REMEDIAL ACTION PLAN
THE SPIRITO FAMILY TRUST PARCEL
4057 AND 4059 GOODWIN AVENUE
(INCLUDING THE FORMER EXCELLO PLATING CO., INC. FACILITY)
CITY OF LOS ANGELES,
COUNTY OF LOS ANGELES, CALIFORNIA

LARWQCB Reference:
Excello Plating Co., Inc.
CAO No. R4-2003-0038-R
LARWQCB Site ID No. 2040209
LARWQCB File No. 113.5243

Prepared by:

KLEINFELDER WEST, INC.
620 West 16th Street, Unit F
Long Beach, California 90813

Kleinfelder Project No. 101942

September 30, 2010

Copyright Kleinfelder 2010

REMEDIAL ACTION PLAN
THE SPIRITO FAMILY TRUST PARCEL
4057 AND 4059 GOODWIN AVENUE
(INCLUDING THE FORMER EXCELLO PLATING CO., INC. FACILITY)
CITY OF LOS ANGELES,
COUNTY OF LOS ANGELES, CALIFORNIA

Kleinfelder Project No. 101942

Prepared by:

John Donatucci, P.E.
Senior Engineer

Michael A. Counte, R.E.A., R.B.P.
Environmental Group Manager

Reviewed by:

William Golightly, P.E.
Senior Principal Engineer

KLEINFELDER WEST, INC.
620 West 16th Street, Unit F
Long Beach, California 90813

September 30, 2010

Copyright Kleinfelder 2010

TABLE OF CONTENTS

Section **Page**

1. EXECUTIVE SUMMARY 1
2. INTRODUCTION 7
3. SITE BACKGROUND 9
   - 3.1 SITE DESCRIPTION 9
   - 3.2 REGIONAL GEOLOGY/HYDROGEOLOGY 11
   - 3.3 PREVIOUS INVESTIGATIONS 17
   - 3.4 PREVIOUS REMEDIAL ACTIONS 29
4. COC EVALUATION 30
   - 4.1 COPCs 30
   - 4.2 SITE-SPECIFIC SSLs CALCULATIONS 32
     - 4.2.1 Site-Specific Soil Parameter Sampling and Analyses 33
     - 4.2.2 Site-Specific Soil Parameter Analytical Results 36
     - 4.2.3 Calculation of Site-Specific SSLs 37
     - 4.2.4 SSLs for Metals in Soil 43
     - 4.2.5 SSLs for VOCs in Soil Vapor 45
     - 4.2.6 Vapor-Water Partitioning for VOCs in Soil Vapor 54
   - 4.3 COC SELECTION 57
   - 4.4 COC CLEANUP GOALS 58
5. CONCEPTUAL SITE MODEL UPDATE 62
6. EXTENT OF REMEDIATION BASED ON CLEANUP GOALS 64
7. REMEDIAL ALTERNATIVE SCREENING 66
   - 7.1 REMEDIAL ALTERNATIVE SCREENING METHODOLOGY 66
   - 7.2 DESCRIPTION OF REMEDIAL ALTERNATIVES FOR CR^{6+} IN SOIL 67
   - 7.3 SCREENING OF REMEDIAL ALTERNATIVES FOR CR^{6+} IN SOIL 70
   - 7.4 COMPARATIVE EVALUATION OF ALTERNATIVES FOR CR^{6+} IN SOIL 82
   - 7.5 DESCRIPTION OF REMEDIAL ALTERNATIVES FOR PCE AND TCE IN SOIL VAPOR 82
   - 7.6 SCREENING OF REMEDIAL ALTERNATIVES FOR PCE AND TCE IN SOIL VAPOR 84
   - 7.7 COMPARATIVE EVALUATION OF ALTERNATIVES FOR PCE AND TCE IN SOIL VAPOR 87

Copyright Kleinfelder 2010

TABLE OF CONTENTS (CONTINUED)

Section **Page**

8. PROPOSED REMEDIAL ALTERNATIVE FOR CR^{6+} IN SOIL 88
- 8.1 DESCRIPTION OF REMEDIAL ALTERNATIVE FOR CR^{6+} IN SOIL 88
- 8.2 LARGE-DIAMETER AUGER MIXING/ISCR PILOT TESTING AND DESIGN 90
- 8.3 ENGINEERED CAP 92
  - 8.3.1 Proposed Cap Design 92
  - 8.3.2 Cap Maintenance Plan 92
- 8.4 LDA/ISCR PERMITTING 93
- 8.5 LDA/ISCR IMPLEMENTATION 94
  - 8.5.1 Performance Assessment 95
  - 8.5.2 Backup Plan 96
  - 8.5.3 Site Restoration 97
- 8.6 WDR PERMIT MONITORING 97
- 8.7 WASTE MANAGEMENT 97
- 8.8 HUMAN HEALTH RISK ASSESSMENT FOR SOIL 98
- 8.9 HEALTH AND SAFETY PLAN 98
- 8.10 REPORTING 99

9. PROPOSED REMEDIAL ACTION FOR PCE AND TCE IN SOIL VAPOR 100
- 9.1 CONCEPTUAL DESIGN FOR PCE AND TCE IN SOIL VAPOR 100
- 9.2 INSTALLATION OF SVE WELLS 101
- 9.3 SVE PILOT TESTING 103
- 9.4 SVE SYSTEM DESIGN PACKAGE 104
- 9.5 PERMITTING OF SVE SYSTEM 104
- 9.6 INSTALLATION OF SVE SYSTEM 106
- 9.7 REMEDIATION SYSTEM START-UP AND MONITORING 108
- 9.8 SVE SYSTEM OPERATIONS AND MAINTENANCE 108
- 9.9 SVE SYSTEM SHUTDOWN 109
- 9.10 HUMAN HEALTH RISK ASSESSMENT FOR PCE AND TCE IN SOIL 110
- 9.11 ENGINEERING CONTROLS 112

Copyright Kleinfelder 2010

TABLE OF CONTENTS (CONTINUED)

Section **Page**

9.12 SPILL CONTINGENCY PLAN 112
9.13 HEALTH AND SAFETY PLAN 112
9.14 SVE SYSTEM REPORTING 112
9.15 SVE SYSTEM WASTE MANAGEMENT 113
10. PROPOSED BUILDING SURVEY, ABATEMENT AND DEMOLITION 114
10.1 HAZARDOUS BUILDING MATERIALS SURVEY 114
10.2 HAZARDOUS BUILDING MATERIALS PERMITTING AND ABATEMENT 114
10.3 WASTE MANAGEMENT 115
10.4 REPORTING 115
10.5 HBMS HEALTH AND SAFETY PLAN 115
10.6 BUILDING DEMOLITION 115
10.6.1 General Building Demolition Scope of Work 116
10.6.2 Health and Safety of Personnel 116
10.6.3 Concrete Slab and Footings Removal 117
10.6.4 Demolition Debris Transportation and Disposal 117
10.6.5 Dust Abatement 118
10.7 CLARIFIER REMOVAL 118
10.8 HBMS AND BUILDING DEMOLITION COSTS 119
11. QUALITY ASSURANCE/QUALITY CONTROL 120
12. PUBLIC PARTICIPATION 121
13. SCHEDULE 123
13.1 CONCEPTUAL LDA/ISCR PRE-FIELD ACTIVITIES 124
13.2 CONCEPTUAL LDA/ISCR RAP IMPLEMENTATION 125
13.3 CONCEPTUAL SVE PRE-FIELD PILOT TESTING AND DESIGN ACTIVITIES 126
13.4 CONCEPTUAL SVE RAP IMPLEMENTATION 126
14. LIMITATIONS 127
15. REFERENCES 129

Copyright Kleinfelder 2010

TABLE OF CONTENTS (CONTINUED)

PLATES

Plate 1 Site Vicinity Map
Plate 2 Site Plan
Plate 3A TCE Isoconcentrations in Soil Vapor Versus Depth
Plate 3B Hexavalent Chromium Isoconcentrations Versus Depth
Plate 3C Conceptual Site Model – Three-Dimensional Block Diagram
Plate 4A Hexavalent Chromium in Soil Contour Map – 5 ft bgs
Plate 4B Hexavalent Chromium in Soil Contour Map – 15 ft bgs
Plate 4C Hexavalent Chromium in Soil Contour Map – 25 ft bgs
Plate 4D Hexavalent Chromium in Soil Contour Map – 35 ft bgs
Plate 5A Cross-Section Location Map
Plate 5B TCE in Soil Vapor Cross-Section A-A'
Plate 5C TCE in Soil Vapor Cross-Sections B-B' and C-C'
Plate 5D Hexavalent Chromium in Soil Cross-Section A-A'
Plate 5E Hexavalent Chromium in Soil Cross-Sections B-B' and C-C'
Plate 6 Conceptual Engineered Cap Design Plan View
Plate 7A Conceptual LDA Mixing/ISCR Locations and Depths for Hexavalent Chromium in Soil
Plate 7B Conceptual Depth of ISCR/Stabilization and Stabilization Only for Hexavalent Chromium in Soil
Plate 8 Conceptual Layout of SVE Well Locations, Piping, and Estimated ROI
Plate 9 Conceptual SVE and Observation Well Design

TABLE

Table 1 Comparative Evaluation of Remedial Alternatives

APPENDICES

Appendix A Legal Description
Appendix B Response to January 19, 2010 Draft RAP Comments Matrix
Appendix C Deed Restriction Language
Appendix D Assessor's Parcel Map
Appendix E 1951 Sanborn Fire Insurance Map
Appendix F Glendale City Council Meeting Minutes (Cr^{6+} Voluntary Cleanup Goal)

Copyright Kleinfelder 2010

TABLE OF CONTENTS (CONTINUED)

Appendix G	Plates 6A through 14B from 2008 Supplemental Site Assessment
Appendix H	Tables 1 through 3 from 2008 Supplemental Site Assessment
Appendix I	Site-Specific Soil Screening Level Calculations
Appendix J	Johnson and Ettinger Modeling Calculations
Appendix K	Logs of Borings and Physical Parameter Analytical Testing Results
Appendix L	Cement Stabilization Bench-Scale Treatability Testing
Appendix M	Bench-Scale Testing Report
Appendix N	Calculation of Treated Cr^{6+}-Impacted Soil Mass
Appendix O	Case Studies
Appendix P	Cost Estimate Summaries
Appendix Q	General Order R4-2007-0019
Appendix R	Transportation and Disposal Plan
Appendix S	Initial Draft Health and Safety Plan
Appendix T	Spill Contingency Plan
Appendix U	Flowcharts
Appendix V	Conceptual Remedial Action Plan Implementation Schedule

Copyright Kleinfelder 2010

1. EXECUTIVE SUMMARY

This Remedial Action Plan (RAP) includes an assessment of various potential remedial alternatives, and provides a recommended approach to remediate certain volatile organic compounds (VOCs) and metals designated as chemicals of concern (COCs) in soil beneath the parcel located at 4057 and 4059 Goodwin Avenue, in the City of Los Angeles, Los Angeles County, California (the "Site"), as more fully described in the legal description in Appendix A. This RAP does not address remediation of groundwater.

The primary objectives of this RAP are to:

- establish COCs for the Site soils and soil vapor;
- propose soil and soil vapor cleanup goals; and
- identify preferred alternatives for remediation of COCs in the Site soil and soil vapor.

Kleinfelder prepared a *Draft RAP* (Kleinfelder, 2010), and submitted it to the Los Angeles Regional Water Quality Control Board (LARWQCB) and other regulatory agencies, including the United States Environmental Protection Agency (US EPA) Region 9, on behalf of The Spirito Family Trust, owner of the Site. The LARWQCB and other regulatory agencies reviewed the *Draft RAP* and provided comments that were considered in the preparation of this RAP. Agency comments and Kleinfelder responses to them are included as Appendix B.

A plating facility operated by the Excello Plating Co., Inc. (Excello), which is no longer in business, was located on the southern portion of the Site (4057 Goodwin Avenue). An older plating facility was previously located on the rear, northern portion of the Site (4059 Goodwin Avenue). The older facility was operated by the Plating Engineering Company, Inc. (PECI) from at least 1946, but was destroyed by a fire in 1955. Operations at these two plating facilities resulted in the release of VOCs and metals to vadose zone soil beneath the Site, as documented by past assessments. Groundwater beneath the Site is also impacted with some of the VOCs and metals present in Site vadose zone soil. Metals-contaminated groundwater (primarily with hexavalent

Copyright Kleinfelder 2010

chromium [Cr^{6+}]) has affected US EPA extraction well GS-3, which is one of four extraction wells operating near Goodwin Avenue as part of the regional remedy for VOC-impacted groundwater in the Glendale South Operable Unit (GSOU) of the San Fernando Valley Superfund Site.

The Spirito Family Trust is the present owner of the Site and has been deemed by the LARWQCB to be the Responsible Party for Site cleanup, as indicated in a September 25, 2007 revised Cleanup and Abatement Order (CAO) No. R4-2003-0038-R, prepared by LARWQCB.

The Spirito Family Trust has reported that it has insufficient financial assets to pay for a Site cleanup that will meet regulatory requirements. A prospective purchaser of the Site has indicated a willingness to perform a regulatory agency-approved remediation of vadose-zone soil beneath the Site to accommodate such prospective purchaser's use of the Site's surface, providing that such a cleanup can be performed on acceptable terms. The prospective purchaser would intend to use the Site for a driveway and apron for parking, maneuvering, and loading and unloading trucks, and possibly a commercial warehouse.

The goal of the RAP is to prevent, by achieving proposed cleanup goals, future migration of the COCs present in Site vadose-zone soil to underlying groundwater. This RAP is not intended to address any groundwater contamination. In particular, it is not intended to address the regional VOC and Cr^{6+} groundwater contamination. The US EPA is addressing such contamination through Federal Superfund proceedings that include the GSOU of the San Fernando Valley Superfund Site.

Kleinfelder selected a remedial approach for the Site on the basis of evaluations of overall effectiveness, implementability, and cost-effectiveness. Its evaluation considered the Site's intended use. The inorganic COC addressed by this RAP is Cr^{6+}. The organic COCs addressed by the RAP are tetrachloroethene (PCE) and trichloroethene (TCE).

Copyright Kleinfelder 2010

Based on the future intended use of the Site, complete exposure pathways and associated receptors identified for evaluation include the following:

- soil ingestion, dermal contact with soil, and dust inhalation – on-Site workers employed on the Site after redevelopment (e.g., landscape maintenance workers and subsurface utility workers);
- groundwater ingestion – municipal water customers; and
- inhalation of vapors – on-Site workers working in enclosed structures on the Site.

Potentially-complete exposure pathways and associated receptors identified for evaluation include the following:

- soil ingestion, dermal contact with soil, and dust inhalation – construction workers during implementation of the RAP and Site redevelopment;
- inhalation of vapors – construction workers and nearby residents during and after implementation of the RAP; and
- dust inhalation – nearby residents during implementation of the RAP and Site redevelopment.

The Site-specific cleanup goal here employed for Cr^{6+} in soil is 5.6 milligrams per kilogram (mg/kg), which corresponds to the industrial Regional Screening Level (RSL) for Cr^{6+} in soil. This goal was based on agency input, following calculation in the *Draft RAP* of a Site-specific cleanup goal for Cr^{6+} in soil of 7.4 mg/kg, pursuant to US EPA's Soil Screening Guidance (SSG) (US EPA, 1996a; Kleinfelder, 2010). The soil vapor cleanup goals for PCE and TCE in the shallow vadose zone are the commercial/industrial California Human Health Screening Levels (CHHSLs), as requested by LARWQCB. These cleanup goals are 0.603 micrograms per liter (µg/L) and 1.77 µg/L for PCE and TCE, respectively.

Copyright Kleinfelder 2010

The remedial approach recommended in this RAP includes *in-situ* chemical reduction (ISCR) using calcium polysulfide (CaSx). The CaSx will be mixed into the soil using a large diameter auger (LDA). The combined process is referred to as LDA/ISCR. This process will be used to reduce Cr^{6+} to trivalent chromium (Cr^{3+}) to a depth of 35 feet below ground surface (bgs), thereby mitigating the mobility and toxicity of this COC. The LARWQCB has informed Kleinfelder that General Waste Discharge Requirements (WDR) Permit (R4-2007-0019), which includes CaSx as a pre-approved injectant, will be the permit under which LDA/ISCR remedial activities and post-remedial monitoring, will be performed.

Based on the most recent (July 2010) Site monitoring data presently available to Kleinfelder, the depth to groundwater beneath the Site is approximately 46 to 48 feet bgs. Depth to the water table beneath the Site has been consistent with data collected beginning in 2006. According to the California Geological Survey, available historic data indicate the historic high groundwater depth in the immediate Site vicinity is estimated to be approximately 36 feet bgs. To address the proximity of COCs to groundwater, and to mitigate the likelihood of CaSx entering groundwater, a stabilizing agent (i.e., cement) will be added to the soil to a depth of 45 feet bgs to lower the mobility of the Cr^{3+} and residual Cr^{6+} in Site soil. More specifically, from a depth of 35 feet bgs to the groundwater table, COCs in soil will be stabilized in an approximately 10-foot thick, cemented, non-CaSx-treatment buffer zone. Avoiding treatment of soil with CaSx in the buffer zone reduces concern regarding potential leaching and transport of CaSx to groundwater, and thus potential effect on extraction well GS-3, which extracts groundwater through its well screen set between depths of 84 and 174 feet bgs.

An engineered cap will be installed subsequent to completion of LDA/ICSR and cement stabilization remedial activities. The purpose of the engineered cap is to provide surface cover above the buffer zone where only cement stabilization will be used to treat the Cr^{6+}-impacted soil. The buffer zone will be installed between 35 and 45 bgs, within the 5.6 mg/kg Cr^{6+} isocontour (see Plate 4D). The cap will be designed to overlap this zone by as much as 50 feet on all sides.

Copyright Kleinfelder 2010

Soil vapor extraction (SVE) is proposed as the presumptive remedy for mitigation of PCE and TCE in Site vadose-zone soils. PCE and TCE will be removed from the subsurface to the practical limits of the applicable SVE technology. A soil vapor survey will be conducted in the shallow vadose zone following shut down of the SVE system. Results of the soil vapor survey will be used to conduct a human health risk assessment (HHRA) for the intended Site use. A passive or active vapor mitigation system, if necessary, will be considered based on results of the HHRA and future Site use.

Implementation of these remedial actions will be associated with a deed restriction against the Site that limits future property development to commercial and industrial uses. Specifically, as a condition to the transfer of the ownership of the Site, a deed restriction against the Site, referred to as a Covenant and Environmental Restriction on Property (CERP), that corresponds to the restrictions attached as Appendix C, will be recorded against the Site after approval and execution by the LARWQCB's Executive Officer, simultaneously with the acquisition of title to the Site.

Two on-Site groundwater monitoring wells (MW2 and MW3) will be abandoned and re-installed as part of the RAP implementation, to assess and monitor effectiveness of the proposed remedial approach. Well MW-2R will be re-installed on Site, directly downgradient of the treatment area, between extraction well GS-3 and the treatment area. Well MW3R will also be re-installed on Site, crossgradient of the treatment area. These wells will be used for monitoring during RAP implementation. After RAP implementation and WDR permit monitoring are completed, on- and off-Site wells associated with the Site will be abandoned.

Following RAP approval by LARWQCB, field pilot testing for LDA/ISCR will be performed to provide data for the final design of the remedial action. A pilot testing workplan will be prepared to address the specific activities to be performed, and will be submitted to LARWQCB prior to execution of pilot testing activities.

Copyright Kleinfelder 2010

The building currently at the Site will be demolished as part of implementation of the RAP. It will be necessary to perform a hazardous building material survey (HBMS) and properly abate hazardous building materials, if identified, prior to building demolition. A workplan will be submitted for LARWQCB approval of the specific proposed HBMS, hazardous building materials abatement, and building demolition activities, prior to their performance. If impacted soils are encountered in shallow soils during demolition of the building, additional soil samples will be collected and analyzed to complement the Site's currently available assessment data and in support of the remedial action design.

Copyright Kleinfelder 2010

2. INTRODUCTION

This Remedial Action Plan (RAP) presents an assessment of potential remedial alternatives and provides a recommended approach to remediate certain volatile organic compounds (VOCs) and metals in vadose zone soil beneath The Spirito Family Trust parcel, located at 4057 and 4059 Goodwin Avenue, in the City of Los Angeles, Los Angeles County, California (the "Site"), and as more fully described by the legal description attached in Appendix A. Kleinfelder prepared a *Draft RAP* (Kleinfelder, 2010), and submitted it to the Los Angeles Regional Water Quality Control Board (LARWQCB) and other regulatory agencies, including the United States Environmental Protection Agency (US EPA) Region 9, on behalf of the Site owner, the Spirito Family Trust. The LARWQCB and other regulatory agencies reviewed the *Draft RAP* and provided comments that were considered in the preparation of this RAP. Agency comments and Kleinfelder responses to them related to the *Draft RAP* are included as Appendix B.

This RAP was prepared in response both to an October 31, 2007 letter submitted by LARWQCB to The Spirito Family Trust, which provided LARWQCB's comments concerning an August 27, 2007 RAP prepared by others, and subsequent correspondence requiring preparation of a revised RAP. This RAP was prepared in consideration of data provided in reports of past Site assessments and other Site-related documentation, including Kleinfelder's *"Workplan for Supplemental Site Assessment…"* (Kleinfelder, 2008a) and "Supplemental Site Assessment…" (SSA) (Kleinfelder, 2008b), and its *"Site-Specific Cleanup Goals Workplan"* (Kleinfelder, 2009), which respectively reported the results of supplemental Site characterization activities, and summarized the methodology proposed to calculate Site-specific cleanup goals for chemicals of concern (COCs).

Copyright Kleinfelder 2010

The goal of the RAP is to prevent, by achieving proposed cleanup goals, future migration of the COCs present in Site vadose-zone soil to underlying groundwater. This RAP is not intended to address groundwater contamination. In particular, it is not intended to address the regional VOC and hexavalent chromium (Cr^{6+}) groundwater contamination. The US EPA is addressing such contamination through Federal Superfund proceedings that include the Glendale South Operable Unit (GSOU) of the San Fernando Valley Superfund Site.

The primary objectives of this RAP are to:

- establish COCs for the Site soils and soil vapor;
- propose soil and soil vapor cleanup goals; and
- identify preferred alternatives for remediation of COCs in the Site soil and soil vapor.

Copyright Kleinfelder 2010

3. SITE BACKGROUND

3.1 SITE DESCRIPTION

The Site is defined by the legal description included in Appendix A. The Site is located at 4057 Goodwin Avenue, in the City of Los Angeles, California (the Site has a post office address of Glendale, California 90039). The rear (northern) portion of the Site has also been known in the past as "4059 Goodwin Avenue." The Site is referred to as Los Angeles County Assessor's Parcel Number (APN) 5593-020-020, as shown on the assessor's parcel map attached in Appendix D.

The Site is located on the north side of Goodwin Avenue, northwest of the termination of Brunswick Avenue. A vacated former northward extension of Brunswick Avenue adjoins the Site to the east.

The vacated street is not considered part of the Site. The vacated street was used as an employee parking lot by the plating facility operated by the Excello Plating Co., Inc. (Excello), but is not part of the parcel owned in fee by The Spirito Family Trust. The surface elevation along the western side of the vacated street is somewhat higher than that of the eastern Site area that adjoins it (i.e., surface run off from the Site does not flow onto the vacated street), and Kleinfelder's review of historical information did not reveal that the vacated street was used for purposes other than parking. Furthermore, Kleinfelder's evaluation of the existing Site assessment data closest to and within the area of the vacated street does not suggest that metals impact to soils from the Site extends to the area beneath the vacated street.

The Site is a trapezoid with dimensions of 109 feet for the north and south property boundaries, and 385.31 feet for the east and west property boundaries. The southern portion of the Site includes the approximately 13,832-square foot building formerly used by Excello, which is no longer in use. The Site is bordered on the north, east, and west by a retail distribution facility, and on the south by Goodwin Avenue. Beyond these features are residential neighborhoods. A Site Vicinity Map is presented on Plate 1, a Site Plan is presented on Plate 2, and the assessor's parcel map is in Appendix D.

Copyright Kleinfelder 2010

Plating Engineering Company, Inc. (PECI) began operating a plating facility on the northern portion of the Site by 1946. This former plating facility was depicted on a 1951 Sanborn fire insurance map (Appendix E). During 2008 field activities for Kleinfelder's 2008 Supplemental Site Assessment (SSA) (Kleinfelder, 2008b), Kleinfelder encountered an approximately 7-inch-thick concrete layer in the central area of the northern portion of the Site while advancing soil borings (Borings K-37 through K-42, shown on Plate 2). The location of this concrete layer, which is situated approximately 6 inches beneath the surface of the asphalt pavement, is consistent with the location of the building on the former PECI facility as depicted in the 1951 Sanborn map.

Kleinfelder did not identify information concerning details of the historic operations performed at the PECI facility, but surmises that they likely included plating and painting of metal components. The PECI facility was destroyed by a fire in 1955 (Los Angeles Times, 1955), but the plating facility was reconstructed on the southern portion of the Site in 1956, at which time plating operations resumed. Excello subsequently occupied the southern portion of the Site, continuing plating-related activities in the existing on-Site building until Excello ceased operations in 2004 and abandoned the Site. Operations performed at the facility involved plating, anodizing, and painting of metal components, some of which was done for the aerospace industry. Information about the process areas in the building and chemical usage history is included below.

The Excello facility included a building that remains vacant on Site, which contained office space, a decorative chrome plating area, an anodized plating process area, a hard chrome process area, a paint booth, and a plating supply storage area. Drum storage areas were located inside the building near its northwest corner and later in a covered, bermed area outside the northwestern corner of the building. Pursuant to a Department of Toxic Substances Control (DTSC) order, the abandoned tanks and other plating equipment were subsequently decontaminated and removed from the Site in December 2005 by a contractor hired by the current property owner, The Spirito Family Trust, after its tenant, Excello, abandoned the Site. In addition to the building and covered drum storage area, an in-ground, four-stage clarifier remains on the Site near its southeastern corner. The locations of these features are depicted on the Site Plan (Plate 2).

Copyright Kleinfelder 2010

According to information obtained during Kleinfelder's review of Site-related documents, the primary chemicals historically used on the Site by Excello included muriatic acid, nitric acid, sulfuric acid, caustic soda, sodium hypochlorite, chromic acid, sodium cyanide; 1,1,1-trichloroethane (1,1,1-TCA); cadmium oxide, nickel sulfate, nickel chloride, nickel acetate, phosphoric acid, manganous sulfate, barium carbonate, sodium bicarbonate, and ammonium nitrate. Aboveground tanks formerly located in the decorative chrome plating area contained solutions of cadmium (Cd), zincate, copper (Cu), nickel (Ni), acids, and decorative chrome. Tanks formerly located in the anodized plating process area contained solutions of Ni rinsate, dichromate, chromatic acid, and acid. The hard chrome process area contained the hard chrome tanks.

The Excello facility process areas were located within 8-inch-tall, concrete-bermed areas with a wooden platform built on top of the berm at a height of approximately 4 feet above the concrete floor. The bermed areas were designed to contain spills associated with the various tanks. Waste liquids generated during Excello's operations were apparently either disposed to the sewer (via a multi-stage clarifier) or transported to a treatment and disposal facility. Waste liquids disposed to the sewer were reportedly sampled monthly by Excello and the City of Los Angeles, and samples were analyzed for waste discharge compliance. A vapor degreaser was historically used at the Site; however, in 2003 it was removed and replaced with a closed-system parts washer.

3.2 REGIONAL GEOLOGY/HYDROGEOLOGY

The Site is located in the southeastern portion of the San Fernando Valley, which is drained by the Los Angeles River and its tributaries. The San Fernando Valley is located in the southern portion of the Transverse Ranges geomorphic province, which is characterized by roughly east-west trending structural features consisting of folding and thrust faulting, in contrast to the predominant northwest-southeast structural trend with strike-slip faulting of the other geomorphic provinces in California.

Copyright Kleinfelder 2010

The Site is located in the northern portion of the Los Angeles River Narrows, near the San Fernando Valley's downstream terminus, where the antecedent river has incised a channel between the Hollywood Hills of the Santa Monica Mountains to the west of the Site, and the Verdugo Mountains and San Rafael Hills to the east of the Site. The Site is located approximately 0.75 mile east of the Hollywood Hills and approximately 2 miles southwest of the Verdugo Mountains.

The Site is situated on the surface of a southwest-sloping alluvial fan formed by Verdugo Creek, located approximately 1 mile to the north. Undivided, young alluvial-fan deposits of Holocene age are mapped as underlying the Site (USGS, 2005). The fan deposits consist of unconsolidated gravel, sand, and silt; and boulders near mountain fronts, deposited chiefly from flooding streams and debris flows. A lithological contact with Holocene floodplain deposits is depicted to the west of the Site, with the deposits extending to the Los Angeles River. The floodplain deposits consist of unconsolidated, stream-deposited silt, sand, and gravel (USGS, 2005). The Verdugo Fault, which trends in a northwest-southeast direction, is mapped approximately 1.8 miles northeast of the Site.

According to the United States Department of Agriculture, Soil Conservation Service, National Cooperative Soil Survey's State Soil Geographic Database (STATSGO), as cited by Environmental Data Resources, Inc. (EDR, 2007), the dominant soil type in the general area of the Site has been classified as "Urban Land." Subordinate soil types that may appear in the area include loam, clay, silt loam, loamy sand, sandy loam, fine sand, clay loam, gravelly-sandy loam, coarse sand, gravelly sand, and sand (EDR, 2007). Soils encountered during drilling at the Site consisted primarily of sands and silty sands, with lesser amounts of silty clay and clayey silt (Kleinfelder, 2008b). The near-surface soils were generally loose to medium dense, while the deeper soils were dense to very dense. Soils below approximately 20 feet below ground surface (bgs) were noticeably coarser.

The Site is located in the southeastern-most portion of the San Fernando Valley Groundwater Basin (California Groundwater Basin No. 4-12). This groundwater basin consists of the alluvium within the San Fernando Valley, and is bounded on the north and northwest by the Santa Susana Mountains, on the north and northeast by the San

Copyright Kleinfelder 2010

Gabriel Mountains, on the east by the San Rafael Hills, on the south by the Santa Monica Mountains and Chalk Hills, and on the west by the Simi Hills. The San Fernando Valley Groundwater Basin was adjudicated in 1979 and includes the groundwater-bearing sediments beneath the San Fernando Valley, and smaller areas including Tujunga Valley, Browns Canyon, and the alluvial areas surrounding the Verdugo Mountains near La Crescenta and Eagle Rock (California Department of Water Resources [CDWR], 2004).

The alluvium comprising the valley fill in the eastern San Fernando Valley is estimated to be at least 1,200 feet thick in places. It has been subdivided into four distinct aquifer zones (James M. Montgomery, Consulting Engineers, Inc. [JMM], 1992):

- Upper Zone – This unit consists of layers and lenses of silt, sand, and gravel from the ground surface to a depth of approximately 250 feet bgs. According to results of aquifer tests, hydraulic conductivities in this aquifer zone range up to approximately 360 feet per day (ft/day), or about 40,000 meters per year (m/yr).
- Middle Zone – This unit is approximately 50 feet thick. In much of the eastern San Fernando Valley, it contains larger proportions of fine-grained sand and silt than the other zones. , with few wells completed in the zone. In the Site vicinity, it appears to consist of coarser-grained deposits, which makes the Upper and Middle Zones difficult to distinguish lithologically in the area.
- Lower Zone – This approximately 200- to 250-foot thick unit consists of interbedded sand, silt, and gravel, with cobbles in the upper portion. Hydraulic conductivity ranges from approximately 130 to 900 ft/day, and most of the groundwater pumped from the eastern San Fernando Valley is pumped from this highly-productive zone.
- Deep Zone – Where it has been encountered, this unit consists mainly of fine-grained, relatively low-permeability sediments, including silt and clay. Few wells have penetrated this zone, and therefore its thickness and hydraulic characteristics are poorly understood.

Copyright Kleinfelder 2010

Numerous investigations have identified regional groundwater contamination in the San Fernando Valley Groundwater Basin caused by volatile organic compounds (VOCs) including trichloroethene (TCE) and tetrachloroethene (PCE); petroleum compounds, chloroform, nitrate, sulfate; and heavy metals, including Cr^{6+}. The San Fernando Valley includes four National Priorities List (NPL) (Superfund) sites referred to as "Areas 1 through 4." The NPL sites are areas where groundwater from wells has been found to contain contaminants above the state and federal drinking water standards. Federal, state, and local agencies have been performing investigation and cleanup of contaminated groundwater since the VOC contamination was identified to be of concern in 1979.

Area 2, the Glendale/Crystal Springs NPL Site, covers 6,680 acres near the Crystal Springs Well Field in the Cities of Los Angeles and Glendale. The GSOU occupies a portion of Area 2, and includes the Site and immediately surrounding vicinity. This groundwater contamination is linked to prewar, postwar, and current industrialization in the area. Based on figures presented in US EPA's *First Five-Year Review Report for San Fernando Valley – Area 2 Superfund Site* (US EPA, 2008a), the impacted groundwater extends contiguously in an upgradient direction from the Site to and beyond California Route 134, the Ventura Freeway, which is located more than 1 mile north of the Site.

GSOU COCs include TCE and PCE, which have been and/or are being used in the aeronautical, automotive, dry cleaning, and metal plating industries, although Cr^{6+} has recently also been identified as a focus of concern. The solvents migrated to the groundwater as a result of usage, storage, and disposal practices. Other GSOU COCs include 1,1-dichloroethane (1,1-DCA), 1,1-dichloroethene (1,1-DCE), 1,1,1-TCA, cyanide, Cd, and Ni.

Although the focus of the interim remedy in the GSOU has historically been on chlorinated solvent VOCs, US EPA is presently moving forward the organization of a new Potentially Responsible Party (PRP) Group focused on the Cr^{6+} contamination.

Copyright Kleinfelder 2010

A search of the USGS National Water Inventory System (NWIS) Database performed by EDR (2007) identified two water supply wells located within 1 mile of the Site. State Well No. 01N13W19B007S is located nearly 0.5 mile north (upgradient hydrologically) of the northern Site boundary, and has an indicated depth of 462 feet. Well screen interval, water level, and water quality data were not reported. State Well No. 01N13W28L001S is located nearly 1 mile east-northeast (crossgradient hydrologically) of the Site, and has an indicated depth of 342 feet. The indicated depth to groundwater in the well on June 4, 1997 was 91.56 feet below surface, but well screen interval and water quality data are not reported. A search of the California Drinking Water Quality (CA WELLS) Database performed by EDR (2007) identified one well located within 1 mile of the Site. This well, State Well No. 01N13W28L001S, is one of the two wells listed in the NWIS Database as indicated above. Data concerning the screened intervals were not available.

In addition to these wells, four groundwater extraction wells are located near Goodwin Avenue in the Site vicinity. These wells are operated by the City of Glendale as part of the interim remedy to address the VOC cleanup of the Glendale/Crystal Springs NPL Site. Groundwater monitoring wells associated with the Site (discussed further later herein) and off-Site US EPA monitoring wells are also present.

The closest GSOU extraction well (GS-3) to the Site is located approximately 15 feet west of the western Site boundary, on the adjoining property west of the Site (see Plate 2). The other three GSOU extraction wells are GS-4, located approximately 535 feet east of the Site, north of Goodwin Avenue, between San Fernando Road West and the Union Pacific Railroad tracks; GS-1, and GS-2. Well GS-1 is located approximately 1,500 feet west-southwest of the Site, in the Glendale Water Reclamation Plant. GS-2 is located south of the western termination of Goodwin Avenue, approximately 765 feet west-southwest of the Site. Staff of the City of Glendale Department of Water and Power (CGDWP) informed Kleinfelder that the total depth of GS-3 is 199 feet bgs and it is screened between depths of approximately 84 and 174 feet bgs (note that the top of the screen interval of GS-3 is deeper than the screen interval of the two deepest on-Site groundwater monitoring wells [MW2 and MW3], which are screened from 39 to 69 feet bgs as discussed in the next section). The total depths of the other three extraction wells range from 171 feet to 198 feet, and their screened intervals range from 51 feet to

Copyright Kleinfelder 2010

146 feet (in GS-1, the westernmost well), to 78 feet to 173 feet (in GS-4, the easternmost well). All of these wells (including the on-Site groundwater monitoring wells) are screened within the Upper Zone aquifer described earlier in this section.

According to CGDWP staff, wells GS-1 through GS-4 are designed to operate at a pumping rate of 425 gallons per minute (gpm), but the pumping rate and operating times of GS-3 are varied because of Cr^{6+} concentrations in the groundwater produced from the well (CGDWP, 2008, personal communication). Kleinfelder understands that future pumping rates of as high as 700 gpm for well GS-3 are anticipated.

Historical data indicate groundwater in the San Fernando Groundwater Basin reached its highest levels in 1944, but excessive pumping subsequently caused drawdown throughout the basin (California Geological Survey [CGS], 1998, Plate 1.2). Management of the groundwater resource led to stabilizing of groundwater elevations in the 1960s. In some areas groundwater elevations rose in the 1970s and 1980s to levels approaching those of 1944, but data from wells monitored by the Upper Los Angeles River Watermaster showed that water levels did not recover to 1940s levels for most of the eastern San Fernando Valley. Measured groundwater levels from the 1970s, 1980s, and early 1990s tended to be 10 to 20 feet deeper than the 1944 water levels, but were consistently shallower near the Los Angeles River and deeper to the north (ibid.). On the basis of Kleinfelder's interpolation of CGS data, the historic high groundwater depth in the immediate Site vicinity is estimated to be approximately 36 feet bgs.

Based on the most recent groundwater monitoring data available to Kleinfelder for the Site and nearby area, collected during a July 12, 2010 monitoring event and reported by CCI (2010b), the groundwater surface was encountered in the three monitoring wells on the Site (MW1 through MW3) at elevations ranging from 398.91 feet to 399.24 feet above MSL, corresponding to depths of approximately 46.63 feet to 47.73 feet bgs. The contoured groundwater surface elevations indicated a July 12, 2010 flow direction generally to the southwest.

Copyright Kleinfelder 2010

3.3 PREVIOUS INVESTIGATIONS

The southern portion of the Site has been the subject of environmental assessments performed by others, and the entire Site was the subject of a more recent SSA performed by Kleinfelder in 2008 (Kleinfelder, 2008a; 2008b). These assessments identified impact to the Site's subsurface by chlorinated VOCs and metals (primarily total chromium [Cr] and Cr^{6+}, but also Cd and Ni). Results of the past environmental assessments performed by Kleinfelder and others, and Kleinfelder's understanding of the regulatory status of the Site, are summarized as follows:

- AeroVironment Inc. performed a soil vapor investigation at the Excello facility on the southern portion of the Site on November 30, 1993, installing and sampling 12 vapor probes, each of which was advanced to a depth of approximately 5 feet bgs. The report of the assessment (AeroVironment Inc., 1993) indicated elevated concentrations of VOCs were detected in soil vapor samples from locations near floor drains in the central area of the Site building. Maximum VOC concentrations reported during the 1993 soil gas investigation included 2,245.42 micrograms per liter (µg/L) of 1,1,1-TCA, 2,142.90 µg/L of carbon tetrachloride, 113.24 µg/L of TCE, 9.32 µg/L of PCE, 124.03 µg/L of 1,1-DCE, 74.06 µg/L of 1,1-DCA, and 2.70 µg/L of 1,2-dichloroethane (1,2-DCA);

- In response to LARWQCB requirement, AeroVironment Inc. performed a subsequent soil vapor investigation at the Excello facility on the southern portion of the Site in September 1994. A total of 16 additional soil vapor samples were collected from 13 locations, including 10 new locations sampled at 5 feet bgs, two November 1993 survey locations re-sampled at 5 feet bgs, and one new location and three November 1993 survey locations sampled at 15 feet bgs. The report of the assessment (AeroVironment Inc., 1994) indicated all but one of the 16 soil vapor samples contained detectable concentrations of VOCs. Maximum reported VOC concentrations were in the 5-foot bgs samples, and included 6,605.03 µg/L of 1,1,1-TCA, 500.50 µg/L of TCE, 58.16 µg/L of PCE, 56.38 µg/L of 1,1-DCE, and 1.54 µg/L of 1,1-DCA. The VOCs 1,2-DCA and carbon tetrachloride were not detected in the September 1994 samples. AeroVironment Inc. indicated it had reviewed chromatograms from the November 1993 investigation and concluded that a large peak identified as carbon tetrachloride

Copyright Kleinfelder 2010

on one of the chromatograms had likely been misidentified and should instead have been identified as a larger quantity of 1,1,1-TCA. AeroVironment Inc. indicated the results of the September 1994 survey, like the November 1993 survey, suggested that soils beneath this portion of the Site had been impacted with VOCs, via the floor drains inside the building in the vicinity of the area of greatest impact. AeroVironment Inc. concluded based on the results of the 15-foot-bgs samples that VOCs were present at this depth but at lower concentrations than in the 5-foot bgs samples.

- Daly Environmental Services (Daly) performed a soil gas survey and "groundwater investigation" in 1996 at the Excello facility on the southern portion of the Site (Daly, 1996). The investigation goals were reportedly to assess whether a continuous profile of chlorinated hydrocarbon VOCs existed from near the ground surface to groundwater (at an estimated depth of 40 feet bgs at the approximate time of the investigation), whether groundwater beneath the facility was impacted as a result of operations at the Site, and if so, to what extent. A total of 12 soil vapor samples were collected on August 8, 1996 from six locations. Samples were collect at depths of 25 and 35 feet bgs at most locations, with the exceptions of one location where a 5-foot bgs sample was also collected and another location where only a 25-foot bgs sample was collected. The location where the 5-foot bgs sample was collected was the location sampled in September 1994 with the highest detected 1,1,1-TCA concentration (6,605.03 µg/L). The remaining locations sampled in 1994 that had elevated VOC concentrations in 5-foot bgs vapor samples were not re-sampled in 1996. The analytical results of the August 1996 samples indicated VOC concentrations at lower concentrations than previously detected, with maximum concentrations of 7.8 µg/L of 1,1-DCE, 103 µg/L of 1,1,1-TCA, 65 µg/L of TCE, 18 µg/L of PCE, and 0.6 µg/L of 1,1-DCA (which was detected in one sample only). For most of the VOCs, the highest detected concentrations were in the 5-foot bgs sample. LARWQCB reportedly permitted Excello and its consultant, Daly, to perform the 1996 groundwater investigation by reviewing available analytical data of groundwater samples collected by others from off-Site wells installed during previous investigations. Daly reported that TCE and PCE were

Copyright Kleinfelder 2010

detected in groundwater samples from the various off-Site wells, and that VOC sources may exist off the Site.

- Based on the results of the September 30, 1996 soil vapor survey and groundwater investigation report prepared by Daly, and other information contained in LARWQCB files, LARWQCB indicated in a December 26, 1996 letter that there were no further requirements concerning the Site with respect to the Well Investigation Program. LARWQCB indicated that, although initial soil vapor sampling at the Site indicated high VOC concentrations, the last (1996) soil vapor sampling apparently indicated that either the impact had diminished by natural processes or it was limited to a small volume of soil.

- An April 23, 2001 internal LARWQCB file letter indicates an inspection was performed at the Excello facility by LARWQCB on March 29, 2001 to assess the threat posed by Cr and other heavy metals and to inspect the operating conditions. The letter noted that the facility had occupied the Site for approximately 44 years (at the time), and wastewater at the Site was channeled through a multi-stage clarifier prior to being discharged to the municipal sewer system. It was noted by the inspector after a review of the LARWQCB files that the Site had been investigated for VOCs under the previous Superfund investigation, during which soil vapor probes were installed and sampled for VOCs at depths ranging from just below ground surface to 35 feet bgs in 1993, 1994, and 1996. It was further noted that VOCs, including 1,1,1-TCA, TCE, PCE, 1,1-DCE, and 1,1-DCA, were detected at "moderate to elevated" concentrations in soil vapor, and moderate concentrations of the contaminants were detected in US EPA groundwater monitoring wells directly downgradient of the facility. The letter indicated that, to-date, no soil or groundwater samples had been collected for analysis of metal concentrations. LARWQCB recommended, based on the inspection, that a subsurface investigation be conducted in the vicinity of the plating and anodizing areas, in the area of the floor drain where VOCs were previously detected at high concentrations, in the areas of active or former drum or chemical storage, and adjacent to the wastewater treatment system. Samples from these locations were required to be analyzed for Cr^{6+} and other California Code of Regulations (CCR) Title 22 Metals.

Copyright Kleinfelder 2010

- On January 29, 2002, the City of Glendale adopted a measure that identified a voluntary cleanup goal for Cr^{6+} in drinking water of 5 µg/L (Appendix F).

- LARWQCB issued a June 20, 2003 Cleanup and Abatement Order (CAO) (No. R4-2003-0038) concerning the Site, ordering Excello to assess, clean up, and abate the effects of wastes discharged to soil and groundwater at the facility.

- According to a Consent Order signed by Excello on July 26, 2004 and by DTSC on August 5, 2004, an inspection by DTSC and LARWQCB of the Site was performed on August 21 through 26, 2002. The inspection revealed various violations at the facility, including treating waste cyanide solutions; storing waste chromic acid, and waste from chrome anodizing processes without a permit; failing to remove a leaking tank containing chromic acid; disposing Cr^{6+}-contaminated beads and brass polishing waste containing Cu, Ni, zinc, and lead in municipal trash; and disposing of spent PCE in floor sumps. In addition, a "green liquid" was observed oozing from the bottom of the west wall of the building. (In April 2009, as the City of Glendale prepared to commence its work to install additional equipment associated with Well GS-3 on the adjoining property west of the Site, soil sampling was performed in the vicinity of the greenish, yellow stained area at the bottom of the west wall of the building. According to the report of analytical results [American Scientific Laboratories, LLC, 2009], the maximum concentration of Cr^{6+} detected in soil sampled from the location was 1.62 mg/kg, which is below the generic Cr^{6+} industrial risk-based soil screening level.)

- On June 2, 2005 LARWQCB issued Revised CAO No. R4-2003-0038-R concerning the Site to Excello and The Spirito Family Trust. This revised CAO indicated that Excello was named a responsible party by US EPA for releasing chlorinated solvents and heavy metals, including Cr, within the GSOU of the San Fernando Valley Superfund Site. It further indicated that, although Excello was issued a December 26, 1996 "*No Further Requirements*" letter based on sampling performed in 1993, 1994, and 1996, Excello did not test for the "emerging chemicals" 1,4-dioxane, which is a common stabilizer for TCE, PCE, and 1,1,1-TCA; and 1,2,3-trichloropropane (1,2,3-TCP), which is commonly used

Copyright Kleinfelder 2010

as a paint and varnish remover, solvent, and degreasing agent. The revised CAO also indicated that Excello had not tested for heavy metal contaminants (including Cr^{6+}). Therefore, the revised CAO was issued to ensure that Excello and The Spirito Family Trust conduct an assessment on Site, and if necessary, off Site, to assess the lateral and vertical extent of emerging chemicals and heavy metal contaminants (including Cr^{6+}), and if necessary, undertake remediation of impacted soil and groundwater on Site and off Site.

- In December 2005, The Spirito Family Trust retained the services of Environmental Recovery Services, Inc. to clean up aboveground abandoned items at the Excello facility on the Site in response to a DTSC order (Environmental Recovery Services, Inc., 2006). These actions were taken after Excello had abandoned the property. Containers and tanks were pressure washed and triple rinsed, cut up, and disposed off Site. Caps were installed at the clarifier inlet and outlet, the clarifier was covered with Visqueen, and sand bags were placed to prevent entrance of liquids into the clarifier system. The parking lot was pressure washed, and the resulting rinsate was collected in totes and disposed.

  Ceres Associates performed a soil and groundwater investigation of the southern portion of the Site in early 2006, as discussed and approved by LARWQCB, US EPA, and The Spirito Family Trust. According to the report of the investigation (Ceres Associates, 2006a), the investigation was performed to assess the nature and extent of VOCs including the "emergent chemicals," 1,4-dioxane and 1,2,3-TCP; and heavy metals, including Cr^{6+}, in response to the June 2, 2005 CAO. The investigation included the collection of soil samples from 16 soil borings, drilled between February 6 and 8, 2006, at locations including the decorative chrome plating area, anodized plating process area, hard chrome process area, and adjacent to the clarifier. Based on the results of soil samples analyzed during the investigation, 1,4-dioxane and 1,2,3-TCP were not detected at concentrations above their respective detection limits. Cyanide was detected in 12 of 94 analyzed soil samples at concentrations ranging from 0.52 parts per million (ppm) to 26 ppm, with the highest concentration detected in a 1-foot bgs soil sample.

Copyright Kleinfelder 2010

- The February 2006 investigation included installation of three groundwater monitoring wells (MW1, MW2, and MW3) on the southern portion of the Site. Well MW1 is screened from 35 feet to 65 feet bgs, and Wells MW2 and MW3 are screened from 39 to 69 feet bgs. Ceres Associates sampled the three on-Site wells on February 23, 2006, and the groundwater samples were analyzed for CCR Title 22 metals (including Cr^{6+}), VOCs, and cyanide. Samples from Wells MW1 and MW2 were also analyzed for 1,4-dioxane and 1,2,3-TCP. Cyanide and 1,2,3-TCP were not detected in the groundwater samples. Concentrations of Cr^{6+} were detected at respective concentrations of 283 µg/L and 317 µg/L in the samples from Wells MW2 and MW3 (both located downgradient from the Former Hard Chrome Processing Area), and at 96.6 µg/L in the sample from Well MW1 (near the four-stage clarifier). The emergent chemical, 1,4-dioxane, was detected in the samples from Wells MW1 and MW2 at respective concentrations of 3.6 µg/L and 4.9 µg/L. Concentrations of PCE (51 µg/L to 100 µg/L) and TCE (130 µg/L to 200 µg/L) were also detected in the samples from the three wells. The groundwater sample from well MW1 (near the clarifier) contained the lowest PCE and TCE concentrations, and the sample from well MW3 (between the Hard Chrome Process and Anodized Plating Process Areas) contained the highest concentrations.

- Ceres Associates performed an additional soil investigation of the southern portion of the Site later in 2006 (Ceres Associates, 2006b) to further assess the lateral and vertical extent of heavy metal-impacted soil that was detected in February 2006, including sampling in other areas of the former Excello facility (i.e., by floor drains and by a former hazardous materials storage location). On September 6 and 7, 2006, 15 soil borings were advanced and sampled. Most of the borings were advanced to depths between 10 and 25 feet bgs; one was intended to be drilled to a depth of 45 feet bgs, but the direct push drilling equipment encountered refusal at a depth of 31 feet bgs. On October 5 and 6, 2006 Ceres Associates drilled and sampled seven additional borings using a limited access hollow-stem auger drilling rig to a total depth of 45 feet bgs. As described by Ceres Associates (2006b), analytical results of soil samples collected during the investigation indicated that heavy metal-impacted soil in and around the former decorative chrome processing area appeared to be limited to

Copyright Kleinfelder 2010

total Cr and Ni, and to no deeper than approximately 5 feet bgs, with "no significant concentrations" of Cr^{6+} detected (the maximum concentration of Cr^{6+} detected in this area was 28 mg/kg, detected in a 1-foot bgs sample, and the maximum concentration in deeper samples from this area was 3.86 mg/kg, in a 5-foot bgs sample). Heavy metal-impact to soil in and around the former hard chrome processing area appeared to be limited to total Cr and Cr^{6+}, with the highest concentrations of these compounds found in this area of the Site. Cr was reported at concentrations up to 11,000 mg/kg, but at the 45-foot depth was detected at a maximum concentration of only 27 mg/kg. Cr^{6+} was reported at concentrations up to 18,400 mg/kg, but at the 45-foot depth was detected at a maximum concentration of 1.56 mg/kg. Results of samples collected elsewhere at the Site indicated that soil in the vicinity of the former drum storage enclosure and hazardous materials storage shed did not appear to have been affected by prior Site uses.

- LARWQCB issued a July 3, 2007 letter to The Spirito Family Trust, directing it to submit by August 28, 2007 a RAP for cleanup of heavy metal and VOC soil contamination, provide LARWQCB with a Well Installation Report as a result of implementing the RAP, once approved; and provide quarterly groundwater monitoring reports, with the next sequential report submittal due date being October 15, 2007.

- LARWQCB issued a September 25, 2007 *Second Amendment to Cleanup and Abatement Order* (No. R4-203-0038-R) to The Spirito Family Trust. It indicated LARWQCB had determined that the Site was the primary source of the Cr concentrations at GSOU Extraction Well GS-3. As previously indicated herein, well GS-3 is located approximately 15 feet west of the western Site boundary on the property adjoining to the west of the Site, and it is also situated approximately 90 feet west-southwest (roughly downgradient hydrogeologically) of the former hard chrome plating area of the Excello building. Well GS-3 is one of eight wells (including the four wells near Goodwin Avenue and four additional wells some miles upgradient of the Site) that serve as GSOU extraction wells for the Glendale Treatment Plant to treat VOC-impacted groundwater for municipal supply. LARWQCB noted Well GS-3 had been impacted by total Cr and Cr^{6+},

Copyright Kleinfelder 2010

requiring the Glendale Treatment Plant to vary the pumping/extraction rates from this well so that the water satisfies discharge requirements for release to the Los Angeles River. LARWQCB indicated it had therefore revised the CAO based on the continued presence of total Cr at concentrations above the Primary Drinking Water maximum contaminant level (MCL) in groundwater samples from the on-Site monitoring wells; proximity of the Site to US EPA extraction well GS-3; and increasing trend of total Cr concentrations based on a 9-year history. This revised CAO placed Excello and The Spirito Family Trust on notice that LARWQCB has the authority to require Excello and The Spirito Family Trust to provide, or pay for, uninterrupted replacement of water service to the City of Glendale, which could include wellhead treatment for US EPA extraction well GS-3.

- Ceres Associates installed three groundwater monitoring wells at locations off Site between September 2007 and March 2008. In September 2007, Well MW4, which is screened from 40 feet to 70 feet bgs, was installed by Ceres Associates near the northeastern corner of the vacated street adjoining to the east of the Excello portion of the Site (Ceres Associates, 2008). Well MW4, shown on Plate 2, is to the north-northeast (upgradient) of the hard chrome process area in the building that remains on the former Excello portion of the Site, and southeast (crossgradient) of the area of buried concrete on the northern portion of the Site that is believed to be the foundation pad of the former plating facility there. In March 2008, wells MW5 and MW6, which are reportedly screened from 40 feet to 65 feet bgs and 29 feet to 54 feet bgs, respectively, were installed by Ceres Associates in Sequoia Street, one block south of Goodwin Avenue, to assess the downgradient lateral extent of impacted groundwater (Ceres Associates, 2008). Well MW5 is located approximately 360 feet south (downgradient) of the Site, and well MW6 is located approximately 440 feet southwest of the Site. Recent groundwater monitoring results for these wells available to Kleinfelder are summarized later in this section.

Copyright Kleinfelder 2010

- In October 2008 Kleinfelder performed its SSA, which included sampling of soil and soil vapor beneath the former Excello facility on the southern portion of the Site, and beneath the area of the older plating facility formerly operated by PECI on the northern portion of the Site. The findings were presented in Kleinfelder's November 26, 2008 report (Kleinfelder, 2008b), and a summary is included herein. Selected plates from the report showing interpreted lateral and vertical extent of key COCs are included in Appendix G. Tabulated data included in the report are included in Appendix H.

  Based on Kleinfelder's field observations, the sampled soils were red brown, light brown, and red gray in color, and included poorly-graded sand, silty sand, silty clay, and clayey silt. Groundwater was not encountered in the borings. No noticeable odors or visible staining were observed in the soil samples collected. A photo-ionization detector (PID) used in the field to screen soil samples for the potential presence of VOCs yielded a maximum PID reading of 14 parts per million (ppmv), detected in the 40-foot bgs soil sample collected from Boring K-42, located on the northern portion of the Site.

  The SSA included collecting multi-depth soil samples from a total of 17 locations, analysis of a total of 119 primary soil samples and five co-located field duplicate samples for CCR Title 22 Metals, and analysis of five primary soil samples for VOCs. Cd was detected in three primary soil samples collected at depths of 5 to 15 feet bgs from Boring K-41 in the northern portion of the Site, with a maximum concentration of 168 mg/kg detected in the 10-foot bgs sample. Total Cr was detected in 118 primary soil samples and five co-located field duplicate samples, with the maximum concentration of 113 mg/kg detected in the 10-foot bgs sample from Boring K-20 in the former Excello portion of the Site. $Cr^{6+}$was detected in 50 primary soil samples and 2 collocated field duplicate samples, with the maximum concentration of 63.7 mg/kg detected in the 10-foot bgs sample collected from Boring K-20. Ni was detected in 70 primary soil samples and two co-located field duplicate samples, with the maximum concentration of 51.7 mg/kg detected in the 5-foot bgs sample collected from Boring K-41. TCE was detected in one primary soil sample, the 40-foot bgs sample from Boring K-

Copyright Kleinfelder 2010

42 in the northern portion of the Site, at a concentration of 0.016 mg/kg. No other VOCs were detected in the analyzed soil samples.

A total of 128 primary soil vapor samples, plus 2 additional samples from the probe where a purge volume-versus-concentration test was performed (Probe K-11), were collected during the SSA. Seven field duplicate soil vapor samples were also collected.

TCE was detected in 127 primary vapor samples and the seven co-located field duplicate samples, with the maximum concentration, 2,043 µg/L, detected in the 5-foot bgs sample collected from Probe K-35 in the northern portion of the Site.

PCE was detected in 128 primary samples and the seven co-located field duplicate samples, with the maximum concentration, 105 µg/L, detected in the 5-foot bgs sample collected from Probe K-36 in the northern portion of the Site.

The chemical 1,1,1-TCA was detected in 66 primary samples, and three of the co-located field duplicate samples, with the maximum concentration, 19 µg/L, detected in the 5-foot bgs sample collected from Probe K-11 in the former Excello portion of the Site.

Concentrations of TCE and 1,1,1-TCA in vapor samples collected from beneath the central portion of the Excello facility were lower than concentrations reported in soil vapor samples collected from this general area during Daly's prior 1996 investigation of the facility, although PCE concentrations were somewhat higher in the samples from Kleinfelder's assessment of this area than in the 1996 samples.

Other VOCs detected in the SSA vapor samples included 1,1-DCE, which was detected in 36 of 135 analyzed samples at a maximum concentration of 1.3 µg/L. Although 1,1-DCA was reported as detected in one of the 135 samples, the concentration was 0.1 µg/L and should not have been reported as a detect because this concentration was below the laboratory reporting limit.

Copyright Kleinfelder 2010

SSA results obtained on the northern portion of the Site, which had not been previously assessed, indicated the presence of an area of limited lateral and vertical extent with elevated concentrations of cadmium in soil, and a soil vapor plume containing elevated concentrations of TCE, with lower concentrations of PCE. The maximum TCE and PCE concentrations in this area were higher than the concentrations detected on the former Excello portion of the Site. The presence of these constituents appeared consistent with the historic operation of the plating facility known to have formerly been on the northern portion of the Site. The vapor plume in this area appeared to extend southward (consistent with the current groundwater flow direction) beneath the northern portion of the former Excello facility, especially in the deeper vadose-zone soils.

Detected concentrations of analytes in the SSA soil vapor samples were compared to soil gas CHHSLs for commercial/industrial scenarios (Cal/EPA, 2005a), and metals concentrations in soil were compared to US EPA Regional Screening Levels (RSLs) and generic Soil Screening Levels (SSLs) for protection of groundwater (US EPA, 2008b), CCR Title 22 hazardous waste thresholds, and commercial/industrial land use soil CHHSLs (Cal/EPA, 2005a). Results of this comparison indicated concentrations of primarily Cr^{6+}, TCE, and PCE that exceed their respective CHHSLs for commercial/industrial land use exist beneath the former Excello facility (Kleinfelder, 2008b). The concentrations of 1,1,1-TCA detected beneath the former Excello facility were below its CHHSL for commercial/industrial land use.

Based on the combined results of Ceres Associates' 2006 soil sampling investigations and the SSA, it appeared that the extent of TCE-, PCE-, and 1,1,1-TCA-impacted soil vapor and heavy metals-impacted (primarily total Cr and Cr^{6+}) soil within the Excello facility boundaries had been adequately assessed such that Site-specific, risk-based decisions regarding future remedial actions might be made. Based on the results of the SSA, it likewise appeared that the northern portion of the Site had been adequately assessed for such purposes. Results obtained on the northern portion of the Site indicated concentrations of Cd, TCE, and PCE exceeding their respective CHHSLs for commercial/industrial land use.

