



Final
Remedial Investigation Report
B.F. Goodrich Site
Rialto, California

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On behalf of:
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Towson, Maryland**

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Preface

This Remedial Investigation (RI) Report has been produced pursuant to the requirements of the Administrative Settlement Agreement and Order on Consent for Remedial Investigation, CERCLA Docket 2009-01, dated March 17, 2009 (AOC) entered into between Emhart Industries, Inc (EII) and the United States Environmental Protection Agency, Region IX (USEPA). Section 38.e. of the AOC requires this RI Report to include the data from ENVIRON International Corporation's (ENVIRON) field work in 2009 and data from ENVIRON's previous site investigations in 2004, 2006, and 2007. In addition, pursuant to an oral request made by Mr. Wayne Praskins (USEPA), the data from previous investigations by other parties at the B.F. Goodrich Site (Site) also have been included.

Since its inception, the principal focus of ENVIRON's work at the Site has been to investigate all known or suspected West Coast Loading Corporation (WCLC) perchlorate use areas, as well as any alleged WCLC trichloroethene (TCE) use areas. From time to time, this scope was expanded at the request of the USEPA and the Regional Water Quality Control Board – Santa Ana Region (Regional Board) to include certain use areas of other Potentially Responsible Parties (PRPs) at the Site, including the McLaughlin Pit, the Goodrich Burn Pits, and the Southwest Disposal Pits.

This RI report presents in three categories: "Study Areas with Known or Suspected WCLC Activity," "Other Study Areas," and "Site Groundwater Data." The first two categories include soil and soil gas data organized area-by-area. It is important to recognize, however, that due to the complex use history of the Site, often with multiple parties operating in the same areas over time, not all data in an area of known or suspected WCLC activity are attributable to WCLC historical activities.

Executive Summary

To date, 50 Study Areas have been investigated at the B.F. Goodrich Site for the presence of perchlorate and/or trichloroethene (TCE), the two constituents of concern based on the groundwater basin's analytical profile. ENVIRON International Corporation (ENVIRON), working on behalf of Emhart Industries, Inc. (EII) has performed the bulk of the investigation work at the Site, focusing predominantly on those 28 areas where West Coast Loading Corporation (WCLC) is known or suspected of having used a constituent of concern. Of the 28 study areas, perchlorate was detected in four areas; no TCE was detected. The perchlorate detections in these four areas have been bounded by an extended series of consecutive non-detect results (i.e. 18, 13, 11, and 37). There has been no release or threatened release of TCE in the WCLC operations area.

Of the remaining 22 study areas, where WCLC is not known or suspected of having used a constituent of concern, 13 study areas have perchlorate detections. In many of these study areas, the nature and extent of perchlorate, and, in the case of Study Area 45, TCE contamination, have not been fully characterized. In addition, data from groundwater monitoring wells downgradient of some of these areas demonstrate that the underlying groundwater resource has been impacted, as evidenced by historically elevated perchlorate and TCE detections, with values as high as 10,000 parts per billion (ppb) for perchlorate (PW-2), and 1,500 ppb of TCE (CMW-2).

At the request of the United States Environmental Protection Agency – Region IX (USEPA), as set forth in AOC 2009-01, this RI report presents all known perchlorate and TCE data collected at the Site. Where available, additional information has been included by way of Appendices, such as in the case of ENVIRON's 2006, 2007 and 2009 Remedial Investigation (RI) data. Examples include geotechnical data, geophysical logs, and data validation reports.

1 Introduction

1.1 Objective

This Remedial Investigation (RI) Report presents the technical approach and rationale for the 2004, 2006, 2007, and 2009 ENVIRON International Corporation (ENVIRON) soil, soil gas, and groundwater investigations at the property known as the "B.F. Goodrich Site" (Site) in Rialto, California, as well as the combined results of these investigations and all previous investigations by other parties on the Site. This report was prepared by ENVIRON, on behalf of Emhart Industries, Inc. (EII), as set forth in AOC¹ 2009-01.

1.2 Site Background

1.2.1 Site Description

The Site is located in northern Rialto in San Bernardino County, California (Figure 1). It occupies an area of approximately 160 acres in the northern portion of the Rialto-Colton Groundwater Basin. The Site is bounded by Casa Grande Drive to the north, Locust Avenue to the east, the extension of Summit Avenue to the south, and Alder Avenue to the west. A large part of the southern portion of the Site is currently occupied by Rialto Concrete Products (RCP). The northern portion of the Site is owned by Mr. Wong Chung Ming, and is currently being leased by Pyro Spectaculars, Inc. (PSI) and American Promotional Events (APE) – West. Figure 1 shows a site map with the locations and/or use boundaries of entities currently operating at the Site.

1.2.2 Site History

The Site was first developed as part of the approximately 2,800-Acre Rialto Ammunition Back-Up Storage Point (RABSP) for the United States Army during World War II. After the war, the RABSP was declared surplus and transferred to the custody of the Farm Credit Administration (SAIC, 2004). From June 1952 to January 1957, West Coast Loading Corporation (WCLC) operated on approximately 28 acres of the Site, loading, assembling, and testing various types of devices, only three of which contained perchlorate, i.e. ground burst simulators, photoflash cartridges, and XF5A cartridges (WCLC records); the production period for these three products was confined to a thirteen month period. From circa 1957 until circa 1963, B.F. Goodrich (Goodrich) performed rocket motor and propellant research and development, and produced propellant loaded rocket motors at the Site. Goodrich used and disposed of perchlorate and TCE during its tenure on the Site. Since Goodrich's departure in 1963, the Site has been occupied continuously by various fireworks and pyrotechnic companies, including but not limited to United Fireworks, Pyrotronics Corporation, PSI, Astro Pyrotechnics, Inc., Trojan Fireworks, Zambelli Fireworks Manufacturing Company, Apollo Manufacturing, Red Devil Fireworks Holding Corporation, Red Devil Fireworks Company, Clipper Fireworks Company, California Fireworks, Pyrodyne American Corporation, APE, Inc., and APE-West. These fireworks companies used and disposed of perchlorate during their respective tenures at the Site.

¹ Administrative Settlement Agreement and Order on Consent for Remedial Investigation, CERCLA Docket 2009-01, dated March 17, 2009.

1.3 Physical Characteristics Of The Study Area

1.3.1 Surface Features

In general, the landforms of the project area reflect both the climate and recent geologic evolution of the eastward stepping San Andreas Fault System. The San Andreas Fault System has brought four basement blocks into juxtaposition, the San Gabriel, San Bernardino, and San Jacinto Mountains, along with the Perris fault block. The surface of the project area itself is part of a broad alluvial fan deposited by Lytle and Cajon Creeks upon older sedimentary assemblages that lie atop a basement block believed to be of San Jacinto composition. These sediments were shed from the San Gabriel and San Bernardino blocks, which have been uplifted along former splinters of the San Andreas Fault System, as well as antithetic faults such as the Cucamonga, to form the bordering highlands to the north of the project area.

Although the Site lies atop a large alluvial fan, no watercourses presently pass through it, though the generally dry Lytle Creek Wash is present slightly less than one mile to the north. The west bank of Lytle Creek is generally formed of an elongated escarpment of low hills, the Bunker Hill Dike, which is thought to be the surface expression of the San Jacinto Fault, one of the most active faults in California.

There are two surface water bodies in proximity to the Site, the Linden Ponds, less than a mile to the east, and the Cactus Basin, which lies approximately 6 miles to the southeast. Both of these features have been used for artificial recharge of the Rialto-Colton Basin aquifers. Surface water flow from storms in the project area generally occurs as sheetwash and minor channelized flow on the 2 to 3 percent grade that slopes to the south and southeast. (GLA, 2005)

1.3.2 Climate

Southern California is characterized as having a Mediterranean type climate with mild winters and hot summers. In addition, the climate in southern California can generally be characterized as long relatively dry periods interrupted by El Niño events that bring notably higher precipitation to the area. For the period 1945 to 1998, the average annual rainfall in the San Bernardino area was 15.91 inches (Danskin, et al, 2005). Potential evapotranspiration in the semi-arid San Bernardino area amounts to an average of 76 inches per year, nearly five times the average annual precipitation. (Danskin, et al, 2005)

1.3.3 Surface Water Hydrology

The predominant surface water features in the area, in order of proximity and potential relevance, are Lytle Creek and Cajon Creek, which drain into the Santa Ana River, which, in turn, crosses the Rialto-Colton Basin at its southeastern end.

As discussed in Section 1.3.4, the hydrogeology of the Rialto-Colton Basin is highly dependent upon the surface water hydrology inasmuch as direct surface infiltration of precipitation has been demonstrated by many recent studies to be a de minimis source of aquifer recharge (Dutcher and Garrett, 1963; GLA, 2005; Danskin, et al, 2005). The large but temporally isolated flows of Lytle Creek have long been recognized as the most significant source of recharge to the Rialto-Colton Basin (Dutcher and Garrett, 1963; GLA, 2005; Danskin, et al, 2005; Geosyntec, 2006). Recharge associated with the Santa Ana River affects the lower Rialto-

Colton Basin adjacent to the Santa Ana River, but does not affect the northern portion of the basin.

1.3.4 Hydrogeology

The Rialto-Colton Basin is an approximately 30 square mile structural basin lodged in a complex region floored by four crustal blocks juxtaposed along regional through-going fault systems composed of many splays and splinters. The Site is believed to be underpinned by a downfaulted block of San Jacinto composition. The structural origin of the region, and therefore the Rialto-Colton Basin, is a matter of some debate, but in general is related to the eastward stepping right-lateral San Andreas Fault System. These faults are a major influence on groundwater flow in the Rialto-Colton Basin.

1.3.4.1 Hydrostratigraphy

The earliest sediments deposited on the basement block surface are consolidated non-marine continental deposits consisting of well-cemented gravels, sands, silts, and clays. These rocks are considerably deformed, cemented, and generally barren of groundwater. Overlaying these rocks are the only slightly deformed and low-producing (limited specific capacity) beds of the continental San Timoteo Formation.

