will perform additional data gap investigation to evaluate the potential vadose zone source under the former Teledyne building.
3. To address the declining effectiveness of GWET, Allegheny-TDY and Thermo Electron will implement the alternative remedial technology of ERD and MNA as full scale Treatability Study. The ROD and final SCR will need to be amended to reflect the remedy change.
4. To address the concerns regarding the institutional controls, ICs should be included as part of the remedy. If ICs in the form of restrictive covenants are selected in a new

decision document, the legal owners of the former Teledyne and Spectra-Physics properties will record new restrictive covenants for those properties that are consistent with current California law.

The issues, recommendations, follow-up actions and milestone dates are summarized below.

**Table 8 - Issues/Recommendations and Milestones Dates**

| <b>Issue</b>   | <b>Recommendations and Follow-Up Action</b>   | <b>Party Responsible</b> | <b>Oversight Agency</b> | <b>Milestone Date</b> | <b>Affects Protectiveness (Y/N) Current</b> |
|--|---|--------------------------|-------------------------|-----------------------|---|
| Potential vapor intrusion concern in Spring Street Area                                | Perform vapor intrusion assessment in Spring Street Area  | PRPs                     | Regional Water Board    | 2010                  | Defer                                       |
| Potential vadose zone source under former Teledyne building                            | Perform additional data gap investigation to evaluate potential vadose zone source under former Teledyne building | PRPs                     | Regional Water Board    | 2010                  | No  |
| Declining effectiveness of GWET over time  | Further evaluate remedial technology of ERD and MNA.  | PRPs                     | Regional Water Board    | 2010                  | Short term: No<br>Long term: Yes            |
| Remedy Change  | A ROD Amendment will be needed to reflect the change in remedy and potential new RAO for vapor intrusion          | RWQCB                    | EPA                     | 2011                  | Short term: No<br>Long term: Yes            |
| Existing covenant was recorded prior to adoption of California Civil Code section 1471 | Pursuant to a decision to adopt ICs, record new restrictive covenants consistent with current California law      | PRPs                     | Regional Water Board    | 2010                  | Short term: No<br>Long term: Yes            |

## **X PROTECTIVENESS STATEMENT**

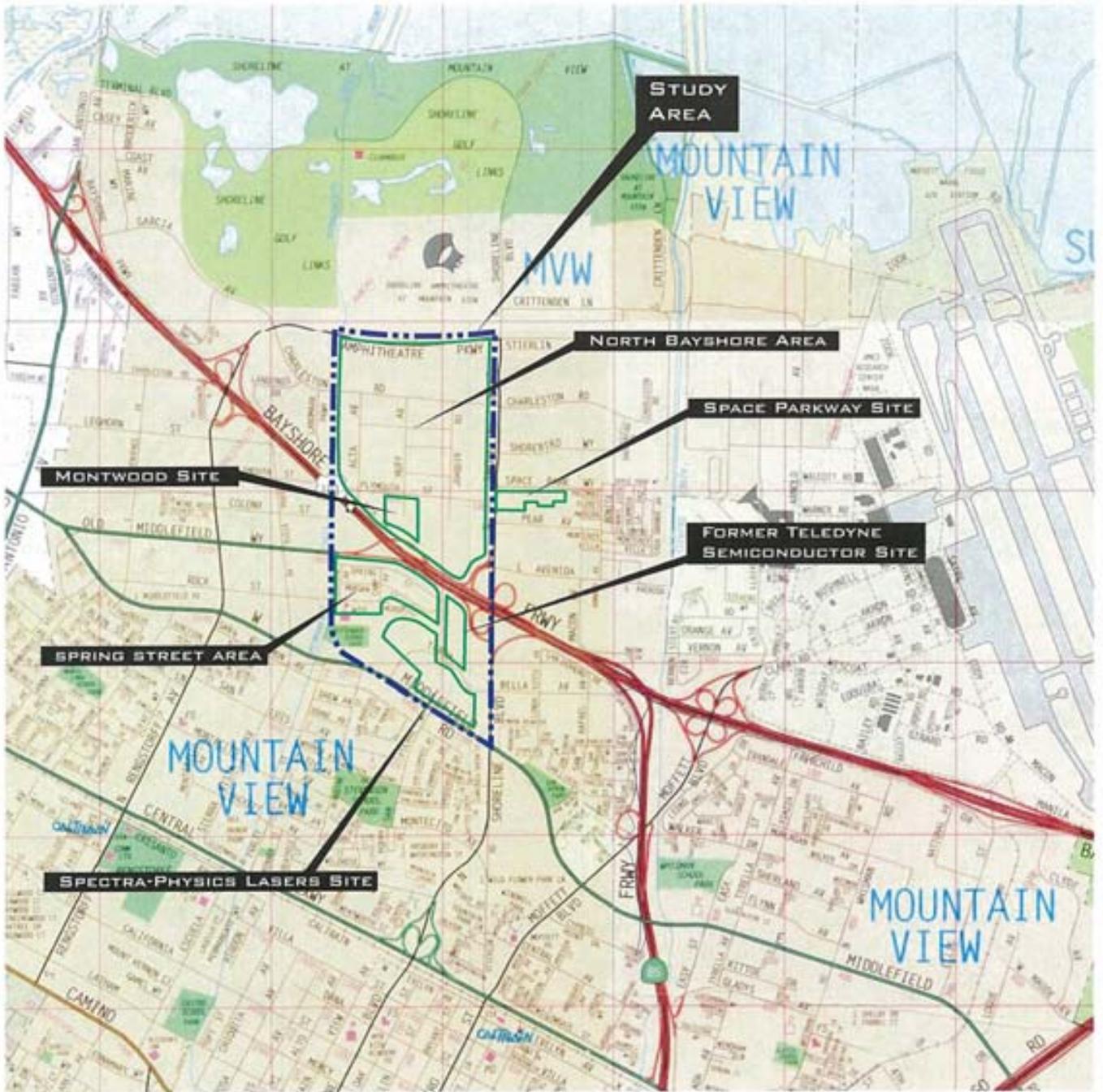
A protectiveness determination of the remedy at the Teledyne/Spectra-Physics Site cannot be made at this time until after a vapor intrusion assessment is completed at the Spring Street

and North Bayshore Areas. There currently is limited information at these two locations to assess the potential for vapor intrusion. All other exposure pathways that could result in unacceptable risks are being controlled, and institutional controls are preventing exposure to, or the ingestion of, contaminated groundwater. In the Spring Street and North Bayshore areas, the vapor intrusion exposure pathway will be reevaluated in approximately one year following the planned vapor intrusion monitoring.

## **XI     NEXT REVIEW**

The next five-year review for the Teledyne/Spectra-Physics site is required by September 30, 2014. Allegheny-TDY and Thermo Electron should submit their next five year report to the Regional Water Board by February 1, 2014. However, in order to make a protectiveness determination, an addendum to the 2009 Five Year Review is required. The FYR addendum should be completed by September 30, 2011.

## APPENDIX A – SITE MAP



### Site Vicinity Map and Property Locations

Spectra-Physics Lasers, Former Teledyne Semiconductor



Figure 1

## APPENDIX B

### Site Document Clearinghouse Link

[http://geotracker.waterboards.ca.gov/profile\\_report.asp?global\\_id=SL721281224](http://geotracker.waterboards.ca.gov/profile_report.asp?global_id=SL721281224)

The State Water Resources Control Board maintains the Geotracker website as a repository of environmental data for regulated facilities in California. You can use the following link(s) to find the covenant(s) that have been recorded for the Site property or properties. In addition, the environmental title search reports will shortly be available at the same link.