Copyright Kleinfelder 2010

- In 2009 and 2010, Excello monitoring wells MW1 through MW6 were monitored and sampled three times, on June 5 and December 29, 2009, and July 12, 2010. Results of the events are reported in CCI monitoring reports (CCI, 2009; 2010a; 2010b). The June 2009 analytical results for the on-Site well groundwater samples indicated Cr^{6+} was detected at concentrations ranging from 270 µg/L (MW2) to 1,500 µg/L (MW1), and TCE and PCE were detected at maximum concentrations of 180 µg/L and 66 µg/L in the sample from MW3. The sample from off-Site MW4 also contained Cr^{6+}, TCE, and PCE, at respective concentrations of 190 µg/L, 140 µg/L, and 51 µg/L. The December analytical results for the on-Site well groundwater samples indicated Cr^{6+} was detected at concentrations of 230 µg/L (MW2) and 240 µg/L (MW1 and MW3). TCE and PCE were detected in the samples at maximum concentrations of 180 µg/L (MW2) and 67 µg/L (MW2 and MW3), respectively. The sample from off-Site MW4 also contained Cr^{6+}, TCE, and PCE, at respective concentrations of 180 µg/L, 130 µg/L, and 54 µg/L. The July analytical results for the on-Site well groundwater samples indicated Cr^{6+} was detected at concentrations of 190 µg/L (MW3) and 240 µg/L (MW1 and MW2). TCE and PCE were detected in the samples at maximum concentrations of 150 µg/L (MW2) and 50 µg/L (MW2), respectively. The sample from off-Site MW4 also contained Cr^{6+}, TCE, and PCE, at respective concentrations of 180 µg/L, 130 µg/L, and 51 µg/L. MW4 is located near the east side of the vacated street adjoining to the east of the Site, at a location that is to the north-northeast (upgradient) of the hard chrome process area, and southeast (crossgradient) of the area of buried concrete on the northern portion of the Site. Based on the location of MW4, the groundwater impact there appears to be associated with the San Fernando Valley Groundwater Basin regional groundwater contamination, as described in US EPA summaries of upgradient sources, rather than with the Site.

Copyright Kleinfelder 2010

In Kleinfelder's opinion, the groundwater beneath the Site appears to be impacted by Cr^{6+} and TCE from known upgradient sources that are part of a regional groundwater plume, as described in:

- *First Five-Year Review Report for San Fernando Valley - Area 2 Superfund Site, Los Angeles County, California* (5-Year Review); and
- LARWQCBs *Chromium VI Investigation: San Fernando Valley Phase I: Inspections Final Report* (SFV Investigation).

Figures 3-1 and 3-2 from the 5-Year Review show the presence of Cr^{6+} and TCE in groundwater within the GSOU. Figure 2 from the SFV Investigation presents the general direction of groundwater flow through the GSOU, which is generally south to southeast. These figures imply that the regional groundwater plume located north of Colorado Street and upgradient of the Site is impacted with Cr^{6+} and TCE and is potentially influencing conditions beneath the Site.

Concentrations of Cr^{6+}, TCE, and PCE in groundwater samples collected in July 2010, in upgradient Well MW4 and downgradient wells MW1, MW5, and MW6 of the Site's monitoring well network, are generally consistent. The sample from upgradient well MW4 contained Cr^{6+}, TCE, and PCE at respective concentrations of 180 µg/L, 130 µg/L, and 51 µg/L. The sample from downgradient well MW1 contained Cr^{6+}, TCE, and PCE at respective concentrations of 240 µg/L, 110 µg/L, and 35 µg/L. The sample from downgradient off-Site well MW5 contained Cr^{6+}, TCE, and PCE at respective concentrations of 290 µg/L, 56 µg/L, and 66 µg/L. The sample from downgradient off-Site well MW6 contained Cr^{6+}, TCE, and PCE at respective concentrations of 130 µg/L, 30 µg/L, and 36 µg/L (CCI, 2010b). The off-Site wells are not further discussed herein because the focus of this RAP is the Site and the remediation of vadose-zone soil contamination at the Site.

3.4 PREVIOUS REMEDIAL ACTIONS

In December 2005 aboveground abandoned items at the former Excello facility on the Site were cleaned up and removed. No remedial actions for soil have been reported at the Site to date.

Copyright Kleinfelder 2010

4. COC EVALUATION

Kleinfelder compared detected concentrations of analytes in soil and soil vapor from previous Site assessment activities to RSLs published by US EPA in May 2010 and to CHHSLs published by California EPA (Cal/EPA) in January 2005. Some analytes do not have an RSL and/or CHHSL. Based on results of the comparisons, chemicals of potential concern (COPCs), which include Cr, Cr^{6+}, Cd, and Ni in soil, and PCE and TCE in soil vapor, were selected (see Section 4.1). Site-specific SSLs (see Section 4.2) were developed for metals COPCs in soil using the *Soil Screening Guidance* (SSG) published by US EPA (US EPA, 1996a) and an associated *Technical Background Document* (TBD) also published by US EPA (US EPA, 1996b), as updated by the *Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites* (US EPA, 2002b). Site-specific SSLs for volatile COPCs were developed using the Johnson and Ettinger (J&E) Model (see Section 4.2). Previous assessment data were compared to results of Site-specific SSL calculations to select the COCs that are addressed by this RAP (see Section 4.3). Site-specific remediation goals were selected as discussed in Section 4.4.

4.1 COPCs

Based on Kleinfelder's evaluation of Site assessment data and as summarized below, the inorganic COPCs include total Cr, Cr^{6+}, Cd, and Ni. Concentrations of cyanide and other detected metals (except arsenic) were below their respective Industrial RSLs and Commercial/Industrial CHHSLs, and so are not considered Site COPCs. Arsenic was judged to be present at approximate regional background levels, and so was also not considered a COPC.

Copyright Kleinfelder 2010

COPC Evaluation Results Summary for Metals and Cyanide

(Site-Wide Soil Data, Ceres Associates 2006a and 2006b, and Kleinfelder 2008 Assessments, Excluding Duplicates)

Analyte	No. Samples Analyzed	No. Detects	Maximum Concentration (mg/kg)	Industrial Soil RSL (mg/kg)	Commercial/ Industrial Soil CHHSL (mg/kg)	COPC?
Total Chromium	345	342	11,000	NV	100,000*	No
Hex. Chromium	344	173	18,400	5.6	37	Yes
Cadmium	345	35	230	800	7.5	Yes
Nickel	345	266	2,600	20,000**	16,000	Yes***
Arsenic	345	35	3.5	1.6	0.24	No****
Cobalt	345	308	23.9	300	3,200	No
Copper	345	329	720	41,000	38,000	No
Lead	345	287	340	800	3,500	No
Mercury	345	20	0.58	310**	180	No
Zinc	345	337	440	310,000	100,000	No
Cyanide	94	12	26	20,000	NV	No

NV – No published value.
* – Value used for Cr^{3+}.
** – Value used for soluble or inorganic salts.
*** – Although maximum detected concentration is below both RSL and CHHSL, LARWQCB indicated nickel is a recognized Site COPC.
**** – Arsenic concentrations were judged to be at approximate regional background levels.

Kleinfelder's 2008 Site-wide soil vapor survey VOC data were evaluated for the selection of VOC COPCs. VOCs that consistently exceeded their respective Industrial RSLs and/or Commercial/Industrial CHHSLs were selected as COPCs. Based on Kleinfelder's evaluation and as summarized below, the Site VOC COPCs include PCE and TCE. The chemical 1,1,1-TCA was not included as a COPC because maximum concentrations in soil vapor are below the commercial/industrial CHHSL. The VOCs 1,1-DCA and 1,1-DCE were each detected in one soil vapor sample at concentrations below the laboratory reporting limit, and are not considered Site COPCs.

Copyright Kleinfelder 2010

COPC Evaluation Results Summary for VOCs
(Site-Wide Soil Vapor Data, Kleinfelder 2008, Excluding Duplicates)

Analyte	No. Samples Analyzed	No. Detects	Maximum Concentration (µg/L)	Maximum Concentration (µg/m^3)	Commercial/ Industrial Soil Vapor CHHSL (µg/m^3)	COPC?
TCE	128	127	2,043	2.04E+06	1.77E+03	Yes
PCE	128	128	105	1.05E+05	603	Yes
1,1,1-TCA	128	66	19	19,000	2.79E+06	No
1,1-DCE	128	34	1.3	1,300	NV	No
1,1-DCA	128	1*	0.1	100	NV	No
1,2-DCE	128	1*	0.4	400	4.44E+04**	No
Chloroform	128	34	0.9	900	NV	No
Other VOCs	128	0	--	--	Vary	No

NV – No published value.
* – Detect was at concentration below laboratory reporting limit.
** – Value used for cis-1,2-DCE, which is lower than the 8.87E+05 microgram per cubic meter (µg/m^3) value for trans-1,2-DCE.

4.2 SITE-SPECIFIC SSLs CALCULATIONS

Site-specific SSLs were developed for metals COPCs in soil using the SSG published by US EPA (US EPA, 1996a) and an associated TBD, also published by US EPA (US EPA, 1996b), as updated by the *Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites* (US EPA, 2002b). These documents provide a series of equations designed to estimate the maximum concentration of a COPC that may remain in soil and be protective of groundwater and ultimately human health. A detailed description of this methodology was presented in Kleinfelder's *Site-Specific Cleanup Goals Workplan* (Kleinfelder, 2009). Equations presented in the SSG address the potential for metals to leach from soils to groundwater, and then be transported to a sensitive receptor (in this case, specifically via consumption of groundwater provided through the municipal supply). SSL calculation summaries, and excerpts from the SSG and TBD which discuss derivation and use of equations to calculate Site-specific SSLs, are presented in Appendix I.

The SSG equations required a combination of parameters established by US EPA in the referenced guidance documentation and Site-specific input parameters. The Site-specific input parameters were obtained via soil sampling and analyses, as described elsewhere herein.

Copyright Kleinfelder 2010

In addition, Kleinfelder calculated SSLs for COPCs in soil vapor. The Site-specific SSLs were developed to address two potential pathways: 1) inhalation of VOCs resulting from intrusion into a hypothetical warehouse on the Site; and 2) partitioning of vapor phase VOCs into groundwater followed by ingestion of impacted groundwater by receptors.

The J&E Model was used to estimate concentrations of vapor phase PCE and TCE that could be present in soil vapor beneath the Site and still be protective of human health in a warehouse (see Appendix J). A calculation assuming equilibrium between the concentrations of PCE and TCE in soil vapor and dissolved PCE and TCE concentrations in groundwater was also used to develop Site-specific SSLs for protection of groundwater. These Site-specific SSLs were developed using Henry's Law constants, along with the estimated groundwater temperature and partial pressure of the chemicals. These calculations estimate the concentrations of vapor phase PCE and TCE that could be present in soil vapor and maintain target groundwater concentrations (i.e., MCLs). Kleinfelder also assessed risks associated with a post-remediation scenario for residents within 100 feet of the Site.

4.2.1 Site-Specific Soil Parameter Sampling and Analyses

Pursuant to the *Site-Specific Clean-Up Goals Workplan* (Kleinfelder, 2009), two additional soil borings were advanced at the Site on November 6, 2009, and soil samples were collected and analyzed for physical parameters for use as input values for the various SSG equations, thereby facilitating calculation of the Site-specific SSLs.

Borings KLF-1 and KLF-2 were advanced to respective depths of approximately 43.5 and 45.5 feet bgs at the locations shown on Plate 2. Based on results of this and prior Site assessments, soil lithology appears to be relatively consistent across the Site (Kleinfelder, 2008b); therefore, collection of soil samples from the two borings was expected to provide representative samples for testing of the needed soil physical parameters.

Copyright Kleinfelder 2010

The location of the boring inside the building formerly used by Excello was selected for collection of soil samples within the approximate area where the highest concentrations of Cr^{6+} were encountered during previous Site assessments. The location of the second boring, which is on the northern portion of the Site that was formerly used by PECI, was in the area of highest Cd concentrations encountered during the SSA.

Prior to drilling, Kleinfelder updated the existing *Site-Specific Health and Safety Plan* (*HASP*) to address potential hazards related to drilling and sampling activities. A visit to the Site was performed to mark the boring locations, evaluate drilling rig accessibility, and identify overhead hazards. Underground Service Alert (USA), a public utility locating service, was notified at least 48 hours (2 business days) prior to the commencement of intrusive field work. A private utility locating company was contracted by Kleinfelder and performed a geophysical survey to identify detectable subsurface utilities before drilling commenced. No such utilities were found in the immediate vicinity of the drilling locations.

The two soil borings were drilled using a limited access, modified Central Mine Equipment (CME) drilling rig equipped with 8-inch outer diameter (OD) hollow-stem augers. The initial approximate 5 feet of each boring were advanced by hand auger. Soil samples were collected from the borings and contained in decontaminated stainless-steel sample sleeves. The boring drilled on the Excello portion of the Site was sampled “continuously” (by taking successive samples, with each sample collected directly beneath the previous sample taken) from a depth of approximately 5 feet bgs to its total depth.

Soil from the boring located on the portion of the Site formerly used by PECI was sampled at intervals between approximately 20 feet to 25 feet bgs and 40 feet to 45 feet bgs. Retrieved samples were examined in the field, and selected samples representative of the lithologies encountered were retained for physical parameter analysis, on the basis of field observations. Ends of each sleeve retained for analyses were covered with Teflon sheets and plastic caps, and the sleeves were labeled with appropriate sample information. Sample handling and chain-of-custody procedures were performed consistent with US EPA SW-846 protocol (US EPA, 1996c). Following its collection, each soil sample was promptly placed in an ice-chilled cooler, where it

Copyright Kleinfelder 2010

was stored at 4 degrees Celsius (°C) ± 2° C until relinquished to the analytical laboratory.

Downhole drilling equipment was high-pressure washed before each boring was advanced. Sampling equipment was cleaned in a detergent solution and double rinsed with potable water before each sample was collected.

Soil borings were logged by a Kleinfelder staff professional under the guidance of a California-registered Professional Geologist. Soil was classified in general accordance with visual procedures as provided by the United Soil Classification System (USCS) in ASTM International (formerly American Society of Testing and Materials) Designation D 2488 09, *Standard Practice for Description and Identification of Soils (Visual-Manual Procedure)*. Logs of Borings KLF-1 and KLF-2 are included in Appendix K.

Soil samples were screened in the field for presence of total VOCs with a PID. Selected soil samples were submitted to Kleinfelder's Long Beach geotechnical testing laboratory, which analyzed the samples for physical parameters per specified methods as follows (PTS Laboratories performed the organic carbon analysis):

Physical Soil Parameter	Analytical Method
Soil texture (particle size analysis)	ASTM D 6913-04
Dry bulk density (ρ_b)	ASTM D 2937-04
Water-filled porosity (W_w)	ASTM D 2216-05
Soil organic carbon (f_{oc})	Walkley-Black Method
Soil pH	ASTM D 4972-01 / CT 643

US EPA's National Contingency Plan requires that management of investigation derived waste (IDW) generated during sampling comply with all applicable or relevant and appropriate requirements to the extent practicable. Management of IDW associated with drilling and sampling of the two soil borings followed guidance provided in US EPA's Office of Emergency and Remedial Response Directive 9345.3 02 (US EPA, 1991). Excess soil from the borings was handled as IDW and placed into Department of Transportation (DOT)-approved 55-gallon drums for temporary storage on the Site pending receipt of analytical results and profiling for disposal at an appropriate facility.

Copyright Kleinfelder 2010

Used personal protective equipment (PPE) and disposable sampling equipment was also drummed and managed as IDW. Decontamination fluids generated during the sampling event included de-ionized water, potentially-impacted soil residue, and tap water containing non-phosphate detergent. The decontamination fluid was handled as IDW and placed into DOT-approved 55-gallon drums for temporary storage on the Site. Based on analytical results, the IDW was profiled as a Resource Conservation and Recovery Act (RCRA) hazardous waste, and removed on January 15, 2009 from the Site, under hazardous waste manifest, for disposal at the US Ecology, Beatty, Nevada Class I disposal facility.

4.2.2 Site-Specific Soil Parameter Analytical Results

Soil sample physical parameter testing results are included in Appendix K and summarized below:

Soil Physical Parameter	Analytical Method	Average Result	Analytical Results Range	Value Used in SSLs Calculations
Soil texture (particle size analysis)	ASTM D 6913-04	NA	Clayey Sand, Sand with Silt, and Sandy Silt	NA
Dry bulk density (ρ_b) (kilograms per liter [kg/L])	ASTM D 2937-04	1.44	1.19 – 1.73	1.44
Moisture content (W_w) (pounds per cubic foot [lb/ft^3])	ASTM D 2216-05	10.3	2.9 – 22.9	10.3
Soil organic carbon (f_{oc}) (grams per gram [g/g])	Walkley-Black	0.00023	0.00014 – 0.00027	NA
Soil pH (pH units)	ASTM D 4972-01	8.0	7.9 – 8.2	8.0

NA – Not applicable.

Copyright Kleinfelder 2010

As previously noted, Boring KLF-1, drilled on the southern portion of the Site inside the building formerly used by Excello, was continuously sampled from approximately 5 feet bgs to its total depth of approximately 43.5 feet bgs. Based on visual logging of soil samples collected from the boring (see log of Boring KLF-1 included in Appendix K), approximately 4 feet of artificial fill, consisting of silty sand, was encountered beneath the approximately 6-inch thick concrete floor slab of the building. Visual logging indicated the underlying 39-foot-thick interval of native soils consists of interlayered sand (comprising approximately 15 percent of the total interval), sand with silt (comprising approximately 40 percent of the total interval), silty sand (comprising approximately 19 percent of the total interval), sandy silt (comprising approximately 18 percent of the total interval), and clayey sand (comprising approximately 8 percent of the total interval). These observations suggest that vadose soils beneath the Site contain appreciably higher proportions of fines (i.e., silt and clay) than the sands and gravels of the underlying groundwater aquifer from which nearby off-Site well GS-3 produces.

4.2.3 Calculation of Site-Specific SSLs

Equations, models, and protocols from the SSG used for calculation of Site-specific SSLs are presented herein, and are summarized in detail in Appendix I. Kleinfelder used available Site-specific assessment data, soil physical parameter data, and values from indicated references as input to the equations discussed below.

The SSG uses a linear equilibrium soil/water partition equation, or a leach model, to estimate contaminant release in soil leachate. It also uses a water-balance equation to calculate a dilution factor to account for reduction of soil leachate concentration from mixing in an aquifer (US EPA, 1996a). SSLs were calculated per the SSG for each of the Site-specific metal COPCs, including total Cr, Cr^{6+}, Cd, and Ni, to allow comparison of previous assessment data to the SSLs for selection of Site-specific COCs.

Copyright Kleinfelder 2010

Calculation of Site-specific SSLs required identification of SSL equations for relevant exposure pathways, Site-specific input parameters derived from the Conceptual Site Model (CSM) summary, and the replacement of default values in SSL equations with Site-specific data. Relevant equations from the SSG (US EPA, 1996a) used to calculate Site-specific SSLs for leaching of COPCs from soil to groundwater, with their equation numbers as per the US EPA guidance document, include:

- Equation 10 – SSL Partitioning Equation for Migration to Ground Water
- Equation 11 – Derivation of Dilution Factor
- Equation 12 – Estimation of Mixing Zone Depth

The primary equation for calculation of Site-specific SSLs is Equation 10, which is based on several general simplifying assumptions that may over-estimate the risk associated with residual concentrations of COPCs in soil leaching into groundwater. Results of Equation 10 can be modified by applying a dilution factor, which accounts for attenuation of COCs as leachate diluted by clean groundwater, and is calculated using Equation 11.

The result produced by Equation 12, which is the mixing zone depth, is used as an input value for Equation 11.

Copyright Kleinfelder 2010

Equation 10 – SSL Partitioning Equation for Migration to Ground Water

Equation 10 calculates a Site-specific SSL as a function of target COC concentrations in leachate, and the partitioning of COCs between the soil organic carbon and pore water (leachate). Equation 10 is based on several simplifying assumptions. These assumptions include:

- an infinite source (i.e., steady-state source concentrations are maintained over the exposure period);
- uniformly-distributed contamination from the surface to the top of the aquifer;
- no contaminant attenuation (i.e., no adsorption, biodegradation, or chemical degradation) in soil;
- instantaneous and linear equilibrium soil/water partitioning;
- an unconfined, unconsolidated aquifer with homogeneous and isotropic hydrologic properties;
- receptor well at the downgradient edge of the source, that is screened within the plume;
- no contaminant attenuation in the aquifer; and
- no non-aqueous phase liquids (NAPLs) are present (i.e., if NAPLs are present, the SSLs do not apply).

The SSL partitioning equation for migration to groundwater (Equation 10) is as follows:

$$\text{Soil Screening Level (mg/kg)} = C_w \left[K_d + (\theta_w + \theta_a \bullet H') / \rho_b\right]$$

Copyright Kleinfelder 2010

Definitions of the equation parameters, input values used for calculation of the SSLs, and sources follow:

Parameter/Definition (units)	Input Parameter(s)	Reference/Source
C_w = Target soil leachate of COC (mg/L)	0.005 0.00006	Glendale Voluntary Cleanup Goal; Office of Environmental Health Hazard Assessment (OEHHA) Draft Preliminary Health Goal (PHG).
K_d = Soil-water partition coefficient (liters per kilogram [L/kg])	Total Cr 4.3E+06 Cr^{6+} 1.4E+01 Cd 4.3E+03 Ni 1.9E+03	K_d value for inorganics using chemical-specific values from Appendix D of the SSG.
K_{oc} = Soil-organic carbon/water partition coefficient (L/kg)	Not applicable (NA) for inorganics	Chemical-specific values from Appendix D of the SSG.
f_{oc} = fraction organic carbon in soil (g/g)	NA for inorganics 0.00023 for organics	Site-specific value acquired during November 2009 field sampling and analysis for organics; NA for inorganics.
θ_w = Water-filled soil porosity (liters water per liters soil [L_{water}/L_{soil}])	0.139 Range (0.04 to 0.272)	Site-specific value for soil moisture content (W_w) acquired by field sampling and analysis and used for the calculation of θ_w, where $\theta_w = W_w/(V_S/\rho_w)$, W_w = weight of water in sample, V_S = volume of soil sample, and ρ_w = density of water.
θ_a = Air-filled soil porosity (liters air per liters soil L_{air}/L_{soil}])	NA for inorganics	$\theta_a = n - \theta_w$ using n from below and value for θ_w as calculated above.
ρ_b = Dry soil bulk density (kilograms per liter [kg/L])	1.44	Site-specific value acquired during 11/09 field sampling and analysis.
n = Soil porosity (liters pores per liters soil [L_{pore}/L_{soil}])	0.457	$n = 1 – (\rho_b/\rho_s)$; Site-specific value ρ_b acquired during 11/09 field sampling and analysis; and ρ_s is the default value shown below.
ρ_s = Soil particle density (kg/L)	2.65	SSG default value.
H' = Henry's law constant (dimensionless)	NA for inorganics	Per SSG (US EPA, 1996a), assumed zero for inorganics.

SSLs calculated by Equation 10 were multiplied by the dilution factor derived from Equation 11. The SSL for Cr^{6+} was calculated using Cw values equivalent to the City of Glendale Cr^{6+} Voluntary Cleanup Goal for municipal water supply, and the OEHHA Draft PHG. SSLs for Cd and Ni were calculated using their respective MCLs as input

Copyright Kleinfelder 2010

values for Cw. Note that although there is a California MCL for total Cr (50 µg/L), there is presently not a California or Federal MCL for Cr^{6+}. The State of California uses 50 µg/L as the MCL for Cr^{6+}.

Equation 10 Results

Total Cr	**C_w (mg/L)**	**SSL (mg/kg)**	**Dilution Factor* (dimensionless)**	**SSL*** (mg/kg)**
Site-Specific SSL (C_W=US EPA total chromium MCL)	0.1	4.3E+05	104	**4.5+07**

Cr^{6+}	**C_w (mg/L)**	**SSL (mg/kg)**	**Dilution Factor* (dimensionless)**	**SSL*** (mg/kg)**
Site-Specific SSL (C_W=City of Glendale Voluntary Clean-up Goal)	0.005	0.07	104	**7.4**
Site-Specific SSL (C_W=OEHHA Draft PHG)	0.00006	0.001	104	**0.1**

Cd	**C_w (mg/L)**	**SSL (mg/kg)**	**Dilution Factor* (dimensionless)**	**SSL*** (mg/kg)**
Site-Specific SSL	0.005	21.5	104	**2,236**

Ni**	**C_w (mg/L)**	**SSL (mg/kg)**	**Dilution Factor* (dimensionless)**	**SSL*** (mg/kg)**
Site-Specific SSL	0.1	190	104	**19,760**

Note that values above include rounding.
* – Value for Dilution Factor was derived using Equation 11.
** – There is no US EPA MCL for nickel.
*** – SSL calculated after application of dilution factor.

Equation 11 – Derivation of Dilution Factor

As leachate moves from its point of generation to a receptor, the concentrations of COPCs in the leachate may be attenuated through adsorption, degradation, and dilution by non-impacted groundwater. Equation 11, the dilution factor equation, accounts for attenuation of COPCs as leachate diluted by clean groundwater. The SSG does not provide a method for estimating attenuation of COPCs through adsorption and degradation in the vadose zone. Because impacted soil at the Site extends vertically to groundwater, the attenuation factor accounting for adsorption and

Copyright Kleinfelder 2010

degradation in the vadose zone was assumed to be "1." The dilution factor equation (Equation 11) for dilution by non-impacted groundwater follows:

Dilution Factor = 1 + [K • i • d] / I • L

Definitions of the equation, input values used for calculation of the SSLs, and sources follow:

Parameter/Definition (units)	Input Parameter(s)	Reference/Source
Dilution Factor (dimensionless)	Calculated	US EPA guidance.
K = Aquifer hydraulic conductivity (m/yr)	24,157	Personal communication, US EPA, 2009.
i = Hydraulic gradient (meter vertical per meter horizontal [m/m])	0.0028	Average calculated gradient*.
d = Mixing zone depth (meters [m])	0.85	Calculated by Equation 12.
I = Infiltration rate (m/yr)	0.07	Personal communication, US EPA, 2009
L = Source length parallel to groundwater flow (m)	8	Calculated, based on length of impacted area parallel to groundwater flow on Site Plan.

* – This value was based on the calculated average gradient using data from CCI, 2008 and 2009, *RWQCB File No. 113.5243*.

Equation 11 Results

	K (m/yr)	**I** (m/m)	**d** (m)	**I** (m/yr)	**L** (m)	**Dilution Factor** (Unitless)
Default	24,157	0.0028	0.85	0.18	8	**41**
Site-Specific	24,157	0.0028	0.85	0.07	8	**104**

Equation 11 was used to derive a Site-specific dilution factor in groundwater, based on Site-specific parameters, such as infiltration rate (I), groundwater gradient (i), aquifer hydraulic conductivity (K), and source length (L).

Copyright Kleinfelder 2010

Equation 12 – Estimation of Mixing Zone Depth

This equation allows for calculation of the mixing zone depth (d) used in Equation 11. The mixing zone depth equation is as follows:

$$d = (0.0112 \bullet L^2)^{0.5} + d_a \bullet \{1- \exp[(-L \bullet I)/(K \bullet i \bullet d_a)]\}$$

Definitions of the equation parameters input values used for calculation of the SSLs, and sources follow:

Parameter/Definition (units)	Input Parameter(s)	Reference/Source
d = Mixing zone depth (m)	Calculated	US EPA guidance.
L = Source length parallel to groundwater flow (m)	8	Calculated, based on impacted area on Site Plan.
I = Infiltration rate (m/yr)	0.07	Personal communication, US EPA, 2009
K = Aquifer hydraulic conductivity (m/yr)	24,157	Personal communication, US EPA, 2009
i = Hydraulic gradient (m/m)	0.0028	Average calculated gradient*.
d_a = Aquifer thickness (m)	49	Personal communication, US EPA, 2009

* – This value was based on the calculated average gradient using data from CCI *2008 and 2009 RWQCB File No. 113.5243*.

Equation 12 Results

	L (m)	d_a (m)	I (m/yr)	K (m/yr)	i (m/m)	d (m)
Site-Specific Value	8	49	0.07	24,157	0.0028	**0.85**

4.2.4 SSLs for Metals in Soil

The COPCs in soil and respective calculated SSLs are as follows:

- Cr – 45,000,000 mg/kg;
- Cr^{6+} – 7.4 mg/kg;
- Cd – 2,236 mg/kg; and
- Ni – 19,760 mg/kg.

Copyright Kleinfelder 2010

The total Cr SSL was calculated using Equation 10, and is a theoretical value. This value incorporates Site-specific parameters as input values, with the key input value being the target groundwater concentration. The theoretical values represented by the Site-specific SSL for total Cr is not likely to occur in nature and would occur only where there were more metal constituents than soil particles. The Site assessment data suggests the residual concentrations of total Cr in soil at the Site do not exceed the industrial RSL for Cr^{3+}, and are several orders of magnitude below the Site-specific SSL for protection of groundwater.

The SSL value calculated using Equation 10 and the Cr^{6+} draft PHG, was not selected as a final SSL. The preface of the draft Cr^{6+} PHG technical support document (OEHHA, 2009) specifies that PHGs are not regulatory standards, and instead represent non-mandatory goals. The preface states specifically that "PHGs are not developed as target levels for cleanup of groundwater or ambient surface water contamination, and may not be applicable for such purposes, given the regulatory mandates of other environmental programs." The City of Glendale Cr^{6+} Voluntary Cleanup Goal in connection with its municipal water supply is a stringent criterion, which is applied to groundwater after it has passed through the City water plant's blending system. By using this criterion as an input into the equations used to derive a soil cleanup level, implementation of this RAP is intended to limit Cr^{6+} impact to the groundwater from the vadose zone soils on this Site to a level acceptable to the City of Glendale Department of Water and Power as a source of supply for its municipal water system. Furthermore, the City may treat or blend the groundwater before delivery (thereby further reducing concentrations of residual Cr^{6+}). Application of the yet more-stringent draft PHG threshold as a Site-specific Cr^{6+} cleanup goal was judged to be inappropriate for three independent reasons, namely: (1) the PHG has not been adopted by any regulatory authority, but rather is simply a proposal by one agency that may be subject to revision; (2) even in the terms proposed by the agency, the threshold is identified as "not a target level for groundwater contamination"; and (3) the goal for the RAP is to prevent future migration of the COCs present in Site vadose zone soil to underlying groundwater.

Copyright Kleinfelder 2010

Based on SSLs calculated using the SSG document, remediation to be accomplished according to the RAP will reduce and immobilize Cr^{6+} concentrations to levels that are not of ongoing concern. The engineered cap contemplated as part of the proposed remediation will further mitigate the concern of future migration of COCs to groundwater. The Site-specific cleanup goals discussed herein are not intended for application to Site groundwater that must be treated for Cr^{6+} because of existing, upgradient regional contamination in any event, but rather the cleanup of vadose zone soil by chemical reduction and stabilization, emplacement of a cement buffer zone above the groundwater table, and coverage with an engineered cap (which together offer additional protection beyond removal of the well-described, limited contaminant mass).

4.2.5 SSLs for VOCs in Soil Vapor

The J&E Model is a widely-accepted method for estimating risks associated with indoor vapor intrusion. The J&E Model is a one-dimensional analytical solution to advective and diffusive vapor transport from subsurface sources into indoor spaces. Advection refers to the movement of vapors with the flow of air through a soil column due to atmospheric effects, including wind and barometric pressure. Diffusion refers to the transport of chemical vapors due to concentration gradients.

The J&E Model generates an estimated attenuation coefficient that relates vapor concentration at the source of contamination to the vapor concentration in indoor air. The J&E Model is the basis for risk-based vapor intrusion models adopted by many regulatory agencies, including DTSC and US EPA. Kleinfelder has developed Site-specific screening levels in a manner consistent with DTSC vapor intrusion guidance (Cal/EPA, 2004).

Copyright Kleinfelder 2010

The J&E Model has been coded into a set of spreadsheets that produce estimates of cancer risk or non-cancer hazard quotient for the inhalation exposure route based on measured or estimated source concentrations in soil vapor, soil, or groundwater. The spreadsheets may also be used to calculate source concentrations based on specified levels of cancer risk or non-cancer hazard quotient. Source concentrations estimated in this way may be used as cleanup levels for the planning and implementation of remedial actions at properties where the migration of volatile COCs from subsurface sources to indoor air may be of health concern. Development of Site-specific soil vapor SSLs was performed in general accordance with the following guidance documents:

- *Interim Final Guidance for the Evaluation and Mitigation of Subsurface Vapor Intrusion to Indoor Air,* Cal/EPA (2004); and
- *OSWER Draft Guidance for Evaluating the Vapor Intrusion to Indoor Air Pathway from Groundwater and Soils (Subsurface Vapor Intrusion Guidance),* US EPA (2002a).

Toxicity criteria provided in the DTSC version of the J&E spreadsheet model (available on-line at http://www.dtsc.ca.gov/AssessingRisk/JE_Models.cfm) have been incorporated into the spreadsheet model developed by Kleinfelder. Specifically, the inhalation unit risks and the inhalation reference concentrations provided on the "VLOOKUP" tab in the spreadsheet model have been updated with toxicity criteria from the OEHHA toxicity criteria database or the US EPA's Integrated Risk Information System (IRIS) as provided in the DTSC version of the model.

On-Site Warehouse Scenario

Health-based, Site-specific soil vapor SSLs were calculated for a hypothetical future warehouse for the volatile COPCs (PCE and TCE) detected in soil and soil vapor samples collected from the Site. Site-specific SSLs were calculated using the J&E Model, to allow comparison of previous assessment data to the SSLs for selection of Site-specific volatile COCs. The Site-specific SSLs represent soil vapor concentrations that yield a cumulative cancer risk of 1×10^{-6} (i.e., one in a million) for those volatile COPCs classified as carcinogens. Because two of the volatile COPCs are classified as

Copyright Kleinfelder 2010

carcinogens (PCE and TCE), the SSL for each was divided by two, which yields soil vapor concentrations based on a cancer risk of 0.5×10^{-6} (i.e., one-half in a million). Thus, the cumulative cancer risk does not exceed 1×10^{-6}. SSLs based on the non-cancerous health effects of the volatile COPCs were based on soil vapor concentrations that yield a non-cancer hazard index of 1.0. Thus, the SSL based on non-cancerous health effects for each volatile COPC was divided by three so that the non-cancer hazard index did not exceed 1.0.

Input values for the model were based on known or estimated Site-specific physical characteristics of the soil, including:

- soil type(s);
- total porosity;
- unsaturated zone moisture content;
- soil temperature; and
- capillary zone moisture content.

Other Site-specific input parameters for the model included assumed building parameters, including:

- mixing height;
- building floor area and ceiling height;
- slab thickness;
- foundation area;
- crack ratio;
- soil-building pressure differential; and
- indoor air exchange rate.

Copyright Kleinfelder 2010

Various scenarios and assumptions for building parameters, based on preliminary architectural plans for a proposed warehouse, were used to perform modeling. Where Site-specific information was not available, literature was reviewed for appropriate estimates, or in some cases, best professional judgment or default values from pertinent guidance documents were applied.

The volume of soil requiring remediation for volatile COPCs was estimated by comparing the Site-specific SSLs calculated using the J&E Model to the Site assessment data.

Site-specific inputs to the model included estimated soil temperature, the type of soil separating the soil vapor from the bottom of the building slab, the depths at which soil vapors may be encountered, and the dimensions of four hypothetical buildings consistent with various Site redevelopment proposals. Potential soil vapor sources were evaluated at three depths: 5, 15, and 40 feet bgs. The shallow depth (5 feet bgs) was selected to assess vapor sources close to the proposed building foundations, and the maximum depth (40 feet) was selected to address vapor sources just above the groundwater table. Based on June 5, 2009 data from on-Site monitoring wells, groundwater was encountered at a depth of approximately 45 feet bgs. These data are consistent with data from the most recent groundwater monitoring event conducted in July 2010. The intermediate depth (15 feet bgs) was selected to provide additional information for remedial design. The four building scenarios were: Small Office, Large Office, Warehouse with 45-foot-high Ceiling, and Warehouse with 80-foot-high Ceiling. Therefore, screening levels were calculated for a total of 12 different scenarios.

Copyright Kleinfelder 2010

Inputs to the model that are common to all scenarios are provided below:

Parameters Common to All Scenarios

Parameter	Value	Units	Comment
Groundwater temperature	19.4	°C	From Environmental Quality Management, Inc. (EQM), 2004.
Stratum A - Soil type immediately beneath building	S	NA	Sand, predominant soil type, from soil geophysical sample KLF-2 (22-23).
Depth below grade to bottom of enclosed space floor	15	cm	Default value for slab-on-grade construction.
Enclosed space slab thickness	18	cm	7-inch slab minimum in preliminary designs of warehouse.
Indoor air exchange rate	1	per hour	Commercial building default, Cal/EPA 2004.
Target risk for carcinogens	$1x10^{-6}$	NA	Considered the *de minimis* standard by US EPA.
Target hazard index for non-carcinogens	1	NA	Considered the *de minimis* standard by US EPA.
Averaging time for carcinogens	70	years	US EPA default value for commercial & industrial workers.
Averaging time for non-carcinogens	25	years	US EPA default value for commercial & industrial workers.
Exposure duration	25	years	US EPA default value for commercial & industrial workers.
Exposure frequency	250	days/year	US EPA default value for commercial & industrial workers

NA – Not applicable.
°C – Degrees Celsius.
cm – Centimeters.

Copyright Kleinfelder 2010

Inputs to the model that are specific to the various scenarios are provided below:

Parameters Specific to Each Building Scenario

Soil Gas Depth	Building Scenario	Stratum A thickness (cm)	Depth to soil gas (cm)	Enclosed space length (cm)	Enclosed space width (cm)	Enclosed space height (cm)
5 ft bgs	Small Office	152	152	610	305	244
5 ft bgs	Large Office	152	152	762	610	305
5 ft bgs	Warehouse 45-foot peak	152	152	7,315	7,315	1,372
5 ft bgs	Warehouse 80-foot peak	152	152	7,315	7,315	2,438
15 ft bgs	Small Office	457	457	610	305	244
15 ft bgs	Large Office	457	457	762	610	305
15 ft bgs	Warehouse 45-foot peak	457	457	7,315	7,315	1,372
15 ft bgs	Warehouse 80-foot peak	457	457	7,315	7,315	2,438
40 ft bgs	Small Office	1,219	1,219	610	305	244
40 ft bgs	Large Office	1,219	1,219	762	610	305
40 ft bgs	Warehouse 45-foot peak	1,219	1,219	7,315	7,315	1,372
40 ft bgs	Warehouse 80-foot peak	1,219	1,219	7,315	7,315	2,438

cm – Centimeters.
Small Office – 20-foot floor length x 10-foot floor width x 8-foot ceiling height.
Large Office – 25-foot floor length x 20-foot floor width x 10-foot ceiling height.
Warehouse 45-foot peak – 240-foot floor length x 240-foot floor width x 45-foot ceiling height.
Warehouse 80-foot peak – 240-foot floor length x 240-foot floor width x 80-foot ceiling height.

Copyright Kleinfelder 2010

The J&E Model version used in this evaluation was SG-ADV (Version 3.1, dated February 2004). Toxicity values for the model are those provided by DTSC in its screening level J&E SG Model (Cal/EPA, 2009). The soil temperature was estimated from guidance provided in US EPA's *User's Guide for Evaluating Subsurface Vapor Intrusion into Buildings* (Environmental Quality Management, Inc. [EQM], 2004). The model spreadsheets were modified to accommodate more than one chemical. The modification did not affect spreadsheet function.

As coded into an Excel spreadsheet, the version of the J&E Model used does not generate soil vapor concentrations based on a given level of cancer risk or non-cancer hazard quotient. Instead, the model generates estimates of cancer risk and non-cancer hazard quotient from estimated or measured soil vapor concentrations of chemicals. Therefore, Site-specific screening values were generated by entering a nominal value for each COPC (1 µg/m^3), then the resulting risk values were converted into concentrations that yield a cancer risk of 1 x 10^{-6} or a non-cancer hazard quotient of 1. The equations used to calculate soil vapor screening levels using the J&E Model are presented below.

Screening Level (µg/m^3):

For cancer risk:
1 x 10^{-6} / cancer risk from constituent concentration of 1 µg/m^3

For non-cancer hazard quotient:
1 / non-cancer hazard quotient from constituent concentration of 1 µg/m^3

The lesser of the soil vapor screening levels based on cancer risk or non-cancer hazard quotient screening levels was identified as the final screening level for each constituent in each scenario. Prior to identification of the lesser of the cancer risk or non-cancer hazard screening levels, the potential contribution of each constituent to add to the cumulative cancer risk or non-cancer hazard was addressed. TCE and PCE are classified as carcinogens. Therefore, their screening levels were divided by a value of two to account for potential additive cancer risks. Each of the three Site volatile COPCs may produce non-cancerous health effects. However, the soil vapor screening level of

Copyright Kleinfelder 2010

two of those constituents, TCE and PCE, based on cancer risks, were two orders of magnitude lower than their screening levels for non-cancer hazard quotients. Remediation of the Site to limit the cumulative cancer risk of TCE and PCE to 1 x 10^{-6} will also reduce their contribution to the cumulative non-cancer hazard quotient to approximately 0.01. Therefore, there was no need to address the potential additivity for non-cancer hazard quotient.

The various SSLs calculated for each redevelopment scenario are presented below. Selection of a specific SSL for each COPC cannot be made at this time because Site redevelopment plans have not been finalized, and therefore actual dimensions of the building that will be constructed at the Site (if one is constructed) are not known.

Summary of VOC Site-Specific Screening Levels

Site Specific Screening Levels in Soil Vapor (µg/m^3)					
Soil Gas Depth	**Building Scenario**	**TCE (µg/m^3)**	**PCE (µg/m^3)**	**TCE (µg/L)**	**PCE (µg/L)**
5 ft bgs	Small Office	1,000	370	1.0	0.37
5 ft bgs	Large Office	1,500	550	1.5	0.55
5 ft bgs	Warehouse 45-ft ceiling	33,000	11,000	33	11
5 ft bgs	Warehouse 80-ft ceiling	58,000	20,000	58	20
15 ft bgs	Small Office	2,700	990	2.7	0.99
15 ft bgs	Large Office	3,600	1,300	3.6	1.3
15 ft bgs	Warehouse 45 ft ceiling	42,000	15,000	42	15
15 ft bgs	Warehouse 80 ft ceiling	75,000	26,000	75	26
40 ft bgs	Small Office	6,800	2,500	6.8	2.5
40 ft bgs	Large Office	8,800	3,200	8.8	3.2
40 ft bgs	Warehouse 45 ft ceiling	65,000	23,000	65	23
40 ft bgs	Warehouse 80 ft ceiling	120,000	42,000	120	42
Commercial/Industrial CHHSLs		**1,770**	**603**	**1.77**	**0.603**

µg/m^3 – Micrograms per cubic meter.
µg/L – Micrograms per liter.
TCE – Trichloroethene.
PCE – Tetrachloroethene.

Copyright Kleinfelder 2010

Based on the data provided in the preceding summary table, the Small Office or Large Office scenario may represent risks to future on-Site workers, as there is a potential to exceed an excess cancer risk of 1 x 10^{-6} in either scenario. The other scenarios evaluated do not present such risks. See Appendix J for additional J&E calculation details.

Off-Site Resident Scenario

VOCs from off-Site sources in regional groundwater are a source of impact to the vadose zone beneath the Site and off-Site properties. As indicated in Section 4.2.6, regardless of on-Site SVE activities performed, off-gassing of TCE and PCE from impacted groundwater will continue to impact on- and off-Site properties until after regional sources are remediated. Modeling of health risks associated with vapor intrusion into off-Site residences due to off-gassing from groundwater is beyond the scope of this RAP.

Health risk modeling performed as part of this RAP using the J&E model estimated risks associated with vapor intrusion into off-Site residences based on assumed soil vapor concentrations. Because Site-specific soil vapor data beneath off-Site residences are not available, it was conservatively assumed that once SVE activities at the Site are completed, and commercial/industrial CHHSLs have been achieved in the vadose zone within the Site property line, concentrations beneath residences will also be equal to commercial/industrial CHHSLs. These soil vapor concentrations were used as input values for the residential scenario because the J&E model is only capable of modeling one-dimensional migration of VOCs from soil vapor to indoor air, and model limitations do not allow the estimation of lateral and then vertical migration of VOCs.

The potential impact to off-Site residents was evaluated assuming that post-remediation shallow soil vapor concentrations are equal to or less than commercial/industrial CHHSLs. The following VOCs were detected at Site soil vapor sampling locations within 100 feet of off-Site residential properties: 1,1-DCE, 1,1,1-TCA, chloroform, PCE, and TCE (Plate 2). Due to lack of off-Site data and as a conservative measure, the VOCs 1,1-DCE, 1,1,1-TCA, and chloroform were included in this modeling scenario. Although soil vapor samples were collected at three depths (5, 15, and 20 feet bgs), the

Copyright Kleinfelder 2010

current conditions scenario was based upon the maximum soil vapor concentration of each sample point regardless of depth.

For the post-remediation scenario, model input concentrations were the commercial/industrial soil vapor CHHSLs or the maximum soil vapor concentration, whichever was lowest. CHHSLs were used in the model input based on scoping discussions with LARWQCB. The maximum soil vapor concentrations of TCE (38,000 µg/m^3) and PCE (12,000 µg/m^3) exceeded commercial/industrial soil vapor CHHSLs (TCE = 1,770 µg/m^3 and PCE = 603 µg/m^3). Therefore the post-remediation scenario concentrations of TCE and PCE were assumed to be equal to the soil vapor CHHSLs. The maximum soil vapor concentration 1,1,1-TCA was less than the CHHSL for that compound; therefore, the maximum concentration was used as the model input concentration under the current and post-remediation scenarios. A CHHSL is not available for 1,1-DCE or chloroform, so the maximum concentration was also used for the post-remediation scenario.

Based upon the results of J&E modeling of post-remediation conditions, as presented in Appendix J, the non-cancer Health Index (HI) is 0.03, and is less than the level that triggers risk management decisions under Cal/EPA policy (HI>1). The results of J&E modeling of post-remediation conditions also indicate an Incremental Lifetime Cancer Risk (ILCR) of 4 x 10^{-6} (four in a million). This ILCR is greater than the level that triggers risk management decisions under Cal/EPA policy (1 x 10^{-6}; i.e., one in a million), but does not exceed the level (1 x 10^{-4}; i.e., one in ten thousand) at which the US EPA considers remedial or mitigation actions to be warranted. Additionally, the ILCR is lower than the OEHHA Proposition 65 "No Significant Risk Level" of 1 x 10^{-5} (one in one hundred thousand). See Appendix J for additional details on the J&E modeling calculation.

4.2.6 Vapor-Water Partitioning for VOCs in Soil Vapor

This subsection describes the methodology used, and calculation results for vapor-water partitioning to estimate whether concentrations of volatile COPCs in soil vapor may be contributing to concentrations of volatile COPCs in groundwater near the vadose zone/groundwater aquifer interface. This is estimated based on Henry's Law,

Copyright Kleinfelder 2010

which expresses the equilibrium partitioning of VOCs between water and air. Using this equation, equilibrium concentration of COPCs in soil vapor and groundwater at the vadose zone/groundwater interface can be estimated.

October 28 and 29, 2008 soil vapor data from the SSA (Kleinfelder, 2008b) for vapor probes installed near the central portion of the VOC plume (specifically, Probes K-26, K-32, K-33, K-35, K-36, and K-37) were reviewed, and maximum soil vapor concentrations at 30 feet bgs (the maximum depth of soil vapor sampling) were used as input values into the equations below. The lateral and vertical extent of the VOC plume approximates the depiction for TCE on Plates 3A, 5B, and 5C. The concentrations of TCE in soil vapor samples from the specified, approximately 30-foot bgs probes ranged from 132 µg/L to 539 µg/L. The detected concentrations of PCE ranged from14 µg/L to 34 µg/L. Concentrations of TCE and PCE remained generally consistent from 5 feet to 30 feet bgs, and it was assumed that concentrations of these constituents in soil vapor at 30 feet bgs are representative of soil vapor concentrations at the vadose zone-groundwater interface (see Plates 3A, 5B, and 5C). The maximum detected concentration of each of these COPCs in the samples from the vapor probes indicated above was used as an input value for the Henry's Law equation to estimate the contribution from soil vapor to groundwater for these constituents.

The Henry's Law equation is represented by the mathematical relationship below:

$$H' = C_{VOC\text{-}V}/C_{VOC\text{-}A}$$

or $$C_{VOC\text{-}V} = H' \times C_{VOC\text{-}A}$$

or $$C_{VOC\text{-}A} = C_{VOC\text{-}V}/ H'$$

where H' = Henry's Law Constant for VOC (dimensionless);

$C_{VOC\text{-}V}$ = Concentration of VOC in soil vapor (in µg/L); and

$C_{VOC\text{-}A}$ = Concentration of VOC in groundwater (in µg/L).

Copyright Kleinfelder 2010

Calculations summarized below were performed to evaluate the concentrations of PCE and TCE that may off-gas from groundwater into soil vapor in the vadose zone, based on vapor-liquid equilibrium according to Henry's Law. The maximum soil vapor concentrations of PCE and TCE were calculated based on September 25, 2008 groundwater monitoring data (CCI, 2008), and Kleinfelder's SSA soil vapor data collected in October 2008 (Kleinfelder, 2008b).

VOC	H' (Dimensionless)	Maximum Observed C_{VOC-A}* (µg/L)	Calculated ** (µg/L)	Maximum Observed C_{VOC-V}*** (µg/L)	Result of Comparison
PCE	0.754	69	52	34	Calculated C_{VOC-V} greater than observed C_{VOC-V} indicates soil vapor concentrations of PCE are not likely contributing to groundwater concentrations
TCE	0.421	180	76	539	Calculated C_{VOC-V} less than observed C_{VOC-V} indicates soil vapor concentrations of TCE are potentially contributing to groundwater concentrations

* – Maximum concentrations of VOCs observed in September 25, 2008 groundwater monitoring data for wells MW1 through MW3 (CCI, 2008), used for input into Henry's Law equation.
** – Maximum calculated concentration of VOCs in soil vapor, assuming equilibrium with observed VOC concentrations in groundwater that were used for input into Henry's Law equation.
*** – Maximum observed October 2008 VOC soil vapor concentration in approximate 30-foot bgs samples from Probes K-26, K-32, K-33, K-35, K-36, and K-37.

Based on the preceding data, maximum concentrations of PCE in soil vapor are not likely contributing to the current concentrations of PCE detected in groundwater. It is possible that current concentrations of TCE in soil vapor may be contributing to groundwater concentrations of TCE.

Soil vapor extraction (SVE) will be implemented to remove as much mass from the subsurface as is practical, employing the applicable technology here described, to reduce potential impact to groundwater by PCE and TCE in soil and soil vapor. The table below shows the approximate soil vapor concentrations that must be achieved in soil vapor (C-VOCv) by SVE to reduce the likelihood that vapor-water partitioning of PCE and TCE would result in groundwater concentrations exceeding respective MCLs,

Copyright Kleinfelder 2010

with the assumption the groundwater beneath the Site is not impacted by PCE and TCE. As explained in Section 4.4, CHHSLs are the target cleanup goals for PCE and TCE in soil vapor. The C-VOCv values for PCE and TCE, based on Henry's Law, are greater than respective CHHSLs; therefore by achieving CHHSLs for these COCs, groundwater would be protected.

COC	H' (Dimensionless)	MCL (µg/L)	C-VOCv (µg/L)	CHHSL (µg/L)
PCE	0.754	5	3.77	0.603
TCE	0.421	5	2.11	1.77

Where C-VOCv = H' x MCL, per Henry's Law.

4.3 COC SELECTION

Based on results of comparisons of SSA data to RSLs and CHHSLs; calculation of Site-specific SSLs; and vapor-water partitioning calculations, the inorganic COC addressed by this RAP is Cr^{6+}, and the organic COCs addressed by this RAP are PCE and TCE. Other compounds, including total Cr, Cd, Ni, 1,1,1-TCA, 1,1-DCA, and 1,1-DCE, are not considered Site COCs, for reasons discussed below.

Ni and Cd do not appear to be present in soils at concentrations of concern. Recent groundwater monitoring (performed between February 2006 and July 2010, and reported in the July 28, 2010, *Groundwater Monitoring Report, First Semi-Annual 2010,* prepared by CCI), found that Ni concentrations ranged from not detected to a maximum concentration of 5.9 µg/L, a concentration that is below the Cal/EPA MCL for Ni (100 µg/L). In the February 2006 groundwater samples, Cd was detected in one sample (from MW2) at a concentration of 5.2 µg/L, slightly exceeding its Cal/EPA MCL of 5.0 µg/L. Cd was not detected in May or September 2008, or June 2009 groundwater samples. In the December 2009 and July 2010 samples, Cd was again detected in one sample (from MW2), at a concentration of 3.5 µg/L and 3.2 µg/L, respectively, which is below the Cal/EPA MCL (5 µg/L). Therefore contributions of Cd and Ni from the Site are not anticipated to be concerns in groundwater extracted from GS-3 at this time.

Copyright Kleinfelder 2010

1,1,1-TCA is not a COC at the Site for the following reasons: (1) The maximum concentration of 1,1,1-TCA detected during previous soil vapor Site assessment activities was several orders of magnitude below the industrial CHHSL; (2) 1,1,1-TCA was not detected in the 30-foot bgs vadose-zone soil vapor samples collected from probes K-26, K-32, K-33, K-35, K-36, and K-37 during October 2008 assessment activities; and (3) concentrations of 1,1,1-TCA were below detection limits in the groundwater samples collected from monitoring wells (MW1 through MW6) as reported by CCI (2010b).

4.4 COC CLEANUP GOALS

The Cr^{6+} Site-specific SSL of 7.4 mg/kg included in the *Draft RAP* was calculated using US EPA's SSG (US EPA, 1996a). Although this value was based on conservative model inputs and thought to be protective of groundwater, based on agency input, the US EPA 5.6 mg/kg industrial RSL for Cr^{6+} in soil was adopted as the Site-specific cleanup goal for this constituent.

Site-specific cleanup goals for PCE and TCE concentrations in soil vapor in the shallow vadose zone are commercial/industrial CHHSLs (1.77 µg/L and 0.603 µg/L, respectively), indicated by LARWQCB. It may not be possible to achieve the cleanup goals for PCE and TCE due to practical limits of the SVE technology and continued off gassing of TCE and PCE from impacted groundwater beneath the Site. Therefore, consideration will be given to an active or passive vapor mitigation system, if necessary and appropriate to protect future on-Site workers should a building be constructed on the Site. The SVE system will be operated to the practical limits of the technology, as here described in this section. Prior to shutting down the SVE system, the rebound test described below will be performed with LARWQCB approval. The rebound test will be proposed in a *SVE System Quarterly Progress Report* once asymptotic conditions have been achieved. The practical limits of the SVE technology, and the achievement of asymptotic conditions, will be demonstrated as follows:

1. During SVE system operation, the extracted soil vapors, and individual SVE well screened intervals, will be sampled (using Summa® canisters or glass bulbs) and analyzed for total PCE and TCE on day 1 and monthly thereafter.

Copyright Kleinfelder 2010

2. Weekly monitoring of the VOCs concentrations in vapors using a PID, at the influent to the SVE system and at individual SVE wells will be performed.
3. When four successive weekly vapor samples indicate that VOC concentrations have reached asymptotic conditions (i.e., the concentration difference between successive sampling events is negligible, and the total PCE and TCE concentrations are approaching *de minimis* values), the SVE system will be switched to pulse operation.
4. During pulse operation the SVE system will be shut down for 2 weeks.
5. Following the system shutdown, Kleinfelder proposes to re-start the system and collect influent samples at the following frequencies: 1 day, 7 days, and every 2 weeks until two consecutive concentrations are at non-detect or asymptotic levels for PCE and TCE.
6. When the weekly monitoring indicates that VOC vapor concentrations measured with a PID have again reached asymptotic levels, the system will be shut down for another 2-week interval and the pulse operation cycle repeated.
7. The VOC vapor concentrations measured with a PID on day 1 of the SVE system startup and day 1 of each of the pulse operation cycle will be plotted.
8. This pulse operation will continue until the day-1 VOC vapor concentrations measured with a PID and PCE and TCE concentrations measured in a laboratory have reached asymptotic conditions. This will be considered to be the practical limits of the SVE technology.

Achieving commercial/industrial CHHSLs in the vadose zone may not be practical due to off-gassing of PCE and TCE in the regional groundwater plume, which is anticipated to be a continuing source of these COCs in soil vapor beneath the Site. As previously noted in the regional hydrogeology discussion in Section 3.2, PCE-, TCE-, and Cr^{6+}-contaminated groundwater extends contiguously in an upgradient direction from the Site to and beyond California Route 134, the Ventura Freeway, which is located over 1 mile north of the Site (US EPA, 2008a). This contaminated groundwater upgradient of the Site will continue to migrate beneath the Site for many years. September 25, 2008 results of the groundwater sample from Excello monitoring well MW4, located at the northeast corner of the vacated street to the east of the Site, indicate PCE and TCE concentrations of 51 µg/L and 150 µg/L, respectively (CCI, 2008). Because this well is roughly upgradient of the Excello portion of the Site, its groundwater sample results are

Copyright Kleinfelder 2010

interpreted as illustrative of the migration of the referenced upgradient groundwater contamination beneath the Site. The estimated concentrations of PCE and TCE being volatilized from regional groundwater into the vadose zone in the vicinity of well MW4, based on Henry's Law, are 38 µg/L and 59 µg/L, respectively, whereas the CHHSLs for PCE and TCE are 1.77 µg/L and 0.603 µg/L. Therefore, it is evident that VOCs in regional groundwater will continue to be a source of impact to the vadose zone beneath the Site until after the off-Site sources are remediated. This ongoing migration will prevent achievement of commercial/industrial CHHSLs in the deeper vadose zone by SVE.

The PCE and TCE concentrations off-gassed by regional groundwater, as estimated by Henry's Law, were compared to the 40-foot depth J&E Model results for potential future building scenarios. This comparison suggests that PCE and TCE concentrations off-gassed by regional groundwater could exceed Site-specific soil vapor SSLs (at 40 feet bgs) calculated for the four building scenarios; therefore, these off-gassed COCs could be an on-going source of impact to indoor air quality for a future building. The Henry's Law calculation was performed to demonstrate the potential for a continuing source of PCE and TCE in the vadose zone from the PCE- and TCE-impacted groundwater beneath the Site, and in Kleinfelder's opinion, is a reasonable first approximation of the PCE and TCE concentrations just above the groundwater/vadose zone interface. In the experience of Kleinfelder remediation engineers, volatilization of PCE and TCE from groundwater into the vadose above the aquifer can be an ongoing problem, especially within the 5 to 10 feet of vadose zone above an aquifer. Also, the natural fluctuation (rise and fall) of the water table can contribute to off-gassing of PCE and TCE from groundwater into the vadose zone. As the water table falls, impacted groundwater is left in the capillary fringe, from which PCE and TCE tend to off-gas into the vadose zone.

Copyright Kleinfelder 2010

Once VOC concentrations in extracted vapors from the deeper vadose zone are reduced to asymptotic levels, SVE will be halted in this zone. It is appropriate that any decision regarding land re-use including a warehouse considers an appropriate combination of the options for further soil vapor sampling, to evaluate residual risks of exceeding applicable commercial/industrial CHHSLs, and/or design and implement an active or passive vapor mitigation system.

A soil vapor survey will be conducted in the shallow vadose zone following shutdown of the SVE system. Results of the soil vapor survey will be used to conduct a human health risk assessment (HHRA) for the intended Site re-use. The need for implementation of an active or passive vapor mitigation system, if necessary, will be considered based on results of the HHRA.

Copyright Kleinfelder 2010

5. CONCEPTUAL SITE MODEL UPDATE

Site data was compiled and a "Conceptual Site Model" (CSM) was prepared based on the data. TCE and Cr^{6+} were selected as COCs for this CSM. Isoconcentration contours with respect to depth for TCE in soil vapor and Cr^{6+} in soil are shown on Plates 3A and 3B, respectively.

This CSM incorporates known sources of contamination beneath the Site (metals in soil and VOCs in soil vapor), affected media (soil, soil vapor, and groundwater), potential migration routes for COCs, complete and incomplete exposure pathways, and potential receptors. A three-dimensional block diagram-type CSM was prepared that provides a graphical view of complete and potentially complete pathways, and potential receptors, as shown on Plate 3C. Plates 4A through 4D provide further detail regarding the concentrations of Cr^{6+} in Site soil at respective depths of 5 feet, 15 feet, 25 feet, and 35 feet bgs. Plate 5A shows the locations of three cross sections (A-A', B-B', and C-C'). Plates 5B and 5C indicate soil vapor TCE concentrations, and Plates 5D and 5E indicate Cr^{6+} concentrations on the cross sections.

The assumed primary sources of the contaminants were pooling liquids, tanks, drums, etc., which were used to store chemicals and wastes used in the plating operations that historically took place on the Site. These chemicals were presumably released due to inadequate handling and disposal practices, and penetrated cracks in the flooring, foundations, and/or containment structures of the former plating facilities. Sources may have also included shallow subsurface releases via floor drain systems and through underground piping.