A period of intense middle Pleistocene tectonism associated with movement on the San Andreas Fault System produced a flood of basinal sediments comprising the Older Alluvium, which hosts the primary producing aquifers of both the Chino and Rialto-Colton basins. Tectonism and deposition of the Older Alluvium were contemporaneous, creating both the aquifer itself, as well as the basin boundary faults, such that movement along these faults has affected earlier depositional units of the Older Alluvium (thought to host the Regional Aquifer) more than younger units. Therefore these faults, and their splays, tend to form better hydraulic barriers with depth, depending upon the age of initiation of the faults.

The Younger Alluvium overlies the Older Alluvium and is uncut by most faults, however it may be cut by the San Jacinto Fault based on the presence of the Bunker Hill dike described in Section 1.3.1.

Dutcher and Garrett (1963) established the initial hydrostratigraphy of the Rialto-Colton Basin, primarily from water well drillers logs and petroleum exploration borehole logs. Woolfenden and Kadhim (1997) refined the hydrostratigraphy of the Older Alluvium into three water-bearing units, the upper, middle, and lower. Geo-Logic Associates (GLA, 1998) subdivided Woolfenden and Kadhim's (1997) middle water-bearing unit into three intermediate aquifers in the area around the Site, which they define as the A, B, and C zones:

- A-zone: 300-330 feet below ground surface (bgs), unconfined
- B-zone: 350-485 feet bgs, confined
- C-zone: >500 feet bgs, deep, regional, confined

GLA (2007) indicated that the A zone has gone dry and that the B zone is believed to be perched atop an aquitard that is present beneath the Site, but pinches out in the vicinity of Rialto

Municipal Airport. It is from the C zone aquifer that most municipal water is withdrawn in the Rialto-Colton Basin.

Additional information regarding the hydrostratigraphy and lithology at the Site was obtained during ENVIRON's remedial investigations and has been included in the appendices of this Report. Appendix D contains the shallow soil boring logs, Appendix E contains trench schematics, Appendix F contains the stratigraphy and well construction information of the two monitoring wells installed by ENVIRON (CMW-04 and CMW-05) as well as the boring logs for all borings deeper than 75 ft, Appendix G contains Geophysical Logs for CMW-04, CMW-05, and CML-01, and Appendix H contains the geotechnical data obtained from selected soil samples collected at the Site.

1.3.4.2 Basin Recharge

Dutcher and Garrett (1963), Woolfenden and Kadhim (1997), Woolfenden and Koczot (2001) and GLA (2007) have presented water budget estimates for recharge and flux for groundwater basin modeling purposes in the Rialto-Colton Basin. Dutcher and Garrett (1963) suggested that a significant amount of recharge is likely to be attributed to precipitation and snow-melt runoff events channeled down Lytle Creek, which has a portion of its surface overlying the northern or northeastern corner of the Rialto-Colton Basin. Dutcher and Garrett (1963) state that "Lytle Creek is the principal source of recharge to the north half of Rialto-Colton basin" (p.88) (see also Danskin, et al, 2005).

2 ENVIRON Site Investigations

2.1 Constituents of Concern

As stipulated in the 2006 Work Plan (Appendix B), the primary Constituents of Concern (COCs) identified as materially affecting groundwater quality are the perchlorate anion and the volatile organic compound (VOC) TCE. ENVIRON's 2004 RI focused on the presence of perchlorate and TCE in soil and soil gas. ENVIRON's 2006 RI focused on the presence of perchlorate in soil and groundwater and TCE in soil gas, soil, and groundwater. ENVIRON's 2007 and 2009 RIs focused solely on the presence of perchlorate in soil². To date, ENVIRON has collected over 1,000 soil, soil gas and groundwater samples at the Site for analysis of perchlorate and/or TCE.

2.2 Study Areas

For purposes of uniformity, ENVIRON has adopted an alphanumeric designation system for the study areas investigated at the Site. Currently, investigations have occurred at 50 individual study areas on the Site. This allows for a standardized approach and alleviates the need to use multiple area designations depending on the investigating party. Figure 2 shows the 50 study areas and all sampling locations on the Site. Since the study area number system post-dates the majority of the sampling at the Site, the area boundaries are generally drawn as rectangular boxes, inclusive of all sampling conducted in the general vicinity of a feature of interest. One notable exception is the sampling performed by Geosyntec in 2004 in the area near the Southwest Disposal Pits (Study Areas 47 and 48), where sample locations missed the actual feature of interest (the pits), to the degree that the study area outline was not expanded to include these points.

2.3 Chronology

2.3.1 2004 RI

On behalf of EII, in 2004, ENVIRON completed a site investigation that involved the sampling of soil and soil gas. The investigation was requested and the sampling locations selected by the USEPA, as described by ENVIRON in the 2004 Work Plan (Appendix A). In total, 11 study areas were investigated and 130 soil and soil gas samples were collected. The results of this investigation were previously reported in the February 10, 2005 Site Investigation Report (ENVIRON, 2005). Sampling locations from the 2004 RI are shown on Figure 3.

2.3.2 2006 RI

The principal objective of the 2006 RI was to investigate the shallow soil and soil gas in all areas of recognized or suspected WCLC perchlorate and/or alleged WCLC TCE use at the Site, and to bound any detections encountered. The USEPA and Regional Board expanded the scope of work in several ways, including adding the investigation of certain areas used by other parties (e.g. McLaughlin Pit, Goodrich Burn Pits, Southwest Disposal Pits), and the installation and monitoring of two wells. In total, 36 study areas were investigated and 450 soil and soil gas samples were collected. Since the 2006 RI, ENVIRON has collected 108 groundwater samples

² In addition, one grab groundwater sample was collected during ENVIRON's 2009 RI.

from its monitoring wells installed during this phase of work. The investigation was performed in accordance with the work plan dated February 21, 2006 (see Appendix B). The results of this investigation were previously summarized in the March 30, 2007 Revised Focused Summary Report (ENVIRON, 2007). Sampling locations from the 2006 RI are shown on Figure 3.

2.3.3 2007 RI

On behalf of EII, ENVIRON initiated the 2007 RI, after new information suggested that full characterization of Study Area 18, a location of known WCLC perchlorate use, required additional sampling. In total, 190 additional soil samples were collected from Study Area 18. The work was performed in accordance with the 2006 Work Plan. The results of this investigation were previously summarized in the Revised Focused Summary Report. Sampling locations from the 2007 RI are shown on Figure 3.

2.3.4 2009 RI

As required by the AOC entered into between EII and USEPA, in 2009 ENVIRON performed additional soil investigation in five study areas. In total, 153 additional samples were collected from a series of deep soil borings and a floor drain. The work was performed in accordance with the 2008 Work Plan (Appendix C). The results of this investigation (together with results from all previous investigations at the Site) are presented in this Report. Sampling locations from the 2009 RI are shown on Figure 3.

2.4 Identifying and Locating Potential Source Areas

The identification of potential WCLC source areas resulted from a cooperative effort among EII, ENVIRON, Environmental Research, Inc. (ERI), the USEPA, and the Regional Board. This process was initiated in 2004 and was subsequently continued in the period preceding the 2006 field investigation, by which time a considerable body of information on historical site operations had become available. During this process, multiple sources of information were reviewed, analyzed, or otherwise considered. The various sources of information included: i) witness deposition testimony and other anecdotal evidence, ii) pertinent historical documents, and iii) historical aerial photographs, including low angle, low altitude obliques. In addition, wherever the USEPA deemed it appropriate, ENVIRON included for further evaluation in its 2006 RI certain WCLC use areas investigated previously during its 2004 work at the Site.

This collective effort made use of all information available at the time to identify the location of all areas where WCLC was known or suspected (regardless of the basis for that suspicion) to have used perchlorate, or suspected (regardless of the basis for that suspicion) of having used TCE. This exercise, combined with the source identification efforts for the 2004 investigation, yielded a list of 28 study areas where there was a basis to believe or suspect that TCE and/or perchlorate may have been used and, therefore, had the potential to be released by WCLC. The rationale for investigating each of these individual areas is described in the work plans prepared for the 2004, 2006, and 2009 investigations, included herein as Appendices A, B, and C, respectively. Combined, the field investigations of ENVIRON's 2004 work and the work conducted under the subsequent 2006, 2007, and 2009 RIs, have comprehensively dealt with each of the 28 study areas under the direction and supervision of USEPA and/or Regional Board staff.

During the 2006 RI, in addition to investigating all areas where WCLC was known or suspected to have used the constituents of concern, a number of other parties' operational and/or use areas were also investigated by ENVIRON at USEPA's request. Examples include the Goodrich Burn Pits (Area 45), the McLaughlin Pit (Area 46), the Southwest Disposal Pits (Areas 47 and 48), and the 150-gallon mixer area (Area 28).

Coordinates for the sample locations were established based on geo-referenced aerial photographs, and checked against the many historical physical features that still exist at the Site today. Specific sample locations were specified in the field by ENVIRON using geodetic coordinates with the aid of a commercial grade backpack-mounted Garmin™ Global Positioning System (GPS) receiver. Prior to initiating the field work, site walks were conducted during which the USEPA and/or Regional Board staff were able to verify, or alter if desired, the locations staked out for field investigation. In addition, in the course of ENVIRON's 2006 field work, numerous additions and or alterations to the Work Plan scope were requested by Regional Board staff, all of which were incorporated by ENVIRON.

To deal with those portions of the Site where few historical features exist today, the USEPA and ENVIRON established an expanded sampling area during the 2004 field investigation to account for the uncertainty in location of several suspect former use areas. Subsequently, in 2006, and again in 2009, the USEPA requested further sampling from those areas where it judged additional sampling coverage might be informative. In addition, draft versions of the 2006 and 2009 Work Plans were submitted to the Regional Board and the USEPA for comments prior to being finalized, to allow interested parties the opportunity to raise questions regarding its content, including sampling rationale and locations. With respect to the 2009 Work Plan, on April 6, 2009, ENVIRON responded to comments submitted by the Regional Board, Geosyntec (on behalf of Goodrich), SES (on behalf of the City of Rialto), and the County of San Bernardino.

2.5 Sampling Rationale

The sampling rationale for all areas investigated during the ENVIRON 2004, 2006, 2007, and 2009 RIs are listed in the Work Plans included in this report as Appendices A, B and C.

2.6 Soil and Soil Gas Investigations

Soil boring and soil gas probe locations, depths of samples, sampling rationale, access, sampling procedures, equipment decontamination, and sample analyses procedures were detailed in the 2006 and 2008 Work Plans. ENVIRON conducted its work at the Site in general conformance with the provisions of these Work Plans, which were prepared consistent with the National Oil and Hazardous Substance Pollution Contingency Plan (NCP). For some areas the number, type, and location of the samples were subsequently altered at the request of Regional Board or USEPA staff. During the 2009 RI, at 3 boring locations in Study Areas 11, 13, and 37, ENVIRON extended the sampling depth beyond what was specified in the 2008 Work Plan in order to bound the extent of the encountered contamination.

Soil and soil gas sampling areas in the 2004, 2006, 2007, and 2009 RIs are shown on Figure 3. The specific sampling locations were selected in consultation with and the approval of the Regional Board and/or USEPA, and in coordination with the current owners/operators of the respective properties.

After sampling locations were confirmed in the field by Regional Board and/or USEPA staff, ENVIRON notified Underground Service Alert (USA) regarding the drilling and sampling locations. In addition, ENVIRON retained the services of Spectrum Geophysics (Spectrum) of San Fernando, California to conduct a geophysical survey at each sampling point. This task was performed to minimize the possibility of damaging subsurface utilities encountered during the investigation. Based on the results of the geophysical survey, individual sampling points in several sampling areas were moved small distances (1 to 2 feet).

Site-specific Health and Safety Plans (HASPs) were prepared to minimize exposure of ENVIRON field personnel to potentially hazardous materials and daily tailgate safety meetings were conducted with all on-site ENVIRON and subcontractor staff.

2.7 Groundwater Investigation

The 2006 Work Plan called for the installation of five triple-completion monitoring wells. Three of these were installed by Adverus on behalf of PSI; ENVIRON installed the remaining two wells on behalf of EII. The locations of the monitoring wells were established in conjunction with Regional Board staff, and are presented on Figure 6. In addition to the two ENVIRON monitoring wells, the Work Plan also called for the installation of at least one intermediate depth boring to 200 ft, with the option of extending the boring to groundwater and converting it to a monitoring well, depending on the findings down to 200 ft. This boring was installed through the center of the McLaughlin Pit, and, based on the analytical results over the first 200 ft of soil, the boring was extended to groundwater, where a number of grab groundwater samples were collected. The subsequent effort to install a clustered monitoring well at this location was unsuccessful and the borehole was grouted up. Boring logs and well construction details for the wells installed by ENVIRON can be found in Appendix F.

2.8 Waste Handling

Investigation derived waste, including equipment decontamination rinse water, used personal protective equipment (PPE), and purge water and/or soil cuttings, were placed in Department of Transportation (DOT)-approved 55-gallon drums or in roll-off bins. The drums and bins were sealed and labeled, and stored at a secure location at the Site. Sampling for the purpose of waste profiling was conducted and the waste was disposed of at an appropriate off-site location.

3 Chronology of Other Investigations

Environmental investigations have been performed on behalf of numerous current and former owners and tenants of the Site and its immediate vicinity. These investigations, which have focused on perchlorate and TCE, have been conducted at the request of USEPA and/or the Regional Board, and in one case, the Department of Toxic Substances Control (DTSC). The following is a brief summary of all other investigations known to ENVIRON to have been conducted at the Site. Results of these investigations are included in the data discussion in Sections 4 and 5.

3.1 APE Perchlorate Investigation (PES, 2003)

On behalf of APE, and at the request of the Regional Board, PES Environmental, Inc. (PES) performed an investigation to evaluate whether perchlorate was discharged at areas where APE stored or handled fireworks. Trenches were installed at 15 sampling locations during the PES investigation. These locations fall within Study Areas 3, 22, 28, and 34. Soil samples were generally collected at 2 and 8 feet below ground surface (bgs) at each location. All samples were analyzed for perchlorate, with selected samples also analyzed for VOCs. Sampling took place from March 11 through March 13, 2003.

3.2 PSI Perchlorate Investigation (Kleinfelder, 2003)

On behalf of PSI, and in response to the Regional Board investigation order issued on October 7, 2002, Kleinfelder conducted an investigation to evaluate whether PSI's activities at the Site resulted in the release of perchlorate to the ground surface adjacent to certain storage and production areas. On November 6, 2003, Kleinfelder excavated three trenches to a depth of approximately 10 ft bgs, and collected soil samples from depths of 1, 5, and 10 ft bgs.

3.3 APE Supplemental Perchlorate Investigation (PES, 2004)

At the request of the Regional Board, PES, on behalf of APE, performed an investigation to further characterize the lateral and vertical extent of perchlorate in soil at Area 22. One trench was excavated for this study. On December 15, 2003, PES collected a total of eight soil samples and one duplicate soil sample from four locations within the trench. All samples were submitted for perchlorate analysis.

3.4 Wong Chung Ming Preliminary Perchlorate Soil Investigation (Locus, 2004)

On behalf of Wong Chung Ming, and at the request of the Regional Board, Locus Technologies (Locus) conducted soil sampling to investigate potential perchlorate releases. From March 9 through March 11, 2004, Locus collected soil samples from 11 study areas, typically at depths of 1, 5, 10, and 15 ft bgs; ten of those locations were immediately adjacent to clarifier outfalls and one location was at an apparent "disposal pile." All samples were submitted for perchlorate analysis. Selected samples were also submitted for metals and VOC analyses.

3.5 Goodrich Remedial Investigation (Geosyntec, 2005)

On behalf of Goodrich, and at the request of the USEPA and the Regional Board, Geosyntec Consultants, Inc. (Geosyntec) conducted soil gas and soil sampling investigations at various

locations at and in the vicinity of the Site. From May 18 through June 9, 2004, Geosyntec collected 12 soil samples from eight locations on the Site, as well as 115 soil gas samples from 61 locations. In addition, four monitoring wells were installed on or in the immediate vicinity of the Site.³

3.6 PSI McLaughlin Pit Investigation (Kleinfelder, 2005a)

On behalf of PSI, and at the request of the Regional Board, Kleinfelder conducted an initial perchlorate investigation at the McLaughlin Pit. The investigation consisted of collecting 11 samples from five 4 to 5 ft deep trenches, and two 20 ft deep borings. The sampling took place on December 22, 2004 and on January 5, 2005; samples were analyzed for perchlorate only.

3.7 Engle Property Perchlorate Assessment (Kleinfelder, 2005b)

On behalf of Lowell Locust, LLC, and at the request of the Regional Board, Kleinfelder conducted limited shallow soil sampling on a property known as the 'Engle Property,' partially located on the Site. Six of the 38 soil samples collected during this investigation were located on the Site; the remaining 32 samples were collected from a parcel south of the Site. Sampling took place on January 13, 2005. The samples were collected at depths ranging from 6 inches to 1 foot bgs using a hand trowel, and analyzed for perchlorate.

3.8 PSI Monitoring Well Installation (Adverus, no report issued yet)

On behalf of PSI, and at the request of the Regional Board, Adverus Inc. (Adverus) installed three multi-screen monitoring wells at the Site (CMW-01 through CMW-03) as described in the 2006 Work Plan. During the installation of the wells, between March and June 2006, Adverus collected 70 soil samples, and 28 grab groundwater samples from these three locations.

3.9 "Pyrotechnic Dud Round" Investigation (BBL, 2005 / Kleinfelder, 2008)

On behalf of National Construction Rentals (NCR) and Edward Graves & Associates (EG&A), and at the request of the DTSC, Blasland Bouck & Lee, Inc. (BBL) and Kleinfelder conducted several rounds of soil and soil gas investigation consisting of trench/pothole excavation and the advancement of soil borings in Study Area 50, the location of a former Broco facility, where explosive magazines and underwater welding and cutting rods were manufactured. From 2005 through 2008, 145 soil samples were collected and analyzed for perchlorate and 4 samples were analyzed for TCE.

³ In 2006, Goodrich also installed five Westbay® monitoring wells (PW-5 through PW-9) further down gradient of the Site.

3.10 USEPA Investigation of Goodrich Burn Pits (no report issued yet)

On behalf of USEPA, CH2M Hill installed three 100-ft deep soil borings in and around the former Goodrich Burn Pits in Study Area 45. During the installation of the soil borings, between April 27 and May 4, 2009, CH2M Hill collected 33 soil samples, and installed 12 soil vapor probes.

4 Study Areas with Known or Suspected WCLC Activity

4.1 Introduction

Section 4 of this report includes a discussion of all relevant⁴ data collected from study areas where WCLC, based on available historical records, witness statements, forensic evaluation, and USEPA and Regional Board technical staff judgment, is known or suspected (regardless of the basis for that suspicion) to have used perchlorate, or alleged to have used TCE. In certain cases, WCLC is the only party known to have operated in a given study area (e.g. Study Area 18); in other cases, WCLC is one of several parties. In certain cases, WCLC's use of a contaminant⁵ is reasonably well established; in other cases, it is not well supported. Whichever the case may be for a given study area, a brief description of the activities that are known or suspected to have taken place is provided, together with a discussion of the available soil and/or soil gas data for the area. The study areas where WCLC is known or suspected to have used perchlorate and/or TCE, are 4, 5, 7, 8, 9, 10, 11, 13, 14, 15, 16, 17, 18, 19, 21, 23, 24, 25, 29, 30, 31, 37, 38, 39, 40, 42, 43, and 44. The four study areas where perchlorate was detected are presented at the beginning of Section 4.2, in order of decreasing maximum perchlorate detections, regardless of whether the perchlorate in the area is known to relate to a WCLC activity. The remaining 24 study areas are presented in alphanumerical order. Sample locations for each study area described in this section are shown in Figure 4, analytical sample results for perchlorate in soil and TCE in soil and soil gas can be found in Tables 1 and 2, respectively.