Only one complete exposure pathway for the planned land use (a parking lot and driveway) was identified at the time the SSA was prepared. This pathway was based on the assumption that metals could leach from soil to groundwater with subsequent consumption of the affected groundwater by receptors. In addition, the dissolution of VOCs from soil vapor into groundwater is considered a complete exposure pathway, when groundwater is extracted and ingested by receptors using the municipal water supply system. Subsequent to the preparation of the SSA, the planned land use has been expanded to potentially include a future warehouse. With the addition of this land

Copyright Kleinfelder 2010

use, exposure pathways were re-evaluated and complete exposure pathways and associated receptors now include the following:

- soil ingestion, dermal contact with soil, and dust inhalation – on-Site workers employed on the Site after redevelopment (e.g., landscape maintenance workers and subsurface utility workers);
- groundwater ingestion – municipal water customers; and
- inhalation of vapors – on-Site workers working in enclosed structures on the Site.

Potentially-complete exposure pathways include:

- soil ingestion, dermal contact with soil, and dust inhalation – construction workers during implementation of the RAP and Site redevelopment;
- inhalation of vapors – construction workers and nearby residents during and after implementation of the RAP; and
- dust inhalation – nearby residents during implementation of the RAP and Site redevelopment.

Copyright Kleinfelder 2010

6. EXTENT OF REMEDIATION BASED ON CLEANUP GOALS

The Cr^{6+} Site-specific SSL of 7.4 mg/kg included in the *Draft RAP* was calculated using US EPA's SSG (US EPA, 1996a). Although this value was based on conservative model inputs, and thought to be protective of groundwater, based on agency input, the 5.6 mg/kg industrial RSL for Cr^{6+} in soil was adopted as the Site-specific cleanup goal for this constituent. Proposed Site cleanup goals for PCE and TCE concentrations in soil vapor in the shallow vadose zone are commercial/industrial CHHSLs (1.77 µg/L and 0.603 µg/L, respectively), as requested by LARWQCB. It has been assumed that the entire vadose zone beneath the Site contains concentrations of PCE and TCE exceeding commercial/industrial CHHSLs. Although commercial/industrial CHHSLs for PCE and TCE concentrations in soil vapor are the cleanup goals, the SVE technology which will be used to remediate these COCs may have limitations. The SVE system will be operated to the practical limits of the technology, a soil vapor survey will be conducted, and an HHRA to assess residual risk in soil vapor will be performed. The practical limits of the SVE technology will be demonstrated as follows:

1. During SVE system operation, the extracted soil vapors, and individual SVE well screened intervals, will be sampled (using Summa® canisters or glass bulbs) and analyzed for total PCE and TCE on day 1 and monthly thereafter.
2. Weekly monitoring of the VOCs concentrations in vapors using a PID, at the influent to the SVE system and at individual SVE wells will be performed.
3. When four successive weekly vapor samples indicate that VOC concentrations have reached asymptotic conditions (i.e., the concentration difference between successive sampling events is negligible, and the total PCE and TCE concentrations are approaching *de minimis* values), the SVE system will be switched to pulse operation.
4. During pulse operation the SVE system will be shut down for 2 weeks.
5. Following the system shutdown, Kleinfelder proposes to re-start the system and collect influent samples at the following frequencies: 1 day, 7 days, and every 2 weeks until two consecutive concentrations are at non-detect or asymptotic levels for PCE and TCE.

Copyright Kleinfelder 2010

6. When the weekly monitoring indicates that VOC vapor concentrations measured with a PID have again reached asymptotic levels, the system will be shut down for another 2-week interval and the pulse operation cycle repeated.
7. The VOC vapor concentrations measured with a PID on day 1 of the SVE system startup and day 1 of each of the pulse operation cycle will be plotted.
8. This pulse operation will continue until the day-1 VOC vapor concentrations measured with a PID and PCE and TCE concentrations measured in a laboratory have reached asymptotic conditions. This will be considered to be the practical limits of the SVE technology

The lateral and vertical extent of Cr^{6+}-impacted soil requiring remediation, based on this 5.6 mg/kg Cr^{6+} cleanup goal, is shown on Plates 3B, and 4A through 4D. The estimated volume of soil requiring remediation is approximately 5,800 cubic yards, as depicted on Plate 7B.

The primary source area for Cr^{6+} is within the Excello building footprint, whereas the primary source area for PCE and TCE is north of the building. Therefore, LDA/ISCR treatment of Cr^{6+} impacted soil is not expected to negatively impact SVE activities.

Copyright Kleinfelder 2010

7. REMEDIAL ALTERNATIVE SCREENING

7.1 REMEDIAL ALTERNATIVE SCREENING METHODOLOGY

This section presents a streamlined screening of remedial alternatives that have the potential to achieve the Site-specific cleanup goals for Cr^{6+} in soil, and PCE and TCE in soil vapor. The various alternatives are screened with respect to their overall effectiveness, implementability, and cost effectiveness. These criteria are discussed below.

The effectiveness of a remedial alternative is evaluated based on the alternative's expected ability to obtain cleanup goals. The effectiveness of an alternative may be further described with regard to how well it protects public health, the local community, workers (both during and after its implementation), and the environment; and how it complies with regulatory statutes and requirements. Other key components of effectiveness evaluation include whether the remedial alternative will reduce toxicity, mobility, or volume of contamination via treatment; long-term effectiveness; and short-term effectiveness.

The implementability of an alternative depends on its technical feasibility, the availability of necessary technologies and resources to support the alternative, reliability of technologies, and administrative feasibility such as the anticipated acceptance of an alternative by regulatory agencies and the community.

To evaluate cost, each retained alternative is evaluated to estimate its projected overall implementation cost. The costs developed for each alternative include capital costs, construction management costs, and post-construction costs.

The following sections include a description of the potential remedial alternatives, an initial screening of each alternative against the three primary criteria summarized above, and a comparative evaluation of the alternatives with respect to the evaluation criteria and each other.

Copyright Kleinfelder 2010

7.2 DESCRIPTION OF REMEDIAL ALTERNATIVES FOR CR^{6+} IN SOIL

Five potential remedial alternatives to address Cr^{6+} in soil were evaluated. These are:

- no further action (NFA);
- cement stabilization, with engineered cap;
- LDA mixing/ISCR and cement stabilization, with engineered cap;
- excavation and off-Site disposal; and
- engineered cap.

These alternatives are briefly described below:

No Further Action

The no further action (NFA) alternative is typically used as a comparative baseline for other potential alternatives. The performance of a Site-specific HHRA is typically required in order to apply for an NFA letter from the overseeing agency; however, existing Site assessment data show elevated concentrations of Cr^{6+} in soil that LARWQCB has required be addressed by active remediation.

Cement-only Stabilization and Cap

This alternative would require the use of LDAs to deliver and mix, in-situ, a specified formulation of Portland cement to reduce the mobility of primarily Cr^{6+} in impacted soil designated for treatment. This alternative has been used to reduce the mobility of numerous metals in soil at numerous sites; however, its effectiveness for reducing the mobility of Cr^{6+} was uncertain. Therefore, a cement stabilization bench-scale treatability test was performed to assess the effectiveness of this technology to reduce mobility of Cr^{6+} in the buffer zone; and to assess this potential alternative as a stand-alone technology.

Copyright Kleinfelder 2010

In addition, this alternative includes the installation of an engineered cap at ground surface covering residual Cr^{6+} left in place in the buffer zone, to impede infiltration of water from the surface. The locations and volume of soil to be addressed by the alternative are based on the cleanup goal of 5.6 mg/kg established for Cr^{6+}. Based on the lateral and vertical extent of Cr^{6+} exceeding 5.6 mg/kg, as summarized on Plates 3B and 4A through 4D, the estimated volume of soil requiring treatment via LDA and cement stabilization is 5,800 cubic yards. As depicted in the aforementioned plates, Cr^{6+}-impacted soil is anticipated to extend as deep as 45 feet below grade (i.e., to groundwater) in some locations.

Bench-scale testing of cement-only stabilization was performed as part of the development of this RAP. The results are discussed later in this section. A field pilot scale test would be required to estimate the proper formulation of cement and soil under field conditions. Confirmation borings and confirmatory testing of treated materials will be needed. There is a waste disposal component for this alternative, necessary to address swell material generated during the mixing of cement with soil.

LDA Mixing and ISCR, with Cement Stabilization

This alternative will require the use of LDAs to deliver and mix, in-situ, a formulation of a chemical reducing agent to reduce Cr^{6+} to Cr^{3+} (to mitigate the toxicity of Cr^{6+}) and a stabilizing agent (such as cement) to lower mobility in the soil.

An initial screening of potential in-situ chemical reducing agents for Cr^{6+} in vadose-zone soil was performed. Based on this screening, many of the reducing agents were removed from further consideration due to concerns regarding the technical feasibility. For example, zero-valence iron (ZVI) is a proven remedial alternative for reduction of Cr^{6+} in the saturated zone as part of a permeable reactive barrier (PRB). However, for ZVI to work in the vadose zone, a significant amount of water would need to be added to the vadose zone, essentially to the point of saturation, with the potential for flushing Cr^{6+} or other COCs from the vadose zone into groundwater during the process. Two chemical reducing agents (CaSx and ferrous sulfate) previously used for reduction of

Copyright Kleinfelder 2010

Cr^{6+} at similar sites were selected for bench-scale testing and proven technically feasible and effective for the Site; therefore, other potential ISCR agents were not considered in this RAP.

To reduce the potential for infiltration of the reducing agent to groundwater, the reducing agent will be applied only to a depth of 35 feet bgs, leaving a 10-foot thick buffer zone of untreated soil. The soil in this buffer zone will be treated with a stabilizing agent (i.e., cement) to reduce the mobility of both the reducing agent and residual Cr^{6+} within the buffer zone. In addition, this alternative includes the installation of an engineered cap at ground surface covering residual Cr^{6+} left in place in the buffer zone, to impede infiltration of water from the surface. The locations and volume of soil to be addressed by the alternative are based on the cleanup goal of 5.6 mg/kg established for Cr^{6+}. Based on the lateral and vertical extent of Cr^{6+} exceeding 5.6 mg/kg as summarized on Plates 3B and 4A through 4D, the estimated volume of soil requiring treatment via LDA/ISCR is 5,800 cubic yards. As depicted in the aforementioned plates, Cr^{6+}-impacted soil extends as deep as 43.5 feet below grade (i.e., to groundwater) in some locations.

Bench-scale testing of ISCR was performed as part of the development of this RAP. The results are discussed later in this section. In addition, supplemental cement stabilization bench-scale treatability testing was performed, as described later in this RAP. A field pilot scale test will be required to assess whether the proper formulation(s) of chemical reducing agent and stabilizing agent, and proper delivery are achievable under field conditions. Confirmation borings and confirmatory testing of treated materials will be needed. There is a waste disposal component for this alternative, necessary to address swell material generated during the application of the ISCR formula to soil.

Excavation and Off-Site Disposal

This remedial alternative consists of excavating impacted soil and transporting it to an approved off-Site treatment, storage, and disposal facility (TSDF). The volume of Cr^{6+}-impacted soil requiring excavation is approximately 5,800 cubic yards. The approximate excavation dimensions would be 105 feet by 45 feet, by 25 feet deep; plus

Copyright Kleinfelder 2010

a deeper area of approximately 45 feet by 45 feet by 18 feet deep. An additional 800 cubic yards of soil would also be removed for side sloping of the excavation. The impacted soil would be removed within pre-determined areas to established depths (based on the existing Site assessment data), and followed by soil confirmation sampling at the edges and bottom of the excavation to assess the need for further removal of impacted soil. This alternative will require shoring to allow excavation to the limits of impacted soil, equipment to excavate impacted soil and overburden, trucks to transport and dispose of excavated soil at a licensed TSDF, clean fill to be used for backfill material, and equipment to place and compact backfill.

Engineered Cap

This alternative involves placing a low-permeability engineered cap over impacted soil to impede surface water infiltration and leaching of COCs to groundwater. Typical single-layer caps are composed of concrete or bituminous asphalt. Typical multi-layer (engineered) caps consist of multiple layers of various materials, which may include a geomembrane, clay, sand, gravel, impermeable barrier(s), and in some cases vegetation. Caps require periodic inspections and long-term maintenance to ensure that they remain intact. Assuming no treatment, the engineered cap would cover most of the Excello portion of the Site, have a surface area of approximately 21,000 square feet; and include base material, an impermeable barrier, and a 9-inch-thick, reinforced concrete surface completion.

7.3 SCREENING OF REMEDIAL ALTERNATIVES FOR CR^{6+} IN SOIL

No Further Action

Effectiveness – This remedial alternative will not address impact to the subsurface, is not protective of human health and the environment, and will not achieve regulatory-/risk-based cleanup goals developed for the Site. This remedial alternative does not reduce the toxicity, volume, or mobility of impacts to soil via treatment. It provides short-term effectiveness but does not provide long-term effectiveness and permanence.

Copyright Kleinfelder 2010

Implementability – This remedial alternative does not require equipment, labor force, permits, or other resources to implement, and therefore is readily implementable. The implementation of this remedial alternative will require use of a deed restriction limiting future property use to commercial and industrial uses following US EPA institutional controls guidance. The regulatory agencies and local community are not expected to accept this alternative.

Costs – There are no costs associated with this alternative; therefore, the alternative is cost-effective.

This alternative was not retained for further consideration because it does not address known impact to the subsurface and is not expected to be accepted by the community or regulatory agencies.

Cement-only Stabilization with Engineered Cap

The intent of cement-only stabilization is to reduce the mobility of Cr^{6+} (and other metals) in soil, once encapsulated in cement. *In-situ* chemical stabilization technologies are classified as either "wet" or "dry," depending on how the stabilizing agent is applied to the soil. For the wet mix method, a stabilizer-water slurry is injected through large diameter mixing augers and drilled to a specific depth. Injection is usually performed on the down stroke, with mixing accomplished on both the down and up strokes.

The LDA and cement stabilization technology, when applied to soil, generates swell material that typically requires off-Site disposal. The volume of swell material can be 20 to 30 percent of the total soil volume treated; therefore, understanding the quantity of material that will be generated, and the waste classification and disposal options for this material, is an important consideration for this alternative. Excess swell material that contains concentrations of Cr^{6+} below the Site-specific cleanup goals may be used during rough grading to level the Site surface prior to construction of the cap.

Copyright Kleinfelder 2010

The screening evaluation for LDA application of cement, with an engineered cap is as follows:

Effectiveness – As part of the development of this RAP, cement stabilization bench-scale testing was performed by Prima Environmental, Inc. (PRIMA), an independent bench-scale testing firm. The primary objective of cement-only bench-scale treatability testing activities was to assess the feasibility and effectiveness of cement soil stabilization for application within the buffer zone. Also, this testing was performed to assess the potential feasibility and effectiveness of cement stabilization/solidification as a stand-alone technology for stabilizing metals-impacted soil at the Site, which included Cr^{6+}, Cr, Cd, and Ni. As the latter three metals are not Site COCs, the results were not included in the RAP text, but can be found in Appendix L. The performance goal of the cement-only bench-scale treatability testing included a concentration for Cr^{6+} of less than 5 µg/L (City of Glendale Voluntary Cleanup Goal for groundwater) for the leachate from the cement-treated soil samples.

Bench-scale testing was performed using soil collected simultaneously with the soil samples collected for physical parameter testing. Soil from boring KLF-1 (see Plate 2), drilled in November 2009, was selected for bench-scale testing because it was collected in the vicinity of the highest concentrations of Cr^{6+}, near borings B-20, B-22, B-37, and K-20, and is thought to be representative of the types of soil that will be encountered during remedial activities. The soil from boring KLF-1 for bench-scale testing was collected from boring spoils, and consists primarily of sands and silty sands, which is consistent with nearby boring logs. Several cement concentrations by weight, including 4%, 8%, 12% and 18%, were added to Site soils to allow for curing and subsequent leach testing to select the quantity of cement to be added to soil during field implementation. Soil and cement samples were allowed to cure for 7 days prior to being subjected to analytical laboratory chemical testing. Cured samples were then submitted to an analytical laboratory for leach testing in general accordance with the modified deionized water (DI) waste extraction test (WET), US EPA Method 6020, and US EPA Method 7199.

Copyright Kleinfelder 2010

Results of cement-only bench-scale treatability testing are included in Appendix I, and are briefly summarized below:

- cement cores disintegrated during the extraction process possibly due to insufficient curing time;
- the leachable concentration of Cr^{6+} did not meet the performance goal listed above; and
- although not appreciable, the mobility of Cr^{6+} was further reduced with increasing concentrations of cement.

Based on the results of the bench-scale testing performed, cement stabilization as a stand-alone remedial alternative would not be effective as it does not appear to be protective of human health and the environment; and it does not result in an adequate reduction of toxicity, volume, and mobility of Cr^{6+} to groundwater. The effectiveness of this remedial alternative may be enhanced by the installation of an engineered cap above the buffer zone, which would reduce the amount of rainwater infiltration entering the subsurface, and thereby reduce the migration of Cr^{6+} to groundwater. This remedial alternative may be implemented in less than 1 year and therefore provides short-term effectiveness. The cement stabilization/solidification technology is not expected to provide long-term effectiveness and permanence, and is not expected to achieve the cleanup goals developed for the Site.

Implementability – This remedial alternative has been implemented at sites with metal-impacted soil. This alternative requires equipment, labor force, raw materials, and resources that are readily available; however, the implementation of this remedial alternative may cause temporary disruption and/or nuisance to the surrounding community, for which various countermeasures could be implemented to reduce such impact. A number of measures will need to be in place during implementation of this alternative to ensure that construction workers, nearby residents, and the environment are protected. These measures may include, at minimum, sound barriers, dust monitoring and suppression, odor suppression, and installation of stormwater best management practices (BMPs) to mitigate potential runoff of rainwater carrying impacted soil. Dust and odor suppression may be achieved by spraying water or an approved surfactant on the soil during the construction activities. There are various

Copyright Kleinfelder 2010

BMPs that may be implemented, including silt fences, hay bales, sand bags, retention ponds, street sweeping, and others. Implementation of LDA-applied cement stabilization is expected to generate swell material requiring off-Site disposal. Due to the commercial/industrial Site-specific cleanup levels, the implementation of this remedial alternative will also require use of a deed restriction that includes language attached as Appendix C, limiting future property use to commercial and industrial uses following institutional controls guidance of US EPA and LARWQCB. This remedial alternative has been used successfully at other properties and is expected to be acceptable to the community and regulatory agencies.

Costs – Because this alternative is not expected to be effective or achieve remedial goals, costs for it were not developed. However, these costs are expected to range from moderate to high, depending on the waste categorization of the impacted soil and commensurate disposal costs.

This alternative was not retained for comparative evaluation.

LDA Mixing and ISCR with Engineered Cap

The Cr^{6+} in soil may be reduced *in situ* using one of several reducing agents, including CaSx or Fe^{2+} sulfate. These reagents reduce Cr^{6+} to Cr^{3+} and form low-solubility, Cr precipitates. *In-situ* chemical stabilization technologies are classified as either "wet" or "dry," depending on how the stabilizing agent is applied to the soil. For the wet mix method a stabilizer-water slurry is injected through large diameter mixing augers and drilled to a specific depth. Injection is usually performed on the down stroke, with mixing accomplished on both the down and up strokes.

The LDA/ISCR technology, when applied to soil, generates swell material that typically requires off-Site disposal. The volume of swell material can be 20 to 30 percent of the total soil volume treated; therefore, understanding the quantity of this material that will be generated, and the waste classification and disposal options for this material, is an important consideration for this alternative. Excess swell material that contains concentrations of Cr^{6+} below the Site-specific cleanup goals may be used during rough grading to level the Site surface prior to construction of the cap.

Copyright Kleinfelder 2010

As part of the development of this RAP, bench-scale testing was performed by PRIMA, an independent bench-scale testing firm, to assess the potential effectiveness of ISCR on the Site soils. The bench-scale testing evaluated the use of CaSx and Fe^{2+} sulfate as chemical reducing agents to convert Cr^{6+} in the Site soils to Cr^{3+}. Bench-scale testing was performed using soil collected simultaneously with the soil samples collected for physical parameter testing. Several formulations of CaSx and Fe^{2+} sulfate were tested, to evaluate the performance of the reducing agent to be added to soil during field implementation. Bench-scale testing also included the addition of cement to the soil as a stabilizing agent to reduce mobility of Cr^{6+} (see Appendix L). Results of bench-scale testing indicate that both reducing agents were effective at reducing Cr^{6+} to Cr^{3+}, and leach testing performed using the Synthetic Precipitation Leaching Procedure (SPLP, performed using US EPA Method 1312) indicated that both the CaSx (with or without cement) and Fe^{2+} sulfate (with cement) significantly reduced the mobility of Cr^{6+} (see Appendix M). No additional bench-scale testing for reducing agents is proposed, as both CaSx and Fe^{2+} sulfate were successful in reducing Cr^{6+} in soil during bench-scale testing, have been used at similar sites, and are included in the General Waste Discharge Requirements (WDR) Permit.

The results of the bench-scale testing also identified several engineering considerations that have implication for both the effectiveness and implementability of this alternative. These considerations are listed by reducing agent below. Mitigation measures are provided following the summary of these considerations.

CaSx Reduction

- CaSx has a strong sulfide odor.
- Temperature increased and soil dried out when CaSx was applied to soil having a high concentration of metals (i.e., spiked soil; see Appendix M). Use of additional water may therefore be needed in areas of high metals concentrations.

Copyright Kleinfelder 2010

- CaSx was rapidly consumed when added to soil with high metals concentrations, but consumed much more slowly when added to soil with low metals concentrations. The amount of CaSx added to the soil should be adjusted depending on the concentration of metals in the soil. In addition, residual unreacted CaSx may remain in the soil after treatment. Use of other engineering controls may be needed to completely decompose excess CaSx and prevent impact to groundwater and downgradient wells.

Fe^{2+} Sulfate Reduction

- Fe^{2+} sulfate must be added as an acidic solution (i.e., with acidified make-up water if added dry) to prevent pre-mature oxidation of Fe^{2+} to ferric iron (Fe^{3+}).
- Fe^{2+} sulfate should be used only in conjunction with cement in order to ensure at minimum near-neutral pH after treatment. Fe^{2+} sulfate alone effectively decreased concentrations of Cr^{6+}, but because of low pH most other metals were highly leachable.
- Based on bench-scale testing results, the acidity of the solution that must be injected into the subsurface would be approximately 2 pH units; therefore, an acid with much lower pH would require delivery, handling, and on-Site mixing, to create the solution of desired pH.
- Application of Fe^{2+} sulfate requires careful mixing of the solution being applied to the subsurface, and if not properly applied can create a flush of Cr^{6+} to groundwater, which could negatively impact quality of groundwater extracted from well GS-3.
- The cement dose must be optimized to ensure the final pH is adequate to prevent leaching of Cr^{6+}, but also not applied at too high a cement concentration because of the possibility of acidifying the soil with $FeSO_4 \bullet 7H_2O$ and leaching of other metals which would negatively impact quality of groundwater being extracted at well GS-3.

Based on the results of the bench scale testing (Appendix M), and considerations discussed above, CaSx appears to be a more-desirable reducing agent than Fe^{2+} sulfate primarily due to the potential hazards to construction workers associated with the need to handle low pH acids for dissolution of the Fe^{2+} sulfate reagent; the potential

Copyright Kleinfelder 2010

to increase the mobility of Cr^{6+} under the resulting acidic conditions; and the need to add cement to carefully control the soil pH, which may not be feasible under field conditions.

Mitigation measures for negative impacts of the reducing agent will be included in the design plans and specifications, to be prepared following performance of the field pilot test. A summary of these mitigation measures is provided below.

- Odors may be mitigated by use of a light spray of water or an approved surfactant.
- To mitigate the potential for unreacted CaSx to reach groundwater it is proposed that the LDA/ISCR only be applied to a depth of 35 feet bgs, leaving an approximately 10-foot-thick buffer zone between the bottom of the ISCR-treated soil and the groundwater table. In this proposed scenario the buffer zone will be treated with stabilizing agent (cement) only, to reduce permeability and therefore mobility of Cr^{6+}, and provide a vertical interval for unreacted CaSx (if any) to be assimilated and oxidized before reaching groundwater. This approach will result in the treatment of approximately 93 percent of the estimated Cr^{6+} mass in Site soil (see calculation provided in Appendix N) via ISCR, and the remaining approximately 7 percent of Cr^{6+} mass will be addressed by stabilization only.
- To reduce the potential for surface water infiltration, this alternative includes an engineered cap, covering and extending by as much as 50 feet beyond the lateral limits of the buffer zone. See Plate 6 for a conceptual representation of the engineered cap.

The screening evaluation for LDA/ISCR is as follows:

Effectiveness – Based on the results of the bench-scale testing performed as part of the RAP preparation, this alternative appears to have a high level of effectiveness at reducing Cr^{6+} to Cr^{3+} and immobilizing the Cr^{6+} in place. Field pilot testing is needed as part of the implementation, to assess whether bench-scale test results for injection and mixing of CaSx and cement translate to the field, as expected, and if odor control measures will be needed. This remedial alternative may be implemented in less than 1 year and therefore provides short-term effectiveness. This remedial alternative will

Copyright Kleinfelder 2010

address impact to the subsurface, and is anticipated to be protective of human health and the environment by reducing the toxicity, volume, and mobility of Cr^{6+}. The ISCR technology is expected to provide long-term effectiveness and permanence, and is expected to achieve the cleanup goals developed for the Site. Case studies documenting the effectiveness of the use of CaSx as a means of reducing Cr^{6+} to Cr^{3+} in soil, are included as Appendix O.

Implementability – This remedial alternative has been implemented at properties with similar COCs in the subsurface. This alternative requires equipment, labor force, raw materials, and resources that are readily available; however, the implementation of this remedial alternative may cause temporary disruption and/or nuisance to the surrounding community, for which various countermeasures could be implemented to reduce such impact. A number of measures will need to be in place during implementation of this alternative to ensure that construction workers, nearby residents, and the environment are protected. These measures may include, at minimum, sound barriers, dust monitoring and suppression, odor suppression, and installation of stormwater BMPs to mitigate potential runoff of rainwater carrying impacted soil. Dust and odor suppression may be achieved by spraying water or an approved surfactant on the soil during the construction activities. Various BMPs may be implemented, including silt fences, hay bales, sand bags, retention ponds, street sweeping, and others. Implementation of LDA/ISCR is expected to generate swell material requiring off-Site disposal. Due to the commercial/industrial Site-specific cleanup levels, the implementation of this remedial alternative will also require use of a deed restriction that includes language attached as Appendix C, limiting future property use to commercial and industrial uses following institutional controls guidance of US EPA and LARWQCB. This remedial alternative has been used successfully at other properties and is expected to be acceptable to the community and regulatory agencies.

Costs –Various costs are associated with this alternative, including those for project management, engineering, permitting, equipment, labor, subcontractors, chemicals, capping materials, water, and waste disposal. Costs for implementing this alternative may range from moderate to high, depending on the waste categorization of the impacted soil and commensurate disposal costs. The actual cost of this alternative may vary across a wide range, depending primarily on the volume of soil to be

Copyright Kleinfelder 2010

addressed by LDA/ISCR, and waste disposal. The rough order of magnitude cost to implement LDA/ISCR for the estimated volume of soil exceeding the cleanup goal of 5.6 mg/kg for Cr^{6+} ranges from $2,500,000 to approximately $2,800,000. These costs do not include performing a hazardous building material survey (HBMS) of the existing Site building, hazardous building material abatement, or building demolition. A cost summary for this alternative is included as Appendix P.

This alternative was retained for comparative evaluation.

Excavation and Off-Site Disposal

Effectiveness – This remedial alternative will address impact to the subsurface, is anticipated to be protective of human health and the environment, and is expected to achieve regulatory-/risk-based cleanup goals developed for the Site. However, the volume, toxicity, and mobility of COCs are not actually addressed by treatment under this alternative, but rather are physically moved to another location. This remedial alternative can be implemented in less than 1 year, and therefore provides short-term effectiveness. In addition, because the impacted soil is removed from the Site, this alternative provides long-term effectiveness and permanence.

Implementability – This remedial alternative has been implemented at properties with similar COCs in the subsurface, and therefore is technically feasible. The implementation of this remedial alternative may cause temporary disruption and/or nuisance to the surrounding community due to various factors including relocation of utilities, dust, noise, and increased truck staging and traffic. This alternative would also have negative impacts to the environment including increased greenhouse gas emissions and increased landfill contributions. This alternative requires equipment, labor force, raw materials, and resources that are readily available. Various measures will need to be in place, during implementation of this alternative, to protect construction workers, nearby residents, and the environment. These measures may at minimum include sound barriers, fugitive dust and VOC monitoring and suppression, and installation of stormwater BMPs to mitigate potential runoff of rainwater carrying impacted soil. Dust and odor suppression may be achieved by spraying water or an approved surfactant on the soil. Various BMPs may be implemented, including silt

Copyright Kleinfelder 2010

fences, hay bales, sand bags, retention ponds, street sweeping, and others. Excavation and off-Site disposal will provide long-term effectiveness and permanence. Implementation of this remedial alternative will require use of a deed restriction (with language attached as Appendix C) regarding future property use following US EPA institutional controls guidance, due to use of industrial/commercial cleanup goals.

Various concerns are related to the implementation of this alternative, including the large number of truck trips necessary to transport hazardous and potentially hazardous soils through the community on public roadways, with potential exposure of the general public to these materials. The large number of truck trips anticipated would result in greenhouse gas emissions, increased traffic, and an increased risk of accidents on neighborhood streets. The numerous truck trips will have a temporary negative impact on the quality of life of nearby residents caused by the increased truck traffic, noise, and emissions. Regulatory agencies have been known to limit the allowable number of truckloads that can be hauled in a given day, which could extend the duration of this alternative. For these reasons, this remedial alternative may not be acceptable to the community.

Costs –Various costs are associated with this alternative, including those for permitting, equipment, labor, subcontractors, water, and waste disposal. Costs for implementing this alternative could range from moderate to high, depending primarily on the waste categorization of the impacted soil and commensurate disposal costs. The wide cost range is primarily due to the degree of uncertainty regarding the disposal profile(s) of the excavated soil and resulting disposal costs. The rough order-of-magnitude cost to implement excavation and off-Site disposal for the estimated volume of soil exceeding the cleanup goal 5.6-mg/kg Cr^{6+}, plus overburden, ranges from $2,800,000 to approximately $4,300,000. These costs do not include performing an HBMS of the existing Site building, hazardous building material abatement, or building demolition. A cost summary for this alternative is included as Appendix P.

This alternative was retained for comparative evaluation.

Copyright Kleinfelder 2010

Engineered Cap

Effectiveness – This remedial alternative used alone will not reduce the volume or toxicity of impact to the subsurface, but is anticipated to be more protective of human health and the environment than the NFA alternative. This remedial alternative can be implemented in less than 1 year, and therefore provides short-term effectiveness. Should the groundwater level rise, this alternative will not prevent leaching of Cr^{6+} in soil by groundwater that comes into contact with it.

Implementability – This remedial alternative has been implemented at properties with similar COCs in the subsurface, and therefore is technically feasible. The implementation of this remedial alternative will be anticipated to cause relatively minimal disruption and nuisance to the surrounding community. This alternative requires equipment, labor force, raw materials, and resources that are readily available. The engineered cap will require long-term maintenance to ensure long-term effectiveness and permanence. The implementation of a cap will also require a deed restriction (with language included as Appendix C) regarding future property use following US EPA institutional controls guidance.

Costs –Various costs are associated with this alternative, including those for permitting, equipment, labor, subcontractors, materials, water, and waste disposal (if excess soil is generated from clearing and grubbing). The cost to implement this alternative is expected to be low to moderate, depending on cleanup goals and the footprint of impacted soil associated with the cleanup goals. A cost summary for this alternative is included as Appendix P.

A key evaluation criterion for this remedial alternative is whether it will be accepted by the regulatory agencies and community. Preliminary indications are that this alternative, used solely, will not be acceptable to these parties; therefore, this alternative will not be developed further in this document.

Copyright Kleinfelder 2010

7.4 COMPARATIVE EVALUATION OF ALTERNATIVES FOR CR^{6+} IN SOIL

The alternatives retained for the comparative analysis included LDA/ISCR with an engineered cap, and excavation and off-Site disposal. A comparative analysis of the retained remedial alternative was performed to evaluate the relative anticipated performance. A summary of this evaluation is provided in Table 1. Although the alternatives of NFA and capping without treatment were not retained for consideration, they are also presented in Table 1. In summary, the comparative evaluation of retained remedial alternatives indicates that LDA/ISCR with an engineered cap, using CaSx as the reducing agent and cement as the stabilizing agent, is the preferred alternative for Cr^{6+}-impacted soil at the Site. This reducing agent is preferred because it may be implemented *in situ*, has been previously implemented in Los Angeles County (see Appendix O for case studies), does not require a large staging area (unlike that required for alternatives requiring excavation), and is more cost-effective than other alternatives.

Excavation with off-Site disposal was not a preferred alternative for several reasons, most notably because it was not cost-effective in view of the need to dispose of considerable waste material at high cost, and because the removal of such large amounts of material would result in large traffic impacts to the community.

7.5 DESCRIPTION OF REMEDIAL ALTERNATIVES FOR PCE AND TCE IN SOIL VAPOR

Three potential remedial alternatives to address PCE and TCE in soil vapor were considered, as follows:

- NFA;
- SVE and treatment with vapor-phase granular activated carbon (VPGAC); and
- excavation and on-Site thermal desorption.

<u>No Further Action</u>

The NFA alternative is typically used as a comparative baseline for other potential alternatives.

Copyright Kleinfelder 2010

Soil Vapor Extraction

SVE is an *in-situ* vadose zone soil remediation alternative where vacuum is applied to the subsurface by an extraction blower of adequate specifications to induce the extraction of soil vapors, and remove volatile and some semi-volatile organic compounds from soil and soil vapor. Extracted vapors are treated to recover or destroy the contaminants. Extracted VOCs are removed from the extracted vapor stream via VPGAC, which will adsorb VOCs to avoid their release to the atmosphere, and would require periodic replacement. An SVE well and observation wells would be installed to facilitate SVE pilot testing, which would allow the proper sizing and selection of specifications of an extraction blower and VPGAC vessels, the proper spacing of SVE wells with respect to the achievable effective radius of influence (ROI) in the vadose zone and VOC plume, and sizing of extracted vapor conveyance piping.

SVE with adsorption by VPGAC is a proven technology that has been implemented at many properties, and is a presumptive remedy for the removal of VOCs from the vadose zone (US EPA, 1996d). SVE has the ability to treat large areas of vadose zone impact with minimal surface disturbance.

Excavation, On-Site Thermal Desorption, and Backfill and Compaction

This remedial alternative consists of on-Site staging, excavating impacted soil, and treating soil on-Site with a thermal oxidizer. There may be a need to transport some excavated soil off-Site to a licensed TSDF. Soil excavation would be achieved at the Site by the use of heavy-duty equipment, such as a backhoe, trackhoe, excavator, or other earth-moving equipment, to facilitate the removal of pre-determined impacted soil volumes (based on existing Site assessment data), with lateral and vertical extents established by cleanup goals for PCE and TCE in the vadose zone. Soil confirmation sampling at the lateral and vertical limits of the excavation would be required to assess the need to further remove impacted soil in a targeted manner. Most of the lateral extent of Site soil, extending vertically to groundwater, will require excavation to implement this alternative. An appropriately-sized thermal desorption unit would be mobilized to the Site and used to treat PCE and TCE in excavated soil. The treated soil would then be used to backfill the excavation.

Copyright Kleinfelder 2010

7.6 SCREENING OF REMEDIAL ALTERNATIVES FOR PCE AND TCE IN SOIL VAPOR

No Further Action

The NFA alternative is typically used as a comparative baseline to other potential alternatives. The performance of a Site-specific HHRA is typically required in order to apply for a NFA letter from the overseeing agency. However, existing Site assessment data indicate elevated concentrations of PCE and TCE in soil that LARWQCB has required be addressed with active remediation.

Effectiveness – This remedial alternative will not address impact to the subsurface, is not protective of human health and the environment, and will not achieve regulatory-/risk-based cleanup goals developed for the Site. This remedial alternative does not reduce the toxicity, volume, or mobility of impacts to soil.

Implementability – This remedial alternative requires no equipment, labor force, permits, or other resources to implement, and therefore is readily implementable. As previously noted, existing Site assessment data indicate the presence of elevated concentrations of PCE and TCE in soil that LARWQCB has required be addressed by active remediation. This alternative is, therefore, not expected to be acceptable to regulatory agencies and the community.

Costs – There are no costs associated with this alternative; therefore, the alternative is cost effective.

This alternative was not retained for further consideration because it does not address known impact to the subsurface and it is not expected to be accepted by the regulatory agencies or community.

Copyright Kleinfelder 2010

Soil Vapor Extraction

SVE is an *in-situ* vadose zone soil vapor remediation alternative whereby vacuum is applied to the subsurface to induce the extraction of vapors and remove volatile and some semi-volatile organic compounds from the soil. Extracted soil vapors are treated to recover or destroy the contaminants.

Effectiveness – This remedial alternative will address impacts to the subsurface and is anticipated to be protective of human health and the environment. The alternative is expected to reduce the toxicity, volume, and/or mobility of impacts to soil via treatment. Treatment or adsorption of the extracted PCE and TCE poses minimal risk to the community, on-Site workers, and the environment.

Implementability – This remedial alternative has been implemented at properties with similar COCs in the subsurface, and therefore is expected to be technically feasible. Pilot testing must be performed, however, to assess the ROI of vapor extraction wells and whether this alternative will work at the Site as expected. This alternative requires equipment, labor force, raw materials, and resources that are readily available. This remedial alternative is expected to be acceptable to the regulatory agencies and community because it is the US EPA presumptive remedy for remediation of VOCs in soil and soil vapor.

Costs –Various costs are associated with this alternative, including those for permitting, equipment, labor, chemicals, utilities, and waste disposal. The estimated rough order of magnitude cost to perform SVE treatment at this Site ranges from $500,000 to approximately $750,000. These costs do not include performing an HBMS, hazardous building material abatement, or building demolition, should these be required prior to implementing this alternative. Costs may exceed this range if long-term (i.e., greater than 12 months) operations and maintenance (O&M) is needed.

Copyright Kleinfelder 2010

Excavation, On-Site Thermal Desorption, and Backfill and Compaction

This remedial alternative consists of excavating impacted soil, treating it on Site with a thermal oxidizer and using the treated soil to backfill the excavation. There may be a need to transport some soil off-Site to a licensed TSDF. Soil excavation may be achieved by the removal of pre-determined areas to pre-established depths (based on existing Site assessment data), followed by soil confirmation sampling at the lateral and vertical extent of the excavation to assess the need to further remove impacted soil in a targeted manner. An appropriately-sized thermal desorption unit will be mobilized to the Site and used to treat PCE and TCE in soil.

Effectiveness – This remedial alternative will address impact of PCE and TCE to the subsurface, but not Cr^{6+} impacts, and therefore alone will not be protective of human health and the environment. It is expected to reduce the toxicity, volume, and/or mobility of only the VOC COCs in soil, via treatment. However, this remedial alternative will not achieve regulatory-/risk-based cleanup goals developed for Cr^{6+}.

Implementability – This remedial alternative has been implemented at properties with similar COCs in the subsurface, and therefore is technically feasible. The implementation of this remedial alternative may cause long-term disruption and/or nuisance to the surrounding community due to various factors, including the possible shutdown of Goodwin Avenue, relocation of utilities, fugitive dust and VOCs, noise, and odor; however, various measures may be implemented to reduce this impact. This alternative would also have negative impacts to the environment including increased greenhouse gas emissions due to excavation and soil handling equipment. Other disadvantages of this alternative include the need to excavate the entire Site (approximately 64,000 cubic yards of soil); the use of extensive shoring during excavation; the proximity of the proposed excavation and risk of damage to extraction well GS-3; the use of off-Site soil staging area, and off-Site SVE equipment staging and operation, prolonging the implementation of the remedial alternative. This alternative requires equipment, labor force, raw materials, and resources that are readily available. The thermal desorption of PCE and TCE will provide long-term effectiveness and permanence, but will not address Cr^{6+}. For these reasons, this remedial alternative may not be acceptable to the regulators and the community.

Copyright Kleinfelder 2010

Costs –Various costs are associated with this alternative, including those for permitting, equipment, labor, chemicals, water, and waste disposal. This alternative is expected to be very expensive because of the need to excavate a large volume of soil prior to on-Site treatment of the impacted soil with a thermal desorption unit, and it is therefore cost-prohibitive in comparison to soil vapor extraction.

This alternative was not retained for further evaluation because it will be cost-prohibitive.

7.7 COMPARATIVE EVALUATION OF ALTERNATIVES FOR PCE AND TCE IN SOIL VAPOR

The SVE remedial alternative was the only alternative retained for further evaluation; therefore, there is no comparative evaluation of PCE and TCE remedial alternatives. The preferred remedial alternative for PCE and TCE in soil is SVE. The scope of activities pertaining to implementation of this remedial alternative is as shown above. A conceptual design of the SVE remedial alternative is presented in Section 9.0.
Selection of this alternative is appropriate because:

- SVE is the US EPA's presumptive remedy for VOC-impacted soil;
- the Site soils have characteristics that make SVE a favorable alternative;
- other than NFA, it is likely to be the lowest cost alternative for reducing VOC concentrations in the Site soil; and
- implementation of this remedial alternative would not cause temporary disruption and/or nuisance to the surrounding community associated with excavation.

Copyright Kleinfelder 2010

8. PROPOSED REMEDIAL ALTERNATIVE FOR CR^{6+} IN SOIL

8.1 DESCRIPTION OF REMEDIAL ALTERNATIVE FOR CR^{6+} IN SOIL

The preferred remedial alternative for addressing Cr^{6+} in soil is LDA/ISCR with an engineered cap. The estimated volume of affected soil requiring treatment is approximately 5,800 cubic yards, based on a cleanup goal for Cr^{6+} of 5.6 mg/kg. The estimated lateral and vertical extents of Cr^{6+}-impacted soil are shown on Plates 4A through 4D, and Plate 7B. A limited area of impacted soil extends the total depth of the vadose zone to groundwater, but much of the impacted area extends only to shallower depths. The vertical extent of impacted soil exceeding the Site-specific cleanup goal for Cr^{6+} will be treated by LDA /ISCR where impact does not extend to within 10 feet of groundwater. Areas with Cr^{6+}-impacted soil that extends to within 10 feet of groundwater and deeper will be treated with ISCR and stabilizing agent to a depth of approximately 35 feet bgs, leaving an approximate 10-foot thick buffer zone between 35 feet and 45 feet bgs that will be treated with stabilizing agent only.

Soil to 35 feet bgs (in designated areas) will be treated by ISCR prior to cement-stabilizing the interval from 35 to 45 feet bgs; therefore, Cr^{6+} above the 35- to 45-foot interval is expected to be reduced to Cr^{3+} prior to cement-stabilization of the 35- to 45-foot zone. This is intended to preclude the dragging of Cr^{6+} into the 35- to 45-foot interval.

The LDAs will be advanced using a center spacing as appropriate to provide 20 percent overlap of columns to mix impacted soil with the reducing and stabilizing agents (see Plate 7A). The LDAs are attached to appropriate equipment and advanced to the desired depth, with reducing and stabilizing agents delivered, via metering pump, down the center of the LDA mixing tool to optimize mixing of soil and reagents. The extent of soil to be treated, and the 10-foot-thick, cement-stabilized soil buffer zone that will be maintained, are shown on Plate 7B.

An engineered cap is proposed as part of the preferred alternative, because it will impede infiltration of rain water that might otherwise enter the vadose zone and potentially serve as a transport mechanism for the migration of COCs to groundwater.

Copyright Kleinfelder 2010

The cap will be designed in concert with the concrete truck apron currently planned for the Site, and is expected to consist of a base material, impermeable barrier, and concrete surface. The cap will cover approximately 11,500 square feet, as shown on Plate 6. The purpose of the engineered cap is to provide surface cover above the buffer zone where only cement stabilization will be used to treat the Cr^{6+}-impacted soil. The buffer zone will be installed between 35 and 45 feet bgs, within the 5.6 mg/kg Cr^{6+} isocontour (Plate 6). The cap will be designed to overlap this zone by as much as 50 feet on all sides.

This remedial alternative also includes the following:

8.1.1 Remedial design, permitting, and notifications.

8.1.2 Permitting, abandonment, and re-installation of two on-Site groundwater monitoring wells (that will be impacted by Site remedial activities; RAP Activity IV).

8.1.2.1 Re-installing Well MW-2R directly downgradient of the treatment area, between extraction well GS-3 and the treatment area (see Plate 2), for continued monitoring during RAP implementation of COCs in groundwater.

8.1.2.2 Re-installing Well MW-3R crossgradient of the treatment area, along the treatment area and crossgradient of extraction well GS-3 (see Plate 2), for continued monitoring during RAP implementation of COCs in groundwater.

8.1.2.3 Screening of the wells for CaSx, discoloration, and odors potentially resulting from treatment (monitoring of these wells after implementation, as well as monitoring other wells initially installed as part of Site characterization, is part of the regional groundwater remedy, which is not part of this RAP).

8.1.2.4 Related reporting activities.

Copyright Kleinfelder 2010

8.1.3 Land surveying of the treatment area.

8.1.4 Implementation of stormwater BMPs, Site security, and noise and visual barriers.

8.1.5 Confirmation testing of treated soil via laboratory analyses on a daily basis, as well as drilling and sampling of four confirmation sampling borings, each to a total depth of 45 feet below grade.

8.1.6 Loading and off-Site disposal of excess swell material to a Class III (and possibly Class I) TSDF (it is anticipated that the volume of swell material will be 20 to 30 percent of the total volume of soil treated).

8.1.7 Site restoration.

A deed restriction against the Site, referred to as a CERP, that corresponds to the restrictions attached as Appendix C, will be recorded against the Site after approval and execution by the LARWQCB's Executive Officer, simultaneously with the acquisition of title to the Site.

8.2 LARGE-DIAMETER AUGER MIXING/ISCR PILOT TESTING AND DESIGN

Prior to LDA /ISCR pilot testing a LDA/ISCR Pilot Test Workplan will be prepared. The Workplan will summarize the field procedures for the pilot test that will be performed, the testing schedule, and the data proposed for collection. The Workplan will be submitted to LARWQCB for approval prior to performing the pilot test.

A design package for potential contractors capable of implementing LDA /ISCR will be prepared. The bid package is anticipated to include a Site plan, logs of borings, plan-view and cross-section drawings illustrating the lateral and vertical extent of soil impact, specifications, and other relevant information. The bid package will be submitted to LARWQCB for review and approval prior to submittal to contractors.

Copyright Kleinfelder 2010

Field pilot testing of LDA/ISCR will be performed to confirm results of the bench-scale testing. Prior to performing the pilot test, a Site visit will be performed to observe potential overhead obstructions, utility locations, means of ingress and egress, potential safety issues, and other concerns that might impede field activities or cause safety-related issues. A land surveyor will be mobilized to the Site to survey and mark the location of the Cr^{6+}-impacted area for pilot testing, as well as the locations for full-scale field implementation. A private subsurface utility locating service will be mobilized to the Site to assess for the potential presence of subsurface features that may be encountered during the pilot testing. Additionally, Underground Service Alert (USA) will be notified at least 48 hours (2 business days) prior to the commencement of intrusive field work.

The LDA and support equipment will be mobilized to the Site to perform the pilot test. A staging area of approximately 50 feet by 50 feet will be required for on-Site storage of tanks, chemicals, and equipment. An area with diameter of approximately 5 feet will be treated using CaSx and stabilizing agents during the pilot test. The LDAs will be advanced to a maximum depth of 35 feet bgs, with injection and mixing of the CaSx reagent with impacted soil.

Some treated soil will surface during the rotation of the LDAs, and will be sampled and allowed to cure for approximately 7 days. After 7 days the sample will be submitted to an analytical laboratory and analyzed for total metals using US EPA Method 6020, for Cr^{6+} using US EPA Method 7199, and for leachable concentrations of metals per the SPLP using US EPA Method 1312. A confirmation boring will also be advanced in the treated area and samples will be collected from approximate depths of 5 feet and 15 feet bgs, and submitted for SPLP method analysis. Leachable concentrations of metals will be compared to the concentrations observed during bench-scale testing, to evaluate the correlation between bench-scale and pilot test results.

If the pilot test is not successful, alternative reducing agents will be evaluated. Only those reagents listed on general order number R4-2007-019 will be considered. In addition, stabilization using cement only will be evaluated.

Copyright Kleinfelder 2010

The California State Water Resources Control Board (SWRCB) requires acquisition of a WDR Permit prior to injection of materials into the subsurface for remediation purposes that have the potential to impact groundwater quality. LARWQCB has informed Kleinfelder that General Order Number R4-2007-0019, *Revised General Waste Discharge Requirements for Groundwater Remediation at Petroleum Hydrocarbon Fuel, Volatile Organic Compound and/or Hexavalent Chromium Impacted Sites*, is the general permit under which remedial activities at the Site will be performed (see Appendix Q).

8.3 ENGINEERED CAP

8.3.1 Proposed Cap Design

An engineered cap to impede infiltration of surface water will be designed and installed at the Site, with estimated lateral extent as shown on Plate 6 (approximately 11,500 square feet). The proposed cap will consist of a base, impermeable barrier, and 9-inch reinforced concrete surface layer. The cap will be designed as part of the truck apron proposed for the Site and will include features to impede infiltration of water from the surface into the subsurface. These features may include additional reinforcement to prevent cracking and a reduction in the quantity and/or sealing of construction and control joints.

8.3.2 Cap Maintenance Plan

Prior to implementation of the cap, a cap maintenance plan will be prepared and submitted to the LARWQCB for its approval. The maintenance plan will outline the cap inspection procedure and repair methods necessary to maintain its integrity. The plan will provide that an annual inspection and cap integrity report will be prepared and submitted to LARWQCB.

Copyright Kleinfelder 2010

8.4 LDA/ISCR PERMITTING

Implementation of this remedial alternative may require the acquisition of several key permits, including but not limited to:

- 90-Day Temporary Hazardous Waste Generator Permit
- WDR Permit from LARWQCB to allow for injection of the ISCR reagent(s);
- South Coast Air Quality Management District (SCAQMD) Rule 1166 Site-Specific Permit;
- National Pollutant Discharge Elimination System (NPDES) Stormwater Permit for construction, from LARWQCB;
- grading permit from the City of Los Angeles; and
- traffic control plan/permit from the City of Los Angeles.

The permit requiring the longest lead-time for LDA/ISCR is the WDR permit. Although CaSx is an LARWQCB-approved reducing agent, the acquisition of this permit may require up to 3 months for approval. Communication early and often with LARWQCB will be required to facilitate the project's permitting process.

An SCAQMD Rule 1166 permit will be required due to the planned disturbance of soil and potential for fugitive VOC emissions. The need for an NPDES permit for stormwater will be evaluated, depending upon the expected extent of the surface area that will be disturbed during implementation of the LDA/ISCR alternative. It is not presently expected that the NPDES permit will be required, but various stormwater BMPs will be implemented to mitigate the potential for surface water runoff to transport impacted Site soil to the surrounding environment. A grading permit from the City of Los Angeles will presumably be required before performing LDA/ISCR and before installing the engineered cap. A traffic control permit will be acquired to accommodate truck traffic entering and leaving the Site.

Additional permits may be required, as to be determined during interaction with regulatory agencies during the design phase of the remedial alternative.

Copyright Kleinfelder 2010

8.5 LDA/ISCR IMPLEMENTATION

Implementation of the LDA/ISCR remedial alternative will require, at a minimum, the following tasks:

- subsurface clearance;
- utilities capping/close-out;
- set up and maintain stormwater BMPs;
- field pilot testing;
- coring and injection of ISCR and stabilizing agents, requiring 6 to 7 weeks of field time, barring unforeseen events such as rain, limitations to truck traffic, limitations on hours of operations, or other possible complications;
- confirmation sampling;
- cap installation; and
- site restoration.

Security measures will be put in place to secure the Site throughout remediation. Fencing with enviroscreen, noise barriers, and stormwater BMPs will be installed. The equipment will be mobilized to the Site to an approximately 50-foot by 50-foot staging area for on-Site storage of tanks, chemicals, and equipment. Field pilot testing, as previously described, will be performed. Assuming that the pilot testing is successful, full-scale implementation of LDA/ISCR will commence.

During the implementation of LDA/ISCR, fugitive dust will require controls to limit potential impacts to on-Site workers and off-Site receptors per SCAQMD permit requirements, and possibly requirements of DTSC. The final remedial design documents will include a fugitive dust control plan. Dust control will be required during construction, demolition, excavation, soils and swell material handling, and other earthmoving activities, including but not limited to land clearing, grubbing, scraping, travel on Site, and travel on access roads to and from the Site.

Copyright Kleinfelder 2010

Soil within a surface area of approximately 3,800 square feet (5,800 cubic yards) will be treated with LDA/ISCR, and LDAs will be advanced to various depths depending on location, as shown on Plate 7A. The approximately 8-foot LDAs will be advanced on appropriate centers to provide 20-percent overlap of columns, to thoroughly mix impacted soil with the reducing and stabilizing agents. The LDAs are attached to appropriate equipment and advanced to the desired depth, with reducing and stabilizing agents delivered via metering pump down the center of the mixing tool to optimize mixing of soil and reagents. Impacted areas exceeding the Site-specific cleanup goals that do not extend to within 10 feet of groundwater will be treated by LDA/ISCR. Impacted areas extending within 10 feet of groundwater will be treated with ISCR and stabilizing agent to a depth of 35 feet bgs. CaSx will be applied in this treatment zone first, and allowed to reduce Cr^{6+} to Cr^{3+} for at least 24 hours, after which stabilizing agent will be applied from surface to 45 feet bgs, creating an underlying 10-foot thick buffer zone (between 35 feet and 45 feet bgs) treated with stabilizing agent (i.e., cement) only. The formulation of reducing and stabilizing agents may require modification throughout field implementation, depending on a number of parameters, including but not limited to soil types, the concentrations of metals in soil, and soil moisture content.

8.5.1 Performance Assessment

An LDA/ISCR Implementation Workplan will be prepared to describe the process and procedures for implementing this remedial alternative. This Workplan will include a discussion of LDA/ISCR performance assessment, which is summarized in this subsection.

Four performance assessment soil borings will be advanced within the soil treatment area following the application of CaSx and collection of performance assessment samples. The time frame for collecting performance assessment samples following CaSx application will be determined based on results of LDA/ISCR field pilot testing. Performance assessment samples will be collected from depths of 10 feet, 20 feet, and 30 feet bgs, and submitted to an analytical laboratory for analysis of Cr^{6+} using US EPA Method 7199. Sample collection and analysis will be performed per the quality assurance/quality control (QA/QC) discussion later in this document. If results of the

Copyright Kleinfelder 2010

performance assessment sample analyses indicate the Cr^{6+} soil cleanup goal (i.e. 5.6 mg/kg) has been achieved, the RAP activities will proceed with the application of the cement stabilizer. If results of the performance assessment sample analyses indicate the Cr^{6+} soil cleanup goal has not been achieved, the backup plan described in Section 8.5.2 will be implemented.

8.5.2 Backup Plan

If the Cr^{6+} soil cleanup goal is not achieved during the first application of CaSx, the soil will be re-treated. Additional performance assessment samples will then be collected in the re-treated areas to confirm the Cr^{6+} soil cleanup goal has been achieved. If the Cr^{6+} soil cleanup goal is achieved following re-treatment, the cement stabilizer will be applied.

If the Cr^{6+} soil cleanup goal is not achieved following the second application of CaSx, additional treatment with CaSx may be considered, or the cement stabilizer will be applied, depending on the magnitude of the discrepancy between the performance assessment results and the cleanup goal.

The cement stabilizer will be applied to the CaSx treated areas at a concentration based on results of LDA/ISCR field pilot testing. Following application of the cement stabilizer, additional performance assessment borings will be advanced and performance assessment samples collected as described in Section 8.5.1. The performance assessment samples will be submitted to an analytical laboratory and analyzed for Cr^{6+} in soil using US EPA Method 7199, and the leachable concentration of Cr^{6+} using the SPLP/US EPA Method 1312. If results of the performance assessment sample analyses indicate the Cr^{6+} soil concentration exceeds the Cr^{6+} soil cleanup goal, or the leachable concentration of Cr^{6+} exceeds the City of Glendale Voluntary Cleanup Goal (5 µg/L), consideration will be given to applying a higher concentration of cement.

If it is not possible to achieve the Cr^{6+} soil cleanup goal, or to immobilize Cr^{6+} sufficiently to reduce the leachable concentration of Cr^{6+} to below the City of Glendale Voluntary Cleanup Goal, then an HHRA will be performed to assess the risks associated with the

Copyright Kleinfelder 2010

residual concentrations of Cr^{6+} remaining in the vadose-zone soil. The HHRA will take into consideration the reduction of Cr^{6+} mobility resulting from installation of an engineered cap.

8.5.3 Site Restoration

Once LDA/ISCR is completed, the Site will be rough graded. Additional grading will be required prior to installation of the engineered cap. Compaction of soil, placement of various layers of the cap, including but not limited to a sand layer, impermeable barrier, base material, and 9-inch reinforced concrete surface layer, will be performed. Annual inspection and maintenance of the engineered cap will be required.

8.6 WDR PERMIT MONITORING

One year of quarterly groundwater monitoring and analyses is anticipated following completion of remedial activities. Monitoring will include a sampling and analysis program prepared in accordance with General WDR Permit R4-2007-0019, included in Appendix Q. Additional Site-specific requirements may be required by the LARWQCB approval letter. As previously stated, wells MW-2R and MW-3R (see Plate 2) will be included in post remediation monitoring. In addition, one or more of wells MW1, MW4, MW5, and/or MW6 may also be included in the monitoring well network. Consideration will be given to use of neighboring US EPA extraction wells as WDR monitoring points if their screening intervals are appropriate. After RAP implementation and WDR permit monitoring are completed, both on- and off-Site wells will be abandoned.

8.7 WASTE MANAGEMENT

Excess swell material that contains concentrations of Cr^{6+} below the Site-specific cleanup goals may be used during rough grading to level the Site surface prior to construction of the cap. Remaining excess swell material from the implementation of LDA/ISCR will be handled as IDW and placed into DOT-approved 55-gallon drums or roll-off bins for temporary storage on the Site, or loaded directly into trucks for off-Site disposal, once analytical results for profile samples are obtained and the IDW is profiled for disposal at an appropriate facility. Used PPE and disposable sampling equipment will also be drummed and managed as IDW.

Copyright Kleinfelder 2010

Decontamination fluids and other fluids generated during field activities will be handled as IDW and placed into DOT-approved 55-gallon drums for temporary storage on the Site until analytical results are obtained and the IDW is profiled for disposal at an appropriate facility.

A Transportation and Disposal Plan, including maps, for off-Site transportation and disposal of swell material and other waste materials will be required to manage the loading, transportation, and disposal of wastes generated during remedial activities. A Transportation and Disposal Plan was be prepared for the preferred remedial alternative, and is included as Appendix R.

8.8 HUMAN HEALTH RISK ASSESSMENT FOR SOIL

A Site-specific HHRA for residual concentrations of Cr^{6+} in soil is not planned. The SSLs calculated, and cleanup goals adopted, for metals in soil are risk-based values for the protection of human health and the environment. If cleanup goals for Cr^{6+} in soil are not achieved by the preferred remedial alternative, as indicated in Section 8.5.2, then an HHRA will be performed for the Site.

8.9 HEALTH AND SAFETY PLAN

Kleinfelder will prepare a Site-specific Health and Safety Plan (HASP) to be used on-Site during LDA/ISCR field activities. The HASP will be submitted to LARWQCB for review and approval prior to the performance of the proposed remedial field activities. Occupational Safety and Health Administration (OSHA) Hazardous Waste Operations (HAZWOPER) training will be required of all personnel engaged in field activities. Tailgate safety meetings are standard elements of Kleinfelder's HASPs. The Initial Draft HASP (Appendix S) specifies that health and safety tailgate meetings will be required, at a minimum, at the beginning of each work day, and prior to each new activity.

Copyright Kleinfelder 2010

8.10 REPORTING

A report documenting pilot testing, LDA/ISCR field activities, confirmation borings, plates, tables, field logs, analytical results, and other relevant information will be prepared and submitted to LARWQCB upon completion of RAP implementation. In addition, one year of quarterly WDR permit compliance reporting will be performed.

Copyright Kleinfelder 2010

9. PROPOSED REMEDIAL ACTION FOR PCE AND TCE IN SOIL VAPOR

9.1 CONCEPTUAL DESIGN FOR PCE AND TCE IN SOIL VAPOR

Kleinfelder's proposed remedial alternative for PCE and TCE in the Site vadose zone is to perform SVE using VPGAC adsorption, with the goal of reducing soil vapor concentrations of PCE and TCE to the practical limits of the technology.