4.2 Soil and Soil Gas Data

4.2.1 Study Area 18

Study Area 18, specifically Building 42, was identified as an area where WCLC filled pyrotechnic devices with photoflash mix that contained perchlorate (SOP I-6, KWKA00013716). Barrels of unknown contents are also visible in historical aerial photos dating back to WCLC's tenure at the Site (UCSB Frame 55: 3705). Based on the known activities and regulator requested analytical testing, the constituents of potential concern associated with WCLC's use of this area are perchlorate and TCE.

In 2006, ENVIRON collected seven soil samples from one boring and two trenches. The samples were analyzed for perchlorate; there were no detections.

In 2007, after additional information had become available regarding locations of potential perchlorate release in this area, 190 additional soil samples collected from 31 borings, two

⁴ The term "relevant" is used to indicate data related to the constituents of concern only, which, based on basin-wide groundwater chemistry, have been identified as perchlorate and TCE. Most investigators performed additional analyses, which will not be discussed in this report. The complete set of analytical data for ENVIRON's 2006, 2007 and 2009 RI is available in the appendices to this report. For complete data sets of other investigations, we refer the reader to the RI reports incorporated by reference in this report.

⁵ The only constituent of concern, in ENVIRON's opinion, of which the use by WCLC is reasonably well established, is perchlorate. There is no plausible evidence that WCLC used TCE at the Site.

angled borings and four trenches were analyzed for perchlorate; there were 32 detections ranging from 20 ppb to 12,000 ppb, the latter at 2 ft bgs.

In 2009, at the request of USEPA, ENVIRON collected 33 soil samples from three additional 100-ft deep borings installed in this study area; results were consistent with previous findings in 2006 and 2007, where the perchlorate is confined to the shallow soils and concentrations decrease rapidly with depth.

Soil gas was analyzed at two locations within the study area; no TCE was detected.

4.2.2 Study Area 13

Study Area 13, specifically Building 40, was identified as an area where WCLC may have weighed and blended photoflash powder (SOP W-4, KWKA00013749 and SOP I-4, KWKA00013720), where United Fireworks may have loaded marine flares with perchlorate (RFDW006298, letter dated October 23, 1968 from United Fireworks to Rialto Fire Department) and where Goodrich may have used rocket propellant (Haggard Deposition, Exhibit 282). Barrels of unknown contents are also visible in historical aerial photos dating back to WCLC's tenure at the Site (UCSB Frame 55: 3705). Based on the suspected activities and regulator requested analytical testing, the constituents of potential concern associated with WCLC's use of this area are perchlorate and TCE. Based on the suspected activities, the constituent of concern associated with United Fireworks' use of this area is perchlorate.

In 2006, ENVIRON collected nine soil samples from three borings. The samples were analyzed for perchlorate; there were no detections.

In 2009, ENVIRON installed two additional soil borings outside the west and east doors of Building 40. The soil boring on the west side of Building 40 was completed to a depth of 75 ft, and nine soil samples were collected and analyzed for perchlorate with no detections. The soil boring on the east side of Building 40 was completed to a depth of 390 ft; 40 soil samples and 1 grab groundwater sample were collected and analyzed for perchlorate. The highest perchlorate detection of 3,000 ppb was found at a depth of 210 ft bgs. Below 280 ft bgs, perchlorate was no longer detected in soil, nor was perchlorate present in the sample that was collected at 390 ft bgs from a 4 ft thick zone of what is believed to be perched groundwater.

Soil gas was analyzed at two locations within the study area; no TCE was detected.

4.2.3 Study Area 11

Study Area 11, specifically Building 47, was identified as an area where WCLC (SOP D-8, KWKA00013693) and subsequently Goodrich (Bland Deposition, Exhibit 37, June 13, 1955 at 455, and Exhibit 102 to Haggard Deposition) may have screened and dried perchlorate. Based on the suspected activities, the constituent of potential concern associated with both WCLC's and Goodrich's use of this area is perchlorate.

In 2006, ENVIRON collected 10 soil samples from one L-shaped trench. The samples were analyzed for perchlorate; there was one detection of 58 ppb at 10 ft bgs.

In 2009, at the request of USEPA, ENVIRON installed a soil boring outside the location of the south door to Building 47. The soil boring was completed to a depth of 400 ft bgs, and 44 soil

samples were collected and analyzed for perchlorate. The highest perchlorate detection was found at a depth of 10 ft bgs; below 269 ft bgs there was one detection of perchlorate (30 ppb at 329 ft bgs), followed by non-detect results to 400 ft bgs.

4.2.4 Study Area 37

Study Area 37 was identified by USEPA as a former soil and rock pile, first visible in a 1953 aerial photograph, during WCLC's occupation of the Site (Aerial photograph PAI/AM November 19, 1953, Frame 348A). The origin of the pile is unknown and there is no known WCLC activity associated with this area, though multiple parties have generally operated on and around this portion of the Site throughout the Site's history. Subsequent to the 2009 investigation, additional aerial photography review and analysis established that the feature in the 1953 photograph was no longer visible by September 13, 1968 (USGS), and that a new similar feature became visible several feet to the north by February 13, 1985 (IK Curtis). Based on the regulator requested analytical testing, the constituents of potential concern associated with historical use of this area are perchlorate and TCE.

In 2004, ENVIRON collected soil samples at six locations in this area. One sample contained perchlorate, at 110 ppb; there was no TCE detected in any of the soil samples.

During the 2006 RI, at the request of USEPA, ENVIRON collected two additional soil samples from one trench. The samples were analyzed for perchlorate; there were no detections.

In 2009, at the request of USEPA, ENVIRON collected 23 additional soil samples from a 200-ft deep boring, adjacent to the location of the 2004 perchlorate detection. The highest perchlorate detection of 340 ppb was found at a depth of 90 ft bgs. Below 100 ft bgs, perchlorate was not detected in 12 samples to 199 ft bgs.

Soil gas was analyzed at eight locations within the study area; no TCE was detected.

4.2.5 Study Area 4

Study Area 4 is the location of darkened and possibly stained areas adjacent to Building 49 as shown on aerial imagery dating back to WCLC's tenure at the Site (October 1955 Aerial 149REV). In addition, this study area is the location of an in-ground clarifier subsequently installed and used by fireworks companies operating at the Site (Locus, 2004). Based on the regulator requested analytical testing, the constituent of potential concern associated with WCLC's use of this area is TCE. Based on the reported analytical testing, the constituents of potential concern associated with fireworks companies' use of this area are perchlorate and TCE.

In 2004, Locus investigated the shallow soil near the outfall of a clarifier for the presence of perchlorate and TCE; there were no detections. In addition, during the ENVIRON 2004 RI, soil gas was analyzed at four locations within the study area; no TCE was detected.

4.2.6 Study Area 5

Study Area 5, specifically Building 41, was identified as an area where WCLC may have formulated photoflash mix that contained perchlorate (SOP B-4, KWKA 00013684). In addition, this study area is the location of an in-ground clarifier subsequently installed and used by

fireworks companies operating at the Site, as well as an apparent pyrotechnics disposal area (Locus, 2004). Based on the suspected activities, the constituent of potential concern associated with WCLC's use of this area is perchlorate. Based on the reported analytical testing, the constituents of potential concern associated with fireworks companies' use of this area are perchlorate and TCE.

In 2004, Locus investigated the shallow soil near the outfall of a clarifier, and near an apparent pyrotechnics disposal area, for the presence of perchlorate and TCE; there were no detections.

In 2006, ENVIRON collected three soil samples from one trench, and submitted the samples for perchlorate analysis to a lab; there were no detections.

4.2.7 Study Area 7

Study Area 7 is the location of a former WCLC incinerator visible in a 1955 aerial photograph (UCSB Frame 55: 3707, KWK 44394). Based on the regulator requested analytical testing, the constituents of potential concern associated with WCLC's use of this area are perchlorate and TCE.

In 2006, ENVIRON collected two soil samples from one trench. The samples were analyzed for perchlorate; there were no detections. Soil gas was analyzed at two locations within the study area; no TCE was detected.

4.2.8 Study Area 8

Study Area 8, specifically Building 15, was identified as an area where WCLC may have tested 60 mm flares, which did not contain perchlorate (John Melito Deposition, November 1, 2005 at 122-123). In addition, a small incinerator located immediately to the east of the building is visible in a 1955 oblique air photo (UCSB Frame 55: 3707, KWK 44394). Based on the regulator requested analytical testing, the constituent of potential concern associated with WCLC's use of this area is perchlorate.

In 2006, ENVIRON collected four soil samples from one trench. The samples were analyzed for perchlorate; there were no detections.

4.2.9 Study Area 9

Study Area 9 was identified as an area where WCLC may have disposed of chemicals and other debris (Davis Deposition, December 1, 2004 at 262-263). Based on the regulator requested analytical testing, the constituents of potential concern associated with WCLC's use of this area are perchlorate and TCE.

In 2006, ENVIRON collected nine soil samples from four trenches. The samples were analyzed for perchlorate; there were no detections, and no debris was found. Soil gas was analyzed at four locations within the study area; no TCE was detected.

4.2.10 Study Area 10

Study Area 10, specifically Building 48, was identified as an area where WCLC may have weighed perchlorate (Davis Deposition, December 1, 2004 at 255 and Exhibit 84). Based on

the suspected activities, the constituent of potential concern associated with WCLC's use of this area is perchlorate.

In 2006, ENVIRON collected three soil samples from one trench. The samples were analyzed for perchlorate; there were no detections.

4.2.11 Study Area 14

Study Area 14, specifically Building 28, was identified as an area where WCLC may have inspected potassium perchlorate (SOP I-6, KWKA00013715). In addition, an in-ground clarifier was subsequently installed and used in this area by fireworks companies operating at the Site (Locus, 2004). Based on the suspected activities, the constituent of potential concern associated with WCLC's use of this area is perchlorate. Based on the reported analytical testing, the constituents of potential concern associated with fireworks companies' use of this area are perchlorate and TCE.

In 2004, Locus investigated the shallow soil near the outfall of a clarifier for the presence of perchlorate and TCE; there were no detections. In addition, as part of the ENVIRON 2006 RI, two soil samples collected from one trench were analyzed for perchlorate; there were no detections.

4.2.12 Study Area 15

Study Area 15, specifically Building 12, was identified as an area where Goodrich may have screened and dried ammonium perchlorate (Wever Deposition, November 9, 2004 at 94-95 and Exhibit 140). It was also identified as an area where WCLC may have handled perchlorate (Davis Deposition, December 1, 2004 at 207 and Exhibit 82). Based on the suspected activities, the constituent of potential concern associated with both WCLC's and Goodrich's use of this area is perchlorate.

In 2006, ENVIRON collected five soil samples from one trench. The samples were analyzed for perchlorate; there were no detections.

4.2.13 Study Area 16

Study Area 16 is the location of drums and darkened, possibly stained, surface soil adjacent to Building 8 during WCLC's tenure at the Site as shown on a 1955 aerial image (UCSB Frame 55: 3705). Based on the regulator requested analytical testing, the constituent of potential concern associated with WCLC's use of this area is TCE.

Soil gas was analyzed at four locations within the study area; no TCE was detected.

4.2.14 Study Area 17

Study Area 17 is the location of a former WCLC incinerator visible in a 1955 aerial photograph (UCSB Frame 55: 3707, KWK 44394). Based on the regulator requested analytical testing, the constituents of potential concern associated with WCLC's use of this area are perchlorate and TCE.

In 2006, ENVIRON collected two soil samples from one trench. The samples were analyzed for perchlorate; there were no detections. Soil gas was analyzed at two locations within the study area; no TCE was detected.

4.2.15 Study Area 19

Study Area 19, specifically Building 34, was identified as an area where Goodrich may have dried, blended, and screened perchlorate (Exhibit 92 to Wever Deposition). In addition, discolored soil and barrels of unknown contents are visible in historical aerial photos dating back to WCLC's tenure at the Site (UCSB Frame 55:3706). Based on the suspected activities, the constituent of potential concern associated with Goodrich's use of this area is perchlorate. Based on the regulator requested analytical testing, the constituent of potential concern associated with WCLC's use of this area is TCE.

In 2006, ENVIRON collected four soil samples from one boring. The samples were analyzed for perchlorate; there were no detections. Soil gas was analyzed at two locations within the study area; no TCE was detected.

4.2.16 Study Area 21

Study Area 21, specifically Building 30, was identified as an area where WCLC may have weighed perchlorate (KWKA00023310). In addition, an in-ground clarifier was subsequently installed and used in this area by fireworks companies operating at the Site (Locus, 2004). Based on the suspected activities, the constituent of potential concern associated with WCLC's use of this area is perchlorate. Based on the reported analytical testing, the constituents of potential concern associated with fireworks companies' use of this area are perchlorate and TCE.

In 2004, Locus investigated the shallow soil near the outfall of a clarifier for the presence of perchlorate and TCE; there were no detections.

In 2006, ENVIRON collected two soil samples from one trench. The samples were analyzed for perchlorate; there were no detections.

4.2.17 Study Area 23

Study Area 23, specifically Building 35, was identified as a former WCLC assembly shop and an area where WCLC may have used TCE as a solvent (J. Allegranza, July 13, 2005 at 37:17 to 39:25). Based on the suspected activities, the constituent of potential concern associated with WCLC's use of this area is TCE.

Soil gas was analyzed at four locations within the study area; no TCE was detected.

4.2.18 Study Area 24

Study Area 24 is the location of an apparent former WCLC scrap material storage area north of Building 27 (October 1955 Aerial 149REV). Based on the regulator requested analytical testing, the constituent of potential concern associated with WCLC's use of this area is TCE.

Soil gas was analyzed at three locations within the study area; no TCE was detected.

4.2.19 Study Area 25

Study Area 25, specifically Building 18, was identified as a former WCLC maintenance shop and an area where WCLC may have used of TCE as a solvent (F. Gardner, July 6, 2005 at 423:14 to 424:1). Based on the suspected activities, the constituent of potential concern associated with WCLC's use of this area is TCE.

Soil gas was analyzed at six locations within the study area; no TCE was detected.

4.2.20 Study Area 29

Study Area 29, specifically Building 43, was identified as an area where WCLC may have disassembled photoflash cartridges and tested them for moisture (SOP I-2, KWKA 00013723). In addition, based on deposition testimony of a former employee, WCLC may have used solvents in this area (J. Pfarr Deposition, pages 60-61). This study area is also the location of an in-ground clarifier subsequently installed and used by fireworks companies operating at the Site (Locus, 2004). Based on the suspected activities and the reported analytical testing, the constituents of potential concern associated with both WCLC's and fireworks companies' uses of this area are perchlorate and TCE.

In 2004, Locus investigated the shallow soil near the outfall of a clarifier for the presence of perchlorate and TCE. There were no detections.

In 2006, ENVIRON collected two soil samples from one boring⁶. The samples were analyzed for perchlorate and TCE; there were no detections. Soil gas was analyzed at six locations within the study area; no TCE was detected.

4.2.21 Study Area 30

Study Area 30, specifically Building 35, is a former WCLC assembly shop where TCE may have been used (J. Allegranza, July 13, 2005 at 37:17 to 39:25). Based on the regulator requested analytical testing, the constituent of potential concern associated with WCLC's use of this area is TCE.

Soil gas was analyzed at four locations within the study area; no TCE was detected.

4.2.22 Study Area 31

Study Area 31 is the location of darkened, possibly stained, surface soil west of Building 27 during WCLC's tenure at the Site (October 1955 Aerial 149REV). Based on the regulator requested analytical testing, the constituent of potential concern associated with WCLC's use of this area is TCE.

Soil gas was analyzed at four locations within the study area; no TCE was detected.

⁶ This boring is shown as two separate sampling locations on Figure 4 due to refusal being encountered before the target depth was reached. The boring was redrilled a few feet from the original location to obtain a soil sample at 25 ft.

4.2.23 Study Area 38

Study Area 38 is the location of a former drum storage area visible in historical aerial photographs dating back to WCLC's tenure at the Site (1955 141REV, 1955 144REV). Based on the regulator requested analytical testing, the constituent of potential concern associated with WCLC's use of this area is TCE.

Soil gas was analyzed at eleven locations within the study area; no TCE was detected.

4.2.24 Study Area 39

Study Area 39 is the location of a former drum storage area visible in historical aerial photographs dating back to WCLC's tenure at the Site (1955 141REV, 1955 144REV). Based on the regulator requested analytical testing, the constituent of potential concern associated with WCLC's use of this area is TCE.

Soil gas was analyzed at four locations within the study area; no TCE was detected.

4.2.25 Study Area 40

Study Area 40 was identified as an area where WCLC may have used solvents to clean spray guns used to paint floatlights (J. Allegranza, July 13, 2005 at 52:2 to 57:10). Based on the suspected activities, the constituent of potential concern associated with WCLC's use of this area is TCE.

Soil gas was analyzed at two locations within the study area; no TCE was detected.

4.2.26 Study Area 42

Study Area 42 was identified as a former rail spur where WCLC may have disposed of trash, based on a 1955 oblique air photograph (UCSB October 29, 1955, Frame 55:3705). Based on the regulator requested analytical testing, the constituent of potential concern associated with WCLC's use of this area is perchlorate.

The 2006 Work Plan called for two soil borings at this location. At the request of the Regional Board, ENVIRON installed ten trenches in an attempt to locate remnants of material visible in the historical oblique air photograph. No evidence of waste disposal was found, and no samples were collected. Subsequently, the Regional Board requested the installation of four borings in this area. In 2006, ENVIRON collected ten soil samples from four borings. The samples were analyzed for perchlorate; there were no detections.

4.2.27 Study Area 43

Study Area 43 was identified as an area where a liquid discharge appears to have occurred from the former WCLC boiler house (UCSB October 29, 1955, Frame 55:3709). Based on the regulator requested analytical testing, the constituents of potential concern associated with WCLC's use of this area are perchlorate and TCE.

In 2004, ENVIRON collected soil samples at six locations in this area; no perchlorate or TCE were detected. During the 2006 RI, four additional soil samples were collected from two borings

and analyzed for perchlorate and TCE⁷; there were no detections. Soil gas was analyzed at eight locations within the study area; no TCE was detected.

4.2.28 Study Area 44

Study Area 44 was identified as a former rail spur where WCLC may have disposed of trash, based on a 1955 oblique air photograph (UCSB October 29, 1955, Frame 55:3705). Based on the regulator requested analytical testing, the constituent of potential concern associated with WCLC's use of this area is perchlorate.

In 2006, ENVIRON collected 10 soil samples from one trench and one boring. The samples were analyzed for perchlorate; there were no detections⁸.

⁷ One of the four samples was analyzed for VOCs and perchlorate; the remaining four samples were analyzed for perchlorate only.

⁸ One sample was collected from an epoxy-type material found on the inside of a warped 55-gallon drum encountered during the excavation. This sample was analyzed for SVOCs and VOCs and had detections of 1200 ppb chloroform, 830 ppb p-cymene, 670 ppb styrene, 290 ppb propylbenzene, 270 ppb 1-methylethylbenzene and 180 ppb ethylbenzene. No SVOCs were detected.