It is estimated that VOCs in soil vapor extend laterally across most of the Site, as shown for TCE on Plate 8, and conservatively assumed that this impact extends vertically to 45 feet bgs (the approximate depth to groundwater beneath the Site). For the purpose of conceptual design, Kleinfelder has assumed that the effective ROI of a hypothetical SVE well installed at the Site will be approximately 60 feet, based on evaluation of available logs of borings and experience with SVE applications in vadose soil lithologies typical of those beneath the Site. Plate 8 shows the proposed placement of SVE wells, anticipated ROI of SVE wells, conceptual piping layout, and the proposed location of the equipment compound. The effective ROI will be assessed during SVE pilot testing activities, and vapor extraction wells will be installed with an appropriate spacing based on the pilot test results.

The conceptual design for the SVE system includes the following:

- a 20-foot by 20-foot equipment compound, surrounded by chain-link fencing with two, 10-foot wide gates, containing green enviroscreen and protected by permanent and/or removable bollards, to be installed in the parking lot;
- subsurface 2-inch diameter Schedule 40 polyvinyl chloride (PVC) vapor conveyance pipe, with top of pipe at a depth of approximately 24 inches bgs;
- tracer wire and caution tape to flag trenches;
- bedding sand approximately 12 inches thick;
- a piping manifold consisting of 2-inch diameter Schedule 80 PVC risers, 2-inch ball valves, sample ports, and 4-inch diameter Schedule 80 PVC manifold header, which will allow system optimization at the treatment compound;

Copyright Kleinfelder 2010

- SVE wells as described in Section 9.2;
- SVE unit with blower capable of 500 standard cubic feet per minute (SCFM), vacuum of 14 inches of mercury minimum, vapor/liquid separator, and two, 2,000-pound VPGAC vessels;
- a piping manifold between VPGAC vessels to allow for the opening/closing of valves to change the lead VPGAC vessel to lag position and vice versa; and
- installation of piping, conduit, utilities, compound, and equipment in accordance with applicable codes, ordinances, and regulations.

The above is a conceptual design only, and may require modification based on field SVE pilot testing and other Site-specific conditions. A final design package will be prepared following completion of the SVE pilot test.

9.2 INSTALLATION OF SVE WELLS

Initially, one dual-nested SVE well and two dual-nested vacuum observation wells will be installed at the Site to facilitate the performance of an SVE pilot test. These are shown on Plate 8, identified as wells VEW-1S/D, OBS-1, and OBS-2.

Once SVE pilot testing is completed and the effective ROI at the Site is calculated, additional dual-nested SVE wells will be installed. For the purpose of this RAP, it is assumed that a total of five dual-nested SVE wells (VEW-1S/D, and four additional unlabeled wells on Plate 8) and two vacuum observation wells (OBS-1 and OBS-2) will be installed at the Site to facilitate full-scale extraction of soil vapors from the vadose zone. The SVE wells will be nested, with screened intervals from 5 to 25 feet bgs, and from 30 to 45 feet bgs. The isolated screened intervals will enable SVE activities to be focused on targeted depths. Observation wells, OBS-1 and OBS-2, to be used during SVE pilot testing, will be screened similarly and could be added to the vapor extraction well network to enhance VOC recovery in the more highly impacted portions of the vadose zone. Spacing of the SVE wells will be based on results of pilot testing. SVE wells and vacuum observation wells will be installed under the direct supervision of a California-registered Professional Geologist.

Copyright Kleinfelder 2010

Prior to drilling, necessary permits will be obtained and a visit to the Site will be performed to mark boring locations, evaluate drilling rig accessibility, and identify overhead hazards. A private utility locating service will be subcontracted, USA will be notified, and a geophysical survey will be performed to identify detectable subsurface utilities before initiating drilling. Each proposed wellbore will initially be advanced using a hand auger or airknife to a depth of approximately 5 feet bgs. Drilling will be performed with a CME 85 (or comparable) drilling rig using 10-inch OD hollow-stem augers. Downhole drilling equipment will be high-pressure, hot water washed before each wellbore is drilled. Sampling equipment will be cleaned in a potable water-detergent solution and double rinsed in potable water before each sample is collected.

The SVE and observation wells will each be installed to a depth of approximately 45 feet bgs. Proposed well locations are shown on Plate 8. Each well will consist of a dual completion using 2-inch diameter Schedule 40 PVC casing, installed in borings advanced using a hollow-stem auger drilling rig employing industry-accepted methodology. The dual-completed wells will include screened intervals from approximately 5 to 25 feet bgs and 30 to 45 feet bgs, using 0.020-inch slotted casing for the screened intervals. A filter pack consisting of screen-washed No. 2/12 Monterey sand (or equivalent) will be placed from total depth to approximately 2 feet above the top of the well screen. A 2-foot thick layer of bentonite chips will be placed on top of the sand filter pack of the lower screened interval (and below the upper screened interval) to seal the annular space between the lower and upper filter pack intervals. A 3-foot-thick layer of hydrated bentonite chips will be placed on top of the upper sand filter pack as a seal, and the interval from the top of the bentonite chips to 2 feet bgs will be sealed with bentonite/cement grout. Each well will be completed at the ground surface with a traffic-rated well vault set in concrete. A well construction diagram depicting the proposed construction of the SVE wells is presented on Plate 9.

The boreholes will be logged by a geologist or engineer under the supervision of a California-registered Professional Geologist. Soil will be classified in general accordance with visual procedures as provided for by the United Soil Classification System (USCS) per ASTM International (ASTM) Designation D 2488-93.

Copyright Kleinfelder 2010

9.3 SVE PILOT TESTING

Prior to SVE pilot testing, a SVE Pilot Test Workplan will be prepared. The workplan will summarize the field procedures for a 1-day pilot test, the testing schedule, and the data proposed for collection. The workplan will be submitted to LARWQCB for approval prior to performing the pilot test. The purposes for the SVE pilot test will be to confirm the 60-foot ROI used to develop the conceptual SVE system, and to collect Site-specific performance data to be used in the final SVE system design.

During the 1-day SVE pilot test, vacuum step testing and constant rate testing will be performed, using the dual-completed vapor extraction well (consisting of wells VEW-1S and VEW-1D) for vapor extraction, and the two dual-completed observation wells (consisting of wells OBS-1S, OBS-1D, OBS-2S, and OBS-2D) as vacuum observation points. A mobile SVE system including blower, having a various locations permit from SCAQMD, will be used to perform the SVE pilot test. The SVE unit will be operated, monitored, and sampled in accordance with the requirements of the SCAQMD permit. An electrical generator may provide temporary power for operation of the SVE unit, to eliminate the need for on-Site power, although if an adequate local power supply is available it will be used. Flexible hoses will connect the blower to the extraction wells. Magnehelic™ gauges will be connected to the blower, extraction wells, and observation points to monitor vacuum readings. In addition, flow and temperature measurements will be monitored and recorded.

Soil vapor samples will be collected at various times, frequencies, and locations during the SVE pilot test. Vapor samples will be analyzed for PCE and TCE in accordance with US EPA Method TO-15.

Data collected during the SVE pilot test will be used to calculate mass removal rates, ROI, and achievable flow rates to facilitate a final remedial system design. Normalized plots of induced vacuum versus distance to observation wells, and an airflow model will be used to estimate the effective ROI at the Site. A simple airflow model will be constructed to estimate vapor velocities and assess the maximum well spacing that will meet the vapor velocity criteria.

Copyright Kleinfelder 2010

9.4 SVE SYSTEM DESIGN PACKAGE

An SVE system design package will be prepared, and will consist of:

- a drawing schedule;
- a Site plan showing vapor extraction wells, piping layout, and compound location;
- trench details for subsurface conveyance piping;
- trench details for subsurface conduit and utilities;
- a process and instrumentation diagram (P&ID) depicting the remedial system components, piping, utilities, controls, process information, and other relevant information;
- an equipment compound detail for fence with gates, safety barriers, equipment layout, manifold location, utility stub-ups, power pole, eyewash station and fire extinguisher, permit posting location, and warning and contact signage;
- construction notes;
- specifications for trenching, subsurface PVC piping and conduit installation, trench backfilling, soil compaction, asphalt and concrete, trench bedding material, waste disposal, utilities, and other relevant specifications; and
- specifications for the blower, vapor/liquid separator, VPGAC vessels and manifolding, VPGAC, and filters.

The design package will be submitted to LARWQCB for review and approval.

9.5 PERMITTING OF SVE SYSTEM

Prior to system installation, applicable permits for the installation and operation of the SVE system will be obtained from the City of Los Angeles Planning, and Building and Safety Departments, and the local fire authority. In addition, an air permit for operation of the remedial system will be obtained from SCAQMD. Utility permits will be obtained, and inspections will be scheduled, as required.

Copyright Kleinfelder 2010

Required permits are summarized below:

- SCAQMD air discharge permit for the SVE unit;
- City of Los Angeles Planning Department permit;
- City of Los Angeles Building and Safety Department permit, which will include review of mechanical, plumbing, and electrical plans; and
- electrical permit.

Typical SCAQMD Site-specific permit application processing can require from 4 to 6 months, even when using the expedited permitting process. The possible use of a vendor with various-location permitted equipment would enable sooner mobilization to the field, and more time-efficient achievement of remedial goals for VOCs in soil and soil vapors.

The City of Los Angeles will perform a plan check for compliance with planning and zoning requirements; and mechanical, plumbing, and electrical codes. A permit will be obtained from the City of Los Angeles Department of Water and Power for electrical service, and from the City of Los Angeles Building and Safety Department. The City of Los Angeles Fire Department will also be contacted for permitting requirements, but none are expected to be necessary.

A City of Los Angeles Department of Water and Power planner will be contacted to identify a power source for the operation of the SVE unit that will be capable of delivering adequate power supply to the treatment compound. Electrical plans will be prepared and submitted, along with plan check fees, by a licensed electrician. Electrical line design and installation will be performed in accordance with applicable codes, ordinances, and regulations. City of Los Angeles Department of Water and Power will provide plan check and inspections, as required, for electrical design drawings and installation. Electrical power supply will be brought from a nearby transformer and installed sub-grade to the equipment compound.

Copyright Kleinfelder 2010

9.6 INSTALLATION OF SVE SYSTEM

This subsection describes the conceptual installation of the subsurface piping and equipment compound, and the installation and shakedown of remediation equipment specified for the project. The system installation requirements may change based on SVE pilot testing.

A Site visit will be performed prior to subsurface piping and conduit installation to mark the proposed trench locations. USA will be contacted to clear public utilities. A private underground geophysical locator will be subcontracted to identify potential underground utilities, pipes, and other subsurface features that may be damaged if not identified prior to initiating work. In addition, Kleinfelder will implement subsurface clearance procedures, including the use of an air knife or manual probing, and other standard protocols, to minimize the potential for encountering subsurface features during intrusive work.

The installation of the SVE system and equipment will be performed in accordance with applicable codes, ordinances, and regulations.

Subsurface vapor conveyance piping will be sized based on field pilot testing results. Individual conveyance lines will connect the vapor extraction wells to the manifold in the equipment compound. Piping integrity testing will be performed prior to trench backfilling to assess proper installation of piping. Trenches will be approximately 3 feet deep, with bedding sand placed a minimum of 4 inches below and above the piping, and a minimum of 2 inches to either side of the trench walls. The remainder of the trenches will be backfilled with trench spoils where feasible to minimize off-Site disposal and soil import costs. Surface completions will match the surrounding asphalt or concrete, as appropriate.

Compaction testing will be performed during trench backfilling operations to document the percent compaction achieved. A minimum 90-percent relative compaction using ASTM Designation D 1557 will be achieved. A compaction test report will be prepared.

Copyright Kleinfelder 2010

Tracer wire and caution tape will be placed approximately 12 inches below grade to outline and protect subsurface piping. The Schedule 40 PVC pipe will transition to Schedule 80 PVC pipe for above-grade manifold piping at the equipment compound to provide increased strength and ultraviolet (UV) light resistance above grade. The vapor conveyance piping stub-ups in the equipment compound at the manifold will consist of 2-inch diameter Schedule 80 PVC risers, each with a 2-inch ball valve and sample/testing port. The main manifold header will consist of 4-inch diameter Schedule 80 PVC pipe with quick disconnects.

Excess soil cuttings derived from trench excavations will be placed in on-Site roll-off bins and properly disposed after profile characterization. Decontamination water will be contained in 55-gallon, DOT-rated steel drums, and stored on Site pending characterization and off-Site disposal.

The equipment compound will be located as shown on Plate 8. A 6-foot high screened chain-link fence, protected by permanent and/or removable steel bollards, will be constructed. A concrete pad will be constructed for the compound floor. Two, 10-foot-wide swing gates will be installed in the fencing of the compound.

A trailer- or skid-mounted 500-SCFM SVE blower (to be checked by pilot testing), filters, vapor/liquid separator, and VPGAC vessels will be installed in the equipment compound. The specific configuration of the equipment within the compound will be developed once pilot testing is completed and equipment sizing is finalized. Once equipment is offloaded and placed, Seismic Zone 4 tie-downs will be connected, if necessary. The contractor will make connections between the manifold piping and the inlet to the vapor/liquid separator. Piping connections will be made between equipment components; however, equipment specifications will require that equipment connections between components be made prior to shipment, whenever practical. Connections will be made from the electrical panel to the equipment motors, and from equipment to electrical grounding rods.

Copyright Kleinfelder 2010

9.7 REMEDIATION SYSTEM START-UP AND MONITORING

Prior to initiating start-up of the SVE system, an O&M manual will be prepared for the Site, including the following components:

- table of contents
- signature page
- contacts
- operating permits
- start-up, shutdown, and emergency shutdown procedures
- routine operations, inspections, and monitoring, complete with frequencies
- rebound testing procedures
- a Site plan with piping layout, vapor extraction wells, and equipment
- detailed P&ID
- critical equipment list
- monitoring logs
- maintenance logs

9.8 SVE SYSTEM OPERATIONS AND MAINTENANCE

O&M visits will be performed daily during the first week of SVE system operation, and monitoring and/or sampling will be performed in compliance with SCAQMD permit requirements. O&M Site visits will occur weekly after the first week of operation.

An effluent vapor sample will be collected for analytical laboratory analysis in accordance with US EPA Method TO-15 during the first week of operations. This sample will be collected as soon as the SVE system has stabilized, in accordance with the SCAQMD permit, to ensure compliance.

Copyright Kleinfelder 2010

The SVE remediation system will be operated continuously, with a vacuum blower extracting soil vapors from SVE wells, except for periods of regularly scheduled maintenance. System operations will be monitored in accordance with the SCAQMD permit. System effluent concentrations will be monitored using a PID calibrated to hexane. The system's influent concentrations will also be monitored to assess remediation progress and for permit compliance reporting. Influent and effluent samples will be collected on a monthly basis, and select vapor extraction well samples will be collected on a quarterly basis using Summa® canisters, glass bulbs, or syringes. These samples will be delivered, under chain-of-custody procedures, to a California State-certified laboratory for analysis of PCE and TCE per US EPA Method TO-15 (or equivalent).

Periodic maintenance will be performed on equipment components per the manufacturer's recommendations. Condensate collected by the water knock-out will be drained as necessary and temporarily stored on Site along with any extracted groundwater. The condensate will be disposed of in accordance with applicable protocols, and waste disposal manifests will be submitted with each progress report to LARWQCB.

9.9 SVE SYSTEM SHUTDOWN

The operation of the SVE system will be terminated when the practical limits of the SVE technology have been achieved. The practical limits of SVE technology will be demonstrated as follows:

1. During SVE system operation, the extracted soil vapors, and individual SVE well screened intervals, will be sampled (using Summa® canisters, glass bulbs, or syringes) and analyzed for total PCE and TCE on day 1 and monthly thereafter.
2. Weekly monitoring of the VOCs concentrations in vapors using a PID, at the influent to the SVE system and at individual SVE wells will be performed.
3. When four successive weekly vapor samples indicate that VOC concentrations have reached asymptotic conditions (i.e., the concentration difference between successive sampling events is negligible, and the total PCE and TCE concentrations are approaching *de minimis* values), the SVE system will be switched to pulse operation.

Copyright Kleinfelder 2010

4. During pulse operation the SVE system will be shut down for 2 weeks.
5. Following the system shutdown, Kleinfelder proposes to re-start the system and collect influent samples at the following frequencies: 1 day, 7 days, and every 2 weeks until two consecutive concentrations are at non-detect or asymptotic levels for PCE and TCE.
6. When the weekly monitoring indicates that VOC vapor concentrations measured with a PID have again reached asymptotic levels, the system will be shut down for another 2-week interval and the pulse operation cycle repeated.
7. The VOC vapor concentrations measured with a PID on day 1 of the SVE system startup and day 1 of each of the pulse operation cycle will be plotted.
8. This pulse operation will continue until the day-1 VOC vapor concentrations measured with a PID and PCE and TCE concentrations measured in a laboratory have reached asymptotic conditions. This will be considered to be the practical limits of the SVE technology.

9.10 HUMAN HEALTH RISK ASSESSMENT FOR PCE AND TCE IN SOIL

CHHSLs may not be achievable in the shallow vadose zone; therefore, it is proposed to remove PCE and TCE from the subsurface to the practical limits of the applicable SVE technology here described. A soil vapor survey will be conducted in the shallow vadose zone following shut down of the SVE system. Results of the soil vapor survey will be used to conduct an HHRA for the intended Site re-use. The HHRA will estimate the incremental lifetime cancer risks and non-cancer hazard that may be associated with PCE and TCE in soil vapor.

The HHRA will be prepared in general accordance with the following guidance documents:

- *Supplemental Guidance for Human Health Multimedia Risk Assessments of Hazardous Waste Sites and Permitted Facilities.* State of California, Environmental Protection Agency, Department of Toxic Substances Control, Sacramento, California. July, reprinted September 1993, corrected and reprinted August 1996.

Copyright Kleinfelder 2010

- *Risk Assessment Guidance for Superfund (RAGS), Volume 1: Human Health Evaluation Manual (Part A) (Interim Final),* USEPA 1989.
- *Interim Final Guidance for the Evaluation and Mitigation of Subsurface Vapor Intrusion to Indoor Air.* Department of Toxic Substances Control, California Environmental Protection Agency, Sacramento, California. December 15. Revised February 7, 2005.
- *RAGS, Volume 1: Human Health Evaluation Manual Supplemental Guidance – "Standard Default Exposure Factors" (Interim Final),* Publication 9285.7-01B, USEPA 1991.
- *Guidelines for Data Usability in Risk Assessment (Part A)*. Office of Solid Waste and Emergency Response, Publication OSWER9285.7-09A, USEPA 1992.
- *Exposure Factors Handbook*, Volumes I, II, and III, USEPA 1997a.
- *RAGS, Volume I: Human Health Evaluation Manual (Part D, Standardized Planning, Reporting and Review of Superfund Risk Assessments).* Office of Emergency and Remedial Response, Washington, DC, USEPA 2002a.
- *Human Health Toxicity Values in Superfund Risk Assessments*. OSWER 9285.7-53.
- *RAGS, Volume I: Human Health Evaluation Manual (Part E: Supplemental Guidance for Dermal Risk Assessment) Final, USEPA 2004a.*
- *National Oil and Hazardous Substances Pollution Contingency Plan, Final Rule. 40 CFR Part 300. USEPA. 1990.*
- *Role of the Baseline Risk Assessment in Superfund Remedy Selection Decisions. OSWER Directive 9355.0-30. Office of Solid Waste and Emergency Response, U.S. Environmental Protection Agency. Washington DC. April 22. USEPA 1991.*

Copyright Kleinfelder 2010

9.11 ENGINEERING CONTROLS

The SVE system will be operated until the practical limitations of the technology here described have been demonstrated. A soil vapor survey will be conducted in the shallow vadose zone following shutdown of the SVE system. See SVE System Shutdown, Section 9.8, for the protocol used to determine the practical limits of the SVE technology. Results of the soil vapor survey will be used to conduct an HHRA for the intended Site re-use. The need for implementation of active or passive vapor mitigation, if necessary, will be considered based on results of the HHRA.

9.12 SPILL CONTINGENCY PLAN

A Spill Contingency Plan was prepared to provide general guidance for spill response activities that may be required to address hazardous materials that may be encountered during the implementation of the LDA/ISCR, or other remedial activities. A Spill Contingency Plan is included as Appendix T.

9.13 HEALTH AND SAFETY PLAN

Kleinfelder will prepare a Site-specific HASP during VOC remediation field activities, including drilling, well construction, subsurface piping installation, utilities installation, and compound construction. The HASP will be submitted to LARWQCB for review and approval prior to the performance of the planned field activities. OSHA HAZWOPER training will be required of all personnel engaged in field activities. An initial draft HASP is in Appendix S.

9.14 SVE SYSTEM REPORTING

A 30-Day Start-up Report will be submitted to SCAQMD within 45 days of commencement of SVE system operation, as this is a typical SCAQMD permit requirement. A description of the remedial system will be presented in a "*Remedial System Installation and Start-up Report,"* which will be completed following remedial system installation and initiation of remedial system operations. Remediation progress reports will be submitted to LARQWCB on a quarterly basis. The closeout report will be submitted to the LARWQCB upon completion of SVE activities.

Copyright Kleinfelder 2010

9.15 SVE SYSTEM WASTE MANAGEMENT

IDW, including drill cuttings, wash water, and excavated soil generated during SVE well installation and subsurface piping installation activities, and condensate from the vapor-liquid separator in the equipment compound, will be placed in DOT-approved 55-gallon drums and temporarily stored on Site pending results of laboratory analyses. After profiling, IDW will be transported from the Site for disposal at an appropriate permitted facility. The carbon supplier will require sampling and profiling of spent VPGAC prior to transporting it off-Site for regeneration or disposal.

Copyright Kleinfelder 2010

10. PROPOSED BUILDING SURVEY, ABATEMENT AND DEMOLITION

Prior to demolition of the current Site building, an HBMS will be performed. The HBMS will be conducted according to a workplan that will be submitted to LARWQCB following approval of the RAP by LARWQCB. Based on the results of the HBMS, abatement specifications will be prepared and the hazardous materials within the building will be abated, demolition permits for the building will be acquired, and building demolition will be performed. A flowchart showing the sequencing of HBMS and demolition activities is included herein.

Building demolition will also include excavation and removal of a clarifier as discussed further below. A separate workplan will be prepared for this task, and submitted to LARWQCB.

10.1 HAZARDOUS BUILDING MATERIALS SURVEY

The purpose of the HBMS is to evaluate the presence, location, and quantity of accessible suspected hazardous building materials present in the Site structure that may represent a potential worker safety hazard if disturbed and/or may require special handling and/or disposal as hazardous waste as part of planned building demolition. Building materials to be surveyed will include suspect asbestos-containing materials (ACMs); suspect lead-based paint (LBP) and lead-containing paints (LCP); polychlorinated biphenyl (PCB)-containing oils; fluorescent light fixture ballasts; mercury-containing fluorescent light tubes and thermostats; and chlorofluorocarbon (CFC)-containing refrigerants. The HBMS will be performed in accordance with appropriate regulatory guidance documents.

10.2 HAZARDOUS BUILDING MATERIALS PERMITTING AND ABATEMENT

A performance-based Asbestos and Lead-Based Paint Abatement Specification will be prepared subsequent to the HBMS and prior to initiation of abatement activities. Notification to Cal-OSHA, SCAQMD, and other appropriate regulatory agencies will be provided prior to hazardous building material abatement activities.

Copyright Kleinfelder 2010

10.3 WASTE MANAGEMENT

Regulatory oversight for removal and disposal of waste materials is typically provided by a variety of Federal and State agencies. Wastes will be labeled, placarded, and transported per Code of Federal Regulations (CFR) 49. Waste disposal will be performed in accordance with the regulations described below:

- Title 22 (CCR Title 22);
- 40 CFR Part 761;
- 40 CFR Part 82.161;
- Land Disposal Restrictions.

10.4 REPORTING

A closure report documenting results of surveys and assessments, abatement activities, demolition, and disposal of hazardous building materials will be prepared for the project.

10.5 HBMS HEALTH AND SAFETY PLAN

A Site-specific HASP will be prepared by a qualified environmental professional. The HASP will include measures to protect Site workers and the general public by including engineering controls, monitoring, and security measures to limit unauthorized entry to the construction area, and reduce hazards outside it. Contractors would be required to have appropriate HAZWOPER training to work on the Site. A Contingency Plan specific to asbestos and LBP that may be encountered during abatement or demolition activities will be prepared with closure report and abatement specifications.

10.6 BUILDING DEMOLITION

The building at the Site, including remaining equipment, clarifier, and utilities, will be demolished in general accordance with Federal, State, and local guidelines. Appropriate County and local permits will be obtained prior to demolition. In addition, building demolition wastes will be disposed of in accordance with Federal, State, and local regulations. Prior to building demolition, a State of California-licensed abatement

Copyright Kleinfelder 2010

contractor will be retained to remove ACMs and asbestos-containing construction materials (ACCMs), chipping and peeling LBP (i.e., in fair or poor condition), and other potentially hazardous materials (PCBs, mercury, and CFCs) from Site structures.

10.6.1 General Building Demolition Scope of Work

Demolition work will be performed in accordance with Cal OSHA, SCAQMD 403, and other relevant regulations. A summary of the general sequence for demolition activities is included below:

- performance of an HBMS;
- preparation of abatement specifications;
- abatement of hazardous materials;
- pre-construction activities such as permitting and public notification;
- mobilization;
- utility abandoning, moving, or isolation;
- demolition of the existing building; and
- loading, transporting, and disposing of building demolition debris at a licensed facility.

A flowchart showing the sequencing of HBMS and demolition activities can be found in Appendix U.

10.6.2 Health and Safety of Personnel

A HASP will be prepared for demolition activities, with the goal of preventing injury and accidents. The contractor will be responsible for providing a safe work environment for employees, subcontractors, and visitors to the Site. A safe working environment can only be achieved by a coordinated effort by all employees and subcontractor personnel. If a task cannot be performed in a safe manner, demolition activities will be stopped, and modifications to the HASP and working procedures will be made prior to re-starting work.

Copyright Kleinfelder 2010

Daily tailgate meetings for contractor employees and subcontractors will be held prior to commencement of work activities, prior to a change in work activities, and as needed. These meetings are designed to discuss potential hazards associated with the work activities, emergency procedures, and the location and directions to the nearest hospital. Daily safety meeting logs will be maintained on Site at all times, and personnel attending the safety meetings will be required to sign the safety-meeting log to acknowledge attendance at tailgate safety meeting.

10.6.3 Concrete Slab and Footings Removal

Concrete demolition will consist primarily of removal of the building slab and footings. An excavator and appropriate support equipment will be used to demolish the concrete slab to grade elevation. Concrete debris will be handled, stockpiled, profiled, loaded, transported and disposed as appropriate.

The condition of sub-slab soils will be observed and documented following building demolition activities. Soil samples will be collected from areas of obvious discoloration, staining, pooling of liquids, precipitation of plating solutions, or other indications of possible contamination. Soil sampling, once the slab has been removed, is anticipated to be limited, because soil samples were collected from a depth of 1 foot from 37 of the soil borings advanced at the former Excello facility during the assessments performed by Ceres Associates at the Site in 2006 (Ceres Associates, 2006a/2006b).

10.6.4 Demolition Debris Transportation and Disposal

Demolition debris not recycled by the Contractor will be loaded into end dump trucks and hauled to an appropriate disposal facility. Trucks will be covered prior to leaving the Site. In accordance with California Assembly Bill 75, when possible, demolition debris will be diverted from landfills by recycling and re-use. Demolition debris will be hauled to licensed disposal facilities permitted to accept the generated demolition debris.

Copyright Kleinfelder 2010

10.6.5 Dust Abatement

Dust abatement will be implemented throughout demolition activities. Contractors will use a water truck and/or fire hose attached to a local hydrant to reduce the amount of dust generated during demolition operations. When necessary, a localized water spray will be applied at the source of demolition activities. Water spray will be used only when necessary to minimize the likelihood of runoff from the Site, as well as to reduce the occurrence of mud being tracked from the Site to surrounding streets. A backflow device will be installed at the hydrant locations utilized.

10.7 CLARIFIER REMOVAL

The three-stage clarifier located adjacent to the southern end of the Excello building will require removal as part of remedial activities. This task will include the following:

10.7.1 A Site visit for pre-excavation Site activities:

- 10.7.1.1 Mark Site and clarifier location for USA notification;
- 10.7.1.2 Site reconnaissance with excavation subcontractor;
- 10.7.1.3 Collect liquid and sediment samples from clarifier for pre-disposal waste characterization as required by the receiving facility.

10.7.2 Mobilize to the Site with subcontractor to pump-out the clarifier contents (if any) and subsequent rinsate liquids for off-Site disposal.

10.7.3 Excavate the clarifier and abandon in-place the lateral sewer line entering and exiting the clarifier by cutting and capping the lateral at the edge of the clarifier excavation.

10.7.4 Collect two confirmation soil samples from approximately 1 to 2 feet beneath the clarifier and submit the sample to a laboratory for the following analyses:

- 10.7.4.1 pH by US EPA Method 150.1/9045C
- 10.7.4.2 VOCs by US EPA Method 8260C
- 10.7.4.3 CCR Title 22 Metals by US EPA Methods 6010B/7471A
- 10.7.4.4 Cr^{6+} per US EPA Method 7199

Copyright Kleinfelder 2010

10.7.5 Over-excavate impacted soil beneath the clarifier to a maximum depth of 4 feet below the clarifier, after which Kleinfelder will consider the use of LDA/ISCR.

10.7.6 After clarifier removal and post-excavation confirmation sampling, the environmental subcontractor will backfill the excavation with fill material up to a level consistent with the surrounding surface grade.

A clarifier removal report will be prepared, containing the following:

- summary of geophysical survey of utilities, clarifier removal, field procedures; and post-excavation confirmation sampling analytical results;
- photographs of clarifier removal activities;
- waste disposal manifests; and
- key findings and recommendations for additional work, if any.

10.8 HBMS AND BUILDING DEMOLITION COSTS

The estimated costs for performing the HBMS and building demolition are approximately $240,000. These costs are preliminary, and may vary depending upon the results of the HBMS, quantity of hazardous materials identified and costs for abatement; and unknown costs due to unexpected utilities, construction debris costs, and a variety of other factors.

Copyright Kleinfelder 2010

11. QUALITY ASSURANCE/QUALITY CONTROL

Quality Assurance/Quality Control (QA/QC) procedures are intended to provide reasonable assurance that field sampling techniques are performed correctly and consistently, cross-contamination of samples during transport does not occur, proper analytical laboratory testing procedures and protocol are used, and analytical laboratory results are repeatable. The QA/QC procedures may involve collection of field and laboratory QA/QC samples, and performance of data review, verification, and validation. The QA/QC task-specific procedures will be established in future workplans for LDA/ISCR and SVE pre-field activity and RAP implementation tasks.

Copyright Kleinfelder 2010

12. PUBLIC PARTICIPATION

The goal of public participation activities for this project will be to educate and involve the public in agency approved activities; document issues and concerns the community surrounding the Site may have; and facilitate dialogue between the community, the LARWQCB, Cal/EPA, and the US EPA regarding proposed remedial activities to be performed at the Site. Kleinfelder will coordinate with LARWQCB and US EPA to develop the materials to be distributed and presented to the community. Public participation will be part of the overall remedial action process, and will include:

- preparing a community profile;
- preparing a Fact Sheet for the proposed remedial action to be performed at the Site;
- publishing a notice of the availability of the RAP for public review and comment in local newspapers or similar publications, through postings, and through postal mail;
- providing the RAP and other supporting documents to the local public library; and
- documenting public comments received regarding the RAP. Kleinfelder understands that LARWQCB will perform this task.

The community profile will be prepared prior to submitting the notifications for the public meetings planned for the project. The profile will include the following information:

- population affected by the remedial actions;
- demographic and educational composition of the population affected;
- local business and industry; and
- local hospitals, health care facilities, and schools.

Copyright Kleinfelder 2010

A copy of the RAP will be made available to the public for a minimum of 30 days. A notice alerting the community to the availability of the RAP will be published in a local newspaper with general circulation in the vicinity of the Site and notices may be posted in the Site's neighborhood. Additionally, owners of properties contingent to the Site will be provided notice by postal mail. At least one public meeting will be coordinated to provide the community the opportunity to learn about the project and make comments or provide concerns related to the proposed remedial action. The RAP will be made available at the following and/or other applicable locations, based on Kleinfelder's coordination with LARWQCB:

Glendale Public Library
222 East Harvard Street,
Glendale, CA
(818) 548-2020

Once the public comment period is completed, LARWQCB will review and respond to the comments as appropriate. Responses to comments will be amended to the RAP. If significant changes to the RAP are required, as determined by the LARWQCB, it will be revised and resubmitted for public review and comment.

Copyright Kleinfelder 2010

13. SCHEDULE

Upon LARWQCB's approval of this RAP and transfer of the Site to the prospective purchaser, remedial activities will be initiated. It is expected that the permitting and implementation of the LDA/ISCR portion of the project will require approximately 6 to 9 months. It is anticipated the permitting and implementation of the SVE portion of the project will require approximately 15 to 18 months. The schedule attached as Appendix V, and the task list provided below are based on Kleinfelder's present understanding of the project, permitting, and contractor availability. Note that SVE may be performed concurrently elsewhere on the Site while LDA/ISCR remediation is performed in the areas with Cr^{6+} concentrations exceeding the Site-specific Cr^{6+} cleanup goal.

Key milestones for the LDA/ISCR portion of the project, together with time estimates for their implementation, are listed below. A more comprehensive schedule is included as Appendix V. As described in the schedule, certain legal tasks prerequisite to transfer title of the property to the prospective purchaser will be performed between approval of the RAP and change of ownership. Therefore, an updated schedule will be prepared upon initiation of remedial activities. The various RAP implementation activities discussed herein have been numbered for ease of reference in future discussions regarding the Site. The project schedule will be updated with each RAP implementation task workplan.

Copyright Kleinfelder 2010

13.1 CONCEPTUAL LDA/ISCR PRE-FIELD ACTIVITIES

13.1.1 WDR Permitting (to begin immediately following submittal of RAP) – 2 to 3 months (with task scope described in Section 8.4)

13.1.2 HMBS and Reporting – 4 to 6 weeks (with task scope described in Section 10)

13.1.3 HBMS Specifications Preparation and Bidding – 4 weeks (with task scope described in Section 10)

13.1.4 SCAQMD Notification – 2 weeks (with task scope described in Section 10.2)

13.1.5 LDA/ISCR and SVE Pilot Test Workplan Preparation – 4 weeks (with task scope described in Section 8.2)

13.1.6 Agency LDA/ISCR and SVE Pilot Test Workplan Approval – 4 weeks

13.1.7 LDA/ISCR Design Package Preparation – 4 to 6 weeks (with task scope described in Section 8.2)

13.1.8 LDA/ISCR Implementation Workplan – 4 weeks (with task scope described in Section 8.5)

13.1.9 Agency LDA/ISCR Implementation Workplan Approval – 4 weeks

13.1.10 Engineered Cap Design – 2 months (with task scope described in Section 8.3.1)

13.1.11 Cap Installation and Maintenance Plan – 4 weeks (with task scope described in Section 8.3)

13.1.12 Cap Installation and Maintenance Plan Approval – 4 weeks

Copyright Kleinfelder 2010

13.2 CONCEPTUAL LDA/ISCR RAP IMPLEMENTATION

13.2.1 Hazardous Building Materials Abatement – 4 weeks (with task scope described in Section 10)

13.2.2 HBMS Closeout Documentation – 2 to 4 weeks (with task scope described in Section 10.4)

13.2.3 Building Demolition Permitting and Implementation – 4 to 6 weeks (with task scope described in Section 10.6)

13.2.4 LDA Rig and Equipment Mobilization – 4 to 6 weeks (with task scope described in Section 8.5)

13.2.5 LDA/ISCR Field Pilot Test – 3 to 4 weeks (with task scope described in Section 8.5)

13.2.6 LDA/ISCR Field Implementation – 6 to 7 weeks (with task scope described in Section 8.5)

13.2.7 LDA Rig and Equipment Demobilization and Site Restoration – 3 to 5 weeks (with task scope described in Section 8.5.3)

13.2.8 Engineered Cap Installation – 4 to 6 weeks (with task scope described in Section 8.5)

13.2.9 LDA/ISCR Closeout Reporting – 2 months (with task scope described in Section 8.10)

Key milestones for the SVE portion of this project are listed below, together with time estimates for their implementation. A more detailed schedule will be prepared upon project initiation.

Copyright Kleinfelder 2010

13.3 CONCEPTUAL SVE PRE-FIELD PILOT TESTING AND DESIGN ACTIVITIES

13.3.1 SVE Pilot Test Workplan Preparation – 4 to 6 weeks (with task scope described in Section 9.3)

13.3.2 Install SVE Pilot Test Wells – 3 weeks (with task scope described in Section 9.2)

13.3.3 SVE Pilot Test and Calculations – 3 weeks (with task scope described in Section 9.3)

13.3.4 SVE System Design – 3 weeks (with task scope described in Sections 9.3 and 9.4)

13.3.5 SVE System Permitting – 3 to 4 weeks (with task scope described in Section 9.5)

13.4 CONCEPTUAL SVE RAP IMPLEMENTATION

13.4.1 Install SVE Wells, Piping, and SVE System – 2 months (with task scope described in Sections 9.2 and 9.6)

13.4.2 SVE System Start-Up – 2 weeks (with task scope described in Section 9.7)

13.4.3 SVE System O&M – 12 months (with task scope described in Section 9.8)

13.4.4 Rebound testing – 2 months (with task scope described in Section 9.9)

13.4.5 Closeout Reporting – 2 months (with task scope described in Section 9.14)

13.4.6 Preparation of an HHRA for residual concentrations of PCE and TCE in soil vapor – 2 months (with task scope described in Section 9.10)

Copyright Kleinfelder 2010

14. LIMITATIONS

This work was performed in a manner consistent with that level of care and skill ordinarily exercised by other members of Kleinfelder's profession practicing in the same locality, under similar conditions, and at the date the services are provided. Our conclusions, opinions, and recommendations are based on a limited number of observations and data. We have, however, satisfied ourselves that the quantity and nature of the existing observations and data are appropriate in our professional opinion to support our work per the standard of care to which we adhere. It is possible that conditions could vary between or beyond the data evaluated. Kleinfelder makes no other representation, guarantee, or warranty, express or implied, regarding the services, communication (oral or written), report, opinion, or instrument of service provided.

This document may be used only by Kleinfelder's Client, and only for the purposes stated for this specific engagement within a reasonable time from its issuance, but in no event later than 2 years from the date of the document. The foregoing notwithstanding, this document may be submitted by The Spirito Family Trust to LARWQCB in accordance with LARWQCB's requirements. However, by this action, no rights of reliance are granted to The Spirito Family Trust. Non-commercial, educational, and scientific use of this report by regulatory agencies is regarded as a "fair use" and not a violation of copyright.

It should be recognized that definition and evaluation of geologic and environmental conditions comprise a difficult and inexact science. Judgments leading to conclusions and recommendations are generally made with incomplete knowledge of the subsurface conditions present due to the limitations of data from field studies. Although risk can never be eliminated, more-detailed and extensive studies yield more information, which may help understand and manage the level of risk. More extensive studies, including subsurface studies or field tests, may be performed to reduce uncertainties.

Copyright Kleinfelder 2010

During the course of the performance of Kleinfelder's services, hazardous materials may be discovered. Kleinfelder assumes no responsibility or liability whatsoever for any claim, loss of property value, damage, or injury that results from pre-existing hazardous materials being encountered or present on the Site, or from the discovery of such hazardous materials. Nothing contained in this document should be construed or interpreted as requiring Kleinfelder to assume the status of an owner, operator, or generator, or person who arranges for disposal, transport, storage, or treatment of hazardous materials within the meaning of any governmental statute, regulation, or order. The Client/owner is solely responsible for directing notification of all governmental agencies, and the public at large, of the existence, release, treatment, or disposal of any hazardous materials observed at the Site, either before or during performance of Kleinfelder's services.

Health-based screening evaluations, such as the J&E Model, are subject to limitations imposed by the scientific information available at the time of the assessment. The work described in this document is not designed to quantify or identify all potential risks to human health that might be associated with the chemical releases at the Site. The work also does not provide a guarantee regarding the amount of risk at the Site. Risks quantified reflect only the CSM and exposure pathways identified in the document. In addition, risk estimates may change as new scientific or technical information becomes available that may modify the CSM, exposure assessment parameters, and toxicity values. Other risk assessment professionals may reasonably employ different approaches and methods to those described herein.

Copyright Kleinfelder 2010

15. REFERENCES

AeroVironment Inc., 1993. Letter report with subject "Soil Vapor Survey Report, Excello Plating." December 9.

_____, 1994. *Phase II Soil Vapor Survey Report for Excello Plating Inc., 4057 Goodwin Avenue, Los Angeles, California, LARWQCB File No. 113.5243*. September.

American Scientific Laboratories, LLC, 2009. Analytical laboratory report of results ordered by City of Glendale Water & Power for 4057 Goodwin Avenue. May 5.

California Department of Water Resources (CDWR), 2004. California Groundwater – Bulletin 118, Update 2003.

California Environmental Protection Agency (Cal/EPA), 2003. *Guide to Public Health Goals (PHGs) for Chemicals in Drinking Water*. Office of Environmental Health Hazard Assessment (OEHHA). October.

_____, 2004. *Interim Final Guidance for the Evaluation and Mitigation of Subsurface Vapor Intrusion to Indoor Air*. December 15. Revised February 7, 2005.

_____, 2005a. *Use of California Human Health Screening Levels (CHHSLs) in Evaluation of Contaminated Properties*. January.

_____, 2005b. *Recommended DTSC Default Exposure Factors for Use in Risk Assessment at California Military Facilities.* Department of Toxic Substances Control, Sacramento, California. October 27.

_____, 2009. *Screening-Level Model for Soil Gas Contamination. February 4.* Downloaded on June 19, 2009 from: http://www.dtsc.ca.gov/AssessingRisk/JE_Models.cfm.

Copyright Kleinfelder 2010

California Geological Survey (1998). *Seismic Hazard Zone Report for the Burbank 7.5-Minute Quadrangle, Los Angeles County, California*. Plate 1.2, Historically Highest Ground Water Contours and Borehole Log Data Locations, Burbank Quadrangle. 1998.

CCI, 2008. *Groundwater Monitoring Report Third Quarter 2008, Former Excello Plating Company, 4057 Goodwin Avenue, Los Angeles, California 90039, RWQCB File No. 113.5243*. October 15.

_____, 2009. *Groundwater Monitoring Report First Semi-Annual 2009, Former Excello Plating Company, 4057 Goodwin Avenue, Los Angeles, California 90039, RWQCB File No. 113.5243*. June 30.

_____, 2010a. *Groundwater Monitoring Report Second Semi-Annual 2009, Former Excello Plating Company, 4057 Goodwin Avenue, Los Angeles, California 90039, RWQCB File No. 113.5243*. January 15.

_____, 2010b. *Groundwater Monitoring Report First Semi-Annual 2010, Former Excello Plating Company, 4057 Goodwin Avenue, Los Angeles, California 90039, RWQCB File No. 113.5243*. July 28.

Ceres Associates, 2006a. *Soil and Groundwater Sampling Report, Excello Plating Company, 4057 Goodwin Avenue, Los Angeles, California 90039, RWQCB File No. 113.5243*. April 4.

Ceres Associates, 2006b. *Report of Additional Soil Sampling, Excello Plating Company, 4057 Goodwin Avenue, Los Angeles, California 90039, RWQCB File No. 113.5243*. November 9.

Ceres Associates, 2008. *Monitoring Well Installation and 2nd Quarter 2008 Monitoring Report, Excello Plating Company, 4057 Goodwin Avenue, Los Angeles, California 90039, RWQCB File Number 113.5243*. July 30.

City of Glendale, 2002. City Council motion concerning hexavalent chromium concentration in treated water placed into City recycled water supply, adopted January 29.

Copyright Kleinfelder 2010

City of Glendale Department of Water and Power (CGDWP), 2008. Personal communication with Mr. Don Froelich and Mr. Leighton Fong. November 24.

Daly Environmental Services (Daly), 1996. *Results of a Soil Gas Survey and Groundwater Investigation, Excello Plating Company, Inc., 4057 Goodwin Avenue, Los Angeles, California 90039*. September 30.

Environmental Data Resources, Inc. (EDR), 2007. *The EDR Radius Map Report with GeoCheck®, 4841 San Fernando Road West, Los Angeles, CA 90039*. Inquiry Number: 1915935.2s. May 1.

Environmental Recovery Services, Inc., 2006. Above Ground Facility Cleanup Documentation. March.

Environmental Quality Management, Inc. (EQM), 2004. *User's Guide for Evaluating Subsurface Vapor Intrusion into Buildings*. Prepared for Industrial Economics Incorporated, Cambridge, Massachusetts under US EPA Contract 68-W-01-058. Revised February 22.

James M. Montgomery, Consulting Engineers, Inc. (JMM), 1992. *Remedial Investigation Report for the Glendale Study Area*. Submitted to Department of Water and Power, City of Los Angeles, California. January.

Kleinfelder, 2008a. *Workplan for Supplemental Site Assessment, The Spirito Family Trust Parcel, 4057 Goodwin Avenue, Los Angeles, California 90039*. August 22.

Kleinfelder, 2008b. *Supplemental Site Assessment, The Spirito Family Trust Parcel, 4057 Goodwin Avenue, Los Angeles, California 90039*. November 26.

Kleinfelder, 2009. *Site-Specific Cleanup Goals Workplan, The Spirito Family Trust Parcel, 4057 Goodwin Avenue, Los Angeles, California 90039*. November 19.

Kleinfelder, 2010. *Draft Remedial Action Plan for the Spirito Family Trust Parcel, 4057 and 4059 Goodwin Avenue (including the Former Excello Plating Co. Inc. Facility), City of Los Angeles, County of Los Angeles, California*. January 19.

Copyright Kleinfelder 2010

Los Angeles County Department of Public Health, Environmental Health Division, Drinking Water Program (LACDPH), 2009. Personal communication. August 10.

Los Angeles Regional Water Quality Control Board (LARWQCB), 1994. *Water Quality Control Plan, Los Angeles Region*.

LARWQCB, 2008. Letter to Ms. Alice C. Clarno of The Spirito Family Trust. September 15.

LARWQCB, 2002. *Chromium VI Investigation: San Fernando Valley Phase I: Inspections Final Report*. November

Los Angeles Times, 1955. Newspaper article entitled "Spectators Saved by Heroic Fireman: Dashes to Edge of Roaring Chemical Blaze and Steers Gasoline Truck to Safety." Page 2, Part I. September 13.

Office of Environmental Health Hazard Assessment (OEHHA), 2009a. *Draft Public Health Goal for Hexavalent Chromium in Drinking Water*. August.

_____, 2009b. OEHHA toxicity criteria database.

United States Environmental Protection Agency (US EPA), 1991. Management of Investigation-Derived Wastes during Site Inspections. OERR Directive 9345.3-02. May.

_____, 1996a. *Soil Screening Guidance: User's Guide, Second Edition*. Office of Solid Waste and Emergency Response. July.

_____, 1996b. *Soil Screening Guidance: Technical Background Document*. EPA/540/R95/128. May.

US EPA, 1996c. *Test Methods for Evaluating Solid Waste, Volumes IA through IC, SW-846, Third Edition. Updates I, II, IIA, IIB, and III*. OSWER. Washington, D.C. December.

Copyright Kleinfelder 2010

_____, 1996d. *User's Guide to VOCs in Soil Presumptive Remedy.* July.

_____, 2002a. *OSWER Draft Guidance for Evaluating the Vapor Intrusion to Indoor Air Pathway from Groundwater and Soils (Subsurface Vapor Intrusion Guidance).* December.

_____, 2002b. *Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites.* OSWER. December.

_____, 2008a. *First Five-Year Review Report for San Fernando Valley – Area 2 Superfund Site, Los Angeles County, California*. August.

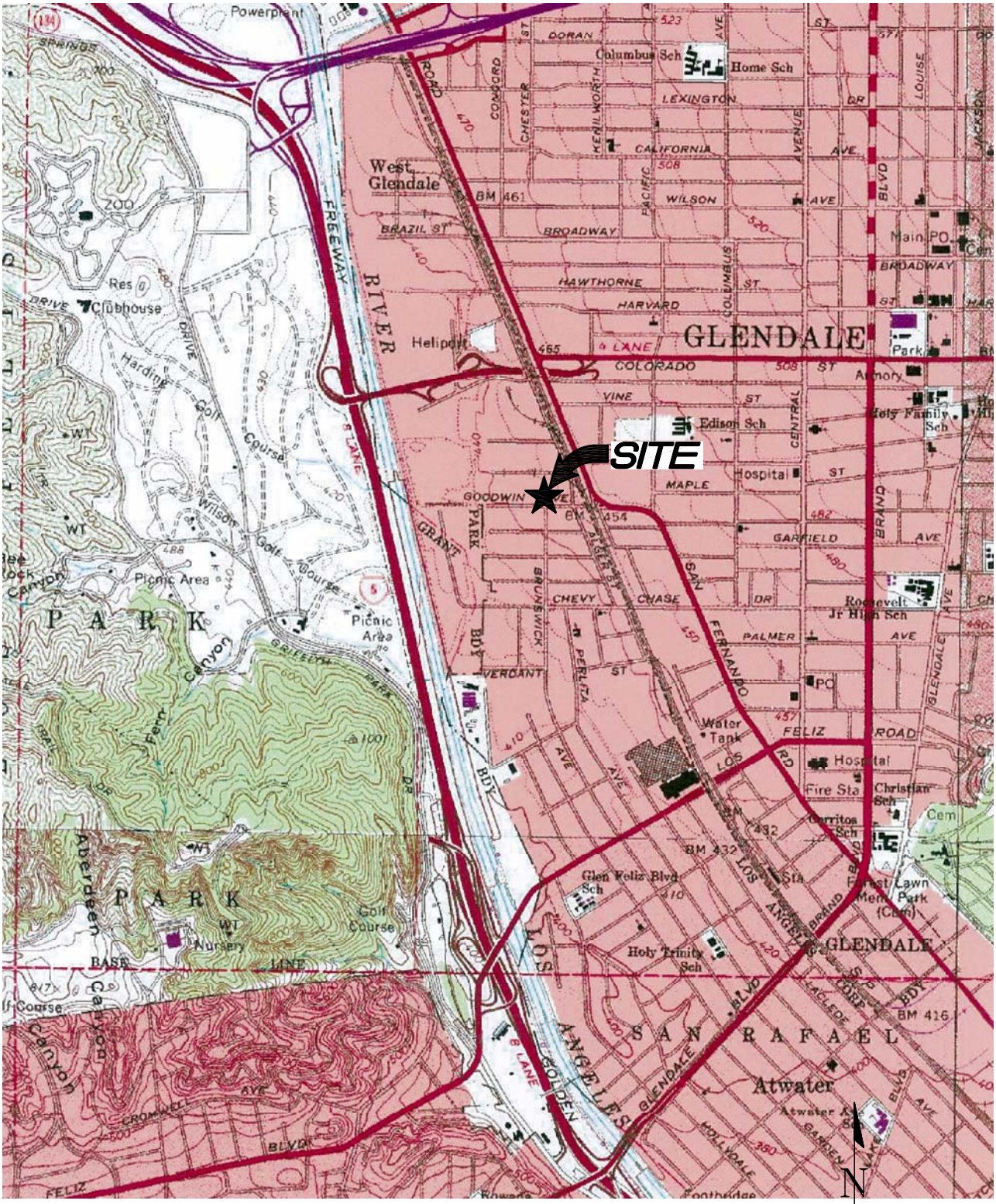
_____, 2008b. *Regional Screening Levels for Contaminants at Superfund Sites*. http://www.epa.gov/region09/waste/sfund/prg/index.html. September 12.

_____, 2009. Personal communication with John Lindquist, US EPA Consultant.

USGS, 2005. *Preliminary Geologic Map of the Los Angeles 30' x 60' Quadrangle, Southern California, Version 1.0*. Compiled by Robert F. Yerkes and Russell H. Campbell, digital preparation by Rachel Alvarez and Kelly Bovard, Open-File Report 2005-1019.

Copyright Kleinfelder 2010

PLATES



SOURCE: U.S.G.S. 7.5' topographic series, Burbank, California quadrangle dated 1966, photorevised 1972.

The Information included on this graphic representation has been compiled from a variety of sources and is subject to change without notice. Kleinfelder makes no representations or warranties, express or implied, as to accuracy, completeness, timeliness, or rights to the use of such information. This document is not intended for use as a land survey product nor is it designed or intended as a construction design document. The use or misuse of the information contained on this graphic representation is at the sole risk of the party using or misusing the information.

KLEINFELDER
Bright People. Right Solutions.
www.kleinfelder.com

PROJECT NO.	101942
DRAWN:	9/2010
DRAWN BY:	MRG
CHECKED BY:	PD
FILE NAME:	101942p1.dwg

SITE VICINITY MAP

EXCELLO PLATING CO., INC.
4057 AND 4059 GOODWIN AVENUE
LOS ANGELES, CALIFORNIA

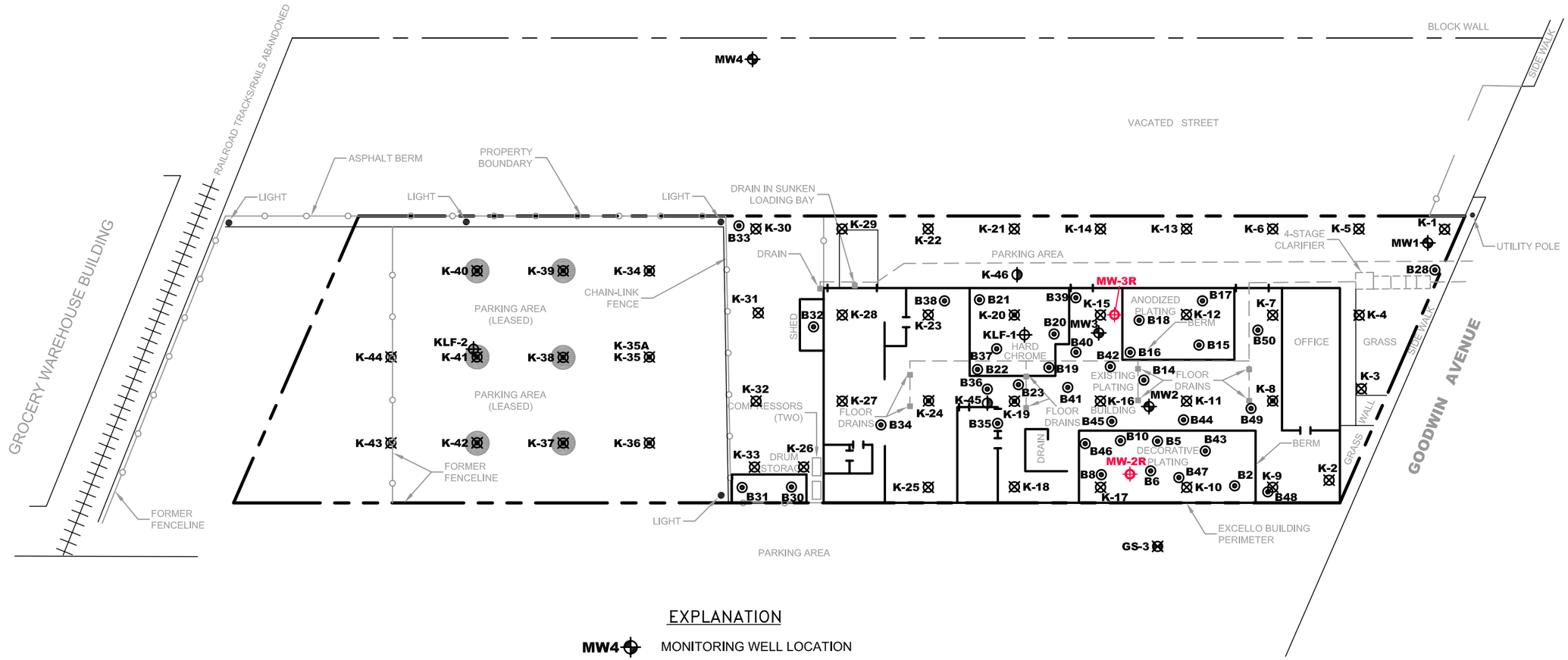
PLATE **1**

ATTACHED IMAGES: Images: 92124p1.JPG
ATTACHED XREFS:
Diamond Bar, CA

CAD FILE: L:\2010\CADD\101942\ LAYOUT: 1

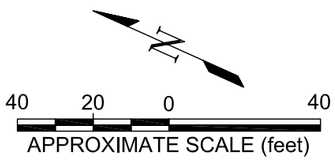
PLOTTED: 24 Sep 2010, 11:18am, mgriffin

PLOTTED: 24 Sep 2010, 11:19am, mgriffin
CAD FILE: L:\2010\CADD\101942\ LAYOUT: 2
ATTACHED IMAGES:
ATTACHED XREFS:
DIAMOND BAR, CA



EXPLANATION

MW4	MONITORING WELL LOCATION
K-33	KLEINFELDER VAPOR PROBE LOCATION
B50	CERES SOIL BORING LOCATION
K-44	KLEINFELDER SOIL BORING AND VAPOR PROBE LOCATION
K-46	KLEINFELDER SOIL BORING LOCATION
GS-3	EXTRACTION WELL LOCATION
KLF-2	PHYSICAL PARAMETER SOIL BORING LOCATION
MW-3R	PROPOSED REPLACEMENT WELL
	BURIED CONCRETE LAYER ENCOUNTERED



The information included on this graphic representation has been compiled from a variety of sources and is subject to change without notice. Kleinfelder makes no representations or warranties, express or implied, as to accuracy, completeness, timeliness, or rights to the use of such information. This document is not intended for use as a land survey product nor is it designed or intended as a construction design document. The use or misuse of the information contained on this graphic representation is at the sole risk of the party using or misusing the information.

KLEINFELDER
Bright People. Right Solutions.
www.kleinfelder.com

PROJECT NO.	101942
DRAWN:	9/2010
DRAWN BY:	MRG
CHECKED BY:	PD
FILE NAME:	101942p2_SP.dwg

SITE PLAN

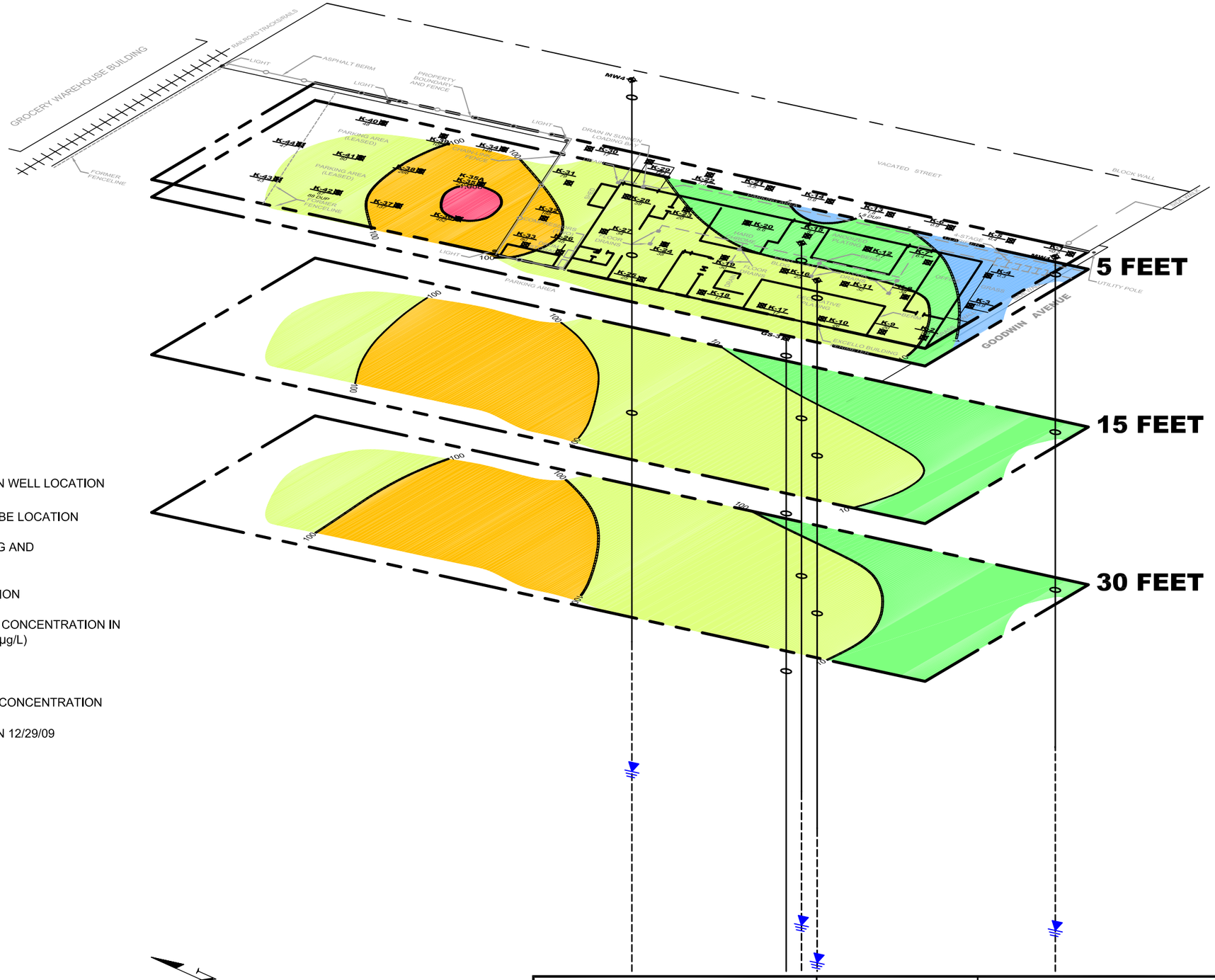
EXCELLO PLATING CO., INC.
4057 AND 4059 GOODWIN AVENUE
LOS ANGELES, CALIFORNIA

PLATE
2

PLOTTED: 24 Sep 2010, 11:33am, mgriffin

CAD FILE: L:\2010\CADD\101942\ LAYOUT: 3A

ATTACHED IMAGES:
ATTACHED XREFS:
DIAMOND BAR, CA



EXPLANATION

- **GS-3** ⊠ KLEINFELDER EXTRACTION WELL LOCATION
- **K-33** ⊠ KLEINFELDER VAPOR PROBE LOCATION
- **K-44** ⊠ KLEINFELDER SOIL BORING AND VAPOR PROBE LOCATION
- **MW-4** ⊕ MONITORING WELL LOCATION
- *2,043* TRICHLOROETHENE (TCE) CONCENTRATION IN MICROGRAMS PER LITER (µg/L)
- *1.8 DUP* FIELD DUPLICATE SAMPLE
- 1,000 ESTIMATED CONTOUR OF CONCENTRATION
- GROUNDWATER DEPTH ON 12/29/09
- BLANK WELL CASING
- SCREEN INTERVAL
- >1,000 µg/L
- 100-1,000 µg/L
- 10-100 µg/L
- 1-10 µg/L
- <1 µg/L

The information included on this graphic representation has been compiled from a variety of sources and is subject to change without notice. Kleinfelder makes no representations or warranties, express or implied, as to accuracy, completeness, timeliness, or rights to the use of such information. This document is not intended for use as a land survey product nor is it designed or intended as a construction design document. The use or misuse of the information contained on this graphic representation is at the sole risk of the party using or misusing the information.