5 Other Study Areas

5.1 Introduction

Section 5 of this report includes a discussion of all data collected from study areas other than where WCLC is known or suspected to have used either perchlorate or TCE, the two constituents of concern. These areas are Study Areas 1, 2, 3, 6, 12, 20, 22, 26, 27, 28, 32, 33, 34, 35, 36, 41, 45, 46, 47, 48, 49, and 50. In thirteen of these study areas perchlorate and/or TCE were detected. These areas where perchlorate and/or TCE were detected are presented at the beginning of Section 5.2, in order of decreasing maximum perchlorate detections. The remaining nine study areas are presented in alphanumerical order. Sample locations for each study area described in this section are shown on Figure 5.

5.2 Soil and Soil Gas Data

5.2.1 Study Area 46

Study Area 46 was identified as the location of the McLaughlin Pit (SBCFC October 15, 1972, C-193 - Frame 21). The McLaughlin Pit was an approximately twenty by twenty by four foot deep “pond” or “swimming pool” built by Pyrotechnics, and used by Pyrotechnics and other fireworks companies for the disposal of pyrotechnic wastes (Hescoc, February 14, 2005 at 105:5-16). Based on the reported analytical testing, and the suspected use, the constituents of potential concern associated with Pyrotechnics’ and other fireworks companies’ use of this area are perchlorate and TCE.

In 2004, Kleinfelder conducted an initial perchlorate investigation at the McLaughlin Pit. The investigation consisted of collecting 11 samples from five 4 to 5 ft deep trenches, and two 20 ft deep borings. Perchlorate was detected in all but two samples, at concentrations ranging from 247 ppb in one of the trenches to 205,000 ppb in boring B-1 at a depth of 15 ft bgs.

In 2006, Adverus collected 25 soil samples from one deep boring (CMW-01) located to the southeast of the McLaughlin Pit. The samples were analyzed for perchlorate; there were 20 detections extending from a depth of 65 ft bgs down to the groundwater interface, ranging from 25 to 3,200 ppb. In addition, 20 of those samples were analyzed for TCE; there were no detections.

In 2006, ENVIRON collected 23 soil samples from one deep boring (CML-01) through the center of the McLaughlin Pit. The samples were analyzed for perchlorate; there were 22 detections extending from the shallow vadose zone down to the groundwater interface, ranging from 33 to 190,000 ppb. In addition, 11 of those samples were analyzed for TCE; detections were encountered in two samples with a maximum of 8.7 ppb at 200 ft bgs.

5.2.2 Study Area 50

Study Area 50 is the location of a Broco facility where explosive magazines and underwater welding and cutting rods were manufactured. In addition, hazardous wastes generated from these activities were accumulated in this area (BBL, 2005). Based on the reported analytical testing, the constituents of potential concern associated with Broco’s use of this area are perchlorate and TCE.

From 2005 through 2008, BBL and Kleinfelder collected 145 soil samples from a series of trenches, potholes, and borings – the deepest being 200 ft. The soil samples were analyzed for perchlorate; there were 80 detections with a maximum of 65,800 ppb. No further sampling has been conducted to date to determine the nature and extent of the perchlorate contamination encountered in the shallow and intermediate depth soils. Soil gas was analyzed at four locations within the study area; no TCE was detected.

5.2.3 Study Area 47

Study Area 47, is the location of the northernmost of the so-called “Southwest Disposal Pits,” and is shown in historical air photographs dating back to Goodrich’s tenure at the Site (UCSB December 5, 1961, C-24223Frame 7-5). It is an area where Goodrich may have disposed of waste. Based on the suspected activities and reported analytical testing, the constituents of potential concern associated with Goodrich’s use of this area are perchlorate and TCE.

In 2004, Geosyntec collected five soil samples from five boring locations, the majority of which were located outside the footprint of the disposal pit. The soil samples were analyzed for perchlorate and TCE; there were no detections. Soil gas was also analyzed at 17 locations, the majority of which were located outside the footprint of the disposal pit; no TCE was detected.

In 2006, ENVIRON collected 12 soil and material samples from one trench at the location of the pit. The soil samples were analyzed for perchlorate; there were 12 detections, ranging from 1,700 to 9,000 ppb. No further sampling has been conducted to date to determine the nature and extent of the perchlorate contamination encountered in the shallow soils. In addition, four of those samples were analyzed for TCE; there were no detections.

5.2.4 Study Area 33

Study Area 33, specifically in and around Building 1, was identified as an area where Goodrich may have conducted casing salvage operations of Sidewinder and other missiles (Polzien Deposition, Exhibit 292). Based on the suspected activities, the constituents of potential concern associated with Goodrich’s use of this area are perchlorate and TCE.

In 2006, ENVIRON collected 33 soil samples from 10 borings. The samples were analyzed for perchlorate; there were 19 detections ranging from 26 to 7,400 ppb. No further sampling has been conducted to date to bound the perchlorate encountered in the shallow soils. Soil gas was analyzed at eight locations within the study area; no TCE was detected.

5.2.5 Study Area 48

Study Area 48 is the location of the middle and southernmost of the so-called “Southwest Disposal Pits,” and is shown in historical air photographs dating back to Pyrotronics’ tenure at the Site (USGS September 13, 1968, M68429 - Frame 102A and Hescox, February 14, 2005 at 114:4-19). It is an area where Pyrotronics and perhaps other fireworks manufacturers disposed of waste. Based on the suspected activities and reported analytical testing, the constituents of potential concern associated with Pyrotronics’ use of this area are perchlorate and TCE.

In 2006, ENVIRON collected 27 soil samples from three trenches and two borings. The samples were analyzed for perchlorate; there were 22 detections, ranging from 22 to 3,900 ppb. No further sampling has been conducted to date to determine the nature and extent of the

perchlorate contamination encountered in the shallow soils. In addition, 17 of these samples were analyzed for TCE; there were no detections.

5.2.6 Study Area 45

Study Area 45 was identified as an area where Goodrich's Burn Pits were located (Aerial photograph USDA, October 15, 1959, 15W - Frame 80, CONT December 14, 1960, 360 - Frame 6-23). Based on the suspected activities and reported analytical testing, the constituents of potential concern associated with Goodrich's use of this area are perchlorate and TCE.

In 2004, Geosyntec collected eight soil samples from four boring locations. The soil samples were analyzed for perchlorate and TCE; there were perchlorate detections in every sample, with a maximum of 630 ppb; no TCE was detected. Soil gas was also analyzed at 14 locations in and around the former Goodrich Burn Pits. TCE was detected in four samples, with a maximum concentration of 1.7 µg/L.

In 2006, Adverus collected 28 soil samples from one deep boring (CMW-02) to the southeast of the Goodrich Burn Pits. The samples were analyzed for perchlorate; there were 14 detections extending from the shallow soils to a depth of 285 ft bgs, with a maximum concentration of 1,700 ppb. In addition, 23 of those samples were analyzed for TCE; there were no detections.

In 2006, ENVIRON collected thirty-five soil samples from eight borings. The samples were analyzed for perchlorate; there were 12 detections, ranging from 23 to 760 ppb. In addition, 20 of those samples were analyzed for TCE; there were no detections.

In 2009, CH2M Hill, on behalf of USEPA, installed three 100-ft borings, and collected 33 soil samples. The samples were analyzed for perchlorate; there were 21 detections, ranging from 18 to 2,800 ppb. In addition, four vapor probes were installed in each boring. TCE was detected in every sample, with a maximum detection of 1,700 µg/m³ at 100 ft in EPASG-3, located southeast of the Goodrich Burn Pits. No further sampling has been conducted to date to determine the nature and extent of the perchlorate contamination encountered in the shallow soils.

5.2.7 Study Area 22

Study Area 22 is the location of APE's former burn area for damaged and "off-spec" fireworks (PES, 2003). Based on the reported analytical testing, the constituent of potential concern associated with APE's use of this area is perchlorate.

In 2003, PES collected 11 soil samples from a series of test trenches. The soil samples were analyzed for perchlorate; there were six detections, ranging from 79 to 2,900 ppb. No further sampling has been conducted to date to determine the nature and extent of the perchlorate contamination encountered in the shallow soils.

5.2.8 Study Area 6

Study Area 6, specifically Building 20, was identified as an area where Goodrich may have conducted strand burning (Graham Deposition, January 19, 2005 at 205:12 to 205:25, and Exhibit 143). In addition, United Fireworks stored oxidizers, including potassium perchlorate, in Building 20 (RFDW006298, letter dated October 23, 1968 from United Fireworks to Rialto Fire

Department). Based on the suspected activities, the constituent of potential concern associated with Goodrich's and United Fireworks' use of this area is perchlorate. Although WCLC originally built and occupied this building, there is no evidence that it used perchlorate at this location.

In 2006, ENVIRON collected 16 soil samples from seven 25-foot deep soil borings⁹ and one grab sample from material within a pipe leading away from the floor drain in Building 20. The samples were analyzed for perchlorate; there were no detections.

In 2009, at the request of USEPA as set forth in AOC 2009-01, the open terminus of the drain pipe was excavated and exposed beneath an existing building north of Building 20. Material from within the pipe as well as soil beneath the terminus were sampled and analyzed for perchlorate. The soil sample did not contain perchlorate above the MRL. The sample of the pipe's contents at the terminus contained perchlorate at a level of 69 ppb¹⁰, as well as a number of other constituents such as polycyclic aromatic hydrocarbons and heavy metals (see Appendix I).

5.2.9 Study Area 28

Study Area 28 is the location of the former Goodrich 150-gallon production mixer where perchlorate was used. (Polzien Deposition April 5, 2005 at 93 and 144-145). This mixer was subsequently used by Pyrotronics (Hescox Deposition, Exhibit 172). Based on the suspected activities and reported analytical testing, the constituents of potential concern associated with both Goodrich's and Pyrotronics' uses of this area are perchlorate and TCE.

In 2003, PES collected three soil samples from one trench. Two of the samples were analyzed for perchlorate; there were no detections. All three samples were analyzed for TCE; there were no detections.

In 2004, Geosyntec analyzed soil gas at 12 locations; no TCE was detected.

In 2006, ENVIRON collected 45 soil samples from three trenches¹¹, nine grab locations, and one deep boring advanced during installation of well CMW-5. The samples were analyzed for perchlorate; there were four detections ranging from 24 to 68 ppb¹².

⁹ Borings were located along the path of an underground pipe, believed to originate from a floor drain in Building 20. Two of the borings were located at the outlet of a buried cesspool.

¹⁰ Perchlorate was first analyzed by USEPA Method 314.0 MOD; no perchlorate was detected above the MRL; however, due to matrix interference the MRL was elevated above the target MRL of 20 ppb. At the request of USEPA, the sample was reanalyzed using USEPA Method 6860 which yielded a result of 69 ppb, however, this result was obtained outside of the hold time. The sample extract – which was still within its hold time - was subsequently analyzed for perchlorate using USEPA Method 6850. Using this method, perchlorate was detected at a level of 34 ppb.

¹¹ One trench was installed beneath a clarifier, one trench was installed along a trench drain along the edge of the former building and a third trench was dug as a series of three potholes following the path of a buried open-jointed clay pipe.

¹² Three of the four detections were encountered in the grab samples taken from the material within the clay pipe or the soil immediately beneath the pipe with concentrations ranging from 24 to 60 ppb. The fourth and highest detection of 68 ppb was encountered in a saturated soil sample from the deep boring (CMW-05) at a depth of 400 feet; all overlying samples in that boring were below the MRL.

5.2.10 Study Area 32

Study Area 32, specifically Building 10, was identified as an area where Goodrich may have weighed ammonium perchlorate (M. Willis Deposition, Page 189 - Exhibit 1045). Based on the suspected activities, the constituent of potential concern associated with Goodrich's use of this area is perchlorate.

In 2006, ENVIRON collected 22 soil samples from eight borings. The samples were analyzed for perchlorate; there were two detections, 54 and 22 ppb, at 1 and 5 feet bgs, respectively, with no detections in the four underlying samples.

5.2.11 Study Area 12

Study Area 12 includes Buildings 2, 3, and 4, which were identified as locations where Goodrich may have mixed ammonium perchlorate in small R&D mixers (Graham Deposition, January 19, 2005 at 204 and Exhibit 123). In addition, in-ground clarifiers were subsequently installed and used in this area by fireworks companies operating at the Site (Locus, 2004). Based on the suspected activities and reported analytical testing, the constituents of potential concern associated with both Goodrich's and fireworks companies' uses of this area are perchlorate and TCE.

In 2004, Geosyntec analyzed soil gas at 18 locations; no TCE was detected.

In 2004, Locus investigated the shallow soil near the outfall of a clarifier for the presence of perchlorate and TCE; there were no detections.

In 2006, ENVIRON collected eight soil samples from three trenches. The samples were analyzed for perchlorate; at one location perchlorate was detected at 57 ppb at 10 ft bgs; perchlorate was not detected in the underlying sample.

5.2.12 Study Area 34

Study Area 34, specifically Building 51, is the location of an APE warehouse where class C explosives were stored (PES, 2003). Based on the reported analytical testing, the constituent of potential concern associated with APE's use of this area is perchlorate.

In 2003, PES collected seven soil samples from three trenches. The samples were analyzed for perchlorate; there was one detection of 41 ppb, but a duplicate of this sample was below the MRL of 40 ppb.

5.2.13 Study Area 36

Study Area 36 is the location of monitoring well CMW-03 installed by Adverus on behalf of PSI. There are no known activities related to perchlorate or TCE in this area. Based on the reported analytical testing, the constituents of potential concern associated with the use of this area are perchlorate and TCE.

In 2006, Adverus collected 15 soil samples from one deep boring (CMW-03). The samples were analyzed for perchlorate; there were three detections: 39 ppb at 100 ft bgs and 33 ppb in two samples at 300 ft bgs. In addition, nine of those samples were analyzed for TCE; there were no detections.

5.2.14 Study Area 1

Study Area 1 is the location of Bunker M-11, used as a mortar storage area by PSI (Kleinfelder, 2003). Based on the reported analytical testing, the constituents of potential concern associated with PSI's use of this area are perchlorate and TCE.

In 2003, Kleinfelder collected three soil samples from one trench. The samples were analyzed for perchlorate and TCE; there were no detections.

5.2.15 Study Area 2

Study Area 2 is the location of PSI's former mortar storage area (Kleinfelder, 2003). Based on the reported analytical testing, the constituents of potential concern associated with PSI's use of this area are perchlorate and TCE.

In 2003, Kleinfelder collected three soil samples from one trench. The samples were analyzed for perchlorate and TCE; there were no detections.

5.2.16 Study Area 3

Study Area 3 is the location of APE's main warehouses. Activities in these buildings (Buildings 76, 77, 78, and 79) include assembly of assortment trays, as well as storage, shipping, and receiving of Class C explosives¹³ (PES, 2003). Based on the reported analytical testing, the constituent of potential concern associated with APE's use of this area is perchlorate.

In 2003, PES collected 21 soil samples from 10 trenches. The samples were analyzed for perchlorate; there were no detections.

5.2.17 Study Area 20

Study Area 20, specifically Building 31, was identified as an area where Goodrich may have mixed ammonium perchlorate in a 100-gallon mixer (Exhibit 92 to Wever Deposition). In addition, an in-ground clarifier was subsequently installed and used in this area by fireworks companies operating at the Site (Locus, 2004). Based on the suspected activities, the constituent of potential concern associated with Goodrich's use of this area is perchlorate. Based on the reported analytical testing, the constituents of potential concern associated with fireworks companies' use of this area are perchlorate and TCE.

In 2004, Locus investigated the shallow soil near the outfall of a clarifier for the presence of perchlorate and TCE; there were no detections.

In 2006, ENVIRON collected four soil samples from two borings. The samples were analyzed for perchlorate; there were no detections.

¹³ Class C explosives include certain types of manufactured articles which contain Class A or Class B explosives, or both, as components but in restricted quantities (Class B explosives possess a flammable hazard, such as propellant explosives. Class A explosives possess a detonating hazard; such as dynamite, nitroglycerin, or black powder).

5.2.18 Study Area 26

Study Area 26, specifically Building 73, is the location of an in-ground clarifier installed and used by fireworks companies operating at the Site (Locus, 2004). Based on the reported analytical testing, the constituents of potential concern associated with fireworks companies' use of this area are perchlorate and TCE.

In 2004, Locus investigated the shallow soil near the outfall of a clarifier for the presence of perchlorate and TCE; there were no detections.

5.2.19 Study Area 27

Study Area 27, specifically Building 72, was identified as an area where Pyrotechnics may have mixed fireworks chemicals that contained perchlorate (Hescox Deposition, February 14, 2005 at 99-100). In addition, an in-ground clarifier was installed and used in this area by fireworks companies. Based on the suspected activities and reported analytical testing, the constituents of potential concern associated with both Pyrotechnics and fireworks companies' use of this area, include perchlorate and TCE.

In 2004, Locus investigated the shallow soil near the outfall of a clarifier for the presence of perchlorate and TCE; there were no detections.

In 2006, ENVIRON collected five soil samples from two borings. The samples were analyzed for perchlorate; there were no detections.

5.2.20 Study Area 35

Study Area 35 is the location of PSI's current mortar storage area (Kleinfelder, 2003). Based on the reported analytical testing, the constituents of potential concern associated with PSI's use of this area are perchlorate and TCE.

In 2003, Kleinfelder collected three soil samples from one trench. The samples were analyzed for perchlorate and TCE; there were no detections.

5.2.21 Study Area 41

Study Area 41 is the location of monitoring well CMW-04 installed by ENVIRON on behalf of EII. There are no known activities in this area. Based on the regulator requested analytical testing, the constituent of potential concern associated with the use of this area is perchlorate.

In 2006, five soil samples collected from one deep boring (CMW-04) were analyzed for perchlorate; there were no detections.

5.2.22 Study Area 49

Study Area 49 is the portion of the so-called "Engle Property" located on the Site. WCLC did not conduct any activities in this area, and subsequent activities by others on this parcel are unknown to ENVIRON. Based on the reported analytical testing, the constituent of potential concern associated with the use of this area is perchlorate.

In 2005, Kleinfelder collected six soil grab samples¹⁴. The samples were analyzed for perchlorate; there were no detections.

¹⁴ In total, 38 soil grab samples were collected, but only six of these are located on the BF Goodrich Site.

6 Site Groundwater Data

Groundwater data for the Site and its immediate vicinity are discussed below by sampling location. Tables 3 and 4 provide a summary of the groundwater analytical results¹⁵ and elevations. The locations of the wells and their positions in relation to the 50 study areas at the Site are shown on Figure 6. Details related to groundwater data collected by ENVIRON as part of its 2006 RI can be found in the appendices of this report. For more information on wells installed by others, we refer the reader to the documents incorporated by reference herein.

6.1 PW-01

PW-1 was installed in 2004 by Geosyntec, on behalf of Goodrich, at the request of USEPA. It is located northwest and upgradient of the Site. The well is screened from 440 to 480 ft bgs. Between October 2004 and February 2008, when Goodrich stopped sampling its wells near the Site, concentrations of perchlorate ranged from below the MRL to 6.3 ppb; TCE has never been detected. Details on well construction and installation, grab sampling, and encountered lithology can be found in the March 24, 2005 Draft Remedial Investigation Report (Geosyntec, 2005).

6.2 PW-02

PW-2 was installed in 2004 by Geosyntec, on behalf of Goodrich, at the request of USEPA. It is located on the southern portion of the of the Site. The well is screened from 455 to 495 ft bgs. Between October 2004 and March 2009¹⁶ concentrations of perchlorate have ranged from 3 ppb to 10,000 ppb; TCE has ranged from 11 ppb to 420 ppb. Details on well construction and installation, grab sampling, and encountered lithology can be found in the March 24, 2005 Draft Remedial Investigation Report (Geosyntec, 2005).