N

50 25 0 50

APPROXIMATE SCALE (feet)

KLEINFELDER
Bright People. Right Solutions.
www.kleinfelder.com

PROJECT NO.	101942
DRAWN:	9/2010
DRAWN BY:	MRG
CHECKED BY:	PD
FILE NAME:	101942p3A_TCE_ISO.dwg

TCE ISOCONCENTRATIONS IN SOIL VAPOR VERSUS DEPTH

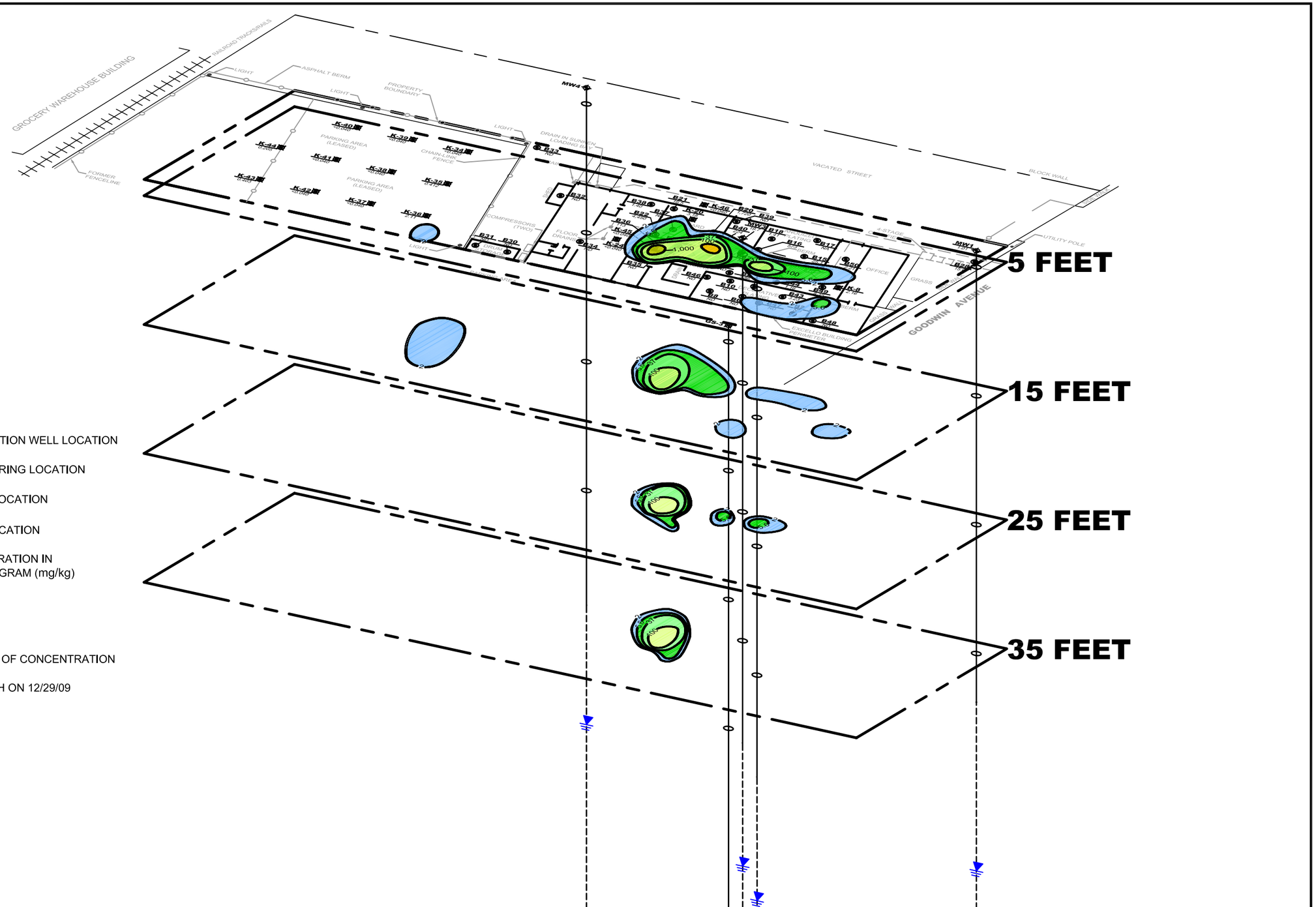
EXCELLO PLATING CO., INC.
4057 AND 4059 GOODWIN AVENUE
LOS ANGELES, CALIFORNIA

PLATE
3A

PLOTTED: 24 Sep 2010, 11:33am, mgriffin

CAD FILE: L:\2010\CADD\101942\ LAYOUT: 3B

ATTACHED IMAGES:
ATTACHED XREFS:
DIAMOND BAR, CA



EXPLANATION

- **GS-3** — KLEINFELDER EXTRACTION WELL LOCATION
- **K-46** — KLEINFELDER SOIL BORING LOCATION
- **B50** — CERES SOIL BORING LOCATION
- **MW-4** — MONITORING WELL LOCATION
- *4,450* — CHROME VI CONCENTRATION IN MILLIGRAMS PER KILOGRAM (mg/kg)
- *NA* — NOT ANALYZED
- *ND* — NOT DETECTED
- 100 — ESTIMATED CONTOUR OF CONCENTRATION
- GROUNDWATER DEPTH ON 12/29/09
- BLANK WELL CASING
- SCREEN INTERVAL
- 1,000-10,000 mg/kg
- 100-1,000 mg/kg
- 37-100 mg/kg
- 5.6-37 mg/kg
- >2 mg/kg

The information included on this graphic representation has been compiled from a variety of sources and is subject to change without notice. Kleinfelder makes no representations or warranties, express or implied, as to accuracy, completeness, timeliness, or rights to the use of such information. This document is not intended for use as a land survey product nor is it designed or intended as a construction design document. The use or misuse of the information contained on this graphic representation is at the sole risk of the party using or misusing the information.

50 25 0 50
APPROXIMATE SCALE (feet)

KLEINFELDER
Bright People. Right Solutions.
www.kleinfelder.com

PROJECT NO.	101942
DRAWN:	9/2010
DRAWN BY:	MRG
CHECKED BY:	PD
FILE NAME:	101942p3B_Cr.VI_ISO.dwg

HEXAVALENT CHROMIUM ISOCONCENTRATIONS VERSUS DEPTH

EXCELLO PLATING CO., INC.
4057 AND 4059 GOODWIN AVENUE
LOS ANGELES, CALIFORNIA

PLATE
3B

PLOTTED: 28 Sep 2010, 2:51pm, dfahrney
CAD FILE: L:\2010\CADD\101942\ LAYOUT: 3C
ATTACHED IMAGES:
ATTACHED XREFS:
DIAMOND BAR, CA

INHALATION OF VOCs BY LOCAL RESIDENTS

INHALATION OF COCs IN DUST BY NEARBY RESIDENTS DURING RAP IMPLEMENTATION

GOODWIN AVENUE

VAPOR INTRUSION AND INHALATION OF VOC COCs BY FUTURE ON-SITE WORKER

INGESTION, INHALATION, AND DERMAL CONTACT OF COCs IN SOIL, DUST, AND FUGITIVE VOC EMISSIONS BY FUTURE ON-SITE MAINTENANCE WORKER

INGESTION, INHALATION, AND DERMAL CONTACT OF COCs IN SOIL, DUST, AND FUGITIVE VOC EMISSIONS BY CONSTRUCTION WORKERS DURING RAP IMPLEMENTATION

PROPERTY LINE

FORMER CHEMICAL PROCESSES

FORMER CHEMICAL LEAKS

FUTURE BUILDING

PROPERTY LINE

WELLHEAD TREATMENT / GLENDALE TREATMENT PLANT

GS-3 PRODUCTION WELL (SCREEN INTERVAL 84'-174' BGS)

INGESTION OF COC-IMPACTED GROUNDWATER BY WATER CUSTOMERS

COCs RELEASED TO SHALLOW SOIL

CONCRETE SURFACE

VAPOR INTRUSION OF VOCs FROM VADOSE ZONE INTO FUTURE BUILDING

VADOSE ZONE

VOLATILIZATION OF VOCs FROM GROUNDWATER TO SOIL VAPOR

VADOSE ZONE (Sand, Silty Sand, and Sand with Silt, with Interbedded Sandy Silt and Clayey Sand)

RESIDUAL COCs IN VADOSE ZONE

RELEASE OF METALS FROM SOIL INTO GROUNDWATER

SOLUTION OF VOCs FROM SOIL VAPOR INTO GROUNDWATER

WELL GS-3 CONE OF DEPRESSION

DEPTH TO WATER ~45' BGS

DISSOLVED-PHASE COCs IN GROUNDWATER

GROUNDWATER FLOW DIRECTION

GROUNDWATER AQUIFER

GROUNDWATER AQUIFER (Sand and Gravel)

N

The information included on this graphic representation has been compiled from a variety of sources and is subject to change without notice. Kleinfelder makes no representations or warranties, express or implied, as to accuracy, completeness, timeliness, or rights to the use of such information. This document is not intended for use as a land survey product nor is it designed or intended as a construction design document. The use or misuse of the information contained on this graphic representation is at the sole risk of the party using or misusing the information.

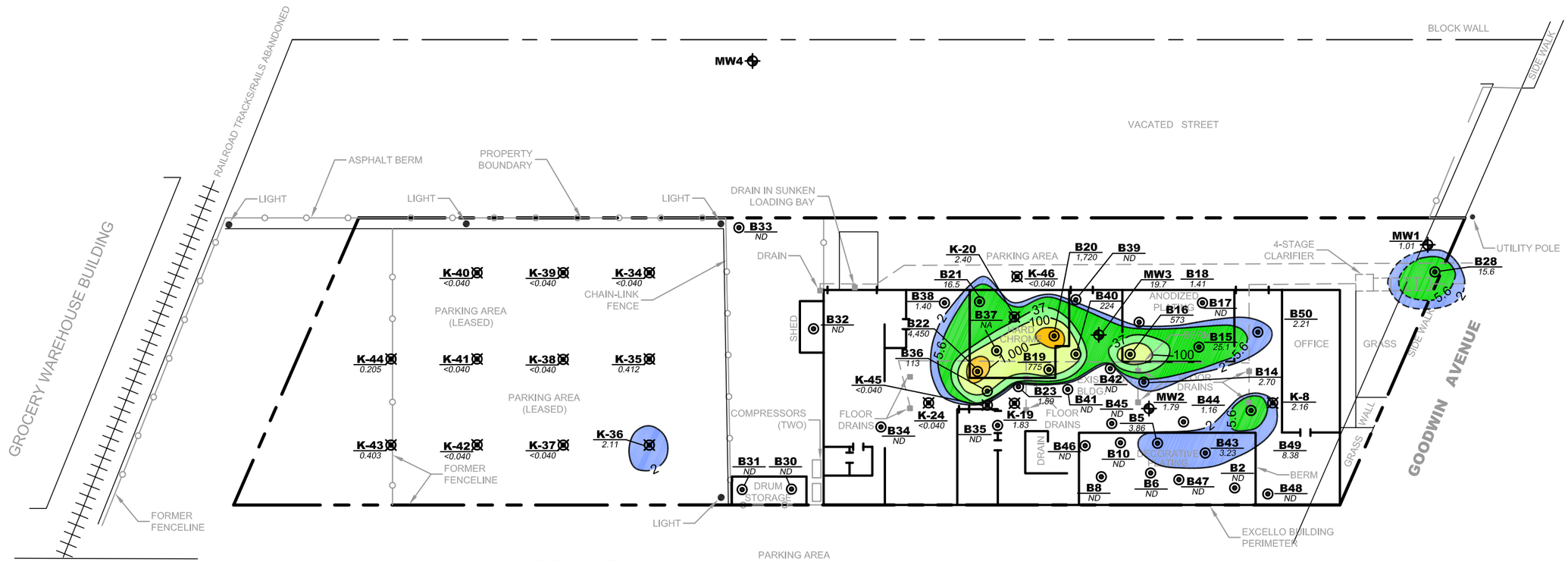
KLEINFELDER
Bright People. Right Solutions.
www.kleinfelder.com

PROJECT NO.	101942
DRAWN:	9/2010
DRAWN BY:	DMF
CHECKED BY:	JD
FILE NAME:	101942p3C.dwg

CONCEPTUAL SITE MODEL - THREE-DIMENSIONAL BLOCK DIAGRAM

EXCELLO PLATING CO., INC.
4057 AND 4059 GOODWIN AVENUE
LOS ANGELES, CALIFORNIA

PLATE
3C



EXPLANATION

K-46	KLEINFELDER SOIL BORING LOCATION
B50	CERES SOIL BORING LOCATION
MW-4	MONITORING WELL LOCATION
4,450	CHROME VI CONCENTRATION IN MILLIGRAMS PER KILOGRAM (mg/kg)
NA	NOT ANALYZED
ND	NOT DETECTED
100	ESTIMATED CONTOUR OF CONCENTRATION
	1,000-10,000 mg/kg
	100-1,000 mg/kg
	37-100 mg/kg
	5.6-37 mg/kg
	2-5.6 mg/kg

40 20 0 40

APPROXIMATE SCALE (feet)

The Information included on this graphic representation has been compiled from a variety of sources and is subject to change without notice. Kleinfelder makes no representations or warranties, express or implied, as to accuracy, completeness, timeliness, or rights to the use of such information. This document is not intended for use as a land survey product nor is it designed or intended as a construction design document. The use or misuse of the information contained on this graphic representation is at the sole risk of the party using or misusing the information.

KLEINFELDER
Bright People. Right Solutions.
www.kleinfelder.com

PROJECT NO.	101942
DRAWN:	9/2010
DRAWN BY:	MRG
CHECKED BY:	PD
FILE NAME:	101942p4A_Hex.Cr-5FT.dwg

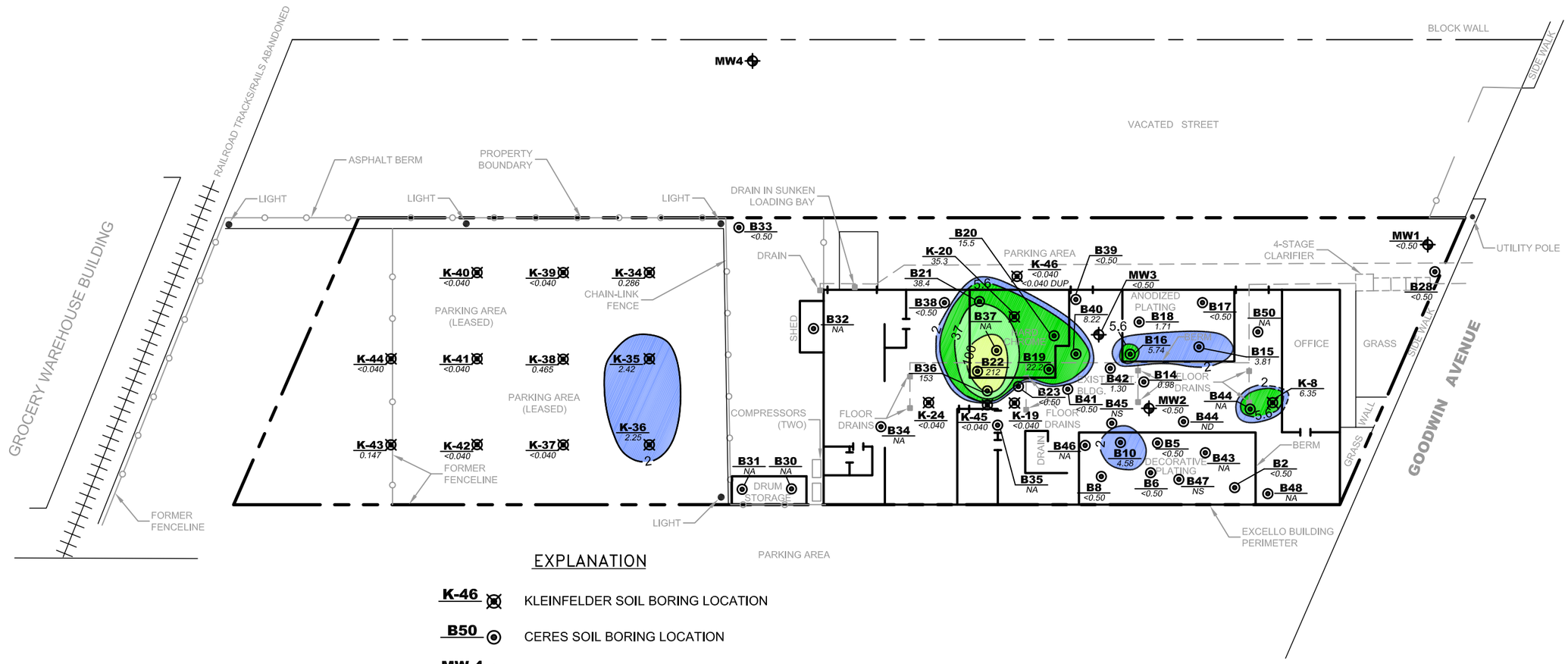
HEXAVALENT CHROMIUM IN SOIL CONTOUR MAP - 5FT BGS

EXCELLO PLATING CO., INC.
4057 AND 4059 GOODWIN AVENUE
LOS ANGELES, CALIFORNIA

PLATE **4A**

PLOTTED: 24 Sep 2010, 11:35am, mgriffin
CAD FILE: L:\2010\CADD\101942\ LAYOUT: 4A
ATTACHED IMAGES:
ATTACHED XREFS:
DIAMOND BAR, CA

PLOTTED: 24 Sep 2010, 11:35am, mgriffin
CAD FILE: L:\2010\CADD\101942\ LAYOUT: 4B
ATTACHED IMAGES:
ATTACHED XREFS:
DIAMOND BAR, CA



EXPLANATION

K-46	KLEINFELDER SOIL BORING LOCATION
B50	CERES SOIL BORING LOCATION
MW-4	MONITORING WELL LOCATION
212	CHROME VI CONCENTRATION IN MILLIGRAMS PER KILOGRAM (mg/kg)
NA	NOT ANALYZED
ND	NOT DETECTED
NS	NOT SAMPLED
<0.040 DUP	FIELD DUPLICATE SAMPLE
100	ESTIMATED CONTOUR OF CONCENTRATION
	100-1,000 mg/kg
	37-100 mg/kg
	5.6-37 mg/kg
	2-5.6 mg/kg

40 20 0 40
APPROXIMATE SCALE (feet)

The Information included on this graphic representation has been compiled from a variety of sources and is subject to change without notice. Kleinfelder makes no representations or warranties, express or implied, as to accuracy, completeness, timeliness, or rights to the use of such information. This document is not intended for use as a land survey product nor is it designed or intended as a construction design document. The use or misuse of the information contained on this graphic representation is at the sole risk of the party using or misusing the information.

KLEINFELDER
Bright People. Right Solutions.
www.kleinfelder.com

PROJECT NO.	101942
DRAWN:	9/2010
DRAWN BY:	MRG
CHECKED BY:	PD
FILE NAME:	101942p4B_Hex.Cr15FT.dwg

HEXAVALENT CHROMIUM IN SOIL CONTOUR MAP - 15FT BGS

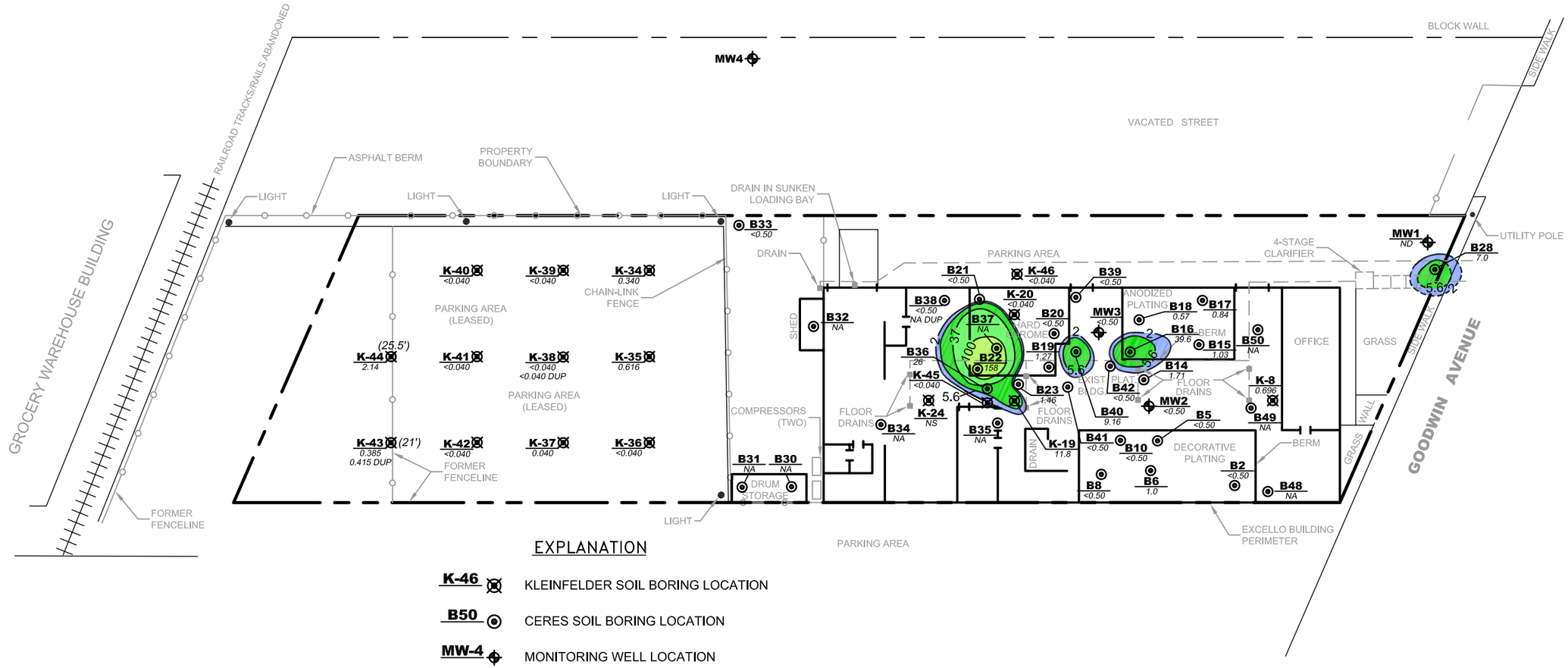
EXCELLO PLATING CO., INC.
4057 AND 4059 GOODWIN AVENUE
LOS ANGELES, CALIFORNIA

PLATE
4B

PLOTTED: 24 Sep 2010, 11:36am, mgriffin

CAD FILE: L:\2010\CADD\101942\ LAYOUT: 4C

ATTACHED IMAGES:
ATTACHED XREFS:
DIAMOND BAR, CA



EXPLANATION

K-46	KLEINFELDER SOIL BORING LOCATION
B50	CERES SOIL BORING LOCATION
MW-4	MONITORING WELL LOCATION
0.84	CHROME VI CONCENTRATION IN MILLIGRAMS PER KILOGRAM (mg/kg)
(25.5')	DEPTH TOTAL OF BORING
NA	NOT ANALYZED
ND	NOT DETECTED
NS	NOT SAMPLED
0.415 DUP	FIELD DUPLICATE SAMPLE
100	ESTIMATED CONTOUR OF CONCENTRATION
	100-1,000 mg/kg
	37-100 mg/kg
	5.6-37 mg/kg
	2-5.6 mg/kg

N

40 20 0 40

APPROXIMATE SCALE (feet)

The information included on this graphic representation has been compiled from a variety of sources and is subject to change without notice. Kleinfelder makes no representations or warranties, express or implied, as to accuracy, completeness, timeliness, or rights to the use of such information. This document is not intended for use as a land survey product nor is it designed or intended as a construction design document. The use or misuse of the information contained on this graphic representation is at the sole risk of the party using or misusing the information.

KLEINFELDER
Bright People. Right Solutions.
www.kleinfelder.com

PROJECT NO.	101942
DRAWN:	9/2010
DRAWN BY:	MRG
CHECKED BY:	PD
FILE NAME:	101942p4C_Hex.Cr-25FT.dwg

HEXAVALENT CHROMIUM IN SOIL CONTOUR MAP - 25FT BGS

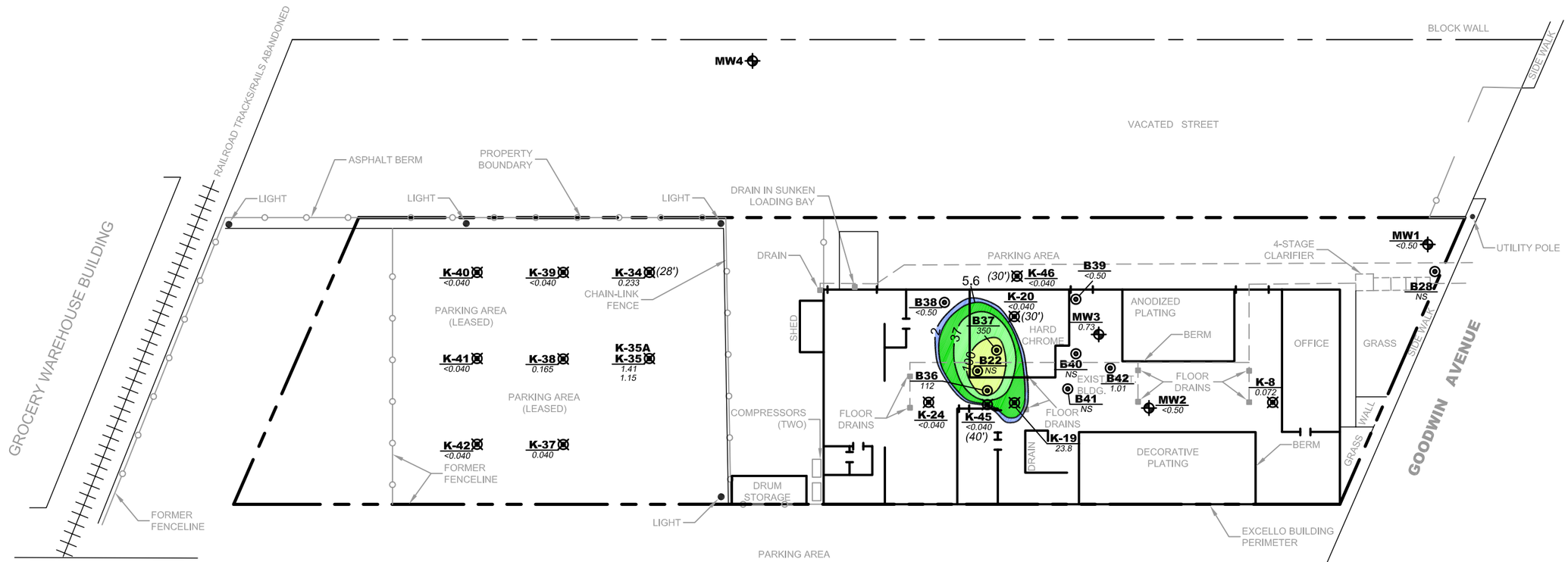
EXCELLO PLATING CO., INC.
4057 AND 4059 GOODWIN AVENUE
LOS ANGELES, CALIFORNIA

PLATE
4C

PLOTTED: 24 Sep 2010, 11:36am, mgriffin

CAD FILE: L:\2010\CADD\101942\ LAYOUT: 4D

ATTACHED IMAGES:
ATTACHED XREFS:
DIAMOND BAR, CA



EXPLANATION

K-46	KLEINFELDER SOIL BORING LOCATION
B50	CERES SOIL BORING LOCATION
MW-4	MONITORING WELL LOCATION
350	CHROME VI CONCENTRATION IN MILLIGRAMS PER KILOGRAM (mg/kg)
(40')	DEPTH TOTAL OF BORING
NA	NOT ANALYZED
NS	NOT SAMPLED
100	ESTIMATED CONTOUR OF CONCENTRATION
	100-1,000 mg/kg
	37-100 mg/kg
	5.6-37 mg/kg
	2 mg/kg

40 20 0 40

APPROXIMATE SCALE (feet)

The Information included on this graphic representation has been compiled from a variety of sources and is subject to change without notice. Kleinfelder makes no representations or warranties, express or implied, as to accuracy, completeness, timeliness, or rights to the use of such information. This document is not intended for use as a land survey product nor is it designed or intended as a construction design document. The use or misuse of the information contained on this graphic representation is at the sole risk of the party using or misusing the information.

KLEINFELDER
Bright People. Right Solutions.
www.kleinfelder.com

PROJECT NO.	101942
DRAWN:	9/2010
DRAWN BY:	MRG
CHECKED BY:	PD
FILE NAME:	101942p4D_Hex.Cr35FT.dwg

HEXAVALENT CHROMIUM IN SOIL CONTOUR MAP - 35FT BGS

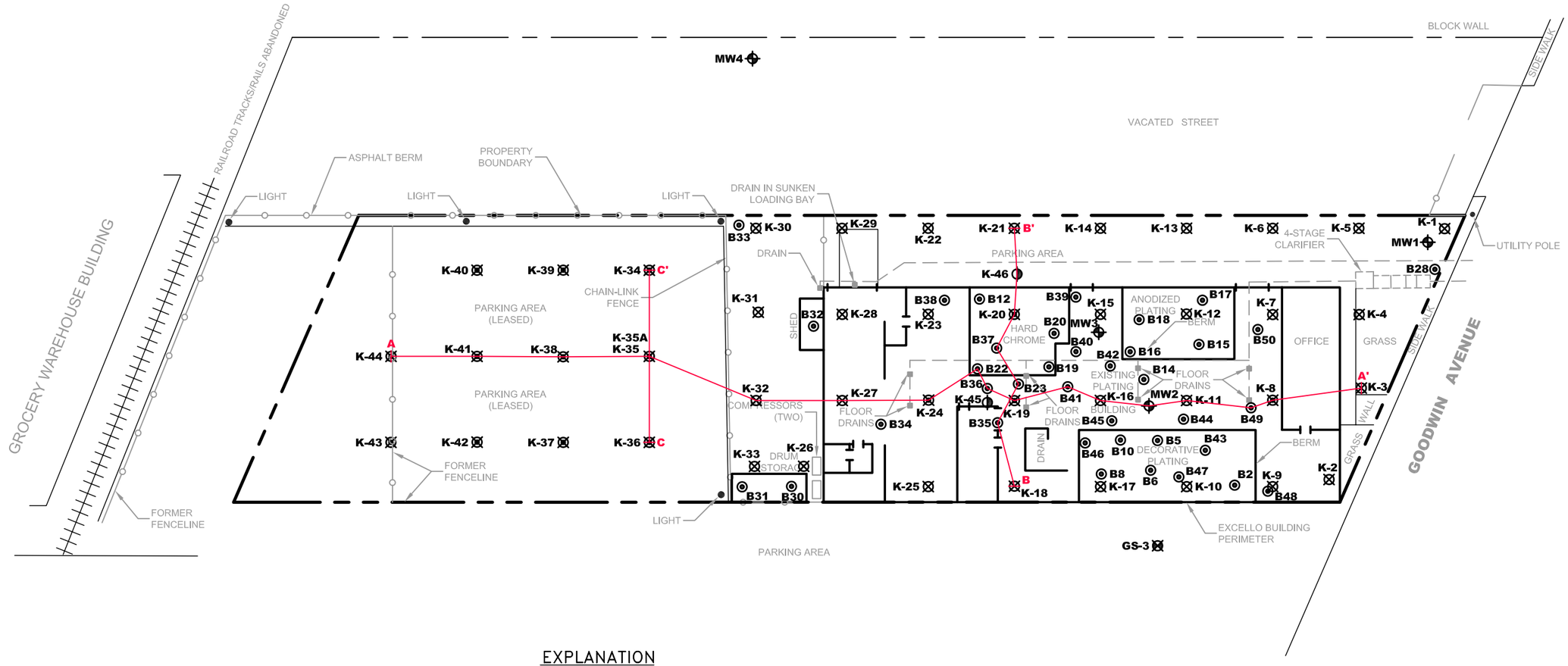
EXCELLO PLATING CO., INC.
4057 AND 4059 GOODWIN AVENUE
LOS ANGELES, CALIFORNIA

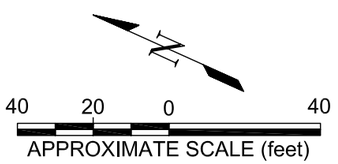
PLATE
4D

PLOTTED: 24 Sep 2010, 11:37am, mgriffin

CAD FILE: L:\2010\CADD\101942\ LAYOUT: 5A

ATTACHED IMAGES:
ATTACHED XREFS:
DIAMOND BAR, CA





EXPLANATION

- MW4 — MONITORING WELL LOCATION
- K-33 — KLEINFELDER VAPOR PROBE LOCATION
- B50 — CERES SOIL BORING LOCATION
- K-44 — KLEINFELDER SOIL BORING AND VAPOR PROBE LOCATION
- K-46 — KLEINFELDER SOIL BORING LOCATION
- GS-3 — EXTRACTION WELL LOCATION
- C — C' — CROSS-SECTION LOCATION

The information included on this graphic representation has been compiled from a variety of sources and is subject to change without notice. Kleinfelder makes no representations or warranties, express or implied, as to accuracy, completeness, timeliness, or rights to the use of such information. This document is not intended for use as a land survey product nor is it designed or intended as a construction design document. The use or misuse of the information contained on this graphic representation is at the sole risk of the party using or misusing the information.

KLEINFELDER
Bright People. Right Solutions.
www.kleinfelder.com

PROJECT NO.	101942
DRAWN:	9/2010
DRAWN BY:	MRG
CHECKED BY:	PD
FILE NAME:	101942p5A_CS-LM.dwg

CROSS-SECTION LOCATION MAP

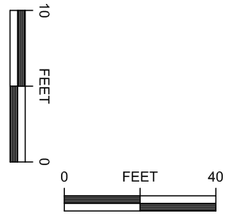
EXCELLO PLATING CO., INC.
4057 AND 4059 GOODWIN AVENUE
LOS ANGELES, CALIFORNIA

PLATE **5A**

PLOTTED: 24 Sep 2010, 11:37am, mgriffin

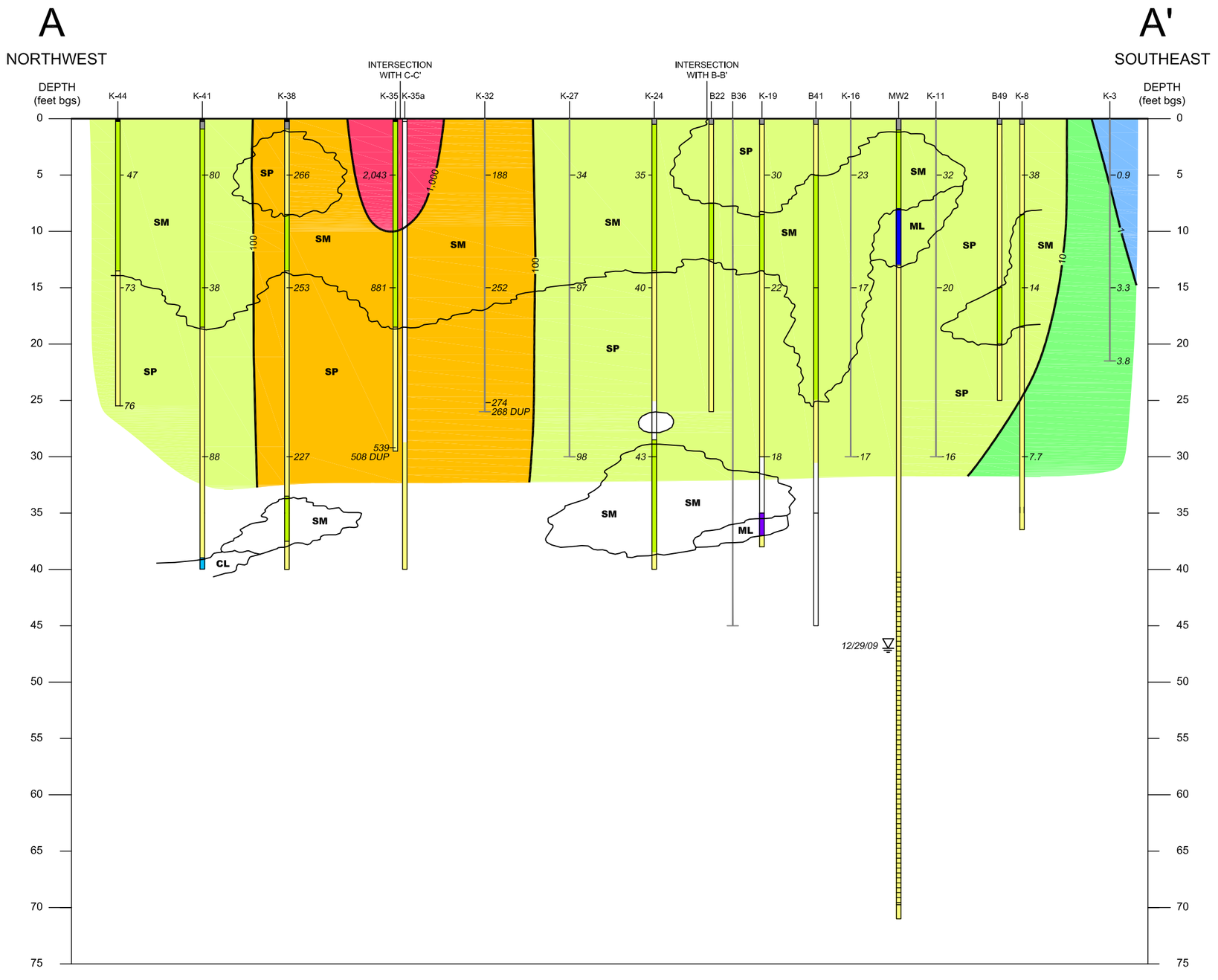
CAD FILE: L:\2010\CADD\101942\ LAYOUT: 5B

ATTACHED IMAGES:
ATTACHED XREFS:
DIAMOND BAR, CA



EXPLANATION

- ASPHALT AND PAVEMENT
- BORING OR VAPOR PROBE
- MONITORING WELL SCREEN INTERVAL
- 12/29/09 — DEPTH TO GROUNDWATER ON DECEMEBER 29, 2009 (CCI, 2010)
- NO RECOVERY OR NOT SAMPLED
- ASPHALT CONCRETE PAVEMENT
- CONCRETE
- (SM) SILTY SAND
- (SP) SAND
- (CL) SILTY CLAY
- (SC) CLAYEY SAND
- (ML) CLAYEY SILT
- *47* — TRICHLOROETHENE (TCE) CONCENTRATION IN MICROGRAMS PER LITER (µg/L)
- *508 DUP* — FIELD DUPLICATE SAMPLE
- 1,000 — ESTIMATED CONTOUR OF CONCENTRATION
- >1,000 µg/L
- 100-1,000 µg/L
- 10-100 µg/L
- 1-10 µg/L
- <1 µg/L



NOTE: MOST BORINGS WERE SAMPLED AT 5-FOOT INTERVALS; THE LITHOLOGIC CONTACTS, AND THEIR EXTENT BETWEEN BORINGS, ARE INFERRED.

The Information included on this graphic representation has been compiled from a variety of sources and is subject to change without notice. Kleinfelder makes no representations or warranties, express or implied, as to accuracy, completeness, timeliness, or rights to the use of such information. This document is not intended for use as a land survey product nor is it designed or intended as a construction design document. The use or misuse of the information contained on this graphic representation is at the sole risk of the party using or misusing the information.

KLEINFELDER
Bright People. Right Solutions.
www.kleinfelder.com

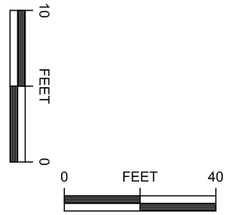
PROJECT NO.	101942
DRAWN:	9/2010
DRAWN BY:	MRG
CHECKED BY:	PD
FILE NAME:	101942p5B_TCE-CS-A.dwg

TCE IN SOIL VAPOR CROSS-SECTION A-A'

EXCELLO PLATING CO., INC.
4057 AND 4059 GOODWIN AVENUE
LOS ANGELES, CALIFORNIA

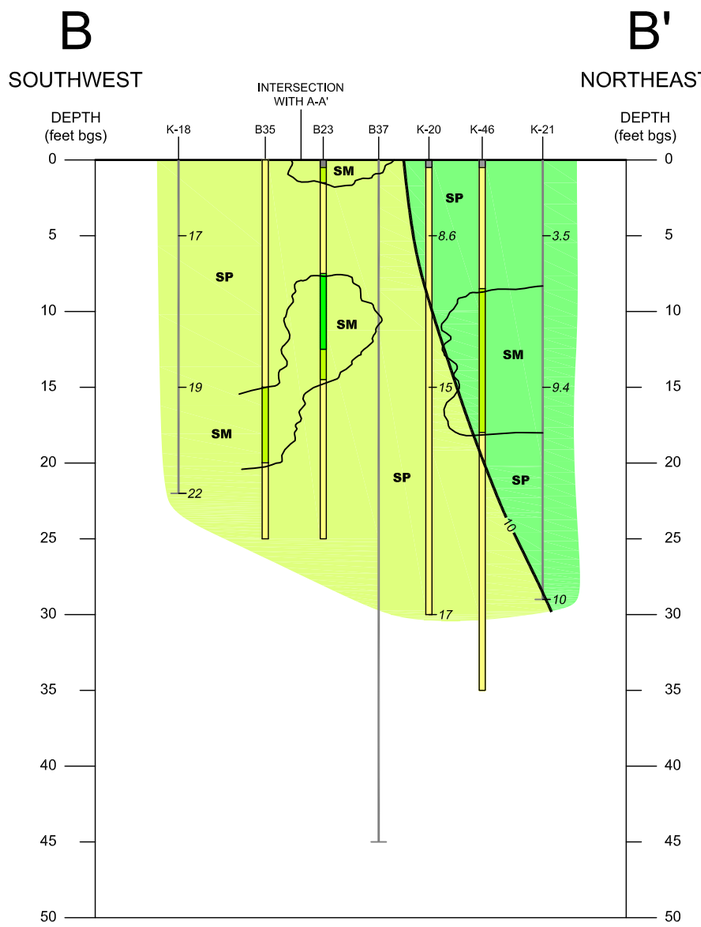
PLATE **5B**

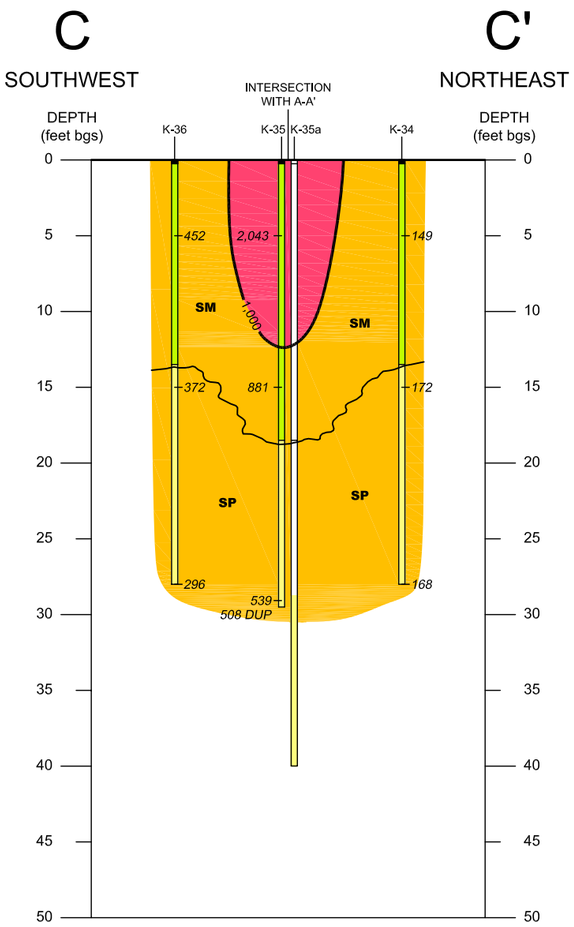
PLOTTED: 24 Sep 2010, 12:27pm, mgriffin
LAYOUT: 5C
CAD FILE: L:\2010\CADD\101942\
Images: temp-delete_1_Page_14.jpg
ATTACHED IMAGES:
ATTACHED XREFS:
DIAMOND BAR, CA



EXPLANATION

- ASPHALT AND PAVEMENT
- BORING OR VAPOR PROBE
- NO RECOVERY OR NOT SAMPLED
- ASPHALT CONCRETE PAVEMENT
- CONCRETE
- (SM) SILTY SAND
- (SP) SAND
- *17* — TRICHLOROETHENE (TCE) CONCENTRATION IN MICROGRAMS PER LITER (µg/L)
- *539 DUP* — FIELD DUPLICATE SAMPLE
- 1,000 — ESTIMATED CONTOUR OF CONCENTRATION
- >1,000 µg/L
- 100-1,000 µg/L
- 10-100 µg/L
- 1-10 µg/L





NOTE: MOST BORINGS WERE SAMPLED AT 5-FOOT INTERVALS; THE LITHOLOGIC CONTACTS, AND THEIR EXTENT BETWEEN BORINGS, ARE INFERRED.

The information included on this graphic representation has been compiled from a variety of sources and is subject to change without notice. Kleinfelder makes no representations or warranties, express or implied, as to accuracy, completeness, timeliness, or rights to the use of such information. This document is not intended for use as a land survey product nor is it designed or intended as a construction design document. The use or misuse of the information contained on this graphic representation is at the sole risk of the party using or misusing the information.

KLEINFELDER
Bright People. Right Solutions.
www.kleinfelder.com

PROJECT NO.	101942
DRAWN:	9/2010
DRAWN BY:	MRG
CHECKED BY:	PD
FILE NAME:	101942p5C_TCE-CS-B&C.dwg

TCE IN SOIL VAPOR
CROSS-SECTIONS B-B' AND C-C'

EXCELLO PLATING CO., INC.
4057 AND 4059 GOODWIN AVENUE
LOS ANGELES, CALIFORNIA

PLATE
5C

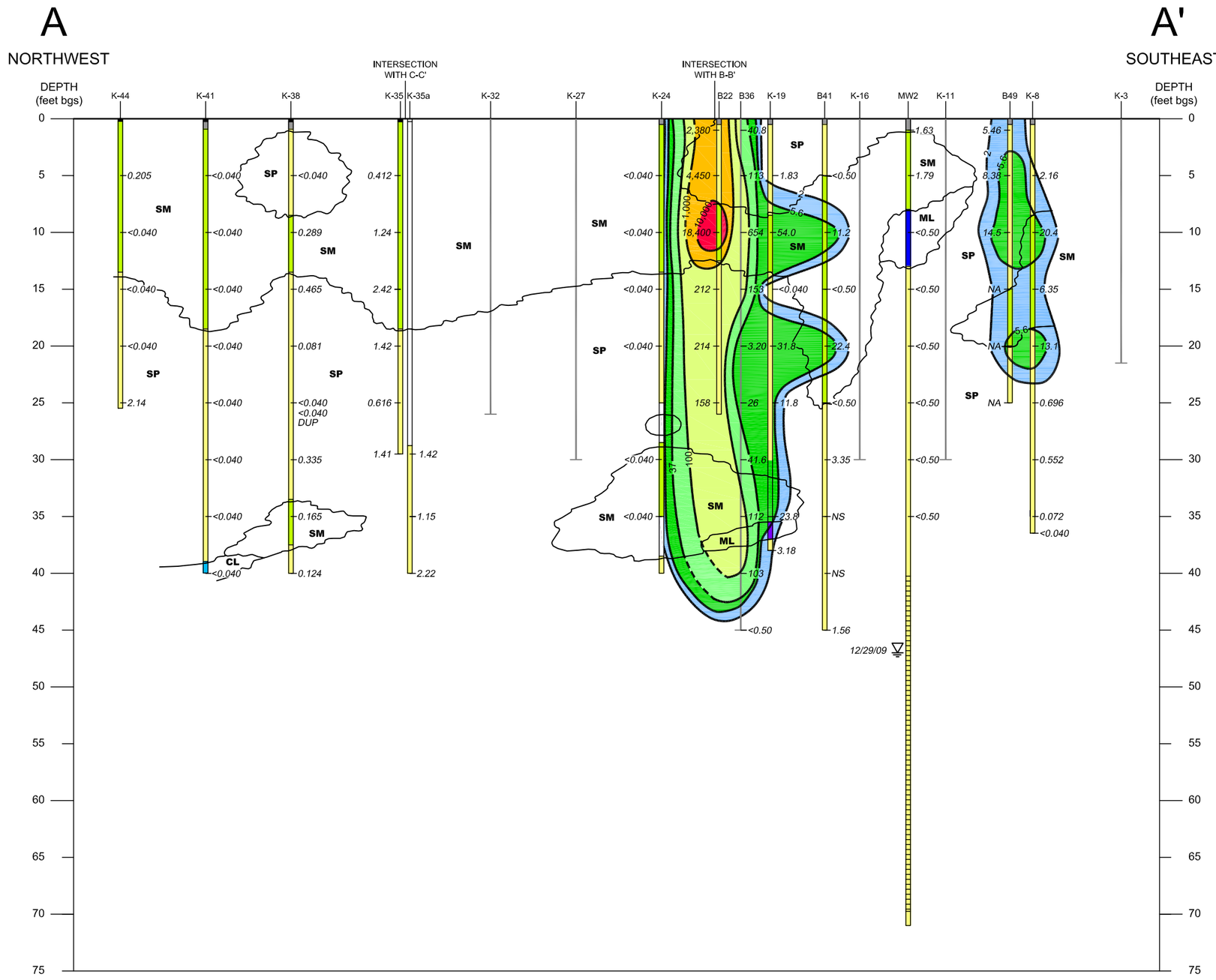
PLOTTED: 24 Sep 2010, 12:27pm, mgriffin

CAD FILE: L:\2010\CADD\101942\ LAYOUT: 5D

ATTACHED IMAGES:
ATTACHED XREFS:
DIAMOND BAR, CA

EXPLANATION

- ASPHALT AND PAVEMENT
- BORING OR VAPOR PROBE
- MONITORING WELL SCREEN INTERVAL
- 12/29/09 — DEPTH TO GROUNDWATER ON DECEMEBER 29, 2009 (CCI, 2010)
- NO RECOVERY OR NOT SAMPLED
- ASPHALT CONCRETE PAVEMENT
- CONCRETE
- (SM) SILTY SAND
- (SP) SAND
- (CL) SILTY CLAY
- (SC) CLAYEY SAND
- (ML) CLAYEY SILT
- *NA* — NOT ANALYZED
- *NS* — NOT SAMPLED
- *8,400* — HEXAVALENT CHROMIUM CONCENTRATION IN MILLIGRAMS PER KILOGRAM (mg/kg)
- *<0.040* — NOT DETECTED ABOVE THE PRACTICAL QUANTITATION LIMIT (PQL)
- *<0.040 DUP* — FIELD DUPLICATE SAMPLE
- 10,000 — ESTIMATED CONTOUR OF CONCENTRATION
- >10,000 mg/kg
- 1,000-10,000 mg/kg
- 100-1,000 mg/kg
- 37-100 mg/kg
- 5.6-37 mg/kg
- >2 mg/kg



NOTE: MOST BORINGS WERE SAMPLED AT 5-FOOT INTERVALS; THE LITHOLOGIC CONTACTS, AND THEIR EXTENT BETWEEN BORINGS, ARE INFERRED.

The Information included on this graphic representation has been compiled from a variety of sources and is subject to change without notice. Kleinfelder makes no representations or warranties, express or implied, as to accuracy, completeness, timeliness, or rights to the use of such information. This document is not intended for use as a land survey product nor is it designed or intended as a construction design document. The use or misuse of the information contained on this graphic representation is at the sole risk of the party using or misusing the information.

KLEINFELDER
Bright People. Right Solutions.
www.kleinfelder.com

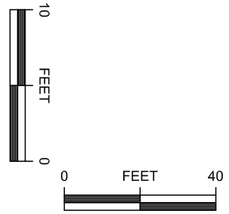
PROJECT NO.	101942
DRAWN:	9/2010
DRAWN BY:	MRG
CHECKED BY:	PD
FILE NAME:	101942p5D_Hex.Cr-CS-A.dwg

HEXAVALENT CHROMIUM IN SOIL CROSS-SECTION A-A'

EXCELLO PLATING CO., INC.
4057 AND 4059 GOODWIN AVENUE
LOS ANGELES, CALIFORNIA

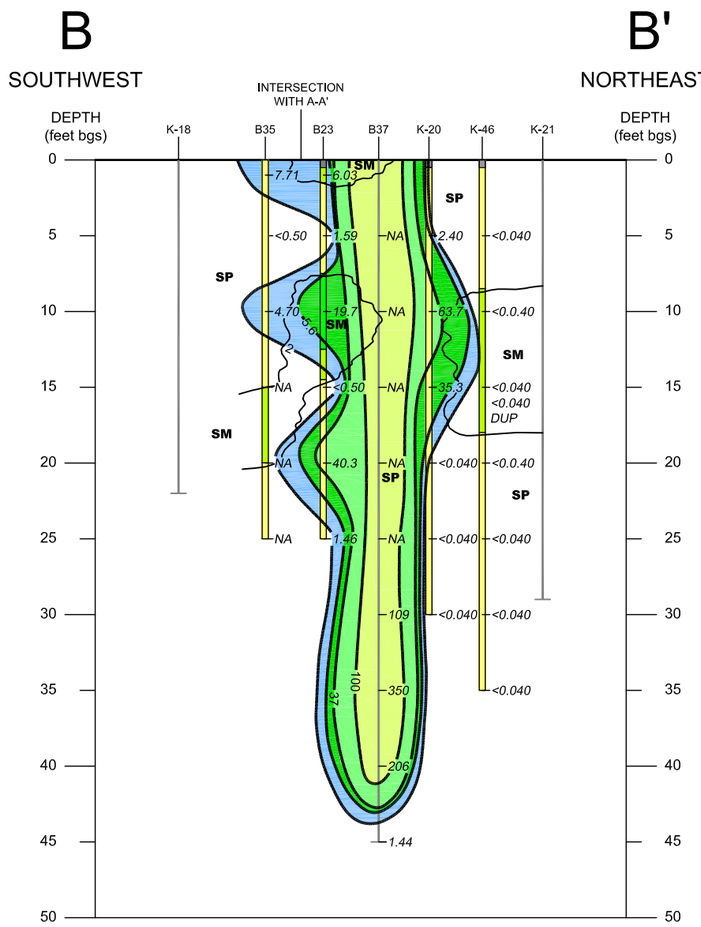
PLATE **5D**

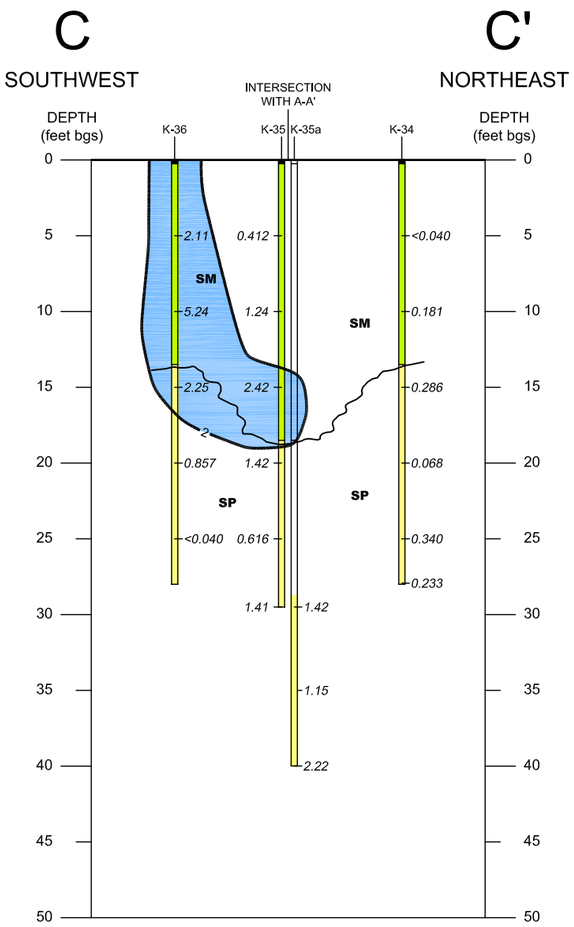
PLOTTED: 24 Sep 2010, 12:28pm, mgriffin
CAD FILE: L:\2010\CADD\101942\ LAYOUT: 5E
ATTACHED IMAGES:
ATTACHED XREFS:
DIAMOND BAR, CA



EXPLANATION

- ASPHALT AND PAVEMENT
- BORING CONCENTRATION (mg/kg)
- NO RECOVERY OR NOT SAMPLED
- ASPHALT CONCRETE PAVEMENT
- CONCRETE
- (SM) SILTY SAND
- (SP) SAND
- *7.71* — HEXAVALENT CHROMIUM CONCENTRATION IN MILLIGRAMS PER KILOGRAM (mg/kg)
- *NA* — NOT ANALYZED
- *<0.50* — NOT DETECTED AT OR ABOVE THE INDICATED REPORTING LIMIT
- *<0.040 DUP* — FIELD DUPLICATE SAMPLE
- 100 — ESTIMATED CONTOUR OF CONCENTRATION
- 100-1,000 mg/kg
- 37-100 mg/kg
- 5.6-37 mg/kg
- >2 mg/kg





NOTE: MOST BORINGS WERE SAMPLED AT 5-FOOT INTERVALS; THE LITHOLOGIC CONTACTS, AND THEIR EXTENT BETWEEN BORINGS, ARE INFERRED.

The information included on this graphic representation has been compiled from a variety of sources and is subject to change without notice. Kleinfelder makes no representations or warranties, express or implied, as to accuracy, completeness, timeliness, or rights to the use of such information. This document is not intended for use as a land survey product nor is it designed or intended as a construction design document. The use or misuse of the information contained on this graphic representation is at the sole risk of the party using or misusing the information.