6.3 PW-03

PW-3 was installed in 2004 by Geosyntec, on behalf of Goodrich, at the request of USEPA. It is located near the southeast corner of the Site. The well is screened from 465 to 496 ft bgs. Between October 2004 and March 2009 concentrations of perchlorate have ranged from 27 to 240 ppb; TCE has ranged from 7.4 to 200 ppb. Details on well construction, grab sampling, and encountered lithology can be found in the March 24, 2005 Draft Remedial Investigation Report (Geosyntec, 2005).

6.4 PW-04

PW-4 was installed in 2004 by Geosyntec, on behalf of Goodrich, at the request of USEPA. It is located on the eastern edge of the Site. The well is screened from 470 to 510 ft bgs. Between October 2004 and March 2009 concentrations of perchlorate have ranged from below the MRL to 81 ppb; TCE has ranged from 0.4 to 13 ppb. Details on well construction, grab sampling, and

¹⁵ Only perchlorate and TCE are shown.

¹⁶ Although Goodrich stopped sampling its wells on and near the Site in early 2008, USEPA performed sampling at some of the wells as recently as March 2009.

encountered lithology can be found in the March 24, 2005 Draft Remedial Investigation Report (Geosyntec, 2005).

6.5 CMW-01

CMW-01 was installed in 2006 by Adverus, on behalf of PSI, at the request of the Regional Board. It is located approximately on the central portion of the Site. The well is triple-completed with screens from 428 to 448 ft bgs (CMW-1A), 470 to 490 ft bgs (CMW-1B), and 513 to 533 ft bgs (CMW-1C). Between July 2006 and August 2009 concentrations of perchlorate ranged from below the MRL to 1,500 ppb, with the highest detections typically encountered in the shallowest zone. During that same period, TCE ranged from below the MRL to 150 ppb, also with the highest detections typically encountered in the shallowest zone. Details on well construction, grab sampling, and encountered lithology have yet to be published in a formal report.

6.6 CMW-02

CMW-02 was installed in 2006 by Adverus, on behalf of PSI, at the request of the Regional Board. It is located approximately on the central western portion of the Site. The well is triple-completed with screens from 432 to 452 ft bgs (CMW-2A), 471 to 491 ft bgs (CMW-2B), and 511 to 531 ft bgs (CMW-2C). Between July 2006 and August 2009 concentrations of perchlorate ranged from below the MRL to 110 ppb, with the highest detections typically encountered in the shallowest zone. During that same period, TCE ranged from below the MRL to 1,500 ppb, also with the highest detections typically encountered in the shallowest zone. Details on well construction, grab sampling, and encountered lithology have yet to be published in a formal report.

6.7 CMW-03

CMW-03 was installed in 2006 by Adverus, on behalf of PSI, at the request of the Regional Board. It is located downgradient of the northwest portion of the Site. The well is triple-completed with screens from 419 to 439 ft bgs (CMW-3A), 459 to 479 ft bgs (CMW-3B), and 504 to 524 ft bgs (CMW-3C). Between July 2006 and August 2009 concentrations of perchlorate ranged from below the MRL to 6.7 ppb, with the highest detections typically encountered in the shallowest zone. During that same period, TCE ranged from below the MRL to 26 ppb, also with the highest detections typically encountered in the shallowest zone. Details on well construction, grab sampling, and encountered lithology have yet to be published in a formal report.

6.8 CMW-04

CMW-04 was installed in 2006 by ENVIRON, on behalf of EII, at the request of the Regional Board. It is located downgradient of the central northern portion of the Site. During the installation of the deep soil boring at this location, 12 grab groundwater samples were collected from six depths and analyzed at two different laboratories for perchlorate and VOCs. Perchlorate was detected in the shallowest grab samples only, at concentrations of 54 and 58 ppb. TCE was detected at various points in the water bearing zone at concentrations ranging from 1.3 ppb to 47 ppb, the highest detections being encountered in the shallowest samples. After grab samples had been collected from the soil boring, the well was triple-

completed with screens from 400 to 440 ft bgs (CMW-4A), 455 to 475 ft bgs (CMW-4B), and 490 to 510 ft bgs (CMW-4C). Between October 2006 and August 2009 concentrations of perchlorate ranged from below the MRL to 150 ppb, with the highest detections typically encountered in the shallowest zone. During that same period, TCE ranged from below the MRL to 40 ppb, also with the highest detections typically encountered in the shallowest zone.

6.9 CMW-05

CMW-05 was installed in 2006 by ENVIRON, on behalf of EII, at the request of the Regional Board. It is located downgradient of the northeast portion of the Site. During the installation of the deep soil boring at this location, 12 grab groundwater samples were collected from six depths and analyzed at two different laboratories for perchlorate and VOCs. Perchlorate was detected throughout the water bearing zone, at concentrations ranging from 38 to 270 ppb. TCE was also detected at various points in the aquifer at concentrations ranging from 7.2 ppb to 100 ppb. The well is triple-completed with screens from 400 to 440 ft bgs (CMW-5A), 460 to 480 ft bgs (CMW-5B), and 500 to 520 ft bgs (CMW-5C). Between October 2006 and August 2009 concentrations of perchlorate ranged from 13 to 470 ppb, with the highest detections typically encountered in the shallowest zone. During that same period, TCE ranged from 2.6 to 270 ppb, also with the highest detections typically encountered in the shallowest zone.

6.10 SB-CML-01

SB-CML-01 was installed in 2006 by ENVIRON, on behalf of EII, at the request of the Regional Board as a soil boring through the center of the McLaughlin Pit. Three grab groundwater samples were collected from this location. Perchlorate was found to range from 8.4 to 1,700 ppb; TCE was detected only in the upper grab sample at a concentration of 150 ppb. The attempt to convert the deep boring to a clustered monitoring well was unsuccessful; therefore no other groundwater data exist at this location.

6.11 Study Area 13

During the ENVIRON 2009 RI installation of a deep soil boring in Study Area 13, a grab groundwater sample was collected from the bottom of borehole SB-M1-05 at depth of approximately 390 ft bgs. The groundwater layer at this depth was approximately 4 feet thick, and is believed to be a perched zone based on water elevations in nearby monitoring wells, and the presence of finer materials immediately below the zone of saturation. The sample was analyzed for perchlorate; there was no detection. The result for this sample has been included with the soil data shown in Table 1.

7 Recommended Further Investigations

The main objective of ENVIRON's work at the Site has been to determine the nature and extent of contamination in the WCLC Operation Areas, and the threat to the public health or welfare or the environment, if any, caused by the release or threatened release of hazardous substances or pollutants or contaminants potentially associated with WCLC operations. With respect to WCLC Operation Areas, sufficient data have now been collected to satisfy this main objective.

In contrast, this does not hold true for many of the areas where WCLC is not known or suspected of having operated, where the degree of sampling conducted to date has generally been less comprehensive than requested by regulators for WCLC Operation Areas. WCLC areas where even small detections of perchlorate were encountered in the shallow soils (e.g. 58 ppb in Study Area 11), were further investigated with the purpose of determining the nature and extent of the contamination – at times collecting samples all the way to groundwater. In contrast, certain non-WCLC areas with far greater shallow soil concentrations remain uncharacterized beyond the top few feet of soil (e.g. 8 ft in Study Area 22). Without recommending any specific study area for further investigation, ENVIRON notes that in general, more data are needed in most non-WCLC Operations Areas to determine the nature and extent of vadose zone contamination and potential groundwater impacts.

8 Summary and Conclusions

8.1 Summary

Since 2003, 50 study areas at the Site have been investigated to varying degrees for the presence of perchlorate and/or TCE, the two main contaminants in groundwater in the Rialto-Colton Basin. WCLC is known or suspected of having used perchlorate, or alleged to have used TCE in a combined total of 28 study areas. No TCE was found in any of the 28 study areas. Perchlorate was found in four of the 28 study areas, namely Study Areas 18, 13, 11, and 37. The perchlorate detections in these four areas have been bounded by an extended series of consecutive non-detect results (i.e. Study Areas 18, 13, 11, and 37).

In the remaining 22 study areas, where WCLC is not known or suspected of having used perchlorate or TCE, perchlorate was detected in 13 study areas, namely Study Areas 46, 50, 47, 33, 48, 45, 22, 6, 28, 32, 12, 34, and 36. In many of these study areas, the nature and extent of perchlorate, and, in the case of Study Area 45, TCE contamination, have not been fully characterized. In addition, groundwater wells downgradient of some of these areas have historically exhibited elevated perchlorate and TCE detections, with values as high as 10,000 ppb for perchlorate (PW-2), and 1,500 ppb of TCE (CMW-2).

8.2 Conclusions

All known or suspected (regardless of the basis for that suspicion) WCLC operations areas have been investigated for TCE and/or perchlorate. No TCE was found in the soil or soil gas samples collected from these areas. As specified in the AOC, the primary objective of ENVIRON's remedial investigation was: "...to determine the nature and extent of contamination in the WCLC operations areas on the Site, and the threat to the public health or welfare or the environment, if any, caused by the release or threatened release of hazardous substances or pollutants or contaminants by WCLC." ENVIRON has met these remedial investigation objectives. The hazardous substance TCE was not detected in any WCLC operations area; thus, there is no indication of a release or threatened release of TCE in the WCLC operations area. The contaminant perchlorate was found in the vadose zone well above the groundwater interface in four study areas, and has been characterized.

In contrast, several non-WCLC study areas were found to contain perchlorate and/or TCE contamination, the nature and extent of which, in almost all cases, remains uncharacterized. Several non-WCLC areas, which have been reasonably well investigated, such as the McLaughlin Pit, were found to be major sources of contamination, with perchlorate consistently present throughout the soil profile and in groundwater directly below and immediately downgradient of the study area. In most non-WCLC study areas, where the nature and extent of the contamination remains largely uncharacterized, further investigation is warranted to evaluate the potential impacts.

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Tables

Figures

Appendices A - N
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