KLEINFELDER
Bright People. Right Solutions.
www.kleinfelder.com

PROJECT NO.	101942
DRAWN:	9/2010
DRAWN BY:	MRG
CHECKED BY:	PD
FILE NAME:	101942p5E_Hx.Cr.CS-B&C.dwg

HEXAVALENT CHROMIUM IN SOIL
CROSS-SECTIONS B-B' AND C-C'

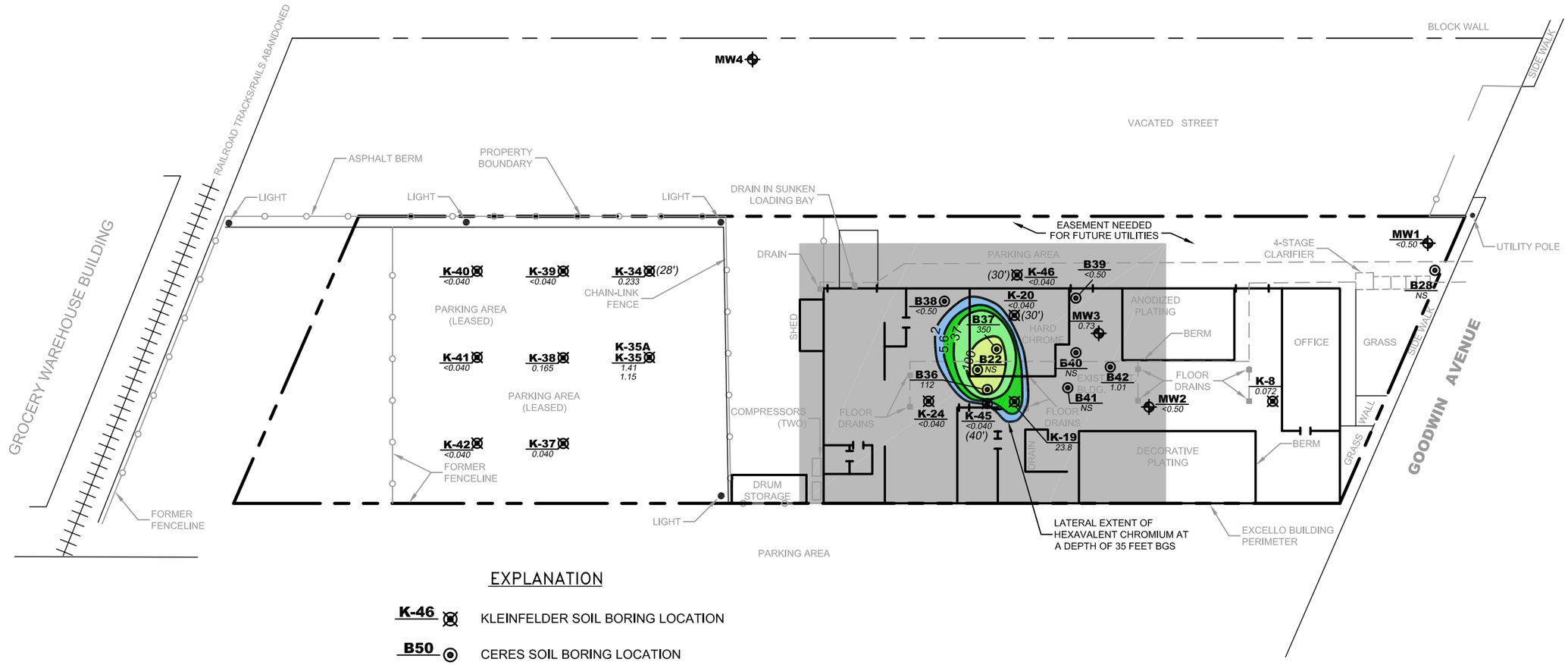
EXCELLO PLATING CO., INC.
4057 AND 4059 GOODWIN AVENUE
LOS ANGELES, CALIFORNIA

PLATE
5E

PLOTTED: 24 Sep 2010, 12:28pm, mgriffin

CAD FILE: L:\2010\CADD\101942\ LAYOUT: 6

ATTACHED IMAGES:
ATTACHED XREFS:
DIAMOND BAR, CA



EXPLANATION

K-46	KLEINFELDER SOIL BORING LOCATION
B50	CERES SOIL BORING LOCATION
MW-4	MONITORING WELL LOCATION
350	CHROME VI CONCENTRATION IN MILLIGRAMS PER KILOGRAM (mg/kg)
(40')	DEPTH TOTAL OF BORING
NA	NOT ANALYZED
NS	NOT SAMPLED
100	ESTIMATED CONTOUR OF CONCENTRATION
	PROPOSED CAPPED SURFACE AREA WITH 50' OVERLAP WHILE MAINTAINING 10' FROM EASTERN PROPERTY LINE 11,500 SQUARE FEET
	100-1,000 mg/kg
	37-100 mg/kg
	5.6-37 mg/kg
	>2 mg/kg

40 20 0 40

APPROXIMATE SCALE (feet)

The information included on this graphic representation has been compiled from a variety of sources and is subject to change without notice. Kleinfelder makes no representations or warranties, express or implied, as to accuracy, completeness, timeliness, or rights to the use of such information. This document is not intended for use as a land survey product nor is it designed or intended as a construction design document. The use or misuse of the information contained on this graphic representation is at the sole risk of the party using or misusing the information.

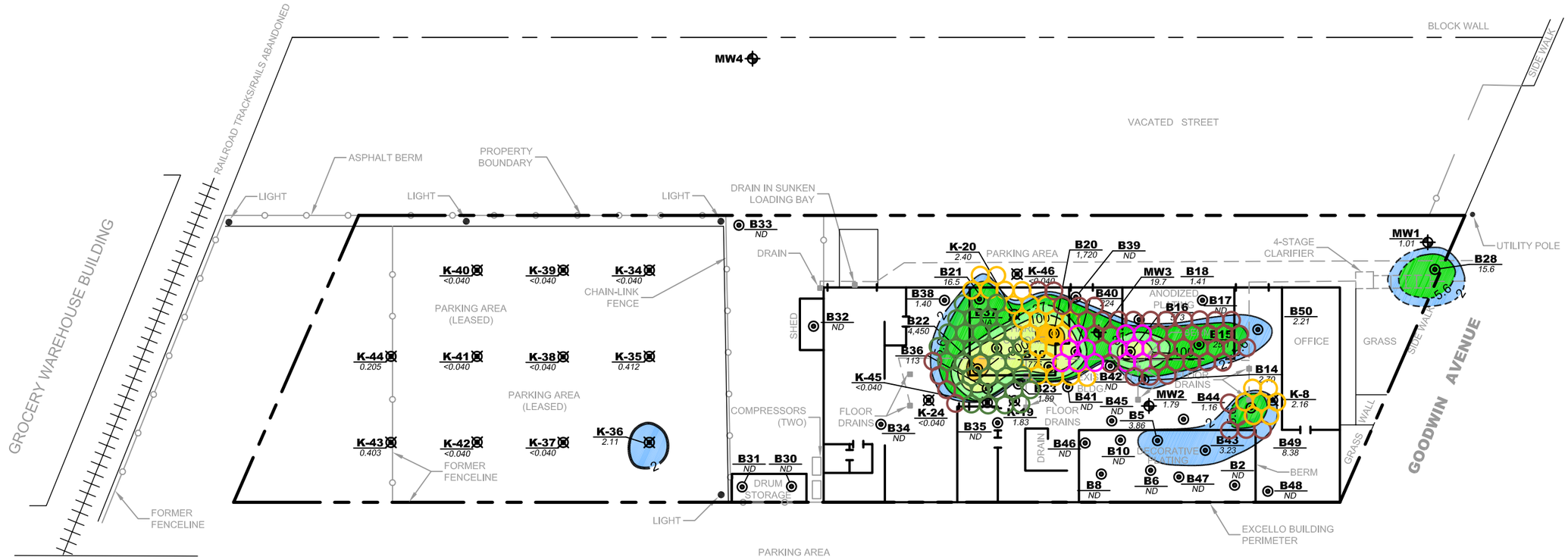
KLEINFELDER
Bright People. Right Solutions.
www.kleinfelder.com

PROJECT NO.	101942
DRAWN:	9/2010
DRAWN BY:	MRG
CHECKED BY:	PD
FILE NAME:	101942p6_Cap-Design.dwg

CONCEPTUAL ENGINEERED CAP DESIGN PLAN VIEW

EXCELLO PLATING CO., INC.
4057 AND 4059 GOODWIN AVENUE
LOS ANGELES, CALIFORNIA

PLATE
6



EXPLANATION

- K-46 — KLEINFELDER SOIL BORING LOCATION
- B50 — CERES SOIL BORING LOCATION
- MW-4 — MONITORING WELL LOCATION
- 4,450 — CHROME VI CONCENTRATION IN MILLIGRAMS PER KILOGRAM (mg/kg)
- NA — NOT ANALYZED
- ND — NOT DETECTED
- 100 — ESTIMATED CONTOUR OF CONCENTRATION
- 1,000-10,000 mg/kg
- 100-1,000 mg/kg
- 37-100 mg/kg
- 5.6-37 mg/kg
- >2 mg/kg

- LDA TO 10' BGS
- LDA TO 20' BGS
- LDA TO 25' BGS
- LDA TO 43.5' BGS

NOTE: 8' DIAMETER LDA

The information included on this graphic representation has been compiled from a variety of sources and is subject to change without notice. Kleinfelder makes no representations or warranties, express or implied, as to accuracy, completeness, timeliness, or rights to the use of such information. This document is not intended for use as a land survey product nor is it designed or intended as a construction design document. The use or misuse of the information contained on this graphic representation is at the sole risk of the party using or misusing the information.

KLEINFELDER
Bright People. Right Solutions.
www.kleinfelder.com

PROJECT NO.	101942
DRAWN:	9/2010
DRAWN BY:	MRG
CHECKED BY:	PD
FILE NAME:	101942p7A_LDA-ISCR.dwg

CONCEPTUAL LDA MIXING/ISCR LOCATIONS AND DEPTHS FOR HEXAVALENT CHROMIUM IN SOIL

EXCELLO PLATING CO., INC.
4057 AND 4059 GOODWIN AVENUE
LOS ANGELES, CALIFORNIA

PLATE **7A**

PLOTTED: 24 Sep 2010, 12:29pm, mgriffin
CAD FILE: L:\2010\CADD\101942\ LAYOUT: 7A
ATTACHED IMAGES: Images: temp-delete_1_Page_7.jpg
ATTACHED XREFS:
DIAMOND BAR, CA

PLOTTED: 30 Sep 2010, 10:05am, dfahrney

CAD FILE: L:\2010\CADD\101942\ LAYOUT: 7B

ATTACHED IMAGES:
ATTACHED XREFS:
DIAMOND BAR, CA

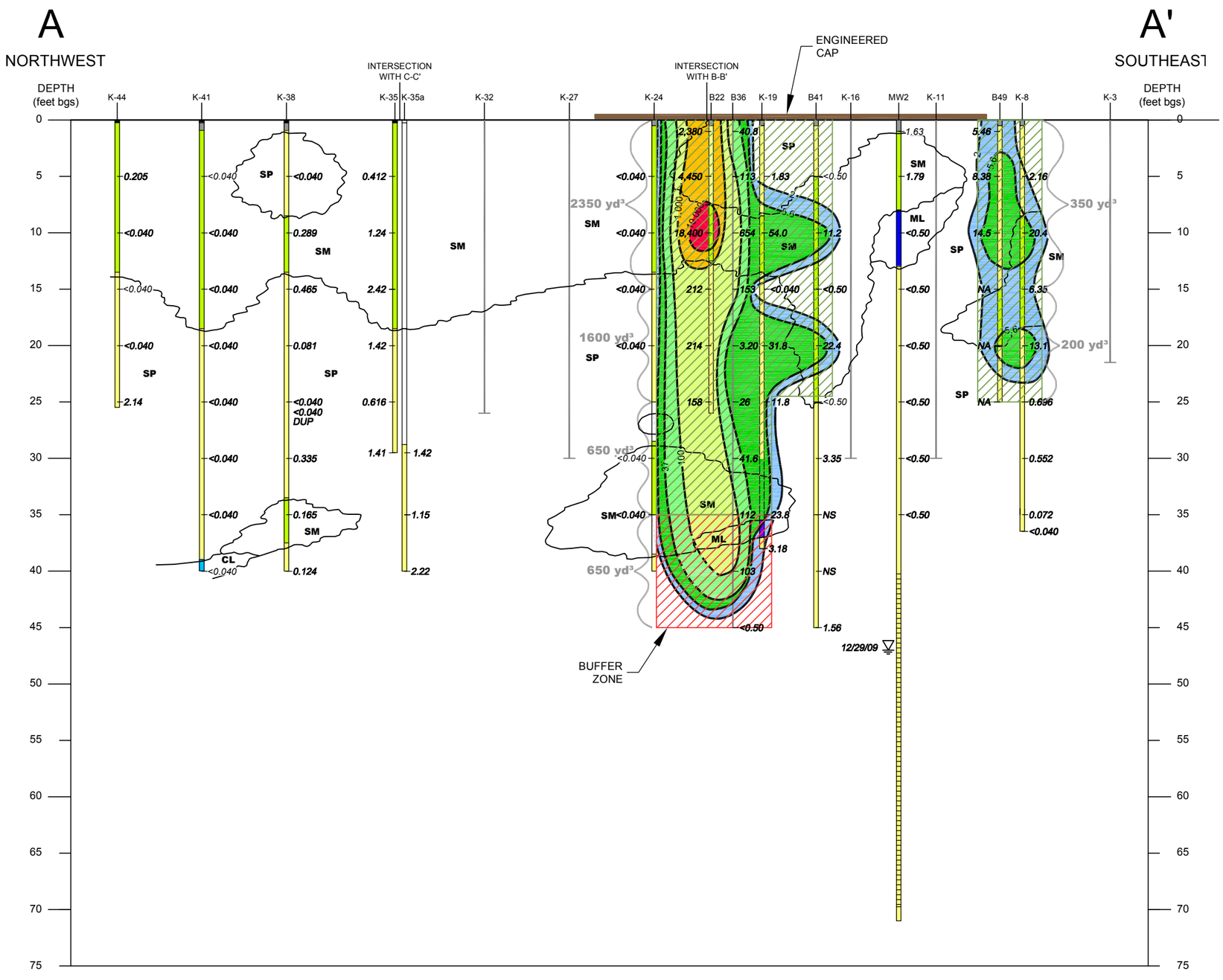
EXPLANATION

- ASPHALT AND PAVEMENT
- BORING OR VAPOR PROBE
- MONITORING WELL SCREEN INTERVAL
- 12/29/09 — DEPTH TO GROUNDWATER ON DECEMEBER 29, 2009 (CCI, 2010)
- NO RECOVERY OR NOT SAMPLED
- ASPHALT CONCRETE PAVEMENT
- CONCRETE
- (SM) SILTY SAND
- (SP) SAND
- (CL) SILTY CLAY
- (SC) CLAYEY SAND
- (ML) CLAYEY SILT
- TREATMENT ZONE OF ISCR AND STABILIZED SOIL
- BUFFER ZONE OF STABILIZED-ONLY SOIL
- ENGINEERED CAP TO INHIBIT SURFACE WATER INTRUSION
- *NA* — NOT ANALYZED
- *NS* — NOT SAMPLED
- *8,400* — HEXAVALENT CHROMIUM CONCENTRATION IN MILLIGRAMS PER KILOGRAM (mg/kg)
- *<0.040* — NOT DETECTED ABOVE THE PRACTICAL QUANTITATION LIMIT (PQL)
- *<0.040 DUP* — FIELD DUPLICATE SAMPLE
- 10,000 — ESTIMATED CONTOUR OF CONCENTRATION

- >10,000 mg/kg
- 1,000-10,000 mg/kg
- 100-1,000 mg/kg
- 37-100 mg/kg
- 5.6-37 mg/kg
- >2 mg/kg

10 FEET 0

0 FEET 40



NOTE: MOST BORINGS WERE SAMPLED AT 5-FOOT INTERVALS; THE LITHOLOGIC CONTACTS, AND THEIR EXTENT BETWEEN BORINGS, ARE INFERRED.

The information included on this graphic representation has been compiled from a variety of sources and is subject to change without notice. Kleinfelder makes no representations or warranties, express or implied, as to accuracy, completeness, timeliness, or rights to the use of such information. This document is not intended for use as a land survey product nor is it designed or intended as a construction design document. The use or misuse of the information contained on this graphic representation is at the sole risk of the party using or misusing the information.

KLEINFELDER
Bright People. Right Solutions.
www.kleinfelder.com

PROJECT NO.	101942
DRAWN:	9/2010
DRAWN BY:	MRG
CHECKED BY:	PD
FILE NAME:	101942p7B_ISCR-CS-A.dwg

CONCEPTUAL DEPTH OF ISCR/ STABILIZATION AND STABILIZATION ONLY FOR HEXAVALENT CHROMIUM IN SOIL

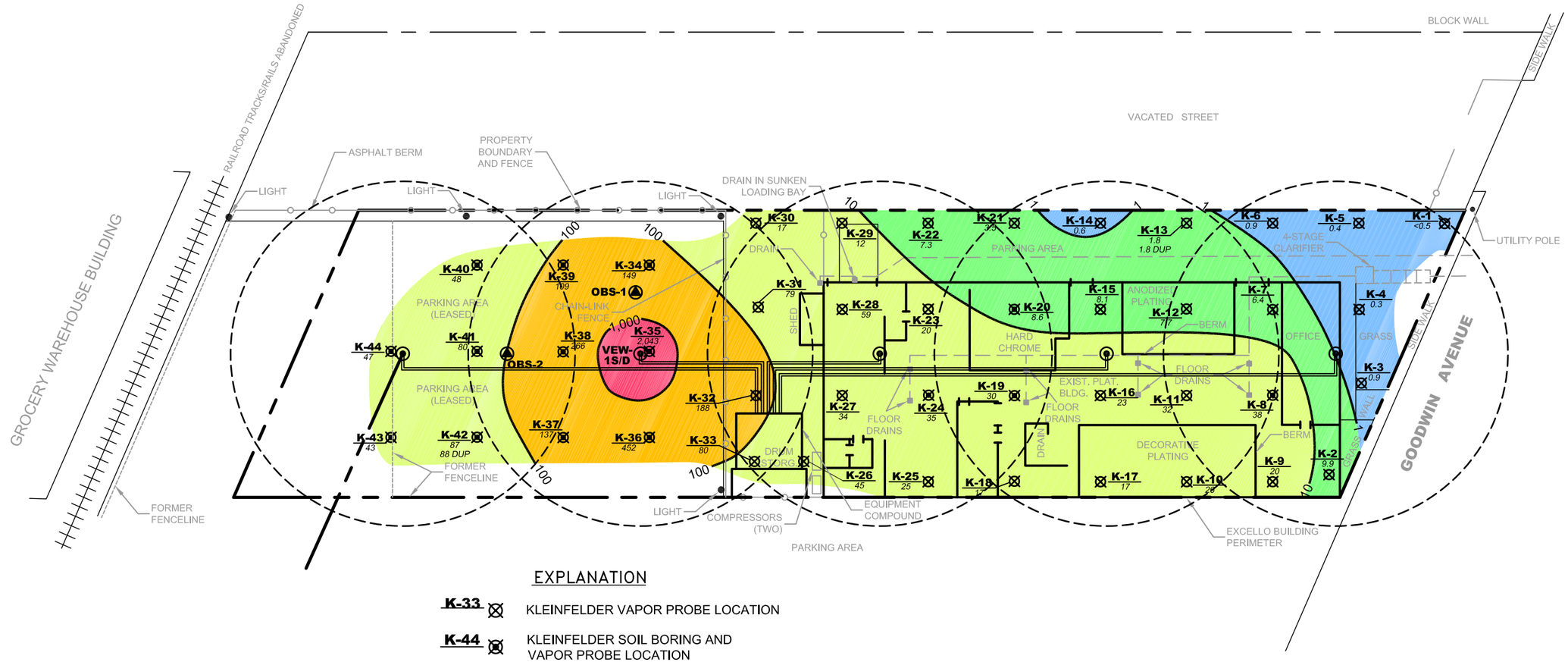
EXCELLO PLATING CO., INC.
4057 AND 4059 GOODWIN AVENUE
LOS ANGELES, CALIFORNIA

PLATE **7B**

PLOTTED: 24 Sep 2010, 12:30pm, mgriffin

CAD FILE: L:\2010\CADD\101942\ LAYOUT: 8

ATTACHED IMAGES:
ATTACHED XREFS:
DIAMOND BAR, CA



EXPLANATION

- K-33 — KLEINFELDER VAPOR PROBE LOCATION
- K-44 — KLEINFELDER SOIL BORING AND VAPOR PROBE LOCATION
- PROPOSED SVE WELL LOCATION
- PROPOSED SVE OBSERVATION WELL LOCATION
- ESTIMATED SVE ROI (60 FEET)
- *2,043* — TRICHLOROETHENE (TCE) CONCENTRATION IN MICROGRAMS PER LITER (µg/L) AT 5 FEET BELOW GROUND SURFACE
- *1.8 DUP* — FIELD DUPLICATE SAMPLE
- 1,000 — ESTIMATED CONTOUR OF CONCENTRATION
- APPROXIMATE SVE PIPING
- >1,000 µg/L
- 100-1,000 µg/L
- 10-100 µg/L
- 1-10 µg/L
- <1 µg/L

40 20 0 40

APPROXIMATE SCALE (feet)

The information included on this graphic representation has been compiled from a variety of sources and is subject to change without notice. Kleinfelder makes no representations or warranties, express or implied, as to accuracy, completeness, timeliness, or rights to the use of such information. This document is not intended for use as a land survey product nor is it designed or intended as a construction design document. The use or misuse of the information contained on this graphic representation is at the sole risk of the party using or misusing the information.

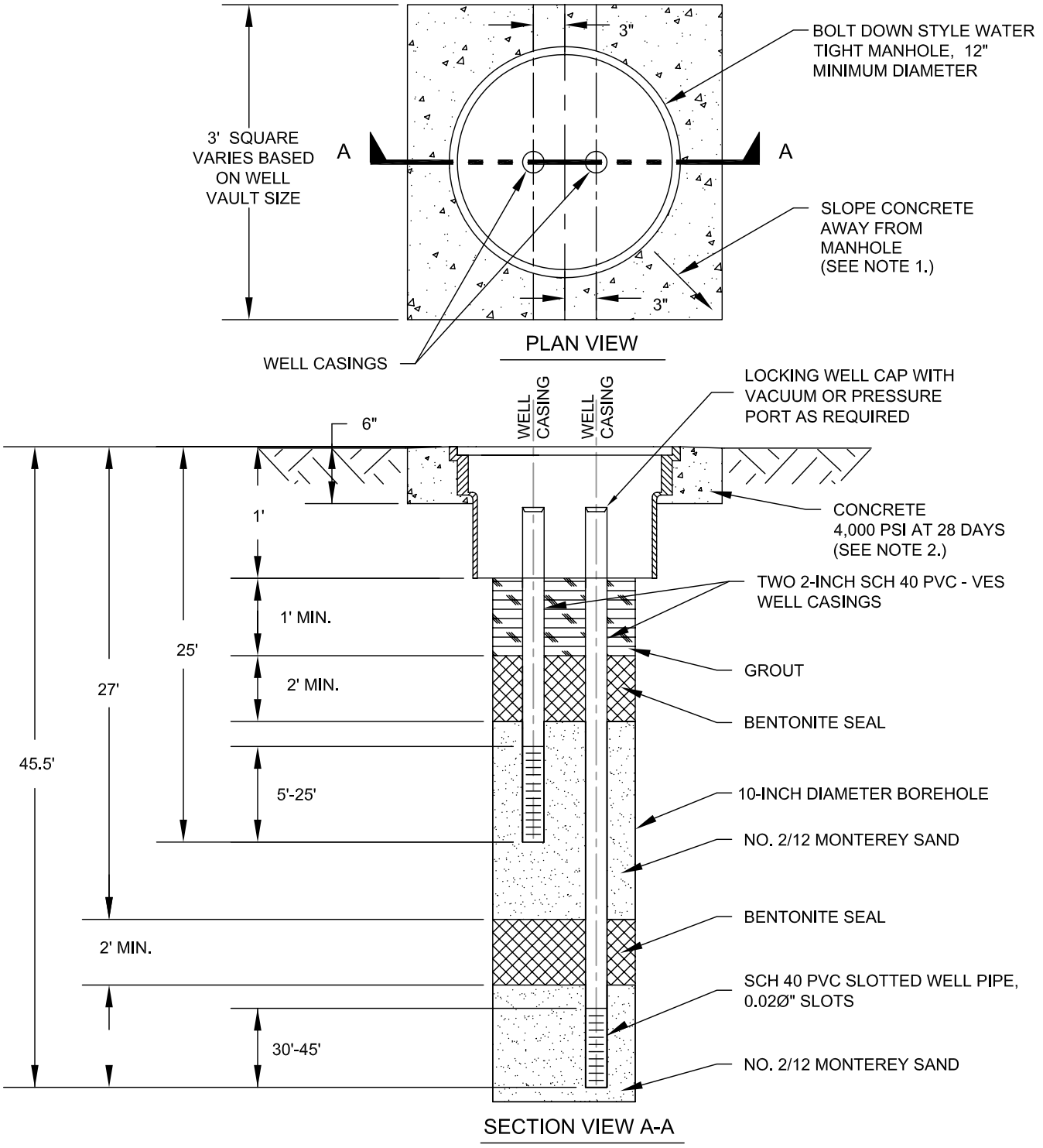
KLEINFELDER
Bright People. Right Solutions.
www.kleinfelder.com

PROJECT NO.	101942
DRAWN:	10/2010
DRAWN BY:	MRG
CHECKED BY:	JD
FILE NAME:	101942p8_SVE-ROI.dwg

CONCEPTUAL LAYOUT OF SVE WELL LOCATIONS, PIPING, AND ESTIMATED ROI

EXCELLO PLATING CO., INC.
4057 AND 4059 GOODWIN AVENUE
LOS ANGELES, CALIFORNIA

PLATE **8**



NOTES:

1. CROWNING REQUIREMENT AT WELL VAULT TOP IS 1/2" PER FOOT.
2. CONCRETE WELL PAD TO BE RATED 4,000 PSI.

The information included on this graphic representation has been compiled from a variety of sources and is subject to change without notice. Kleinfelder makes no representations or warranties, express or implied, as to accuracy, completeness, timeliness, or rights to the use of such information. This document is not intended for use as a land survey product nor is it designed or intended as a construction design document. The use or misuse of the information contained on this graphic representation is at the sole risk of the party using or misusing the information.

PLOTTED: 24 Sep 2010, 12:30pm, mgriffin

CAD FILE: L:\2010\CADD\101942\ LAYOUT: 9

ATTACHED IMAGES:
ATTACHED XREFS:
Diamond Bar, CA

KLEINFELDER
Bright People. Right Solutions.
www.kleinfelder.com

PROJECT NO.	101942
DRAWN:	9/2010
DRAWN BY:	DMF
CHECKED BY:	JD
FILE NAME:	101942p9_WCD.dwg

CONCEPTUAL SVE AND OBSERVATION WELL DESIGN

EXCELLO PLATING CO., INC.
4057 AND 4059 GOODWIN AVENUE
LOS ANGELES, CALIFORNIA

PLATE
9

TABLE

Table 1
Comparative Evaluation of Remedial Alternatives

Evaluation Criteria		1 No Further Action	2a LDA Mixing/ISCR using CaSx with Engineered Cap	2b LDA Mixing/ISCR using $FeSO_4$ with Engineered Cap)	3 Excavation and Off-Site Disposal	4 Capping Site
Effectiveness	Protective of Human Health and the Environment	• Not protective of human health and the environment; • Would not achieve the regulatory-/risk-based clean-up goals developed for the Site. • Rank - 0	• Protective of human health and the environment; • Would achieve the regulatory-/risk-based clean-up goals developed for the Site. • Rank - 4	• Protective of human health and the environment; • Would achieve the regulatory-/risk-based clean-up goals developed for the Site. • Rank - 4	• Protective of human health and the environment; • Would achieve the regulatory-/risk-based clean-up goals developed for the Site. • Rank - 4	• Protective of human health and the environment; • Would not achieve the regulatory-/risk-based clean-up goals developed for the Site. • Rank - 2
	Reduction of Toxicity, Mobility, or Volume via Treatment	• Does not reduce toxicity, mobility, or volume of COCs. • Rank - 0	• Reduces toxicity,and mobility of COCs in soil by: 1) reducing Cr^{6+} to Cr^{3+}; 2) stabilizing soil and reducing mobility; and 3) further reducing mobility by inhibiting surface water infiltration by installation of an engineered cap. • Rank - 4	• Reduces toxicity and mobility of COCs in soil by: 1) reducing Cr^{6+} to Cr^{3+}; 2) stabilizing soil and reducing mobility; and 3) further reducing mobility by inhibiting surface water infiltration by installation of an engineered cap. • Rank - 4	• This alternative reduces the toxicity, mobility, and volume of COCs on site because impacted material is removed, however the impacted soil is only moved from one location to another. • Rank - 3	• Reduces the mobility of COCs by reducing infiltration of surface water, but, does not reduce toxicity or volume. • Rank - 2
	Short-Term Effectiveness	• Not applicable because does not require action. • Rank - 0	• Is effective in the short-term because the alternative can be implemented in less than 1 year (approximately 10 to 12 months). • Rank - 3	• Is effective in the short-term because the alternative can be implemented in less than 1 year (approximately 10 to 12 months). • Rank - 3	• Is effective in the short-term because the alternative can be implemented in less than 1 year (approximately 6 to 9 months). • Rank - 3	• Is effective in the short-term because the alternative can be implemented in less than 1 year (approximately 6 to 9 months).. • Rank - 3
	Long-Term Effectiveness	• Does not provide long-term effectiveness. • Rank – 0	• Provides long-term effectiveness, with proper maintenance of the cap. • Rank - 4	• Provides long-term effectiveness, with proper maintenance of the cap. • Rank - 4	• Provides long-term effectiveness with no maintenance required. • Rank - 4	• Provides long-term effectiveness, with proper maintenance; however, some COCs may remain mobile. • Rank - 2

	Evaluation Criteria	**1** No Further Action	**2a** LDA/ISCR using CaSx with Engineered Cap	**2b** LDA/ISCR using $FeSO_4$ with Engineered Cap)	**3** Excavation and Off-Site Disposal	**4** Capping Site
Implementability	Technically Feasible	• Is technically feasible because no action is required. • Rank - 4	• Is technically feasible, based on bench-scale testing results. • CaSx is a more technically feasible reducing agent, when compared to $FeSO_4$; CaSx could leach to groundwater. • Requires field pilot testing prior to full-scale implementation. • Has been implemented at similar properties. • Implementation may result in noise, dust, sulfur odor, and temporary disruption to the local community; however, mitigation measures are readily available to address these concerns. • Would result in a relatively small increase of truck traffic, disruption to residents, and transport of treated swell material through the community • Implementation may result in potential for runoff during rain events; however, mitigation measures, such as stormwater BMPs, are readily available to address this concern. • Rank - 3	• Is technically feasible, based on bench-scale testing results. • $FeSO_4$ is a less technically feasible reducing agent, when compared to CaSx; requires acid use, which would cause health and safety concerns to field personnel, and has the potential to mobilize other metals, such as Arsenic. • Requires field pilot testing prior to full-scale implementation. • Has been implemented at similar properties. • Implementation may result in noise, dust, and temporary disruption to the local community; however, mitigation measures are readily available to address these concerns. • Would result in a relatively small increase of truck traffic, disruption to residents, and transport of treated swell material through the community • Implementation may result in potential for runoff during rain events; however, mitigation measures, such as stormwater BMPs, are readily available to address this concern. • Rank - 3	• Is technically feasible. • Has been implemented at similar properties. • Implementation may result in noise, dust and temporary disruption to the local community; however, mitigation measures are readily available to address these concerns. • Implementation may result in potential for runoff during rain events; however, mitigation measures, such as stormwater BMPs, are readily available to address this concern. • Implementation would generate a large amount of soil for off-site disposal, with potential long-term liability. • Would result in a large increase of truck traffic, disruption to residents, and transport of untreated, potentially hazardous waste through the community. • Rank - 2	• Is technically feasible. • Has been implemented at similar properties. • Implementation may result in noise, dust, and minor temporary disruptions to the local community; however, mitigation measures are readily available to address these concerns. • Implementation may result in potential for runoff during rain events; however, mitigation measures, such as stormwater BMPs, are readily available to address this concern. • Rank - 3
	Available Services and Materials	• This remedial alternative does not require equipment, labor force, permits, or other resources to implement. • Rank – 0	• Equipment, labor, resources and materials are readily available. • Rank - 3	• Equipment, labor, resources and materials are readily available. • Rank - 3	• Equipment, labor, resources and materials are readily available. • Rank - 3	• Equipment, labor, resources and materials are readily available. The equipment required for installing a cap is more available, and requires a much shorter mobilization time than other active remedial alternatives. • Rank - 3

	Evaluation Criteria	**1** No Further Action	**2a** LDA/ISCR using CaSx with Engineered Cap	**2b** LDA/ISCR using $FeSO_4$ with Engineered Cap)	**3** Excavation and Off-Site Disposal	**4** Capping Site
	Administrative Feasibility	• Would require deed restrictions to leave impacted material in place. • Rank - 0	• Requires permits from RWQCB (WDRs, Stormwaer NPDES) and local agencies. • Deed restrictions would be required for this alternative, to address impacted soils left in place at concentrations that exceed residential SSLs. • Rank - 3	• Requires permits from RWQCB (WDRs, Stormwaer NPDES) and local agencies. • .Deed restrictions would be required for this alternative, to address impacted soils left in place at concentrations that exceed residential SSLs. • Rank 3	• Requires stormwater NPDES permit from RWQCB but WDRs would not be required. Permits from locakl agencies would also be required. • Deed restrictions would be required for this alternative, to address impacted soils left in place at concentrations that exceed residential SSLs. • Rank 3	• Only local construction permits would be required. • Deed restrictions would be required for this alternative, to address impacted soil left in place. • Rank 4
	Community and Regulatory Acceptance	• The community and regulatory agencies would not likely accept this alternative. • Rank – 0	• The community and regulatory agencies are expected to accept this alternative contingent upon the results of field pilot testing. • LARWQCB has accepted this technology for similar sites in the San Fernando Valley. • LARWQCB's General WDR permit accepts CaSx as reducing agent for Cr6+. • Rank - 3	• The community and regulatory agencies are expected to accept this alternative contingent upon the results of field pilot testing. • LARWQCB's General WDR permit accepts $FeSO_4$ as reducing agent for Cr6+. • Rank - 3	• Regulatory agencies are expected to accept this alternative however, community acceptance may be low due to truck traffic and the transport of potentially hazardous wastes on local streets. • LARWQCB has accepted this technology at numerous sites throughout the region, • Rank – 2	• The community and regulatory agencies are not expected to accept this alternative. • LARWQCB has accepted this technology at numerous sites throughout the region, • Rank - 1
Costs		• Zero cost • Lowest cost of assessed alternatives; therefore, the alternative is cost effective. • Rank - 4	• Cost range approximately $2,500,000 to $2,800,000, depending of volume of swell material and waste disposition/costs. • Higher in cost than Alternatives 1 and 4, and similar in cost to Alternative 2b and Alternative 3. • Rank – 2	• Cost range approximately $2,500,000 to $2,800,000, depending of volume of swell material and waste disposition/costs. • Higher in cost than Alternatives 1, and 4, similar in cost to 2a, and lower in cost than Alternative 3. • Rank – 2	• Cost range approximately $2,800,000 to $4,300,000, depending on volume excavated and waste disposition/costs. • Highest cost alternative. • Significant risk to costs due to unknown waste characterization of waste disposed offsite. • Rank - 1	• Cost range approximately $460,000 to $680,000 initial capital cost; long-term maintenance costs would be required. • Lowest cost alternative with action taken. • Rank - 3
Total Ranking		8	29	29	25	23

Notes:

Rank 0 – Worst
Rank 1 – Poor
Rank 2 – Fair
Rank 3 – Good
Rank 4 – Very Good

APPENDIX A

LEGAL DESCRIPTION

The land situated in the City of Los Angeles, County of Los Angeles, State of California, as follows:

PARCEL 1:

THAT PORTION OF LOT 16 OF THE RIVERDALE TRACT, AS PER MAP RECORDED IN BOOK 54 PAGE 41, MISCELLANEOUS RECORDS OF SAID COUNTY, DESCRIBED AS FOLLOWS:

BEGINNING AT A POINT IN THE NORTHERLY LINE OF GOODWIN AVENUE (FORMERLY OAK DRIVE), AS NOW ESTABLISHED 50 FEET WIDE, AS SHOWN ON MAP OF TRACT NO. 644, AS PER MAP RECORDED IN BOOK 15 PAGES 198 AND 199 OF MAPS, IN THE OFFICE OF THE COUNTY RECORDER OF SAID COUNTY, DISTANT THEREON WEST PARALLEL WITH THE SOUTHERLY LINE OF SAID LOT 16, 555.04 FEET FROM THE EASTERLY LINE OF SAID LOT 16, SAID EASTERLY LINE BEING THE SOUTHWESTERLY LINE OF THE SOUTHERN PACIFIC RAILROAD COMPANY'S RIGHT OF WAY; THENCE FROM SAID POINT OF BEGINNING NORTH 22º 50' WEST PARALLEL WITH SAID EASTERLY LINE OF SAID LOT AND SAID RIGHT OF WAY LINE 431.97 FEET, MORE OR LESS, TO THE SOUTHERLY LINE OF THAT CERTAIN 17 FOOT STRIP OF LAND CONVEYED TO SAID SOUTHERN PACIFIC RAILROAD COMPANY BY DEED RECORDED IN BOOK 4036 PAGE 102, OFFICIAL RECORDS OF SAID COUNTY; THENCE WEST ALONG SAID SOUTHERLY LINE 109 FEET; THENCE SOUTH 22º 50' EAST PARALLEL WITH SAID EASTERLY LINE OF SAID LOT AND SAID SOUTHWESTERLY RIGHT OF WAY LINE 431.97 FEET, MORE OR LESS, TO SAID NORTHERLY LINE OF GOODWIN AVENUE; THENCE EAST THEREON 109 FEET TO THE POINT OF BEGINNING.

APPENDIX B

RESPONSE TO JANUARY 19, 2010 DRAFT RAP COMMENTS MATRIX

Responses to Agency Comments to Draft Remedial Action Plan for
The Spirito Family Trust – Former Excello Plating Co., Inc. Facility
(4057 and 4059 Goodwin Avenue, Los Angeles, CA)

Overall Comment	Agency	Specific Comment	Agency Comment	Response	Final RAP Location
1.	LARWQCB	1. General	The RAP needs a section presents a brief description (including decision flowchart or tree, tables, etc.) on the proposed "Demolition (Demo) and Decon (Decontamination) Plan for the existing building located at 4057 Goodwin Avenue. Additionally, the section should include costing information.	A section will be added to the Final Remedial Action Plan (RAP) that summarizes the conceptual decontamination and demolition (D&D) plan, with related estimated costs, for the existing building located at 4057 Goodwin Avenue. The final D&D plan will be presented as a separate document following completion of the hazardous building materials survey (HBMS). The final plan will include descriptions of hazardous materials documented during the HBMS and proposed building decontamination and demolition activities.	Section 10
2.	LARWQCB	2. General	The RAP needs a section which presents a brief description (including tables) for the Sampling Plan which would be implemented during the implementation of the Demolition and Decontamination Plan. The plan would also include steps for sampling the event of an emergency response [i.e., spill(s) caused during the implementation of the RAP]. Additionally, the section should include costing information.	The proposed plan for sampling soil beneath the building floor slab after it is removed will be discussed in a new section within the Final RAP (note that if soil sampling beneath the removed slab is necessary, it is anticipated to be limited, because soil samples were collected from a depth of 1 foot from 37 of the soil borings advanced at the Former Excello Plating Co., Inc. facility during the assessments performed at the Site in 2006). This new section will also briefly discuss methods to be used during building demolition to reduce the likelihood of migration of impacted dust to surrounding properties, such as dust suppression using water trucks, foam, or other possible means. A Contingency Plan will be added as an Appendix to the Final RAP. The Contingency Plan will describe provisions that will be used on Site during implementation of the RAP, and will include emergency response procedures, emergency contact information, and agency notification protocols. The Contingency Plan will also include general procedures for assessing extents and degrees of impacts in the event of a spill during the HBMS process and/or decontamination and demolition activities.	Section 10 Appendix T Appendix P

Copyright 2010 Kleinfelder

Overall Comment	Agency	Specific Comment	Agency Comment	Response	Final RAP Location
				Estimated costs to implement the decontamination and demolition activities will be included in the Final RAP.	
3.	LARWQCB	3. General	The RAP needs a section which presents the Quality Assurance (QA) and Quality Control (QC) including QA/QC for the collection and analysis of samples of various media.	A section will be added to the Final RAP that describes the quality assurance and quality control (QA/QC) procedures to be implemented during future sample collection and analyses.	Section 11 Appendix T
4.	LARWQCB	4. General	The RAP needs a section which presents a brief description on the Health and Safety plan (HASP).	An initial draft of the Site-Specific Health and Safety Plan (HASP) that will be prepared for field activities will be included in the Final RAP as an Appendix.	Appendix S
5.	LARWQCB	5. General	The RAP needs a section on Public Participation including fact sheets, etc. Some issues might also include noise, hydrogen sulfide, dust, traffic, etc.	As discussed to date with the Los Angeles Regional Water Quality Control Board (LARWQCB), a section describing (conceptual only) public participation activities will be included in the Final RAP. Preparation of fact sheets, presentations, public meeting schedules, etc., will be completed following approval of the Final RAP.	Section 12
6.	LARWQCB	6. General	The RAP has not been signed by the Senior Engineer or the Senior Hydrogeologist.	Kleinfelder's policy is to omit signatures from draft documents. The Final RAP will be signed and stamped by the appropriate registered professionals.	Signature page
7.	LARWQCB	7. General	The RAP needs a more detailed schedule with project tasks and milestones.	A more detailed schedule will be prepared and added to the Final RAP.	Section 13
8.	LARWQCB	8. General	The RAP needs to provide text that states a Human Health Risk Assessment will be conducted once the RAP has been completed.	A discussion describing the Human Health Risk Assessment (HHRA) that will be performed following RAP implementation will be included in the Final RAP.	Exec. Summary Section 8 Section 9
9.	LARWQCB	9. General	The RAP needs to provide text that a State of California Deed Restriction may be required once the RAP has been completed. The Deed Restriction may require the use of institutional, administrative, and engineering controls.	The Draft RAP mentions the potential need for deed restrictions following implementation of the Final RAP in several places, including on page 4 in paragraph 3 of the Executive Summary, in subsection 7.3, and in Table 1. A specific reference to LARWQCB's deed restriction policy will be added in the Final RAP, as follows: "The prospective purchaser will submit for	Exec. Summary Section 7 Section 8 Table 1

Copyright 2010 Kleinfelder

Overall Comment	Agency	Specific Comment	Agency Comment	Response	Final RAP Location
				the LARWQCB Executive Officer's approval and execution a deed restriction referred to as a "Covenant and Environmental Restriction on Property (CERP)," that includes the language attached as Appendix A. Upon execution by the Board's Executive Officer, the prospective purchaser will record the CERP on the Property."	
10.	LARWQCB	10. General	The RAP needs to address potential settling issues regarding the use of the CAP and the concrete solidification processes.	Potential settling issues will be addressed in the large diameter auger (LDA)/in-situ chemical reduction (ISCR) and stabilization design plans and specifications, which will be prepared following approval of the Final RAP and performance of the pilot testing.	NA
11.	LARWQCB	11. General	There are no geologic cross-sections showing the distribution of lithologic units across the site. These cross-sections can provide an insight into what difficulties that may be encountered with the implementation of the proposed Soil Vapor Extraction (SVE) system and proposed remedy for heavy metal contamination.	Lithologic information is included on Plates 5B, 5C, 5D, 5E, and 7B of the Draft RAP. More detailed cross sections, showing the inferred distribution of the lithologic units, will be included in the Final RAP. These cross sections will be discussed with emphasis on how and why implementing the LDA/ISCR alternative to mitigate metals in soils is not expected to significantly impact remedial activities for perchloroethylene (PCE) and trichloroethylene (TCE) in the vadose zone.	Plates 5B-5D Plate 7B Section 6
12.	LARWQCB	12. General	The SVE system's 60 feet of ROI was estimated, this estimation needs to be validated by an SVE pilot test, and therefore, the RAP needs a discussion on this SVE pilot test to be conducted.	The proposed soil vapor extraction (SVE) pilot test to be performed prior to RAP implementation is discussed in Section 9.3 of the Draft RAP. The estimated radius of influence (ROI) of SVE wells used to develop the conceptual SVE system was based on our experience with sites of similar geology and will be confirmed during SVE pilot testing, which will be performed after the Final RAP is approved.	Section 9.3
13.	LARWQCB	13. General	The RAP needs to undergo a technical editing review prior to being finalized. For example the Title Block Figure 3A, should read TCE iso-concentrations in Soil Gas versus Depth.	A formal technical editing of the Final RAP will be performed by a Kleinfelder Technical Editor prior to submittal to agencies. As for the cited example, the Title Block of Figure 3A will be revised to read "TCE Iso-concentrations in Soil Vapor versus Depth."	Global

Copyright 2010 Kleinfelder

Overall Comment	Agency	Specific Comment	Agency Comment	Response	Final RAP Location
14.	LARWQCB	14. General	It is not clear as to what the RAP objective(s) are. The RAP needs to include a discussion on the objective(s) in the Executive Summary and Introductory sections.	Objectives stated in the Executive Summary will be reiterated within the appropriate sections in the Final RAP.	Exec. Summary Section 2
15.	LARWQCB	15. General	The RAP's proposed remedy needs the details protocol and a layout in the next phase Design Package/Work Plan with regard to the following: a. Effectiveness, and b. Implementability	Sections will be added to the Final RAP that will discuss the means by which effectiveness and implementability of the remedial treatments will be measured.	Section 8.5 Section 9.9
16.	LARWQCB	1. Specific	Page i — The RAP has not been signed by the Senior Engineer or the Senior Hydrogeologist.	Kleinfelder's policy is to omit signatures from draft documents. The Final RAP will be signed and stamped by the appropriate registered professionals.	Page i
17.	LARWQCB	2. Specific	Page 1 – Executive Summary needs to identify the plating operation located at 4059 Goodwin Avenue as Plating Engineering Company.	The historic plating operation at 4059 Goodwin Avenue will be identified as operated by "Plating Engineering Company, Inc." (which is assigned the acronym "PECI" in the Draft RAP).	Exec. Summary Section 3
18.	LARWQCB	3. Specific	A review of Figure 6 versus Figure 7A suggests that the proposed site CAP be moved 30-40 feet laterally to the south due to the presence of contamination in the southern portion of the site within the building footprint.	The purpose of the engineered cap is to provide surface cover above the buffer zone where only cement stabilization will be used to treat the metals impacted soil. The buffer zone will be installed between 35 and 45 feet below ground surface (bgs), within the 5.6 milligrams per kilogram (mg/kg) hexavalent chromium iso-contour (Figure 6). The cap will be designed to overlap this zone by as much as 50 feet on all sides. The cap is not intended to cover the entire lateral extent of metals-impacted soil. It is intended only to cover the area above the buffer zone with the specified overlap.	Exec. Summary Section 8.1 Plate 7A
19.	LARWQCB	4. Specific	Figure 5B indicates significant a TCE concentration to 30-feet below ground surface (bgs). A technical description needs to be presented in the RAP that	The proposed SVE wells, as described in Subsection 9.2 of the Draft RAP, will be nested, with screened intervals from 5 to 25 feet bgs, and from 30 to 45 feet bgs. The isolated screened	Section 9.2

Copyright 2010 Kleinfelder

Overall Comment	Agency	Specific Comment	Agency Comment	Response	Final RAP Location
			describes how the SVE system will be effective at this and at deeper depths.	intervals will enable SVE activities to be focused on targeted depths. Observation Wells OBS-1 and OBS-2, to be used during SVE pilot testing, are to be screened similarly and could be added to the vapor extraction well network to enhance PCE and TCE recovery in the more highly impacted portions of the vadose zone.	
20.	LARWQCB	5. Specific	Title Block Figure 3A should read TCE iso-concentrations in Soil Gas versus Depth.	The Title Block of Plate 3A in the Final RAP will be revised to read “TCE Isoconcentrations in Soil Vapor versus Depth.”	Plate 3A
21.	LARWQCB	6. Specific	Executive Summary, Page 1, third paragraph the text that states the acronym CAO stands for "Corrective Action Order." The text should be revised to state the acronym CAO stands for Cleanup and Abatement Order. Furthermore the CAO is R4-2003-0038-R.	Text will be edited in the Executive Summary of the Final RAP as requested and a reference to the specific Cleanup and Abatement Order (CAO) will be added.	Exec. Summary
22.	LARWQCB	7. Specific	Executive Summary, Page 1, third paragraph needs to include text that states "This RAP was developed and submitted by a prospective purchaser on behalf of the Trust.	The third sentence in paragraph three on page 1 will be edited in the Final RAP as follows: “This RAP was prepared by Kleinfelder and is being submitted on behalf of The Spirito Family Trust.”	Exec. Summary
23.	LARWQCB	8. Specific	Executive Summary, Page 2, first paragraph, first sentence, the word "interrupt" needs to be replaced with "cease."	During the July 22, 2010 project meeting with LARWQCB and United States Environmental Protection Agency (US EPA), it was agreed the text insert should read, “The goal for the RAP is to prevent future migration of the contaminants of concern (COC) present in Site vadose zone soil to underlying groundwater.”	Exec. Summary Section 2
24.	LARWQCB	9. Specific	Executive Summary, Page 2, first paragraph, second sentence, the word "impact" needs to be replaced with "contamination."	The text of the Final RAP will be edited as requested.	Exec. Summary

Copyright 2010 Kleinfelder

Overall Comment	Agency	Specific Comment	Agency Comment	Response	Final RAP Location
25.	LARWQCB	10. Specific	Executive Summary, Page 2, first paragraph, fourth sentence, the entire sentence needs more clarification. What is meant by *"interpreted complete and potentially-complete contaminant exposure pathways."* A description/definition of this phrase is presented later in the paragraph. Suggest the description/definition be presented earlier in the paragraph.	The content of the referenced paragraph will be re-arranged for clarity in the Final RAP.	Exec. Summary
26.	LARWQCB	11. Specific	Executive Summary, Page 2, first paragraph, last sentence does not include future warehouse workers, if these are not considered, then state why and what administrative/engineering controls will be used to prevent these worker exposure pathways.	Complete pathways for future warehouse workers are addressed by use of the phrase "…and inhalation of vapors by on-Site workers in enclosed structures after redevelopment…" in the Executive Summary of the Draft RAP, in Section 4, and on Plate 3C (Conceptual Site Model). Administrative and engineering controls will be considered, if necessary, to control exposure pathways, as discussed at various locations throughout the Draft RAP.	Exec. Summary Section 5 Plate 3C
27.	LARWQCB	12. Specific	Executive Summary, Page 3, first paragraph, last sentence or (3) reason, the entire reason needs to be rewritten to include text that states the site did contribute to groundwater contamination of the listed COCs including the contamination lying beneath the Site. However, this RAP is not intended to address groundwater contamination. The groundwater contamination will be addressed by USEPA as part of their evaluation of the Glendale Extraction Wells performance, which includes GS-3.	Reason (3) will be re-written to include the following: "The Site contributed to groundwater contamination by the listed COCs;. This RAP is not intended to address groundwater contamination. A final list of COCs will be added to the Executive Summary to ensure it is clear what constituents are and are not considered COCs.	Exec. Summary
28.	LARWQCB	13. Specific	Executive Summary, Page 4, third paragraph, the paragraph should include a reference to the Regional Board's Deed Restriction entitled *"Covenant and Environmental Restriction on Property."*	A specific reference to LARWQCB's deed restriction policy will be added in the Final RAP, as follows: "The prospective purchaser will submit for the LARWQCB Executive Officer's approval and execution a deed restriction	Exec. Summary Section 8.1

Copyright 2010 Kleinfelder

Overall Comment	Agency	Specific Comment	Agency Comment	Response	Final RAP Location
				referred to as a "CERP," that includes the language attached as Appendix A. Upon execution by the Board's Executive Officer, the prospective purchaser will record the CERP on the Property."	
29.	LARWQCB	14. Specific	Executive Summary, Page 5, first paragraph, the paragraph needs to include text that states a Regional Board Waste Discharge Requirements (WDR) permit will be required for the CaSOx injection, because groundwater monitoring will be required to determine whether the injection of the CaSOx is working.	A section will be added to the Final RAP that describes why a State Water Resources Control Board (SWRCB) Waste Discharge Requirements (WDR) Permit will be acquired for the proposed injection of calcium polysulfide (CaSx) in the subsurface, and that monitoring consistent with the permit, and activities discussed in the Final RAP, will be implemented. In addition, a reference to the General WDR Permit (R4-2007-0019), which includes CaSx as a pre-approved injectant, will be provided. The date of WDR Permit Application submittal will be added to the detailed schedule included in the Final RAP. Injection rates and quantities will be specified in the WDR Permit Application.	Exec. Summary Section 8.4
30.	LARWQCB	15. Specific	Page 41, Equation 10 results, why was Federal USEPA MCL for chromium of 100 micrograms per liter (µg/L) used instead of the State of California MCL of 50 µg /L?	The Site-specific soil screening level (SSL) proposed in the Draft RAP is based on the City of Glendale Voluntary Cleanup Goal of 5 micrograms per liter (µg/L) for hexavalent chromium in groundwater, which is more conservative than SSLs generated by use of the US EPA Maximum Contaminant Level (MCL) or California Environmental Protection Agency (Cal EPA) MCL for total chromium. Equation 10 calculates Site-specific SSLs using Site-specific parameters as input values, with the key input value being the target groundwater cleanup goal. The US EPA MCL of 100 µg/L for total chromium was used as an input value for a frame of reference, because its use results in an SSL of 2 mg/kg hexavalent chromium in soil. This	Section 4.2

Copyright 2010 Kleinfelder

Overall Comment	Agency	Specific Comment	Agency Comment	Response	Final RAP Location
				SSL is consistent with the cleanup goal requested by LARWQCB in a letter to The Spirito Family Trust dated October 31, 2007. Calculation of SSLs using the Cal EPA and US EPA MCLs are only intended to provide additional points of reference. The Final RAP will be revised to eliminate equations and input values not being used so as to avoid confusion. In addition, more details regarding the use of Equation 10 to calculate SSLs will be included in the Final RAP.	
31.	LARWQCB	16. Specific	Pages 41 and 42 – Equation 10: why were values from USEPA 2004 Table of PRGs used for some COCs (i.e., hexavalent chromium and nickel) and other values from USEPA's December 2009 RSL table used for other COCs (i.e., total chromium and cadmium)?	Values from US EPA's 2004 table of Preliminary Remedial Goals (PRGs) were not used on pages 41 and 42, or in SSLs calculations using Equation 10. Values used for input into Equation 10 are the Federal and State MCLs, the City of Glendale Voluntary Cleanup Goal for hexavalent chromium in groundwater, and public health goals (PHGs). The Final RAP will be revised to eliminate equations and input values not being used so as to avoid confusion. In addition, more details regarding the use of Equation 10 to calculate SSLs will be included in the Final RAP.	Section 4.2 Appendix I
32.	LARWQCB	17. Specific	Page 43 – Equation 11: as stated in comment number 17, some values used in calculating equation 10 for several COCs were based on values from USEPA 2004 PRG table. The values from this table are assume a "dilution attenuation factor (DAF) of 1 while the remaining COC values for equation 10 are based on USEPA's December 2009 RSL table, which also assumes a DAF of 1. Based on this information it's confusing as to what equation 11 is calculating, since a DAF of 1 suggests, no dilution.	Equation 11, on page 43 of the Draft RAP, and page 4-28 of the US EPA Soil Screening Guidance (SSG) User's Guide, was used to derive a Site-specific dilution factor in groundwater, based on Site-specific parameters such as infiltration rate (I), groundwater gradient (i), aquifer hydraulic conductivity (K), and source length (L). The Final RAP will be revised to eliminate equations and input values not being used so as to avoid confusion. In addition, more details regarding the use of Equation 11 to calculate SSLs will be included in the Final RAP.	Section 4.2 Appendix I

Copyright 2010 Kleinfelder

Overall Comment	Agency	Specific Comment	Agency Comment	Response	Final RAP Location
33.	LARWQCB	18. Specific	Page 45 - Equation 14: See comment presented as number 16 above.	During the July 22, 2010 project meeting with LARWQCB and US EPA, it was agreed to delete Equation 14 and provide an explanation as to why it was removed from the Final RAP.	NA
34.	LARWQCB	19. Specific	Page 46 – proposed cleanup levels should be reviewed and recalculated based on comments presented as numbers 16, 17, and 18 and USEPA comment 12.	Site-specific SSLs calculations will be updated in the Final RAP, and will consider the May 2010 US EPA RSLs.	Section 4.2
35.	LARWQCB	20. Specific	Page 46 – why is a discussion of 8.3 as the default MCL for hexavalent chromium being mentioned, when the MCL value for hexavalent chromium in equation 10 is 2 mg/kg.	The reference to 8.3 µg/L will be removed from the Final RAP.	NA
36.	LARWQCB	21. Specific	Page 46, first paragraph, second sentence needs to be revised to state "The State of California uses 50 µg/L as the MCL for hexavalent chromium.	Text in the Final RAP will be edited as requested.	Section 4.2
37.	LARWQCB	22. Specific	Page 47, first paragraph, reason (3) needs to be revised to state, residual chromium, hexavalent chromium, cadmium, and nickel left in-situ will not be a source for groundwater contamination including the GS-3 well. Note the site is a source of chromium, hexavalent chromium, cadmium, and nickel contamination of groundwater which has impacted GS-3.	Text will be added to the Final RAP to clarify its goal is to prevent future migration of the COCs present in Site vadose zone soil to underlying groundwater. Based on SSLs calculated using the SSG document, COCs in soil after implementation of the proposed remedial action at the Excello site are not expected to impact groundwater extracted by well GS-3 above current cleanup levels. Nickel and cadmium do not appear to be present in soils at concentrations of concern. Recent groundwater monitoring data collected at the Site for nickel and cadmium (collected between February 2006 and December 2009, and reported in the January 15, 2010 "Groundwater Monitoring Report, Second Semi-Annual 2009" prepared by CCI), found that nickel concentrations ranged from not detected to a maximum concentration of 23 µg/L, a concentration that is below the Cal EPA MCL for nickel (100 µg/L). In the February 2006	Section 4.2

Copyright 2010 Kleinfelder

Overall Comment	Agency	Specific Comment	Agency Comment	Response	Final RAP Location
				groundwater samples cadmium was detected in one sample (from Well MW-2), at a concentration slightly exceeding its Cal EPA MCL (5.2 µg/L vs. 5.0 µg/L). Cadmium was not detected in May or September 2008, or June 2009 groundwater samples. In the December 2009 samples, cadmium was again detected in one sample (from Well MW-2), at a concentration of 3.5 µg/L, which is below the Cal EPA MCL. Therefore contributions of cadmium and nickel from the Site are not anticipated to be concerns in groundwater extracted from GS-3 at this time. Total chromium and hexavalent chromium appear to be part of the regional groundwater plume; however, it is possible the Site has contributed to groundwater contamination by these COCs, which could be extracted by GS-3. The remediation to be accomplished according to the RAP will reduce and immobilize the hexavalent chromium concentrations to levels that are not of ongoing concern. Further, the cap contemplated as part of the proposed remediation will further mitigate the concern of future migration of COCs to groundwater.	
38.	LARWQCB	23. Specific	Page 53, table presenting the "Summary of VOC Site-Specific Screening Levels needs to have each site specific screening levels in soil vapor recalculated from micrograms per cubic liter (µg/m^3) to µg/L. Based on these recalculations, the maximum soil vapor concentration (5-feet bgs), and which CHHSL needs to be re-evaluated (For example, the CHHSL for 1,1,1-trichloroethane (1,1,1-TCA) is based on "Indoor Air Human Health Screening Levels using the Commercial/Industrial Land Use	At the request of the LARWQCB, Site-specific soil vapor SSLs will be presented in this table in both micrograms per cubic meter (µg/m^3) and µg/L, for convenience. The row of industrial/commercial California Human Health Screening Levels (CHHSLs) will be revised to include screening levels for soil vapor. The table will also be modified by removing the row with maximum 5-foot soil vapor concentrations from previous assessments, as its inclusion encourages a comparison of modeled values to these, which is not appropriate, and is a potential source of confusion to the reader.	Section 4.2

Copyright 2010 Kleinfelder

Overall Comment	Agency	Specific Comment	Agency Comment	Response	Final RAP Location
			Only," whereas the CHHSLs for trichloroethylene (TCE) and perchloroethylene (PCE) are based on "Shallow Soil Gas Human Health Screening Levels (Vapor Intrusion, using the Commercial/Industrial Land Use Only." The use of CHSSLs needs to be consistent, therefore use either Indoor Air or Shallow Soil Gas values for the calculations. If present building is to be demolished, then the use of Shallow Soil Gas may be more appropriate, however if a building is to be constructed, then use of administrative or engineering controls will be required if remaining in-situ 1,1,1-TCA, TCE, and/or PCE soil gas values are above indoor air CHSSLs. The table needs to reflect in bold red font, those CHHSLs which will be exceeded for 1,1,1-TCA, TCE and PCE regardless of whether Indoor Air or Shallow Soil Gas values are used in the calculations.	Following completion of proposed SVE remedial activities, the residual volatile organic compounds (VOCs) in shallow soil vapor will be sampled, and the results will be used to perform an HHRA. Results of the HHRA will dictate whether administrative and engineering controls are needed.	
39.	LARWQCB	24. Specific	Page 54, first paragraph, second to the last sentence, need to reference the plates that are discussed in comment number 11 with Regional Board General Comments above.	Lithologic information is included on Plates 5B, 5C, 5D, 5E, and 7B of the Draft RAP. This information will be expanded and clarified in the Final RAP by adding more lithologic detail (i.e., inferred lithologic unit contacts) to these cross sections.	Plates 5B-5E Plate 7B
40.	LARWQCB	25. Specific	Page 56, first paragraph, first sentence, need to state the use of administrative or engineering controls (i.e., vapor barrier) will be constructed.	The Final RAP will describe administrative and/or engineering controls that will be considered if it is not possible to achieve CHHSLs or another appropriate risk-based cleanup level within the practical limits of SVE technology. The practical limits of SVE technology will be demonstrated as follows:	Section 9

Copyright 2010 Kleinfelder

Overall Comment	Agency	Specific Comment	Agency Comment	Response	Final RAP Location
				1. During SVE system operation, the extracted soil vapors, and individual SVE well screened intervals, will be sampled (using Summa® canisters or glass bulbs) and analyzed for total PCE and TCE on day 1 and monthly thereafter. 2. Weekly monitoring of the VOCs concentrations in vapors using a PID, at the influent to the SVE system and at individual SVE wells will be performed. 3. When four successive weekly vapor samples indicate that VOC concentrations have reached asymptotic conditions (i.e., the concentration difference between successive sampling events is negligible, and the total PCE and TCE concentrations are approaching a de-minimus value), the SVE system will be switched to pulse operation. 4. During pulse operation the SVE system will be shut down for 2 weeks. 5. Re-start the system and collect influent samples at the following frequencies: 1 day, 7 days, and every 2 weeks until two consecutive concentrations are at non-detect or asymptotic levels for PCE and TCE. 6. When the weekly monitoring indicates that the VOC vapor concentrations measured with a PID have again reached asymptotic levels, the system will be shut down for another 2-week interval and the pulse operation cycle repeated.	

Copyright 2010 Kleinfelder

Overall Comment	Agency	Specific Comment	Agency Comment	Response	Final RAP Location
				7. The VOC vapor concentrations measured with a PID on day 1 of the SVE system startup and day 1 of each of the pulse operation cycle will be plotted. 8. This pulse operation will continue until the day-1 VOC vapor concentrations measured with a PID and PCE and TCE concentrations measured in a laboratory have reached asymptotic conditions. This will be considered to be the practical limits of the SVE technology. A soil vapor survey will be conducted in the shallow vadose zone following shutdown of the SVE system. Results of the soil vapor survey will be used to conduct an HHRA for the intended Site re-use. The need for implementation of administrative and/or engineering controls at the Site will be considered, if necessary, based on results of the HHRA and future Site use.	
41.	LARWQCB	26. Specific	Page 56, first paragraph, last sentence, this assumption is based on what's happening at 40- feet bgs. Need to calculate what the TCE and PCE concentrations will be at 5-feet and 5-feet bgs and compare those to the CHHSLs. What happened to 1,1,1-TCA. Is the omission of 1,1,1-TCA indicate the SVE will remove the compound, or there is no off-gassing of the compound from the regional groundwater contamination. Is the compound part of the regional groundwater contamination? Need to include a brief discussion on this compound.	A final list of COCs will be added to the Executive Summary to ensure it is clear what constituents are and are not considered COCs. Justification will be provided for elimination of constituents as COCs. The last sentence of page 56, paragraph 1, states "This ongoing migration will prevent achievement of commercial/industrial CHHSLs by SVE." This statement was made because PCE and TCE in regional groundwater (i.e., from sources other than the Site) will continue to migrate beneath the Site and thereby provide a source of PCE and TCE to the vadose zone until the regional contamination has been addressed. The goal is to achieve commercial/industrial CHHSLS for PCE and TCE concentrations in the shallow vadose zone (i.e.,	Exec. Summary Section 4.3

Copyright 2010 Kleinfelder

Overall Comment	Agency	Specific Comment	Agency Comment	Response	Final RAP Location
				less than 25 feet bgs), but these screening levels may not be achievable. The PCE and TCE concentrations off-gassed by regional groundwater, as estimated by Henry's Law, were compared to the 40-foot depth Johnson and Ettinger (J&E) Model results for potential future building scenarios. This comparison suggests that PCE and TCE concentrations off-gassed by regional groundwater could exceed Site-specific soil vapor SSLs (at 40 feet bgs) calculated for the four building scenarios; therefore, these off-gassed COCs could be an on-going source of impact to indoor air quality for a future building. 1,1,1-trichloroethane (1,1,1-TCA) was omitted from the discussion on page 56 for two reasons: 1) 1,1,1-TCA was not detected in the 30-foot bgs vadose-zone soil vapor samples collected from Probes K-26, K-32, K-33, K-35, K-36, and K-37 during October 2008 assessment activities; and 2) Concentrations of 1,1,1-TCA were below detection limits in the groundwater samples collected from groundwater monitoring wells (MW-1 through MW-6) as reported in the January 15, 2010 "Groundwater Monitoring Report, Second Semi-Annual 2009" prepared by CCI. On the basis of these results, we have concluded that 1,1,1-TCA is not currently a COC at the Site.	
42.	LARWQCB	27. Specific	Page 56, second paragraph, first sentence, what is meant by asymptotic levels and diminishing returns of VOC mass removal, since cleanup levels have not been calculated. The information needs to be more specific. Need to calculate potential asymptotic levels for the VOCs and/or develop a timeline when diminishing returns of VOC mass	The RAP will be revised to better define the SVE system operation, as described in the response to LARWQCB Specific Comment #25. As stated above, the goal is to achieve commercial/industrial CHHSLS for PCE and TCEin the shallow vadose zone (i.e., less than 25 feet bgs), but these screening levels may not be achievable.	Section 4.4

Copyright 2010 Kleinfelder

Overall Comment	Agency	Specific Comment	Agency Comment	Response	Final RAP Location
			removal might be achieved. This can be done by modeling and by knowing chemical properties when migrating through soil column and what concentrations are in the regional groundwater. EPA had a similar comments: Page 34: Section 5 does not include a cleanup goal for VOCs and Page 57: "Asymptotic levels" and "diminishing returns" are not quantitatively defined. There is no cleanup goal for VOCs.		
43.	LARWQCB	28. Specific	Page 56, second paragraph on VOC Cleanup Goals & Cleanup Levels, an assumption has been made that the VOC cleanup levels are based on soil vapor partitioning only. Need to provide justification why soil matrix samples were not taken, and if needed please provide the steps that will be taken to address the data gap. Additionally, the VOCs cleanup levels are based on attenuation factor methods/leaching. Additional information needs to be presented and discussed on the attenuation factor methods/leaching.	The intent of the discussion on Page 56 was not to establish cleanup levels based on water-vapor partitioning, but rather to highlight that regional groundwater impact will continue to be a source of PCE and TCE off-gassing into the vadose zone, and will likely prevent achieving commercial/industrial CHHSLs in the deeper vadose zone (i.e., more than 25 feet bgs). For different reasons, CHHSLs may not be achievable in the shallow vadose zone (i.e., less than 25 feet bgs). As discussed in the response to LARWQCB Specific Comment #25, we propose to remove VOCs from the subsurface to the practical limits of SVE technology. A soil gas survey will be conducted in the shallow vadose zone following shut down of the SVE system. Results of the soil gas survey will be used to conduct an HHRA for the intended Site re-use. The need for implementation of administrative and/or engineering controls at the Site will be considered based on results of the HHRA and future Site use. The discussion on page 56 will be revised in the Final RAP to clarify the intent of the Henry's Law calculation. It is proposed that SVE will be used to remove VOC mass from Site soils and soil vapor in	Section 4

Copyright 2010 Kleinfelder

Overall Comment	Agency	Specific Comment	Agency Comment	Response	Final RAP Location
				both the shallow and deeper portions of the vadose zone to the extent practicable by the technology. Based on various documented discussions with LARWQCB, we assume Site assessment was previously deemed complete. As a result, no additional assessment is proposed at this time. During a call with Larry Moore on June 1, 2010, he indicated that no responses to the two sentences at the end of Comment #28 are necessary.	
44.	LARWQCB	29. Specific	Page 59, Section LDA Mixing and ISCR, the section needs to include a discussion on the WDR permit including how the treated area will be monitored; need to present a plate/figure showing the proposed injection points in the treated area and which groundwater monitoring wells will be used for monitoring groundwater upgradient of the treated area, in the treated area, and downgradient of the treated area.	A brief discussion of the acquisition of a WDR Permit, and typical monitoring required to ensure compliance with permit conditions, will be added to the Final RAP. The discussion will include that LARWQCB has indicated the General WDR Permit under which LDA/ISCR activities will be performed is Order No. R4-2007-0019, which requires quarterly groundwater monitoring and analyses for hexavalent chromium, VOCs, total organic carbon, sulfide, sulfate, chloride, calcium, arsenic, cadmium, manganese, bromide, iodide, ferrous iron, pH, temperature, conductivity, dissolved oxygen, oxidation-reduction potential, turbidity, and groundwater elevation. There are no “injection points,” but rather orifices along the edges of the LDAs in which chemicals are injected. The area of the circles shown on Plate 7A display the extent of chemical injection. Groundwater monitoring wells MW-2 and MW-3 will be abandoned prior to implementation of LDA/ISCR, and replacement wells MW-2R and MW-3R will be installed to facilitate compliance monitoring. Well MW-2R will be installed between the LDA/ISCR treatment area and GS-3, and Well MW-3R will be installed cross-gradient of the	Exec. Summary Section 8.2

Copyright 2010 Kleinfelder

Overall Comment	Agency	Specific Comment	Agency Comment	Response	Final RAP Location
				LDA/ISCR treatment area. In addition, Well MW-4 will remain in place and serve as the up-gradient groundwater monitoring well, and Well MW-1 will remain in place and serve as a down-gradient groundwater monitoring well. The neighboring US EPA extraction wells will be used as WDR Permit monitoring points only if their screening levels are sufficiently shallow as to be useful.	
45.	LARWQCB	30. Specific	Page 60, first paragraph, second sentence, does the 5,000 cubic yards of soil include the chromium, cadmium, and nickel contaminated soil?	The hexavalent chromium-impacted soil occurs coincident with total chromium-, cadmium-, and nickel-impacted soil that exceeds the respective Site-specific cleanup goals proposed in the Draft RAP. This relationship will be clarified in the Final RAP.	NA
46.	LARWQCB	31. Specific	Page 60, second paragraph, the fourth sentence, needs more discussion on how confirmation borings and confirmatory testing will be done. Information on boring/sampling procedures, types of analyses, lists of methods, what number will be used to stop these boring procedures.	A detailed discussion of the confirmation sampling protocol is beyond the scope of this screening process. Details of the confirmation sampling protocol for the selected alternative will be provided in the Final RAP.	Section 8.5
47.	LARWQCB	32. Specific	Page 60, Section on Excavation and Off-Site Disposal, second sentence referencing an 800 cubic yards of overburden requiring excavation was not mentioned in the other alternatives and should have been. Additionally, there is no mention of confirmation borings and sampling, which should be discussed in this section.	The additional volume of excavated soil is expected due to side-sloping required to allow safe access to areas of impacted soil. This sloping requirement would not apply to the other evaluated alternatives. Confirmation sampling is mentioned but not discussed in detail. A detailed discussion of the confirmation sampling process is beyond the scope of this screening process. Details of the confirmation sampling protocol for the selected alternative will be provided in the Final RAP.	Section 8.5
48.	LARWQCB	33. Specific	Page 65, paragraph on Implementability should include a discussion on the transportation plans.	A subsection will be added to the Final RAP that describes a Transportation and Disposal Plan, including a map, for off-Site transportation and disposal of swell material and other waste materials. In addition, a Transportation and Disposal Plan will be prepared for the preferred	Section 8.7 Appendix R

Copyright 2010 Kleinfelder

Overall Comment	Agency	Specific Comment	Agency Comment	Response	Final RAP Location
				remedial alternative (LDA/ISCR), and included in the Final RAP as Appendix R.	
49.	LARWQCB	34. Specific	Page 66, first paragraph, last sentence needs to include sampling strategy including how samples will be collected and for what and for what analysis.	The intent of this section of the Draft RAP is to screen remedial alternatives. A proposed confirmation boring sampling plan for the LDA/ISCR alternative will be added to the Final RAP.	Section 8.5
50.	LARWQCB	35. Specific	Page 70, Section on Excavation, On-Site Thermal Desorption, and Backfill and Compaction, the last sentence should provide a discussion on treated soil will be sampled and analyzed to confirm the soil is clean and ready to be used as backfill.	The intent of this section of the Draft RAP is to screen remedial alternatives.	NA
51.	LARWQCB	36. Specific	Page 70, Section on No Further Action, the completion of an HHRA will be required regardless of what alternative is chosen, not just the NFA alternative. Therefore, the completion of an HHRA should be discussed in the RAP in the appropriate section.	A discussion describing the HHRA that will be performed following RAP implementation will be included in the Final RAP.	Exec. Summary Section 8.8 Section 9.10
52.	LARWQCB	37. Specific	Page 74, Section on Proposed Remedial Alternative for Metals in Soil, first paragraph, third sentence referencing Plates 4A through 4D; a plate similar to Plate 7B needs to be developed, presented, and discussed in this section as it is associated with Plates 4A through 4D.	Plate 7B will be referenced as requested in the Final RAP.	Section 8.1
53.	LARWQCB	38. Specific	Page 75, second bullet needs to reference a new plate which depicts the existing and any new monitoring well locations.	The second bullet on Page 75 will reference Plate 2, which will be updated to show the proposed locations for Wells MW-2R and MW-3R. Wells MW-1 and MW-4 are already depicted on Plate 2.	Plate 2

Copyright 2010 Kleinfelder

Overall Comment	Agency	Specific Comment	Agency Comment	Response	Final RAP Location
54.	LARWQCB	39. Specific	Page 77, last paragraph, first sentence needs to be rewritten to state that alternative reducing and stabilizing agents to be evaluated must be ones presented in the Regional Board's General WDR Permit approved list of agents.	The first sentence, last paragraph of Page 77 will be supplemented with "If necessary, alternative reducing agents will be evaluated, and only those listed on the General WDR Permit will be considered."	Section 8.2
55.	LARWQCB	40. Specific	Page 78, Section on Large-Diameter Auger Mixing/ISCR Permitting, a new bullet needs to be added that lists the 90-Day Temporary Haz-Waste Generator Permit which would be issued by USEPA and/or DTSC.	A bullet will be added to the Final RAP describing the 90-Day Temporary Hazardous Waste Generator Permit that will be required.	Section 8.4
56.	LARWQCB	41. Specific	Page 80, last paragraph, fourth sentence, what is the backup plan, if the cleanup-goals cannot or are not being achieved. The section needs a discussion on the backup plan.	Section 8.6 of the Final RAP will be supplemented with the following: "If cleanup goals are not achieved during the first treatment by LDA/ISCR in impacted areas, the treated soil will be re-worked, and additional reducing/stabilizing agent will be added to monitor compliance with Site-specific cleanup goals. If re-working treated soil is unsuccessful, consideration will be given to implementing solidification of impacted soil with cement-only as the treatment to immobilize COCs in soil, per the following sequence of events listed below. It should be noted the backup plan solidification process (for metals impacted vadose zone soils) includes relatively higher concentrations of cement than proposed for the buffer zone beneath the ISCR treatment area. The higher concentration of cement is intended to increase the effectiveness of the backup plan treatment. Without reductive effects, the backup plan is not preferred to the proposed LDA/ISCR treatment, but with the engineered cap is a reasonable backup option. 1. Soil will be treated by LDA/ISCR and stabilized with cement;	Section 8.5

Copyright 2010 Kleinfelder

Overall Comment	Agency	Specific Comment	Agency Comment	Response	Final RAP Location
				2. Confirmation samples of treated soils will be collected and leach testing will be performed to verify that leachable concentrations of metals COCs are below the established cleanup goals; 3. If leachable concentrations of COCs exceed respective cleanup goals, then treated soil will be re-worked in an attempt to achieve cleanup goals; 4. Confirmation samples of re-treated soils will be collected and leach testing will be performed to verify that leachable concentrations of metals COCs are below the established cleanup goals; ***5.*** If leachable concentrations of COCs from re-treated soils persist in exceeding cleanup goals, then solidification only as a backup plan will be considered. It should be noted that proposed cement stabilization/solidification bench-scale testing will confirm the potential feasibility of implementing cement solidification as a backup plan. It should be noted, cement solidification will be supplemented with the installation of an engineered cap that will further reduce the potential migration of COCs to groundwater."	
57.	LARWQCB	42. Specific	Page 82, Section on Health and Safety Plan and Reporting, the health and safety plan needs to mention the use of daily tailgate safety meetings.	Tailgate safety meetings are standard elements of Kleinfelder's HASPs. The Final RAP will include the statement "The HASP will specify that health and safety tailgate meetings will be required at the beginning of each work day, and prior to each new activity."	Section 8.9

Copyright 2010 Kleinfelder

Responses to Agency Comments to Draft Remedial Action Plan for
The Spirito Family Trust – Former Excello Plating Co., Inc. Facility
(4057 and 4059 Goodwin Avenue, Los Angeles, CA)

Overall Comment	Agency	Specific Comment	Agency Comment	Response	Final RAP Location
58.	LARWQCB	43. Specific	Page 90, Section on Remediation System Start-Up and Monitoring, an additional bullet needs to be presented which lists rebound testing.	Rebound testing will be added as a new bullet in Section 9.7 and discussed in other relevant sections of the Final RAP.	Section 9.9
59.	LARWQCB	44. Specific	Page 91, second paragraph presents information that Tedlar® bags will be used to collect samples for TO-15 analyses. A review of the method indicates that Summa Canisters should be used. Tedlar® bags are not mentioned in the method. Need clarification from laboratories including the laboratory method indicating State of California approval of them using the bags in lieu of the canisters.	Summa canisters, glass bulbs, or syringes will be used to collect soil vapor samples for US EPA Method TO-15 analyses, instead of Tedlar® bags, and text will be updated accordingly in the Final RAP.	Section 9.9
60.	LARWQCB	45. Specific	Page 93, Section on Pre-RAP Implementation, the bulleted lists needs to include the SVE system operation and maintenance including the rebound testing.	Rebound testing will be added to the bullet list for RAP Implementation, rather than Pre-RAP Implementation, in the Final RAP. System operations and maintenance (O&M) are more appropriate for the RAP Implementation bullet list, and are already included.	Section 13.4
61.	LARWQCB	46. Specific	Page 94, Section on RAP Implementation, the bulleted list needs to include the HHRA.	An HHRA will be added to the RAP Implementation bullets list in the Final RAP.	Section 13.4
62.	LARWQCB	47. Specific	Table 1 needs columns for the following: 1. Timeframe to implement each alternative 2. Which agency has accepted the use of the proposed alternative and where (site, location, contaminants, were cleanup goals achieved, etc.). 3. Costs: including a range indicating low, medium, and high	Table 1 of the Final RAP will be supplemented with the requested information.	Table 1

Copyright 2010 Kleinfelder

Overall Comment	Agency	Specific Comment	Agency Comment	Response	Final RAP Location
63.	LARWQCB	48. Specific	Table which presents TSFT – Excello Chrome VI Percent Calculation w/Depth, which plates present the table's numbers for each interval presented in this first column of the table. Need to develop and present a cross-section that depicts each interval and the cubic yards to be removed.	The table in Appendix J will be supplemented in the Final RAP with references to the Plates used to calculate the estimated mass of hexavalent chromium in each specified depth interval (Plates 4A through 4D of the Draft RAP). In addition, a cross-section Plate will be prepared and annotated to depict the estimated cubic yards of soil requiring treatment within each depth interval.	Appendix N
64.	US EPA	1. General	The following EPA comments provided in October and December 2009 have still not been addressed:	US EPA comments from October and December 2009 are addressed below.	NA
65.	US EPA	2. General	Page 2: Please replace "interrupt" in the 1st sentence with "prevent" to clarify the remedial goal.	During the July 22, 2010 project meeting with LARWQCB and US EPA, it was agreed the text insert should read, “The goal for the RAP is to prevent future migration of the COCs present in Site vadose zone soil to underlying groundwater.”	Exec. Summary Section 2
66.	US EPA	3. General	Groundwater ingestion by municipal water customers is a complete pathway.	Based on a telephone conversation with Mr. Leighton Fong on July 12, 2010, Civil Engineer with the City of Glendale Water and Power, water extracted from Well GS-3 is extracted, treated, blended, and then distributed for consumption by municipal customers. Therefore, Kleinfelder agrees the groundwater ingestion by municipal customers’ pathway is a complete pathway. This exposure pathway is represented on the three dimensional conceptual site model (Plate 3C). Text of the Final RAP will be updated with this clarification.	Exec. Summary Section 5 Plate 3C
67.	US EPA	4. General	Page 7: Please explain the last sentence of the 1st paragraph about US EPA.	During the July 29, 2010 project meeting with LARWQCB and US EPA, it was agreed to delete this sentence.	NA
68.	US EPA	5. General	Page 20, 2nd bullet: The last half of the last sentence states that 1.62 mg/kg is "well below" hexavalent chromium residential and industrial risk based soil screening levels. This is a partially inaccurate statement, since the current regional screening level for hexavalent chromium in residential soil is 0.29 mg/kg.	The 2nd bullet on Page 20 will be revised by removing reference to the residential RSL for hexavalent chromium in soil. The residential RSL is not relevant because the proposed redevelopment of the Site is for commercial/industrial purposes.	Section 3.3

Copyright 2010 Kleinfelder

Overall Comment	Agency	Specific Comment	Agency Comment	Response	Final RAP Location
69.	US EPA	6. General	Page 28: Please explain the last sentence about "US EPA summaries of upgradient sources."	The last sentence on Page 28 of the Draft RAP refers to several known off-Site, up-gradient sources of impact to groundwater, as documented in several reports issued to regulatory agencies. These reports include, but are not limited to • *First Five-Year Review Report for San Fernando Valley - Area 2 Superfund Site, Los Angeles County, California*. US EPA, August 2008 (5-Year Review). • *LARWQCB's Chromium VI Investigation: San Fernando Valley Phase I: Inspections Final Report November 2002* (SFV Investigation). The purpose of the last sentence on Page 28 is to acknowledge that groundwater beneath the Site appears to be impacted by hexavalent chromium and TCE from known upgradient sources that are part of a regional groundwater plume. Figure 3-1 and 3-2 from the 5-Year Review show the presence of these COCs in groundwater within the Glendale South Operable Unit (GSOU). Figure 2 from the SFV Investigation presents the general direction of groundwater flow through the GSOU, which is generally south to southeast. These figures imply that the regional groundwater plume located north of Colorado Street and up-gradient of the Site is impacted with hexavalent chromium and TCE and is potentially influencing conditions beneath the Site. The Final RAP will be revised to delete the reference to “US EPA summaries of upgradient sources” on page 28 and the text included above will be added.	Section 4

Copyright 2010 Kleinfelder

Overall Comment	Agency	Specific Comment	Agency Comment	Response	Final RAP Location
70.	US EPA	7. General	Page 30, table: The industrial Soil RSL values listed in the table for total and hexavalent chromium are listed incorrectly. The current total chromium industrial soil RSL should be listed as NV (no published value), not 1,400 mg/kg. Since the current RSLs list industrial soil values for trivalent and hexavalent chromium but not for total chromium. The current hexavalent chromium industrial soil RSL should be listed as 5.6 mg/kg not NV.	The table on Page 30 of the Draft RAP will be updated in the Final RAP with values from the US EPA May 2010 RSLs table. The May 2010 RSLs table was issued after submittal of the Draft RAP; therefore, updates to this table are required.	Section 4.1
71.	US EPA	8. General	Page 34: EPA believes that, in addition to the refinement of VOC asymptotic levels per Regional Water Quality Control Board specific comment 28, a health-based site specific cleanup goal for VOCs should be developed, with consideration of the influence of contaminated regional groundwater. This is necessary to evaluate whether the proposed asymptotic levels would potentially allow the site to continue as a source of VOC contamination to groundwater.	Commercial/industrial CHHSLs will be the target cleanup goals in the shallow vadose zone (i.e., less than 25 feet bgs) to protect human health; however, it may not be possible to achieve these concentrations using conventional SVE. If PCE and TCE vapor concentrations exceeding commercial/industrial CHHSLs persist in the soil, engineering and/or administrative controls to mitigate human health risks associated with intrusion of residual PCE and TCE vapors into a future building, or exposure to on-Site workers, will be considered. As discussed in the response to LARWQCB Specific Comment #25, it is proposed to remove PCE and TCE from the subsurface to the practical limits of SVE technology. Following completion of SVE activities, a soil gas survey will be conducted in the shallow vadose zone following shut down of the SVE system. Results of the soil gas survey will be used to conduct an HHRA for the intended Site use. The need for implementation of administrative and/or engineering controls at the Site will be considered based on results of the HHRA.	Exec. Summary Section 4

Copyright 2010 Kleinfelder

Overall Comment	Agency	Specific Comment	Agency Comment	Response	Final RAP Location
				A substantial modeling effort for numerous possible Site building scenarios was included in the Draft RAP, in Section 5.5, to address potential health risks to future occupants of an on-Site building, should one be constructed. In addition, a discussion of vapor-water partitioning at the vadose zone/groundwater table interface was included in Section 5.6 to highlight that regional groundwater impact will continue to be a source of PCE and TCE off-gassing into the vadose zone, even after soil and soil vapor remediation, and will likely prevent achieving commercial/industrial CHHSLs in the deeper vadose zone (i.e., deeper than 25 feet bgs) via SVE. A comparison of vapor-water partitioning calculation results to J&E modeled risk-based concentrations in soil vapor below future buildings indicates that current concentrations of PCE in the regional groundwater plume are expected to present a vapor intrusion threat for several future building scenarios. The Site-specific remedial goals and activities proposed in the RAP are intended to mitigate potential impact to groundwater by PCE and TCE in the vadose-zone; however, until the regional dissolved-phase PCE and TCE are addressed, achieving these goals is unlikely. PCE and 1,1,1-TCA soil vapor concentrations at the Site currently do not appear to be contributing to the regional groundwater plume. This statement is made for PCE based on results of vapor-water partitioning calculations performed. 1,1,1-TCA was not reported during recent groundwater monitoring for the Site and was not detected or was detected just above detection limits in soil vapor samples collected at 30 feet bgs. However, based on the groundwater and soil vapor results reported for the	

Copyright 2010 Kleinfelder

<table>
<tr><th>Overall Comment</th><th>Agency</th><th>Specific Comment</th><th>Agency Comment</th><th>Response</th><th>Final RAP Location</th></tr>
<tr><td></td><td></td><td></td><td></td><td>Site, it appears TCE may be contributing to the regional groundwater plume.

As stated above, SVE will be implemented to remove as much mass from the subsurface as is practical, to reduce potential impact to groundwater by PCE and TCE in soil and soil vapor. The table below shows the approximate soil vapor concentrations that must be achieved in soil vapor (C-VOCv) by SVE to reduce the likelihood that vapor-water partitioning of the VOCs modeled would result in groundwater concentrations exceeding respective MCLs, with the assumption the groundwater beneath the site is un-impacted by the VOCs modeled. CHHSLs are the target cleanup goals for PCE and TCE in soil vapor. The C-VOCv values for PCE and TCE, based on Henry's Law, are greater than respective CHHSLs; therefore by achieving CHHSLs for these COCs, groundwater would be protected.

<table>
<tr><th>COC</th><th>H' (constant)</th><th>MCL (µg/L)</th><th>C-VOCv (µg/L)</th><th>CHHSL (µg/L)</th></tr>
<tr><td>PCE</td><td>0.754</td><td>5</td><td>3.77</td><td>0.603</td></tr>
<tr><td>TCE</td><td>0.421</td><td>5</td><td>2.11</td><td>1.77</td></tr>
<tr><td>1,1,1-TCA</td><td>0.705</td><td>200</td><td>141</td><td>2790</td></tr>
</table>
Where C-VOCv = H' x MCL, per Henry's Law.

As stated above, 1,1,1-TCA was not detected in groundwater during a recent groundwater monitoring event, and was not detected or was detected just above detection limits in soil vapor samples collected at 30 feet bgs; therefore, 1,1,1-TCA in soil vapor does not currently appear to be a threat to groundwater.</td><td></td></tr>
</table>

Copyright 2010 Kleinfelder

Overall Comment	Agency	Specific Comment	Agency Comment	Response	Final RAP Location
72.	US EPA	9. General	Paragraph 3: What are the VOC SSLs and do they also address pathways to on-site workers?	Commercial/industrial CHHSLs will be the target cleanup goals in the shallow vadose zone (i.e., less than 25 feet bgs); however, it may not be possible to achieve these concentrations using conventional SVE. If PCE and TCE vapor concentrations exceeding commercial/industrial CHHSLs persist in the soil, engineering and/or administrative controls to mitigate human health risks associated with intrusion of residual PCE and TCE vapors into a future building, or exposure to on-Site workers, will be considered.	Section 4.4
73.	US EPA	10. General	Page 41: The Cr6 cleanup goal is above the Cr6 industrial RSL. Although the 2 mg/kg, value was used in equation Need to review and provide an explanation as to why the proposed total Cr cleanup goal will protect human health and the environment and provide groundwater protection.	A hexavalent chromium concentration of 2 mg/kg in soil was not used to calculate a Site-specific SSL for the Site. Equation 10, on Page 41, calculates SSLs using Site-specific parameters as input values, with the key input value being the target groundwater cleanup goal. In this case, the US EPA MCL for total chromium of 100 µg/L was used as an input value for a frame of reference, because its use results in an SSL of 2 mg/kg hexavalent chromium in soil. The calculation of this SSL, based on generic input values, was not intended to imply the calculation of a Site-specific cleanup goal. This calculated, generic SSL is consistent with the cleanup goal requested by LARWQCB in a letter to The Spirito Family Trust, dated October 31, 2007. The soil/water partitioning coefficient (Kd) for hexavalent chromium was used in Equation 10, to account for the solubility of hexavalent chromium, and allow the calculation of an SSL for hexavalent chromium using the total chromium Cw value of 100 µg/L. This is the methodology used within the SSG to calculate SSLs, and emulated in the Draft RAP. The Site-specific SSL proposed in the Draft RAP is based on the City of Glendale Voluntary Cleanup Goal of 5 µg/L of hexavalent chromium in	Exec. Summary Section 4.4

Copyright 2010 Kleinfelder

Overall Comment	Agency	Specific Comment	Agency Comment	Response	Final RAP Location
				groundwater, which results in a more conservative SSL than the SSLs generated by use of the US EPA MCL or Cal EPA MCL for total chromium. The proposed Site-specific cleanup goal for hexavalent chromium in soil included in the Draft RAP (7.4 mg/kg) was calculated based on Site-specific input parameters. Although this value was modeled to be protective of groundwater, and based on conservative model inputs, during the August 26, 2010 project meeting with LARWQCB and US EPA, it was agreed to adopt the industrial RSL for hexavalent chromium in soil (5.6 mg/kg) as the Site-specific cleanup goal for hexavalent chromium in the Final RAP. However, the Site-specific SSLs for total chromium, cadmium, and nickel proposed in the Draft RAP as cleanup goals will be presented in the Final RAP as the cleanup goals for these constituents.	
74.	US EPA	11. General	Page 42: The cadmium cleanup goal is above the cadmium industrial RSL. Need to review and provide an explanation as to why the proposed total Cr cleanup goal will protect human health and the environment and provide groundwater protection.	A final list of COCs will be added to the Executive Summary to ensure it is clear what constituents are and are not considered COCs. Justification will be provided for elimination of constituents as COCs. Equation 10 shown on Page 41 (from the US EPA's SSG) was used to calculate the Site-specific SSL for cadmium presented on Page 42 using Site-specific parameters as input values, with the key input value being the target groundwater concentration. Thus, the Site-specific cleanup goal proposed for cadmium in soil in the Draft RAP is based on the Cal EPA MCL of 5 µg/L and is therefore expected to be protective of groundwater. Residual concentrations of cadmium in soil exceeding the industrial RSL, but less that the site specific SSL and not treated by LDA/ISCR and	Section 4.4

Copyright 2010 Kleinfelder

Overall Comment	Agency	Specific Comment	Agency Comment	Response	Final RAP Location
				cement stabilization, will be addressed by administrative and/or engineering controls. In addition, the surface of the Site will consist of a parking apron, and/or engineered cap, which will render potential exposure pathways to receptors incomplete.	
75.	US EPA	12. General	Page 46: The total Cr cleanup goal of 46,000,000 mg/kg is above the Cr3 industrial RSL of 1,500,000 mg/kg. The cleanup goal does not seem to be reasonable. Based on the calculation, please provide a technical explanation how onsite soil could contain (i.e., hold within soil pores) a concentration of 46,000,000 mg/kg. Based on this information, the cleanup level should be reviewed and an explanation as to why the proposed total Cr cleanup goal can be technically feasible and how the goal will protect human health and the environment and provide groundwater protection.	The total chromium cleanup goal presented on page 46 of the Draft RAP was calculated using Equation 10 on Page 41, and is a theoretical value only, as is the industrial RSL of 1,500,000 mg/kg for trivalent chromium. These values were calculated using Equation 10 (from the US EPA's SSG) which incorporates Site-specific parameters as input values, with the key input value being the target groundwater concentration. The theoretical values represented by the Site-specific SSL for total chromium and industrial RSL for trivalent chromium are not likely to occur in nature and would occur only where there were more metal constituents than soil particles, are not expected at the Site, and demonstrate how insoluble total chromium and trivalent chromium are. The Kd value within Equation 10 is another important input parameter, which is an indicator of the relative solubility of each specific COC. The Kd value for total chromium is roughly five orders of magnitude higher than for hexavalent chromium, which demonstrates the relatively lower solubility of total chromium. The Site-specific SSL proposed for total chromium in soil in the Draft RAP is based on the Cal EPA MCL of 50 µg/L and is therefore expected to be protective of groundwater. Previously detected concentrations of total chromium in soil are several orders of magnitude below both the Site-specific SSL and industrial RSL values.	Section 4

Copyright 2010 Kleinfelder

Overall Comment	Agency	Specific Comment	Agency Comment	Response	Final RAP Location
				Implementation of LDA/ISCR with cement stabilization, followed by installation of a parking apron and/or engineered cap will provide protection to human health and the environment by rendering exposure pathways incomplete. The site assessment data suggests that the residual concentrations of total chromium in soil at the site do not exceed the industrial RSL for trivalent chromium and are several orders of magnitude below the Site-specific SSL for protection of groundwater. This clarification will be highlighted in the Final RAP .	
76.	US EPA	13. General	Page 74: The Cr6 contaminated area at the rear of the property is not addressed in this section or in Plates 6 and 7A. An explanation needs to be provided why this area is not to be remediated.	The purpose of the engineered cap, as shown on Plate 6, is to provide surface cover above the buffer zone where only cement stabilization will be used to treat the metals impacted soil. The buffer zone will be installed between 35 and 45 feet bgs, within the 5.6 mg/kg hexavalent chromium iso-contour (Plate 6). The cap will be designed to overlap this zone by as much as 50 feet on all sides. The cap is not intended to cover the entire lateral extent of metals-impacted soil. It is intended only to cover the area above the buffer zone with the specified overlap. The area referred to in the comment, on Plate 7A, is located within the iso-contours for hexavalent chromium exceeding 2 mg/kg in soil, near borings K-35 and K-36. The maximum concentration of hexavalent chromium in those borings was 2.11 mg/kg (K-36) at 5 feet bgs and 2.42 mg/kg (K-35) at 10 feet bgs. These concentrations are below the proposed Site-specific cleanup goal for hexavalent chromium in soil; therefore, the area was not proposed for remediation.	Section 8.1

Copyright 2010 Kleinfelder

Overall Comment	Agency	Specific Comment	Agency Comment	Response	Final RAP Location
77.	US EPA	14. General	Page 92: EPA should be copied on all project plans and reports.	The US EPA will be copied on all future project plans and reports.	NA
78.	US EPA	1. Toxicologist	The authors state that they are not proposing to clean up VOCs to a risk-based concentration (e.g., California Human Health Screening Levels [CHHSLs]). They claim that TCE/PCE concentrations in groundwater (when converted to soil gas concentrations, using a partition factor known as Henry's Law) exceed CHHSLs. And, that they would be unable to achieve a CHHSL until the groundwater is cleaned up. True, but this is at the water/soil interface at depth. Soil vapor concentrations in shallow soils (5-20 feet) would be expected to be less than the CHHSLs in areas where there is no soil contamination and groundwater is the only contributor to the vapor intrusion pathway (VIP). Otherwise, CHHSLs in shallow soils would be exceeded throughout Southern California and this is not the case as far as I am aware.	The discussion on vapor-water partitioning at the vadose zone/groundwater table interface was provided in the Draft RAP to highlight that regional groundwater impact will continue to be a source of PCE and TCE off-gassing into the vadose zone, even after soil and soil vapor remediation, and will likely prevent achieving commercial/industrial CHHSLs in the deeper vadose zone (i.e., deeper than 25 feet bgs) via SVE. Commercial/industrial CHHSLs will be the target cleanup goals in the shallow vadose zone (i.e., less than 25 feet bgs); however, it may not be possible to achieve these concentrations using conventional SVE. If PCE and TCE vapor concentrations exceeding commercial/industrial CHHSLs persist in the soil, engineering and/or administrative controls to prevent vapor intrusion will be considered. As discussed in the response to LARWQCB Specific Comment #25, it is proposed to remove PCE and TCE from the subsurface to the practical limits of SVE technology. A soil gas survey will be conducted in the shallow vadose zone following shutdown of the SVE system. Results of the soil gas survey will be used to conduct an HHRA for the intended Site use. The need for implementation of administrative and/or engineering controls at the Site will be considered based on results of the HHRA and future Site use.	Section 4.2
79.	US EPA	2. Toxicologist	After discounting risk-based cleanup standards for VOCs (see above), the authors state that they will run SVE until concentrations reach an asymptote. However, it is anticipated (and acknowledged in the report) that the	Commercial/industrial CHHSLs will be the goal for PCE and TCE in the vadose zone; however, these may not be achievable. As discussed in the response to LARWQCB Specific Comment #25, it is proposed to remove PCE and TCE from the	Section 4.4

Copyright 2010 Kleinfelder

Overall Comment	Agency	Specific Comment	Agency Comment	Response	Final RAP Location
			asymptotic level would likely exceed a risk-based cleanup standard that is based on vapor intrusion. It is noted that SVE alone may not be sufficient to reach a risk-based concentration that addresses the VIP. Enhanced SVE (e.g. "steam injection") can lower the asymptotic concentrations and provide a cleanup goal closer to a risk-based criteria for VOCs in subsurface. However, SVE enhancements are not considered in this report since the authors have ruled out the possibility of achieving risk-based concentrations until groundwater is cleaned up.	subsurface to the practical limits of SVE technology. The cost for SVE enhancements, such as steam, would be prohibitive in comparison to engineering controls that could be implemented to inhibit vapor intrusion into a future building.	
80.	US EPA	3. Toxicologist	Aside from that, the presumptive remedy the authors cite for VOCs was published in 1993. There have been a lot of improvements in VOC subsurface remediation technologies since then and I question the relevance of the presumptive remedy document that is cited 17 years later: Is SVE still considered a presumptive remedy for VOCs in soil today?	The original issue date of SVE as a presumptive remedy for VOCs was 1993, later updated in 1996 (United States Office of Environmental Protection Solid Waste, Directive No. 9355.0-63FS and EPA 540/F-96/008 Agency Emergency Response PB 96-963308, July 1996 4HA User's Guide to the VOCs in Soils Presumptive Remedy). Also, SVE is currently listed on the US EPA webpage as a presumptive remedy for VOCs in soil.	NA
81.	US EPA	4. Toxicologist	The report derives a range of risk-based screening levels using Johnson and Ettinger (J&E) vapor intrusion model for a variety of commercial settings. This is useful information.' As mentioned, these risk-based concentrations may not be achieved using conventional SVE. In any case, if a building is placed on this property, it should: 1) incorporate engineering controls to address VIP; and, 2) test the indoor air for site contaminants to confirm that the VIP is under control and does not pose a health risk for occupants of an on-site building. We	It is our understanding that LARWQCB and the prospective purchaser will negotiate an agreement regarding deed restrictions and institutional controls necessary for the Site. As discussed in the response to LARWQCB Specific Comment #25, it is proposed to remove PCE and TCE from the subsurface to the practical limits of SVE technology. A soil gas survey, with samples collected in summa canisters, glass bulbs, or syringes, will be conducted in the shallow vadose zone (i.e., less than 25 feet bgs) following shut down of the SVE system. Results of the soil gas survey will be used to conduct an HHRA for the intended Site use. The need for implementation of	9.9

Copyright 2010 Kleinfelder

Overall Comment	Agency	Specific Comment	Agency Comment	Response	Final RAP Location
			should have this requirement included as part of an institutional control for the property.	administrative or engineering controls at the Site will be considered, if necessary, based on results of the HHRA and future Site use.	
82.	US EPA	5. Toxicologist	According to the RAP, "the future intended use of the Site is contemplated to be a driveway and apron for the parking, maneuvering, and loading and unloading of trucks". Building a parking lot helps reduce direct contact with soil contaminants and also reduces the leaching of contaminants to groundwater. However, it may also prevent the off-gas of VOCs to the outdoor air. This can have two undesired effects: 1) increase vapor intrusion into on-site buildings since buildings provide a mechanism for VOCs to "escape" from the subsurface; and, 2) increase lateral migration of soil vapors to the perimeters of the parking lot and to off-property locations. These potential undesired effects would become important once SVE is shut down and no longer acts to depressurize on-site soils.	As discussed in the response to LARWQCB Specific Comment #25, we propose to remove PCE and TCE from the subsurface to the practical limits of SVE technology. A soil gas survey will be conducted in the shallow vadose zone following shut down of the SVE system. Results of the soil gas survey will be used to conduct an HHRA for the intended Site use. The need for implementation of administrative or engineering controls at the Site will be considered, if necessary, based on results of the HHRA and future Site use. There is uncertainty as to how vapors will behave after the Site has been redeveloped. Buildings do not necessarily create “escape” pathways and vapors will not necessarily migrate as indicated in point “2)”of the comment. As discussed above, administrative and engineering controls will be considered, and implemented if necessary to address potential migration of PCE and TCE into an on-Site building, or off-Site properties.	Section 9.9
83.	US EPA	6. Toxicologist	The conceptual model mentions off-site residential exposures to dust during site construction. Do off-site residents also need to be evaluated with respect to the VIP? EPA's draft vapor intrusion guidance (2002) recommends applying a 100 foot distance from the source as a cut off criteria for evaluating vapor intrusion. Are residents located within 100 feet of the property boundary?	An evaluation of the residential scenario for the nearest residence will be included in the Final RAP.	Section 4.2 Appendix J
84.	US EPA	1. Contractor	**General Comment:** Frequency of reference citations was inconsistent. In several locations, reports, letters, or CAOs were mentioned, but references to	References will be cited more frequently and consistently in the Final RAP.	Global

Copyright 2010 Kleinfelder

Overall Comment	Agency	Specific Comment	Agency Comment	Response	Final RAP Location
			those documents were difficult to find. While it is not necessary to cite a reference multiple times in the same paragraph, or even section, it would be helpful to provide reference citations when such documents are referred to in a new section or perhaps several Pages after the initial citation.		
85.	US EPA	2. Contractor	**Section 3.4, Table on Page 30**: The source of the Industrial Soil RSLs for total and hexavalent chromium referenced in the table is unclear. The values in the table don't appear to correspond with the December 2009 RSL table from EPA. Please explain.	The table on Page 30 will be updated in the Final RAP with values from the US EPA May 2010 RSLs table.	Section 4.1
86.	US EPA	3. Contractor	**Section 3.4, Table on Page 31**: The source of the Soil Vapor CHHSLs for 1,1,1-TCA, PCE, and 1,2-DCE referenced in the table is unclear. The values in the table appear to be different from the 2005 CHHSLs provided by DTSC by a factor of 1,000, perhaps due to a mismatch of units. Please check. Also, why aren't December 2009 EPA RSLs for Industrial Air shown on the Page 30 table and compared to concentrations detected at the site? RSLs are available for the three VOCs on the table that currently list "NV" values. The paragraph at the bottom of Page 30 indicates that "VOCs that consistently exceeded their respective Industrial RSLs and/or Commercial/Industrial CHHSLs were selected as primary COCs for the Site." However, it is not apparent where detected VOC concentrations are compared to Industrial RSLs.	In the Final RAP, the table on Page 31 will be updated with values from the US EPA May 2010 RSLs table, and units for the soil vapor CHHSLs will be reviewed and corrected, if necessary.	Section 4.1

Copyright 2010 Kleinfelder

Overall Comment	Agency	Specific Comment	Agency Comment	Response	Final RAP Location
87.	US EPA	4. Contractor	**Section 5.3, Page 40 ("Equation 10 — SSL Partitioning Equation..."):** The soil Screening Level formula appears to have a typographical error. It is our understanding that the sum of water-filled porosity and air-filled porosity times Henry's Law constant should be divided by dry soil bulk density, and that appears to be how the calculations were performed. As written on Page 40, the equation implies that all terms to the left of the division symbol should be divided by bulk density. Please check and correct, as appropriate.	Equation 10 contains a typographical error in the text, which will be corrected in the Final RAP.	Section 5.3
88.	US EPA	5. Contractor	**Section 5.3, Page 41 ("Equation 10 Results"):** Why was the USEPA total chromium MCL of 100 µg/L applied to the total chromium Soil Clean-Up Goal instead of the California MCL of 50 µg/L?	Equation 10 calculates SSLs using Site-specific parameters as input values, with the key input value being the target groundwater cleanup goal. The Site-specific SSL proposed in the Draft RAP is based on the City of Glendale Voluntary Cleanup Goal of 5 µg/L for hexavalent chromium in groundwater, which is more conservative than SSLs generated by use of the US EPA MCL or Cal EPA MCL for total chromium. The US EPA MCL for total chromium of 100 µg/L was used as an input value for a frame of reference, because its use results in an SSL of 2 mg/kg hexavalent chromium in soil. This SSL is consistent with the cleanup goal requested by LARWQCB in a letter to The Spirito Family Trust, dated October 31, 2007. The Final RAP will be revised to eliminate equations and input values not being used so as to avoid confusion. In addition, more details regarding the use of Equation 10 to calculate SSLs will be included in the Final RAP.	Section 4.2

Copyright 2010 Kleinfelder

Overall Comment	Agency	Specific Comment	Agency Comment	Response	Final RAP Location
89.	US EPA	6. Contractor	Why are dilution factors applied to the Equation 10 results on Pages 41 and 42? In Kleinfelder's responses to comments to the "Site-Specific Clean-Up Goals RAP" prepared for the Site in November 2009, Kleinfelder states "By using a MCL as Cw (target soil leachate concentration), we are assuming no dilution; therefore, this is a conservative assumption."	Equation 11 was used to derive a Site-specific dilution factor for leached COCs reaching groundwater. The results of Equation 11 are based on Site-specific parameter input values, such as infiltration rate (I), groundwater gradient (i), aquifer hydraulic conductivity (K), and source length (L). Part of the process for calculating Site-specific cleanup goals is calculation of a dilution factor that is representative of site-specific conditions, and in particular, the parameters listed in the previous sentence. As described in the SSG User's Guide, and our "Site-Specific Cleanup Goals Workplan" dated November 19, 2009, the results of Equation 10 are multiplied by the results of Equation 11 to calculate a Site-specific cleanup goal. More details regarding the use of Equations 10 and 11 to calculate SSLs will be included in the Final RAP.	Section 4.2
90.	US EPA	7. Contractor	Why weren't Soil Clean-Up Goals calculated assuming RSLs or risk-based SSLs (from the EPA December 2009 RSL table), as indicated in the "Site-Specific Clean-Up Goals RAP" prepared for the Site in November 2009? It would be useful to compare results based on risk-based screening levels to results based on MCLs.	The variable input values used to calculate Site-specific SSLs via Equation 10 are the target concentrations for COCs in groundwater, or C_w; in this case the City of Glendale Voluntary Cleanup Goal, or Draft PHG, for hexavalent chromium, and MCLs for total chromium, nickel, and cadmium. Risk-based SSLs and MCL-based SSLs are not appropriate as input values within equation 10. A comparison of Site-specific SSLs to risk-based SSLs and MCL-based SSLs from the US EPA May 2010 RSLs table will be included in the Final RAP.	Section 4.2
91.	US EPA	8. Contractor	**Section 5.3, Page 45 ("Equation 14 Results"):** Why weren't Soil Clean-Up Goals calculated assuming RSLs or risk-based SSLs (from the EPA December 2009 RSL table), as indicated in the "Site-Specific Clean-Up Goals RAP" prepared for the Site in November 2009? It would be useful to compare results based	During the July 22, 2010 project meeting with LARWQCB and US EPA, it was agreed to delete Equation 14 and provide an explanation as to why it was removed from the Final RAP.	NA

Copyright 2010 Kleinfelder

Overall Comment	Agency	Specific Comment	Agency Comment	Response	Final RAP Location
			on risk-based screening levels to results based on MCLs.		
92.	US EPA	9. Contractor	**Section 5.4, Page 46:** This section never explains why the "Mass Limited SSLs" calculated using Equation 14 are not chosen as the proposed cleanup goals for the site. It should be noted that according to Section 5.3 (Page 39): "Equation 14 allows the calculation of mass-limited SSLs, accounting for the overly conservative assumptions used to simplify SSLs in calculations of Equation 10." Therefore, Equation 14 would be expected to yield higher values than Equation 10, yet it does not. Please explain.	During the July 22, 2010 project meeting with LARWQCB and US EPA, it was agreed to delete Equation 14 and provide an explanation as to why it was removed from the Final RAP. In Kleinfelder's opinion, Equation 14 was not intended for application to small source areas. As the source area becomes smaller (i.e., smaller value of "d_s") the SSL increases and vice versa. Because the Site's source area has a relatively large value for "d_s," we believe it is inappropriate to apply Equation 14 to this Site.	NA
93.	US EPA	10. Contractor	**Section 5.4, Page 46:** It is not clear whether the proposed clean-up goals for metals in soil in the bullet list on Page 46 are appropriate, given the concerns listed above. Until these issues are resolved, these clean-up goals should not be accepted.	In Kleinfelder's opinion, the calculated Site-specific SSLs are appropriate, in part because they were calculated using US EPA's SSG and Site-specific input parameters for soil, such as infiltration rate (I) and aquifer hydraulic conductivity (K), used by the LARWQCB in regional groundwater models. Site-specific SSLs were calculated in accordance with the US EPA SSG, and as described in Kleinfelder's "Site-Specific Cleanup Goals Workplan," dated November 19, 2009.	Section 4.2 Appendix I
94.	US EPA	11. Contractor	**Section 5.4, Page 46:** The explanation for the target groundwater concentration of 5 µg/L is incomplete. It does not discuss incremental human-health risks, nor does it mention existing concentrations of hexavalent chromium in groundwater. Furthermore, the discussion of how 8.3 µg/L is a *de facto* MCL for hexavalent chromium neglects the fact that in Glendale, nearly 100 percent of dissolved chromium in groundwater typically occurs in the hexavalent state, rather	The cleanup goal of 5 µg/L hexavalent chromium in groundwater is based upon the Voluntary Cleanup Goal established by the City of Glendale. An MCL has yet to be established for hexavalent chromium by US EPA or other agencies, although we understand California regulates hexavalent chromium according to the total chromium MCL of 50 µg/L. We believe use of the City of Glendale Voluntary Cleanup Goal for hexavalent chromium is appropriate because it's applied to groundwater	Section 4.2

Copyright 2010 Kleinfelder

Overall Comment	Agency	Specific Comment	Agency Comment	Response	Final RAP Location
			than the 1:6 hexavalent to trivalent ratio of chromium assumed to naturally occur in groundwater. Please provide further explanation of how the 5 1 µg/L target concentration will be protective of human health.	after it has passed through the City's water plant blending system. By using this criterion as an input into the equations that are used to derive a soil cleanup level, implementation of the RAP is intended to limit hexavalent chromium impact to the groundwater from vadose soils on this Site to a level acceptable to the City of Glendale Department of Water and Power as a source of supply for its municipal water system, which groundwater the City may further treat or blend before delivery (thereby further reducing concentrations of hexavalent chromium). At the request of the LARQWCB, this cleanup level was used as an input value for the calculation of Site-specific SSLs. During the July 22, 2010 project meeting with LARWQCB and US EPA, it was agreed to contact the City of Glendale in an attempt to obtain further explanation as to how the voluntary cleanup goal was established. On September 7, 2010, Kleinfelder contacted Mr. Leighton Fong of the City of Glendale to request additional information that would explain the basis for Glendale's voluntary cleanup goal (VCG) for Cr^{6+} in groundwater extracted for municipal consumption. Mr. Fong provided minutes from the City Council meeting held on January 29, 2002, which established the VCG for Cr^{6+}. In groundwater; however, no derivation information was available. The discussion of "8.3 µg/L" will be removed from the Final RAP.	
95.	US EPA	12. Contractor	**Section 5.5, general comment:** Use of the advanced version of the Johnson & Ettinger model is generally discouraged by DTSC due to the significant uncertainties and the wide range of results that can be obtained	Based on the experience of Kleinfelder's risk assessment staff, the advanced version of the J&E Model does not typically underestimate indoor air concentrations, but rather generally agrees with measured indoor air concentrations, or slightly	Section 4.2

Copyright 2010 Kleinfelder

Overall Comment	Agency	Specific Comment	Agency Comment	Response	Final RAP Location
			by changing select input parameters. For example, the results for TCE screening levels in shallow soil gas at 5 feet bgs range from 1,000 to 58,000 ug/m^3 at the Excello site depending on building size. Due to this considerable uncertainty, an uncertainty analysis of the results should be provided.	overestimates them. Based on these assumptions, we believe an uncertainty analysis is unwarranted.	
96.	US EPA	13. Contractor	**Section 5.5, general comment:** The term "non-cancer hazard" should be globally changed to "non-cancer hazard quotient".	"Non-cancer hazard" will be globally changed to "non-cancer hazard quotient" in the Final RAP.	Section 4.2 Global
97.	US EPA	14. Contractor	**Section 5.5, Page 47**: The end of 3rd paragraph states, "Kleinfelder has developed Site-specific screening levels in a manner consistent with DTSC vapor intrusion guidance." Include a reference to the DTSC guidance.	A reference will be added to the Final RAP as requested.	Section 4.2
98.	US EPA	15. Contractor	**Section 5.5, Page 48:** The text incorrectly states that OEHHA toxicity criteria were incorporated into the EPA version of the Johnson and Ettinger model. The OEHHA reference concentration for 1,1,1-TCA is 1 mg/m^3. A reference concentration of 5 mg/m^3, based on IRIS, was used in the model. Since this IRIS toxicity value is the value provided in the DTSC version of the Johnson and Ettinger model, it is the appropriate value to use. However, the text should be revised to clarify this.	Text of the Final RAP will be revised to be more specific regarding the sources of model inputs.	Section 4.2
99.	US EPA	16. Contractor	**Section 5.5, Pages 48 and 52**: Text states that "The Site-specific SSLs represent soil vapor concentrations that yield a 1x10^{-6} cancer risk for those volatile COCs classified as carcinogens..." However, the site-specific screening levels for carcinogens	The Final RAP will include a more detailed discussion of SSLs calculations and clarification will be provided as requested.	Section 4.2 Appendix I

Copyright 2010 Kleinfelder

Overall Comment	Agency	Specific Comment	Agency Comment	Response	Final RAP Location
			were calculated based on a cancer risk of $5x10^{-7}$ to account for the potential cumulative risk of the two carcinogenic COCs (TCE and PCE). This is discussed on Page 52, but should be clarified on Page 48 and also in the screening level equation for cancer risk provided on Page 52.		
100.	US EPA	17. Contractor	**Section 5.5, Page 49:** DTSC guidance recommends using a value of $5.0x10^{-3}$ for the Crack-to-total area ratio in the J&E model, rather than allowing the model to calculate a value. This DTSC recommended value is hard-wired into the DTSC version of the J&E model.	Kleinfelder maintains that using the US EPA version of the J&E Model, with actual Site-specific data, not default values, is appropriate for the Site. Kleinfelder calculated Site-specific soil vapor SSLs for a number of conceptual buildings that we assumed could potentially be constructed on the Site, as we proposed to do in our "Site-Specific Cleanup Goals Workplan," dated November 19, 2009. An HHRA will be performed after SVE activities are complete, and based on the results, engineering controls, such as a vapor barrier, will be considered.	Section 4.2
101.	US EPA	18. Contractor	**Section 5.5, Page 49:** Text states that "The volume of soil requiring remediation for volatile COCs is estimated in a subsequent section of this report.....". Specify where in the report this is discussed and which screening levels were used (since 12 scenarios were evaluated).	The results of J&E modeling for 12 possible future building scenarios were not used as a basis for identifying the volume of soil to be addressed by SVE. The volume of soil requiring remediation for volatile COCs was assumed to be the entire vadose zone beneath the Site. This zone will be addressed with SVE. This assumption will be clarified in the Final RAP.	Section 6
102.	US EPA	19. Contractor	**Section 5.5, Page** 53: CHHSLs have been provided for comparison purposes on the table "Summary of VOC Site-Specific Screening Levels". The CHHSL listed for 1,1,1-TCA is incorrect. The value listed is the Indoor Air CHHSL. The correct Soil Gas CHHSL for 1,1,1- TCA is $2.79x10^{6}$.	The table on Page 53 will be reviewed and CHHSL values corrected in the final RAP where appropriate.	Section 4.1

Copyright 2010 Kleinfelder

Overall Comment	Agency	Specific Comment	Agency Comment	Response	Final RAP Location
103.	US EPA	20. Contractor	**Section 5.7, Page 56-57**: The assertion that Henry's Law is a reasonable basis to estimate the vapor concentrations does not factor in two controlling features of the transfer of VOCs from groundwater to the vadose zone: the capillary fringe, across which aqueous diffusion is the controlling migration mode; and active diffusion within the entire volume of the vadose zone. Together these two factors make it unlikely that a Henry's Law-based concentration might reestablish itself, once SVE has completed the source removal.	The Henry's Law calculation was performed to demonstrate the potential for a continuing source of PCE and TCE in the vadose zone from the PCE and TCE -impacted groundwater beneath the Site. In our opinion, Henry's Law is a reasonable first approximation of the PCE and TCE concentrations just above the groundwater/vadose zone interface. In the experience of Kleinfelder remedial engineers, volatilization of PCE and TCE from groundwater into the vadose above the aquifer can be an ongoing problem, especially within the 5 to 10 feet of vadose zone above an aquifer. Also, the natural fluctuation (rise and fall) of the water table can contribute to off-gassing of PCE and TCE from groundwater into the vadose zone. As the water table falls, impacted groundwater is left in the capillary fringe, from which PCE and TCE tend to off-gas into the vadose zone. We believe the Henry's Law calculation demonstrated that as long as there is a regional PCE and TCE issue in groundwater, there will remain the potential for off-gassing of PCE and TCE into the vadose zone.	Section 4.2
104.	US EPA	21. Contractor	**Section 5.7, Page 56:** In this section, the CHHSL values are in conflict with previously stated CHHSLs, apparently due to a change in units (without a corresponding change in numerical value). Please check and correct, if necessary.	Units will be corrected as appropriate in the Final RAP.	Section 4.1
105.	US EPA	22. Contractor	**Section 5.7, Page 57**: The proposal for asymptotic monitoring does not specify whether this would involve wellhead monitoring or multi-level piezometer monitoring to determine when an asymptote has been reached. The former approach is considered representative of the zone through which air moves; it has long been recognized in	Clarification of the process that will be used to demonstrate asymptotic conditions and diminishing returns will be included in the Final RAP. Monitoring for asymptotic conditions will be performed at both the influent to the SVE system, as well as at discrete screened intervals of SVE wells. Rebound testing and additional sampling of vapors at these locations will be performed.	Section 4.4 Section 9.9

Copyright 2010 Kleinfelder

Overall Comment	Agency	Specific Comment	Agency Comment	Response	Final RAP Location
			industry that this zone may or may not represent the total zone requiring treatment, which is why monitoring of multi-level piezometers is a much more supportable approach. Please further describe the proposed approach for monitoring when asymptotic levels will be met.	Proposed SVE wells will be screened with discrete intervals from 5 to 25 feet bgs, and 30 to 45 feet bgs, which will allow for extraction of PCE and TCE from targeted vadose-zone intervals, and monitoring of PCE and TCE concentrations at discrete depth intervals at each wellhead. The SVE well network will be optimized during the lifecycle of the SVE system. Optimization will include focusing extraction on producing wells, and closing non-producing wells. Asymptotic conditions will be achieved at each wellhead, and each screened interval, prior to performing rebound testing. Boring logs from previous Site assessment activities indicate that soil in the vadose zone is primarily coarse grained, and fairly consistent from surface to groundwater, implying that rate-limited diffusion of PCE and TCE should not be an issue that negatively impacts the duration of SVE activities and rebound testing. In addition, a soil gas survey will be performed in the source area of the PCE and TCE vadose-zone plume to confirm that SVE remedial activities have been completed. Multi-level piezometers are not proposed for this Site.	
106.	US EPA	23. Contractor	**Section 5.7, Compatibility of SVE and the in-situ treatment of Cr+6.** Plate 8 gives the impression that the SVE system will extend over the entire site, including the area where the Cr+6 is to be stabilized. The sequence of these actions is not explicitly identified, yet the feasibility of SVE following stabilization seems doubtful. Please provide more information on the sequence of the two primary remedial actions at the site (SVE	The intent is for the SVE system to address PCE and TCE across most of the site. Sequencing remedial activities (SVE and LDA/ISCR) is not a significant concern based on the iso-contours for hexavalent chromium depicted on Plates 4A through 4D, and the iso-contour for TCE on Plate 3A, which show the source areas for metals and PCE and TCE do not overlap. LDA/ISCR will be performed in areas of relatively low PCE and TCE concentrations, which are predominantly in soil vapor. The PCE and TCE, in areas where	Section 6

Copyright 2010 Kleinfelder

Overall Comment	Agency	Specific Comment	Agency Comment	Response	Final RAP Location
			and soil stabilization) and explain how each remedial method will affect the other.	LDA/ISCR is used to target metal COCs, are expected to be reduced by mixing with the chemical reductant.	
107.	US EPA	24. Contractor	**Section 7.1, Remedial Alternative Screening Methodology, Page 58:** It would be helpful to explain in Section 7.1 how the few technologies evaluated for treatment of metals in soil were selected. A variety of in-situ treatment methods in addition to those considered have been used for hexavalent chromium in the subsurface, such as in-situ biodegradation and in-situ chemical reduction using injection of liquid phase reductants via wells and solid phase reductants (e.g., zero valent iron) via pneumatic or hydraulic fracturing. Combinations of treatment methods, such as excavation of the most highly contaminated soil combined with in-situ treatment of the less contaminated soil, have also been used. Although the technologies discussed in the draft RAP are applicable to the site, some of these other technologies could be less costly or cause fewer secondary impacts than the methods considered in this RAP.	Additional explanation will be provided for how the remedial alternatives selected for treating metals in soils were selected in the Final RAP. Additional remedial alternatives for the in-situ reduction of metals, such as Zero-Valence Iron (ZVI), were screened during the early stages of the project; however, these were not carried over for further evaluation based on anticipated technical feasibility, implementability, and potential drawbacks of these technologies for the Site. For example, ZVI is a proven remedial alternative for use in the saturated zone as part of a permeable reactive barrier (PRB). For ZVI to work in the vadose zone, a significant amount of water would need to be added to the vadose zone, essentially to the point of saturation, with the potential for flushing COCs from the vadose zone into groundwater during the process.	Section 7.2
108.	US EPA	25. Contractor	**Section 7.2**, **Description of Remedial Alternatives for Metals in Soil, Pages 59.** None of the technologies in this section discuss the remediation of cadmium and nickel in soil and how the technologies will achieve the target cleanup goals for cadmium and nickel. At a minimum, statements that the areas of elevated cadmium and nickel requiring remediation are co-located with the hexavalent chromium contamination that will be treated should be provided. Figures	The Final RAP will discuss that cadmium and nickel concentrations in soil are below the Site-specific cleanup goals calculated and proposed in the Draft RAP, and that cadmium and nickel are not COCs. In general, cadmium and nickel are co-located with total chromium and hexavalent chromium, the latter two of which will drive the cleanup effort. As a conservative measure, Kleinfelder will re-evaluate calculations of Site-specific SSLs.	Section 4.2

Copyright 2010 Kleinfelder

Overall Comment	Agency	Specific Comment	Agency Comment	Response	Final RAP Location
			showing the locations of elevated cadmium and nickel would be helpful for this purpose, as well. If the areas of elevated cadmium and nickel requiring remediation are not co-located with the hexavalent chromium contamination, figures showing the location of elevated concentrations of these metals should be provided and additional information provided regarding how the cleanup goals for these metals will be achieved.		
109.	US EPA	26. Contractor	**Section** 7.2, **Description of Remedial Alternatives for Metals in Soil, Page 59:** It would be helpful to describe common remedial activities that would be implemented for all of the active remedies. For example, it is not explicitly stated but the reader must assume that the existing building and foundation slab shown in the Plates overlying the chromium contamination will be removed prior to implementing the LDA soil mixing. It would be helpful to state what overall activities (e.g., building demolition, utility abandonment or relocation) would be required for implementing the work.	The Final RAP will include a section describing removal of the building and slab prior to implementing remedial activities at the Site. In addition, discussion of pre-building abatement and removal will be discussed in the Final RAP. Discussion of known utilities that will require abandonment or removal prior to, or after, building demolition, will also be provided.	Section 10
110.	US EPA	27. Contractor	**Section 7.2, Description of Remedial Alternatives for Metals in Soil, Page 60, first paragraph:** The lengths, widths, and depths used to estimate the 5,000 cubic yards to be treated should be provided; the basis and assumptions used to calculate the 5,000 cubic yards are not clear.	The basis for the 5,000 cubic yards of soil will be provided in the Final RAP.	Section 7.2

Copyright 2010 Kleinfelder

Responses to Agency Comments to Draft Remedial Action Plan for
The Spirito Family Trust – Former Excello Plating Co., Inc. Facility
(4057 and 4059 Goodwin Avenue, Los Angeles, CA)

Overall Comment	Agency	Specific Comment	Agency Comment	Response	Final RAP Location
111.	US EPA	28. Contractor	**Section 7.2, Description of Remedial Alternatives for Metals in Soil, Page 60, third paragraph:** The proposed dimensions of the excavation should be provided to allow the reader to understand the basis and assumptions used to develop the estimated 5,000 cubic yards to be excavated.	Proposed dimensions of the excavation will be provided in the Final RAP.	Section 7.2
112.	US EPA	29. Contractor	**Section 7.3, Screening of Remedial Alternatives for Metals in Soil, Page 62, first paragraph under LDA Mixing and ISCR:** Were other chemical reductants, such as zero valent iron (ZVI) or EHC, considered for reduction of hexavalent chromium with the LDA mixing? Alternate reductants may offer advantages over ferrous iron and CaSx in that they may provide more electrons, per molecule, for reduction than ferrous iron, are not as readily leachable as the sulfide in CaSx, and would not cause sulfide air emissions. Alternate reductants to CaSx could be evaluated during the additional bench-scale testing that is planned.	No additional bench-scale testing for reducing agents is proposed. Both CaSx and ferrous iron were successful in reducing metals COCs during previous bench-scale testing, have been used at similar sites, and are included in the General WDR Permit. ZVI and EHC are similar reducing agents, and as discussed in response to comment US EPA Contractor #24, are not preferred technologies for this application. The stabilized buffer zone (35 to 45 feet bgs) is designed to minimize the possibility of CaSx reaching groundwater, and engineering controls will be implemented to inhibit sulfide emissions to air.	Section 7.3
113.	US EPA	30. Contractor	**Section 7.3, Screening of Remedial Alternatives for Metals in Soil, Page 65, first paragraph under Implementability:** Are underground utilities present within the target treatment zone that would impact or interfere with implementation of the LDA mixing/ISCR remedy?	A discussion of the need to remove or relocate below-ground utilities will be included in the Final RAP. Underground utilities are likely present and will need to be removed and/or replaced.	Section 8.5

Copyright 2010 Kleinfelder

Overall Comment	Agency	Specific Comment	Agency Comment	Response	Final RAP Location
114.	US EPA	31. Contractor	**Section 7.3, Screening of Remedial Alternatives for Metals in Soil, Page 66, first paragraph under Costs:** Insufficient information is provided to evaluate the accuracy of the cost estimate.	Cost estimate calculation summaries will be added as an Appendix to the Final RAP.	Appendix P
115.	US EPA	32. Contractor	**Section 8.1, Proposed Remedial Alternative for Metals in Soil, Page 74, first paragraph: Has** the LDA mixing/ISCR process been applied for treatment of hexavalent chromium in the vadose zone at other sites with similar geology to this site? If so, how successful was this remedial technology at those sites?	Case studies will be added as an Appendix to the Final RAP. This technology has been successfully applied at sites with similar geology and site characteristics.	Section 7.3 Appendix O
116.	US EPA	33. Contractor	**Section 8.1, Proposed Remedial Alternative for Metals in Soil, Page** 74, **first paragraph:** To mix the soil interval from 35 to 45 ft below land surface, the LDA must first pass through and mix the most contaminated soil situated above this zone. Please comment on the potential for the LDA to drag chromium contamination downward from the shallow vadose zone into the less contaminated deeper vadose zone during this process and what factors would mitigate such downward drag of contamination.	The Final RAP will be updated with additional explanation of the LDA/ISCR process. The explanation will include that soil to 35 feet bgs (in designated areas) will be treated by ISCR prior to stabilizing the interval from 35 to 45 feet bgs; therefore, hexavalent chromium above the 35- to 45-foot interval is expected to be reduced to Cr^{3+} prior to stabilizing the 35- to 45-foot zone. This will preclude the dragging of hexavalent chromium into the 35- to 45-foot interval. Cement stabilization bench-scale testing, as proposed in the Draft RAP and Draft "Cement Stabilization/Solidification Bench-Scale Treatability Testing Workplan," will allow for evaluation of reduced metals COCs mobility in the 35- to 45-foot bgs interval (i.e., buffer zone).	Section 8.1
117.	US EPA	34. Contractor	**Table 1 – Page T-1, Column 4, 1St bullet:** Because the "Capping Site" option, by itself, would allow continued migration of contaminants downward to the aquifer, it doesn't seem to be equally protective of human health and the environment as the other alternatives. Consider changing this bullet point.	Relative comparison rankings of alternatives, with respect to evaluation criteria, will be re-assessed in the Final RAP. Capping, as a stand-alone approach, is a common alternative applied to solid waste management units and landfills, with the intent of reducing infiltration by stormwater, thereby eliminating the	Table 1

Copyright 2010 Kleinfelder

Overall Comment	Agency	Specific Comment	Agency Comment	Response	Final RAP Location
				mechanism for transport of COCs to groundwater. Removing stormwater infiltration as a leaching and mobilizing mechanism would significantly reduce COCs concentrations reaching groundwater. This option has been identified as providing long-term effectiveness with proper maintenance and repair of the cap.	
118.	US EPA	35. Contractor	**Table 1 – Page T-1, Column 4, 5th bullet:** Because the "Capping Site" option, by itself, would allow continued migration of contaminants downward to the aquifer, it doesn't seem to be effective in the long term. Consider changing this bullet point.	Relative comparison rankings of alternatives, with respect to evaluation criteria, will be re-assessed in the Final RAP. Capping, as a stand-alone approach, is a common alternative applied to solid waste management units and landfills, with the intent of reducing infiltration by stormwater, thereby reducing the migration of COCs to groundwater. Removing stormwater infiltration as a leaching and mobilizing mechanism would significantly reduce COCs concentrations reaching groundwater. This option has been identified as providing long-term effectiveness with proper maintenance and repair of the cap.	Table 1
119.	US EPA	36. Contractor	**Table 1– Page T-2, Columns 2a and 2b, 3rd bullet:** Change "filed" to "field".	Text of the Final RAP will be edited as indicated.	Table 1
120.	US EPA	37. Contractor	**Table 1 – Page T-3, Column 1, 3rd bullet:** Although Alternative 1 has a "zero" cost, it is ineffective (achieves limited to no protection of human health and the environment). Therefore, a rating for cost effectiveness of "very good" (numerical value of 4) seems inappropriate. Recommend changing text of this bullet point to something like "Although there are no costs associated	Relative comparison rankings of alternatives, with respect to evaluation criteria, will be re-assessed in the Final RAP. However, the cost-effectiveness category ranking is separate from other evaluation criteria rankings, and because there are no costs associated with implementing the alternative, the ranking in Table 1 and discussion in Section 7.3 are appropriate.	Table 1

Copyright 2010 Kleinfelder

Overall Comment	Agency	Specific Comment	Agency Comment	Response	Final RAP Location
			with this alternative, it does not meet most of the evaluation criteria. Rank – 0". The text in Section 7.3 of the RAP, describing cost effectiveness of Alternative 1, should be similarly modified.		
121.	US EPA	38. Contractor	**Plate 3C:** Hexavalent chromium, cadmium, and nickel in soil and their relevant migration and exposure pathways should be shown on the conceptual site model.	Plate 3C will be updated to clearly show the relevant migration and exposure pathways in the Final RAP.	Plate 3C
122.	US EPA	39. Contractor	**Plates 4A through 4D:** The extent of contamination north of boring B-22, in which the greatest concentrations of hexavalent chromium in soil were detected, does not appear precisely defined to the immediate north of boring B-22. A gap approximately 35 ft wide exists between borings K-24 and B-38 north of boring B-22. High-level hexavalent chromium contamination may extend toward the north in this gap from boring B-22, beyond the isopleths lines shown in Plates 4A through 4D. If so, this could increase the soil area and volume requiring treatment. The extent of chromium contamination north of boring B-22 should be confirmed prior to or during implementation of the remediation to ensure that an area of high chromium contamination is not missed during remediation.	Confirmation borings will be advanced during implementation of LDA/ISCR in the effort to assess and mitigate the vertical and lateral extent of soil impacted above Site-specific cleanup goals. Procedures for performing confirmation borings, sample collection, and analyses will be included in the Final RAP.	Section 8.5
123.	US EPA	40. Contractor	**Appendix G – Johnson** & **Ettinger Modeling Calculations – Table 3 and Attachment A**: The modeled HQ for 1,1,1-TCA for soil vapor at 5 feet bgs, using the small office scenario, is $1.4x10^{-7}$. Using the presented methodology, the screening level should be $7.1 x10^{6}$ rather than $7.4 x10^{6}$.	Results of model calculations will be checked and corrected as necessary during preparation of the Final RAP.	Section 4.2 Appendix J

Copyright 2010 Kleinfelder

Overall Comment	Agency	Specific Comment	Agency Comment	Response	Final RAP Location
124.	US EPA	41. Contractor	**Appendix I – Bench-Scale Testing Report – Tables 4 and 5, Page 10 of Bench-scale Testing Report:** These tables provide analytical results for hexavalent chromium analysis for soil using a deionized water extraction and apparent analysis of the extract colorimetrically using a Hach colorimeter. Typically, colorimetric methods are used for water rather than soil samples. However, the units in the table for these results are in mg/kg, indicating the results are applied to soil samples. It's not clear how colorimetric results for a liquid extract sample (with units of mg/L) were applied to the soil samples (with units of mg/kg). Additionally, this method is not included in the list of Analytical methods of the report. A detailed description of the methodology of how this analysis was conducted, its accuracy compared to the standard laboratory methods listed in Table 3, and how the results were applied to the soil samples should be included to allow for interpretation of the data.	Analysis of hexavalent chromium in soil requires an extraction step. Our bench-scale testing contractor, Prima Environmental, Inc. (Prima) estimated hexavalent chromium in soil using a de-ionized (DI) extraction method rather than the alkaline extraction of US EPA Method 7199. The extract was analyzed for hexavalent chromium using a Hach colorimeter per US EPA Method 7196. The concentration in the soil was determined by multiplying the aqueous concentration by the volume, then dividing by the mass of soil.	Appendix M

Appendix A: Suggested Deed Restriction Language for the Site

Copyright 2010 Kleinfelder

APPENDIX C

DEED RESTRICTION LANGUAGE

ARTICLE III
DEVELOPMENT, USE AND CONVEYANCE OF THE BURDENED PROPERTY

3.1 Restrictions on Development and Use. Covenantor promises to restrict the use of the Burdened Property as follows:

a. Development and use of the Burdened Property shall be restricted to industrial, commercial and/or office space, including, but not limited to, manufacturing, processing or distributing of products and vehicle maintenance activities, in accordance with the zoning requirements set by the City of Los Angeles.

b. No residence for human habitation shall be permitted on the Burdened Property.

c. No hospitals shall be permitted on the Burdened Property.

d. No schools for persons under 21 years of age shall be permitted on the Burdened Property.

e. No day care centers for children or day care centers for Senior Citizens shall be permitted on the Burdened Property.

f. Any contaminated soils brought to the surface by grading, excavation, trenching, or backfilling shall be managed by Covenantor or his agent in accordance with all applicable provisions of local, state and federal law and a site-specific health and safety plan.

g. All uses and development of the Burdened Property shall be consistent with any applicable Board order, which is hereby incorporated by reference including future amendments thereto. All uses and development shall preserve the integrity of any remedial measures taken or remedial equipment installed, and any groundwater monitoring system installed on the Burdened Property pursuant to the requirements of the Board, unless otherwise expressly permitted in writing by the Board.

h. No Owners or Occupants of the Property or any portion thereof shall drill, bore, otherwise construct, or use a well for the purpose of extracting water for any use, including, but not limited to, domestic, potable, or industrial uses, unless expressly permitted in writing by the Board.

i. The Covenantor agrees that the Board, and/or any persons acting pursuant to Board orders, shall have reasonable access to the Burdened Property for the purposes of inspection, surveillance, maintenance, or monitoring, as provided for in Division 7 of the Water Code.

j. No Owner or Occupant of the Burdened Property shall act in any manner that will aggravate or contribute to the Existing Contamination.

3.2 Enforcement. Failure of an Owner or Occupant to comply with any of the restrictions, as set forth in paragraph 3.1, shall be grounds for the Board, by reason of this Covenant, to have the authority to require that Owner or Occupant undertake actions to comply therewith. Violation of the Covenant shall be grounds for the Board to file civil actions against the Owner as provided by law.

3.3 Notice in Agreements. After the date of recordation hereof, all Owners and Occupants shall execute a written instrument which shall accompany all purchase agreements or leases relating to the property. Any such instrument shall contain the following statement in the following form:

> The land described herein contains hazardous materials in soils and in the ground water under the property, and is subject to a deed restriction dated as of _____, 200_, and recorded on _____, 200_, in the Official Records of Los Angeles County, California, as Document No. _____, which Covenant and Restriction imposes certain covenants, conditions, and restrictions on usage of the property described herein. This statement is not a declaration that a hazard exists.

ARTICLE IV
VARIANCE AND TERMINATION

4.1 Variance. Any Owner or, with the Owner's consent, any Occupant of the Burdened Property or any portion thereof may apply to the Board for a written variance from the provisions of this Covenant.

4.2 Termination. Any Owner or, with the Owner's consent, any Occupant of the Burdened Property or a portion thereof may apply to the Board for a termination of the Restrictions as they apply to all or any portion of the Burdened Property.

4.3 Term. Unless terminated in accordance with paragraph 4.2 above, by law or otherwise, this Covenant shall continue in effect in perpetuity.

ARTICLE V
MISCELLANEOUS

5.1 No Dedication Intended. Nothing set forth herein shall be construed to be a gift or dedication, or offer of a gift or dedication, of the Burdened Property or any portion thereof to the general public.

APPENDIX D

ASSESSOR'S PARCEL MAP

5593 | 20

SCALE 1" = 100'

2002

W. 413.29' & S. 0°08' E. 438.19' FROM N.W. COR. LOT 16 RIVERDALE TR.

N.W. Cor. of 17 Ft. Spur Tr. O.R. 4036-102

S. 22°38'27" E. 18.42

S. Line 17 Ft. Spur Tr. R/W. O.R. 4036-102

GLASSELL & CHAPMAN

669.08 Ac.

Por. 16

0.92± Ac. = 40,210± □'

1.0± Ac. = 43,400± □'

38,710± □'

2.70± Ac.

3.85± Ac.

1.06± Ac.

25,550± □'

R=450.09 309.65

R=250

R=200

N. 22°50'W 385.31

N. 22°50'W 421.52

S. 22°50'E. 459.09

N. 0°17'33" W. 281.82

N. 44°42'27" E. 14.14

N. 45°17'33" W. 14.14

N. 0°08'E. 220.44

S. P. R.R.

SAN FERNANDO RD. C.F. 1653

WEST AVE.

GOODWIN AVE.

BRUNSWICK AVE.

RANCHO SAN RAFAEL

D.C.C. 1621

C.F. 61

RIVERDALE TRACT

M.R. 54 - 41

CODE 13

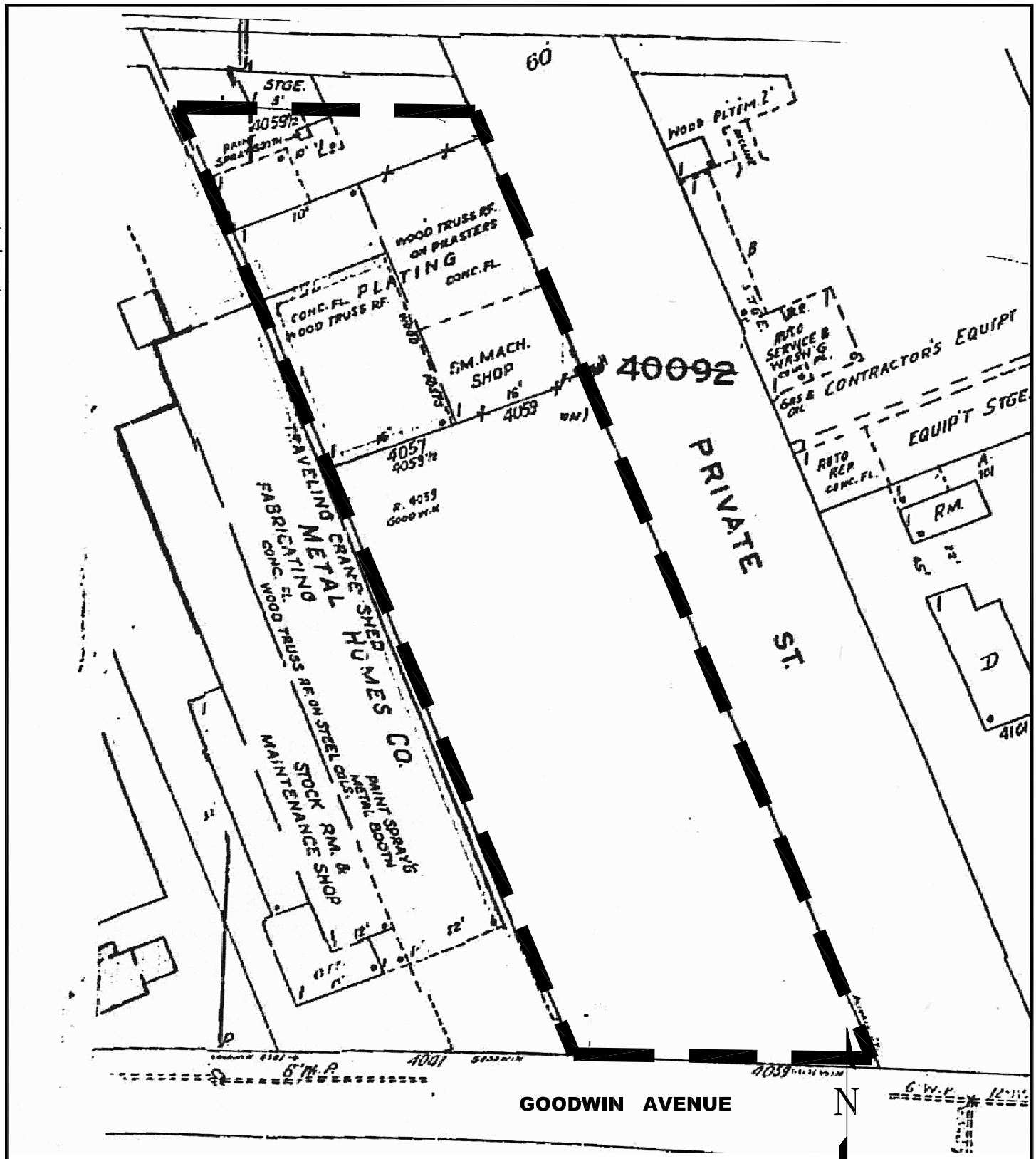
FOR PREV. ASSM'T. SEE: 5593-20

ASSESSOR'S MAP COUNTY OF LOS ANGELES, CALIF.

12-7-56
76,1007
902102
9205080700 1001-29
9501310400 7001-04
9501310400 8001-04
9505100201 0001-04
9602020700 3001-04, 29
9808240800 1001-04
2000052507001001-04
2001091015008001-04
2001091015009001-04

APPENDIX E

1951 SANBORN FIRE INSURANCE MAP



SOURCE: SANBORN 1951

The Information included on this graphic representation has been compiled from a variety of sources and is subject to change without notice. Kleinfelder makes no representations or warranties, express or implied, as to accuracy, completeness, timeliness, or rights to the use of such information. This document is not intended for use as a land survey product nor is it designed or intended as a construction design document. The use or misuse of the information contained on this graphic representation is at the sole risk of the party using or misusing the information.

50 25 0 50

APPROXIMATE SCALE (feet)

ATTACHED IMAGES: Images: 92124p2.JPG Images: 92124p4.JPG
ATTACHED XREFS:
Diamond Bar, CA

CAD FILE: U:\MGriffin\CADD\2008\98498\ LAYOUT: D

PLOTTED: 25 Nov 2008, 4:15pm, MGriffin

KLEINFELDER
Bright People. Right Solutions.
www.kleinfelder.com

PROJECT NO.	98498
DRAWN:	11/25/08
DRAWN BY:	MRG
CHECKED BY:	HAV
FILE NAME:	98498aD.dwg

SANBORN FIRE INSURANCE MAP DATED 1951

THE SPIRITO FAMILY TRUST PARCEL
4057 GOODWIN AVENUE
LOS ANGELES, CALIFORNIA

APPENDIX

D

APPENDIX F

GLENDALE CITY COUNCIL MEETING MINUTES (CR^{6+} VOLUNTARY CLEANUP GOAL)

MOTION

Moved by Council Member Yousefian, seconded by Council Member Manoukian, that city staff is directed to submit a specific plan to EPA which would permit the City to temporarily shut down well GS3 until it can be treated for V.O.C.'s and the treated water then placed into our recycled water system. The City will continue efforts to treat water from well GN3 and increase pumping of water from the low chromium wells. The City shall have a goal of 5ppb of chromium 6.

Vote as follows:

Ayes: Manoukian, Quintero, Yousefian, Gomez.

Noes: Weaver

Absent: None

Abstain: None

MOTION ADOPTED BY THE GLENDALE CITY COUNCIL AT ITS REGULAR MEETING HELD ON Tuesday, January 29, 2002.

APPROVED AS TO FORM

CITY ATTORNEY

DATE 2-3-02

J:\FILES\DOCFILES\FACTFIND\Water treatment agree mtn 2.wpd

7 A 1

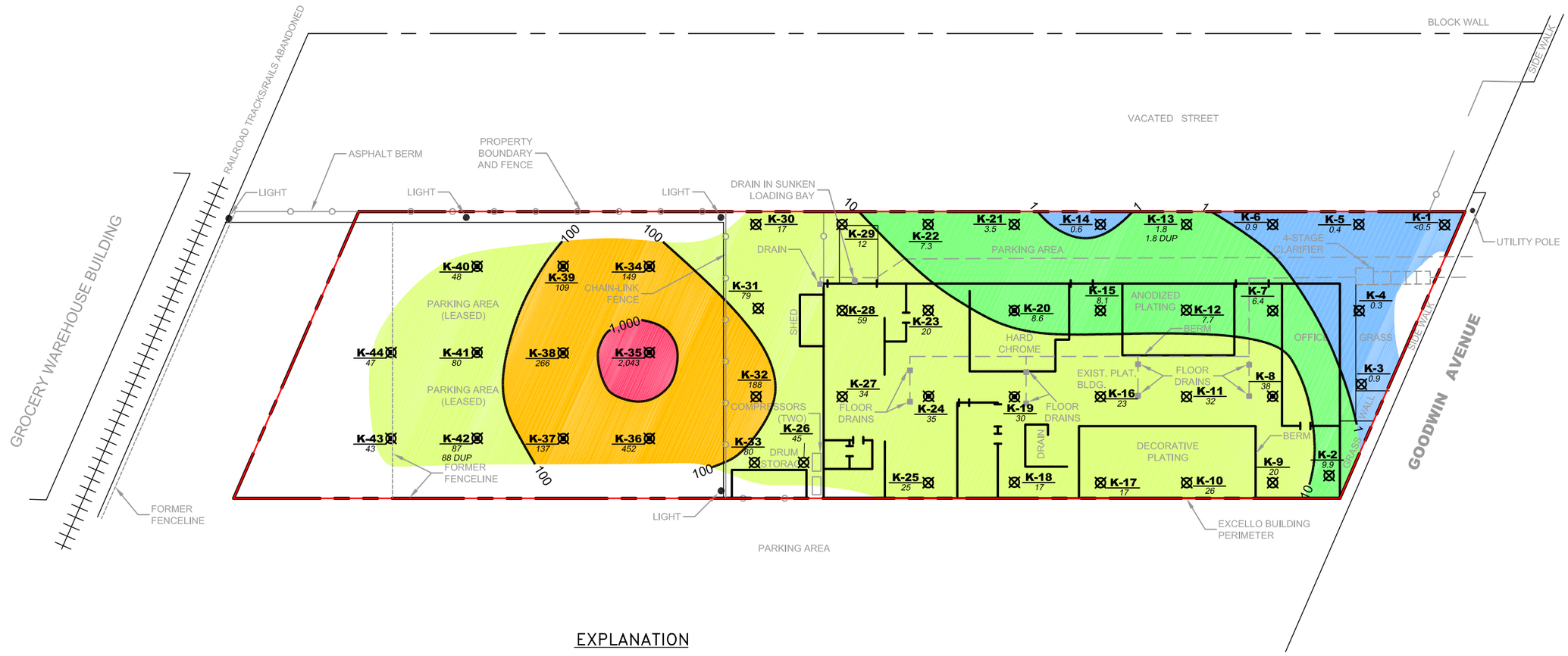
APPENDIX G

PLATES 6A TO 14B FROM 2008 SUPPLEMENTAL SITE ASSESSMENT

PLOTTED: 25 Nov 2008, 5:57pm, MGriffin

CAD FILE: U:\MGriffin\CADD\2008\98498\ LAYOUT: 6A

ATTACHED IMAGES:
ATTACHED XREFS:
DIAMOND BAR, CA



EXPLANATION

- **K-33** ⊠ KLEINFELDER VAPOR PROBE LOCATION
- **K-44** ⊠ KLEINFELDER SOIL BORING AND VAPOR PROBE LOCATION
- *2,043* TRICHLOROETHENE (TCE) CONCENTRATION IN MICROGRAMS PER LITER (µg/L)
- *1.8 DUP* FIELD DUPLICATE SAMPLE
- 1,000 ESTIMATED CONTOUR OF CONCENTRATION
- >1,000 µg/L
- 100–1,000 µg/L
- 10–100 µg/L
- 1–10 µg/L
- <1 µg/L

N

40 20 0 40

APPROXIMATE SCALE (feet)

The Information included on this graphic representation has been compiled from a variety of sources and is subject to change without notice. KleinFelder makes no representations or warranties, express or implied, as to accuracy, completeness, timeliness, or rights to the use of such information. This document is not intended for use as a land survey product nor is it designed or intended as a construction design document. The use or misuse of the information contained on this graphic representation is at the sole risk of the party using or misusing the information.

KLEINFELDER
Bright People. Right Solutions.
www.kleinfelder.com

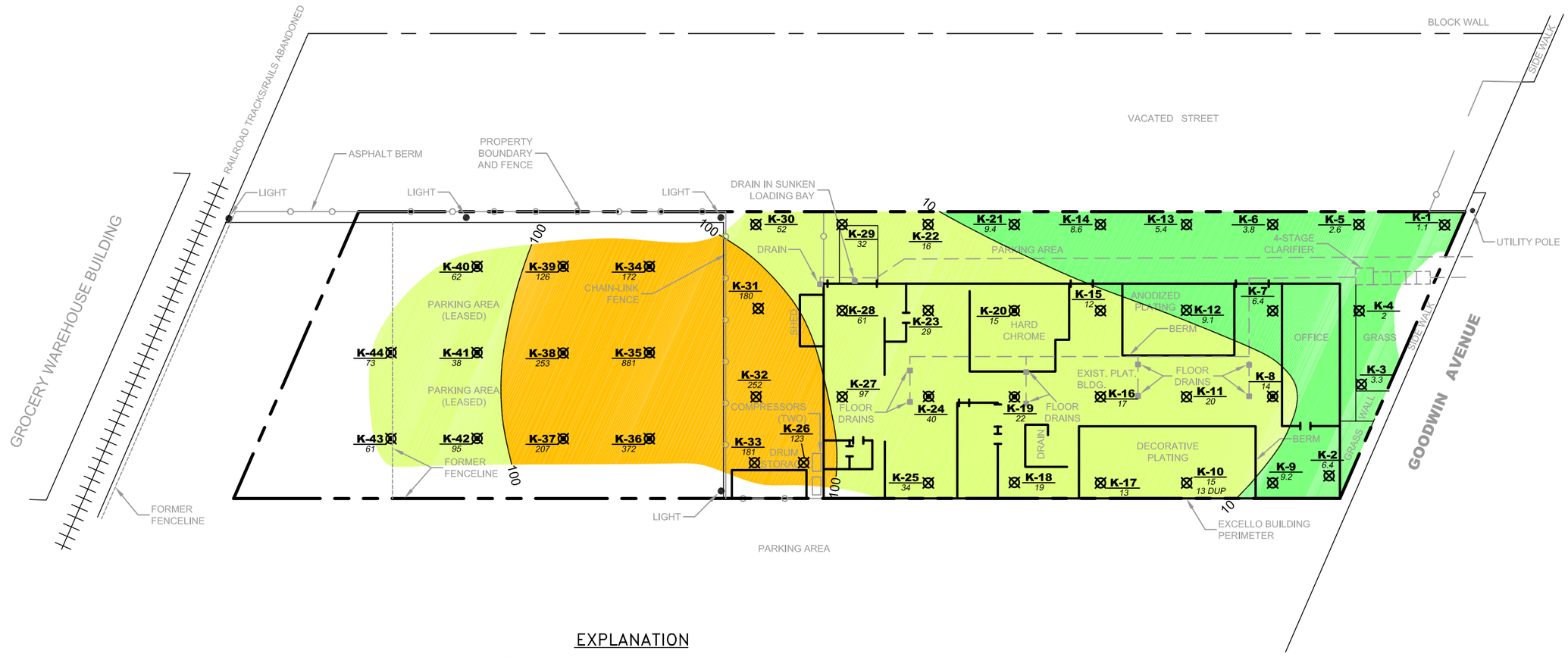
PROJECT NO.	98498
DRAWN:	11/25/08
DRAWN BY:	MRG
CHECKED BY:	PD
FILE NAME:	98498p6A_TCE-5FT.dwg

TCE IN SOIL VAPOR CONTOUR MAP - 5FT BGS

THE SPIRITO FAMILY TRUST PARCEL
4057 GOODWIN AVENUE
LOS ANGELES, CALIFORNIA

PLATE **6A**

PLOTTED: 25 Nov 2008, 5:58pm, MGriffin
CAD FILE: U:\MGriffin\CADD\2008\98498\ LAYOUT: 6B
ATTACHED IMAGES:
ATTACHED XREFS:
DIAMOND BAR, CA



EXPLANATION

- **K-33** ⊠ KLEINFELDER VAPOR PROBE LOCATION
- **K-44** ⊠ KLEINFELDER SOIL BORING AND VAPOR PROBE LOCATION
- *881* TRICHLOROETHENE (TCE) CONCENTRATION IN MICROGRAMS PER LITER (µg/L)
- *1.8 DUP* FIELD DUPLICATE SAMPLE
- 100 ESTIMATED CONTOUR OF CONCENTRATION
- 100–1,000 µg/L
- 10–100 µg/L
- 1–10 µg/L

40 20 0 40
APPROXIMATE SCALE (feet)

The Information included on this graphic representation has been compiled from a variety of sources and is subject to change without notice. Kleinfelder makes no representations or warranties, express or implied, as to accuracy, completeness, timeliness, or rights to the use of such information. This document is not intended for use as a land survey product nor is it designed or intended as a construction design document. The use or misuse of the information contained on this graphic representation is at the sole risk of the party using or misusing the information.

KLEINFELDER
Bright People. Right Solutions.
www.kleinfelder.com

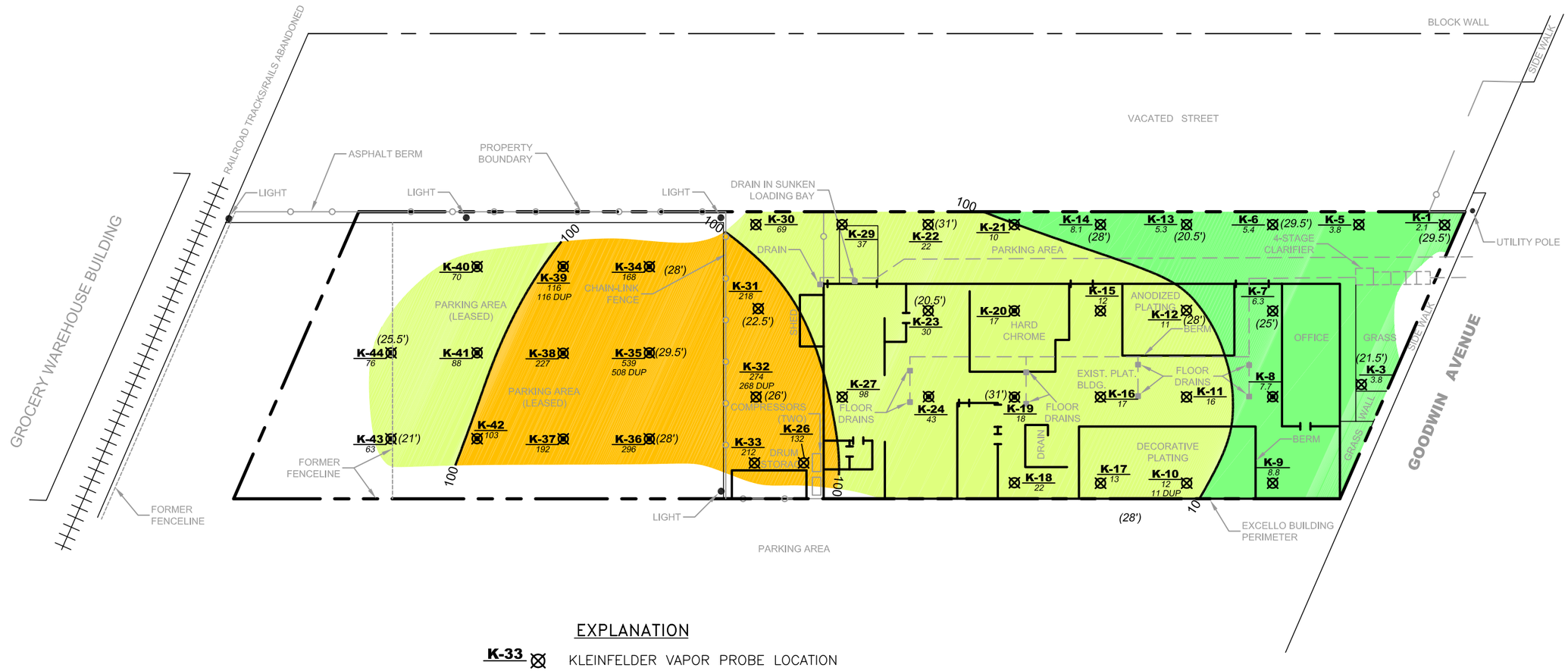
PROJECT NO.	98498
DRAWN:	11/25/08
DRAWN BY:	MRG
CHECKED BY:	PD
FILE NAME:	98498p6B_TCE-15FT.dwg

TCE IN SOIL VAPOR CONTOUR MAP - 15FT BGS

THE SPIRITO FAMILY TRUST PARCEL
4057 GOODWIN AVENUE
LOS ANGELES, CALIFORNIA

PLATE **6B**

PLOTTED: 25 Nov 2008, 5:59pm, MGriffin
CAD FILE: U:\MGriffin\CADD\2008\98498\ LAYOUT: 6C
ATTACHED IMAGES:
ATTACHED XREFS:
DIAMOND BAR, CA



EXPLANATION

K-33 ⊠	KLEINFELDER VAPOR PROBE LOCATION
K-44 ⊠	KLEINFELDER SOIL BORING AND VAPOR PROBE LOCATION
539	TRICHLOROETHENE (TCE) CONCENTRATION IN MICROGRAMS PER LITER (µg/L)
(31')	DEPTH TOTAL OF BORING
508 DUP	FIELD DUPLICATE SAMPLE
100	ESTIMATED CONTOUR OF CONCENTRATION
	100–1,000 µg/L
	10–100 µg/L
	1–10 µg/L

The Information included on this graphic representation has been compiled from a variety of sources and is subject to change without notice. Kleinfelder makes no representations or warranties, express or implied, as to accuracy, completeness, timeliness, or rights to the use of such information. This document is not intended for use as a land survey product nor is it designed or intended as a construction design document. The use or misuse of the information contained on this graphic representation is at the sole risk of the party using or misusing the information.

KLEINFELDER
Bright People. Right Solutions.
www.kleinfelder.com

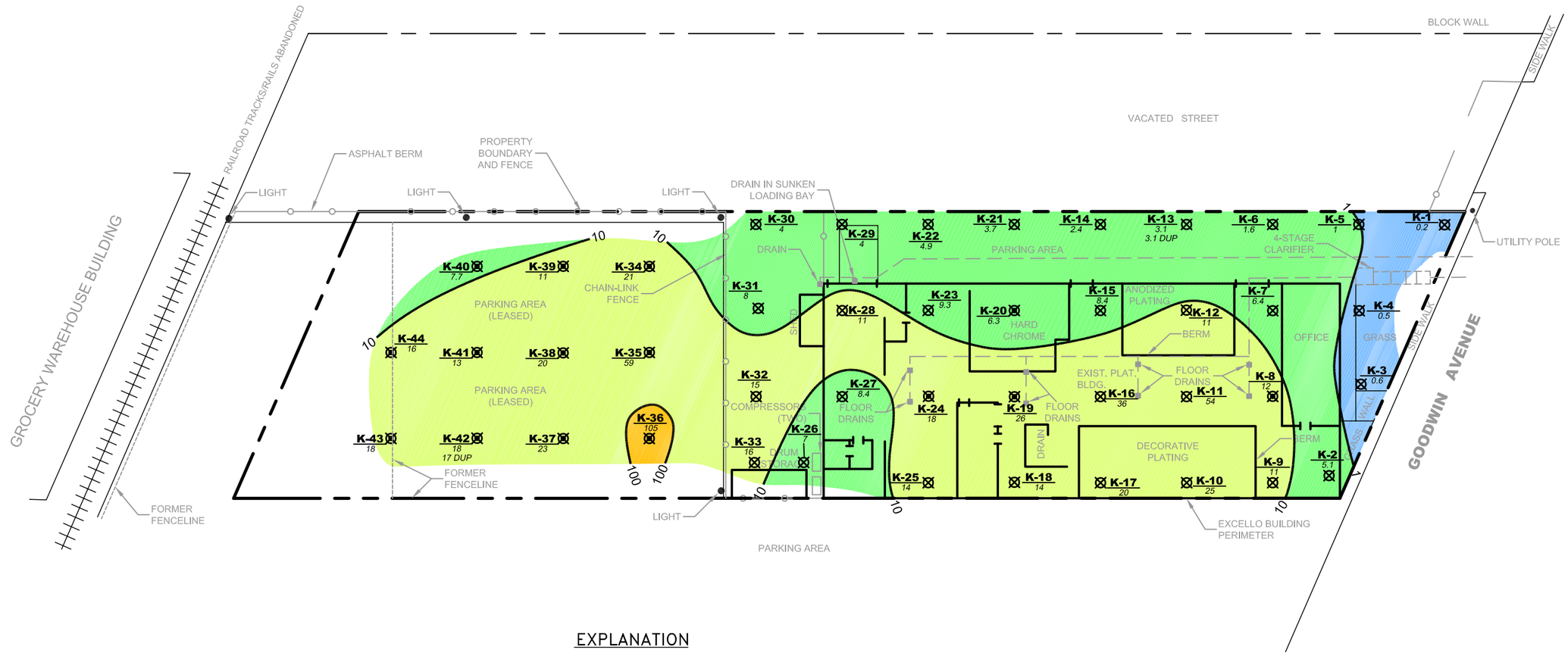
PROJECT NO.	98498
DRAWN:	11/25/08
DRAWN BY:	MRG
CHECKED BY:	PD
FILE NAME:	98498p6C_TCE-30FT.dwg

TCE IN SOIL VAPOR CONTOUR MAP - 30FT BGS

THE SPIRITO FAMILY TRUST PARCEL
4057 GOODWIN AVENUE
LOS ANGELES, CALIFORNIA

PLATE
6C

PLOTTED: 25 Nov 2008, 5:59pm, MGriffin
CAD FILE: U:\MGriffin\CADD\2008\98498\ LAYOUT: 7A
ATTACHED IMAGES:
ATTACHED XREFS:
DIAMOND BAR, CA



EXPLANATION

K-33	KLEINFELDER VAPOR PROBE LOCATION
K-44	KLEINFELDER SOIL BORING AND VAPOR PROBE LOCATION
105	TETRACHLOROETHENE (PCE) CONCENTRATION IN MICROGRAMS PER LITER (µg/L)
17 DUP	FIELD DUPLICATE SAMPLE
100	ESTIMATED CONTOUR OF CONCENTRATION
	100–1,000 µg/L
	10–100 µg/L
	1–10 µg/L
	<1 µg/L

The Information included on this graphic representation has been compiled from a variety of sources and is subject to change without notice. Kleinfelder makes no representations or warranties, express or implied, as to accuracy, completeness, timeliness, or rights to the use of such information. This document is not intended for use as a land survey product nor is it designed or intended as a construction design document. The use or misuse of the information contained on this graphic representation is at the sole risk of the party using or misusing the information.

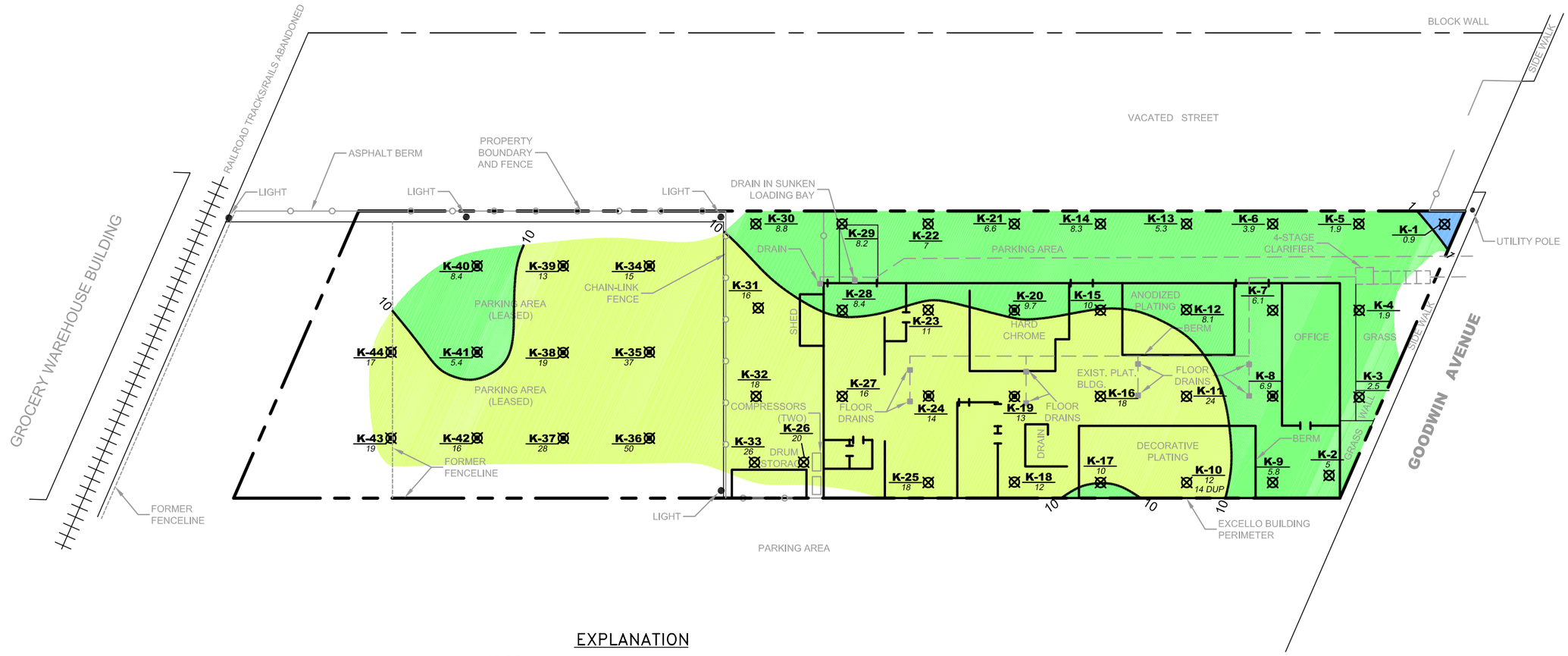
KLEINFELDER
Bright People. Right Solutions.
www.kleinfelder.com

PROJECT NO.	98498
DRAWN:	11/25/08
DRAWN BY:	MRG
CHECKED BY:	PD
FILE NAME:	98498p7A_PCE-5FT.dwg

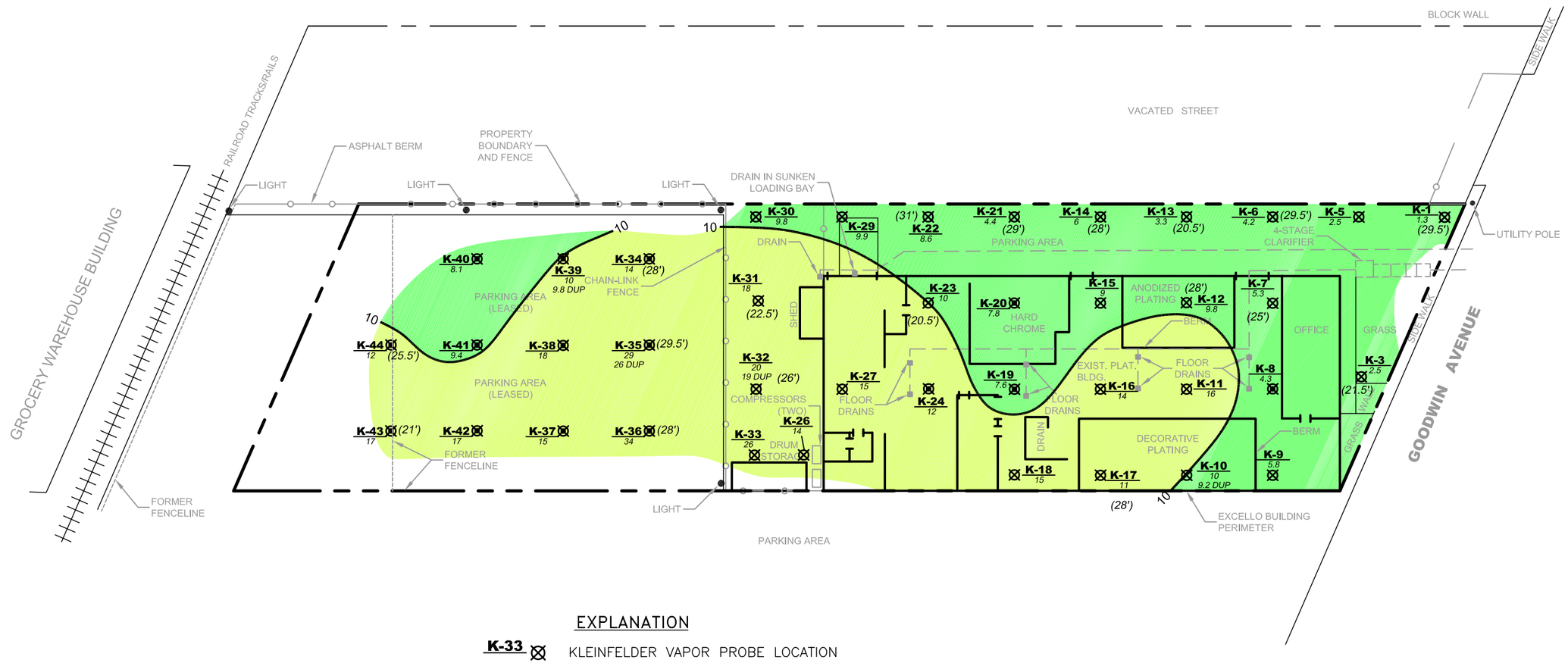
PCE IN SOIL VAPOR CONTOUR MAP - 5FT BGS

THE SPIRITO FAMILY TRUST PARCEL
4057 GOODWIN AVENUE
LOS ANGELES, CALIFORNIA

PLATE **7A**


BLOCK WALL
VACATED STREET
SIDEWALK
RAILROAD TRACKS/RAILS ABANDONED
ASPHALT BERM
PROPERTY BOUNDARY AND FENCE
LIGHT
LIGHT
LIGHT
DRAIN IN SUNKEN LOADING BAY
UTILITY POLE
GROCERY WAREHOUSE BUILDING
K-30 8.8
K-29 8.2
K-22 7
K-21 6.6
K-14 8.3
K-13 5.3
K-6 3.9
K-5 1.9
K-1 0.9
DRAIN
PARKING AREA
4-STAGE CLARIFIER
K-40 8.4
K-39 13
K-34 15
CHAIN-LINK FENCE
K-31 16
K-28 8.4
K-23 11
K-20 9.7
K-15 10
ANODIZED PLATING
K-12 8.1
BERM
K-7 6.1
K-4 1.9
SHED
HARD CHROME
OFFICE
GRASS
SIDEWALK
PARKING AREA (LEASED)
K-44 17
K-41 5.4
K-38 19
K-35 37
K-32 18
K-27 16
EXIST. PLAT. BLDG.
FLOOR DRAINS
K-8 6.9
K-3 2.5
K-16 18
K-11 24
FLOOR DRAINS
K-24 14
K-19 13
FLOOR DRAINS
COMPRESSORS (TWO)
K-26 20
K-43 19
K-42 16
K-37 28
K-36 50
K-33 26
DRUM STORAGE
DRAIN
DECORATIVE PLATING
BERM
K-17 10
K-10 12 14 DUP
K-9 5.8
K-2 5
K-25 18
K-18 12
GRASS WALK
GOODWIN AVENUE
FORMER FENCELINE
FORMER FENCELINE
LIGHT
EXCELLO BUILDING PERIMETER
PARKING AREA
10
10
10

PLOTTED: 25 Nov 2008, 6:00pm, MGriffin
CAD FILE: U:\MGriffin\CADD\2008\98498\ LAYOUT: 7C
ATTACHED IMAGES:
ATTACHED XREFS:
DIAMOND BAR, CA



EXPLANATION

- K-33 — KLEINFELDER VAPOR PROBE LOCATION
- K-44 — KLEINFELDER SOIL BORING AND VAPOR PROBE LOCATION
- 34 — TETRACHLOROETHENE (PCE) CONCENTRATION IN MICROGRAMS PER LITER (µg/L)
- (29.5') — DEPTH TOTAL OF BORING
- 26 DUP — FIELD DUPLICATE SAMPLE
- 10 — ESTIMATED CONTOUR OF CONCENTRATION
- 10–100 µg/L
- 1–10 µg/L

40 20 0 40
APPROXIMATE SCALE (feet)

The Information included on this graphic representation has been compiled from a variety of sources and is subject to change without notice. Kleinfelder makes no representations or warranties, express or implied, as to accuracy, completeness, timeliness, or rights to the use of such information. This document is not intended for use as a land survey product nor is it designed or intended as a construction design document. The use or misuse of the information contained on this graphic representation is at the sole risk of the party using or misusing the information.

KLEINFELDER
Bright People. Right Solutions.
www.kleinfelder.com

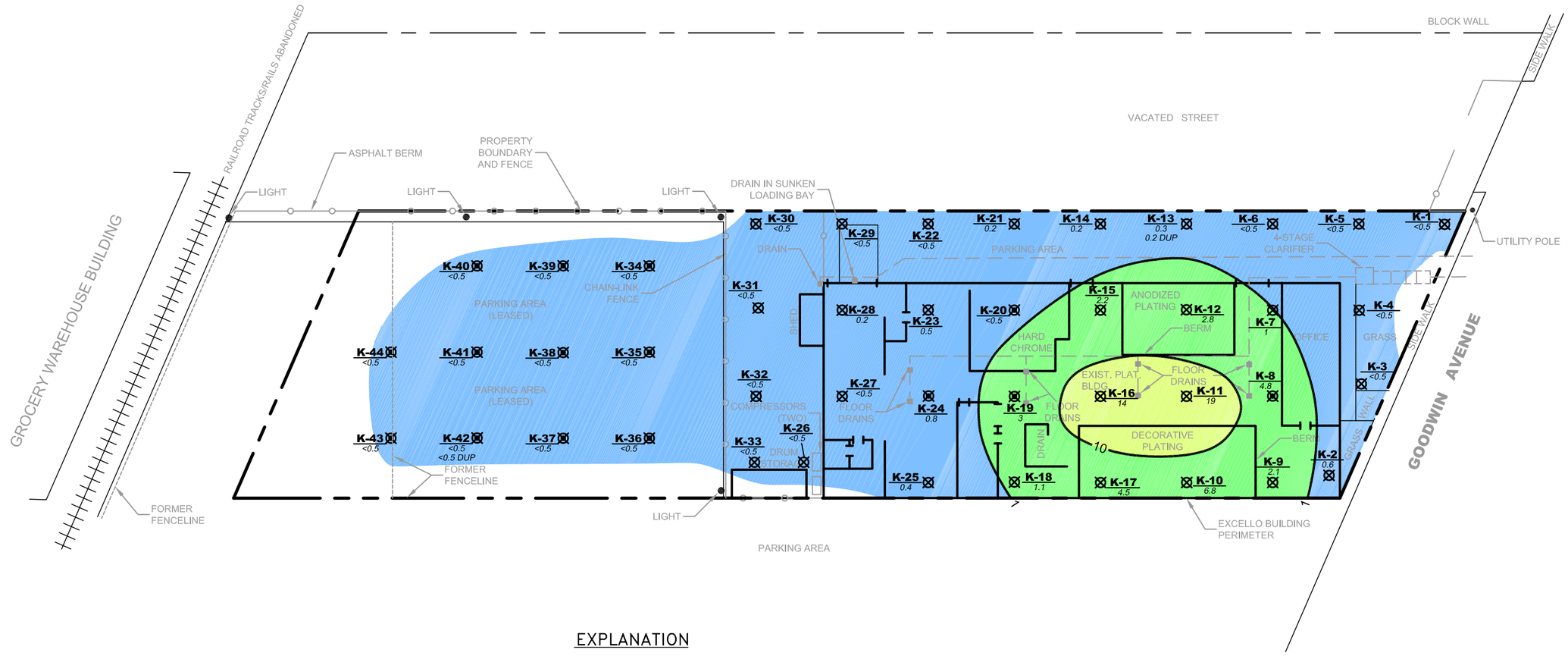
PROJECT NO.	98498
DRAWN:	11/25/08
DRAWN BY:	MRG
CHECKED BY:	PD
FILE NAME:	98498p7C_PCE-30FT.dwg

PCE IN SOIL VAPOR CONTOUR MAP - 30FT BGS

THE SPIRITO FAMILY TRUST PARCEL
4057 GOODWIN AVENUE
LOS ANGELES, CALIFORNIA

PLATE
7C

PLOTTED: 25 Nov 2008, 6:02pm, MGriffin
CAD FILE: U:\MGriffin\CADD\2008\98498\ LAYOUT: 8A
ATTACHED IMAGES:
ATTACHED XREFS:
DIAMOND BAR, CA



EXPLANATION

- **K-33** ⊠ — KLEINFELDER VAPOR PROBE LOCATION
- **K-44** ⊠ — KLEINFELDER SOIL BORING AND VAPOR PROBE LOCATION
- *19* — 1,1,1–TRICHLOROETHANE (1,1,1–TCA) CONCENTRATION IN MICROGRAMS PER LITER (µg/L)
- *0.2 DUP* — FIELD DUPLICATE SAMPLE
- 10 — ESTIMATED CONTOUR OF CONCENTRATION
- 10–100 µg/L
- 1–10 µg/L
- <1 µg/L

40 20 0 40
APPROXIMATE SCALE (feet)

The Information included on this graphic representation has been compiled from a variety of sources and is subject to change without notice. Kleinfelder makes no representations or warranties, express or implied, as to accuracy, completeness, timeliness, or rights to the use of such information. This document is not intended for use as a land survey product nor is it designed or intended as a construction design document. The use or misuse of the information contained on this graphic representation is at the sole risk of the party using or misusing the information.

KLEINFELDER
Bright People. Right Solutions.
www.kleinfelder.com

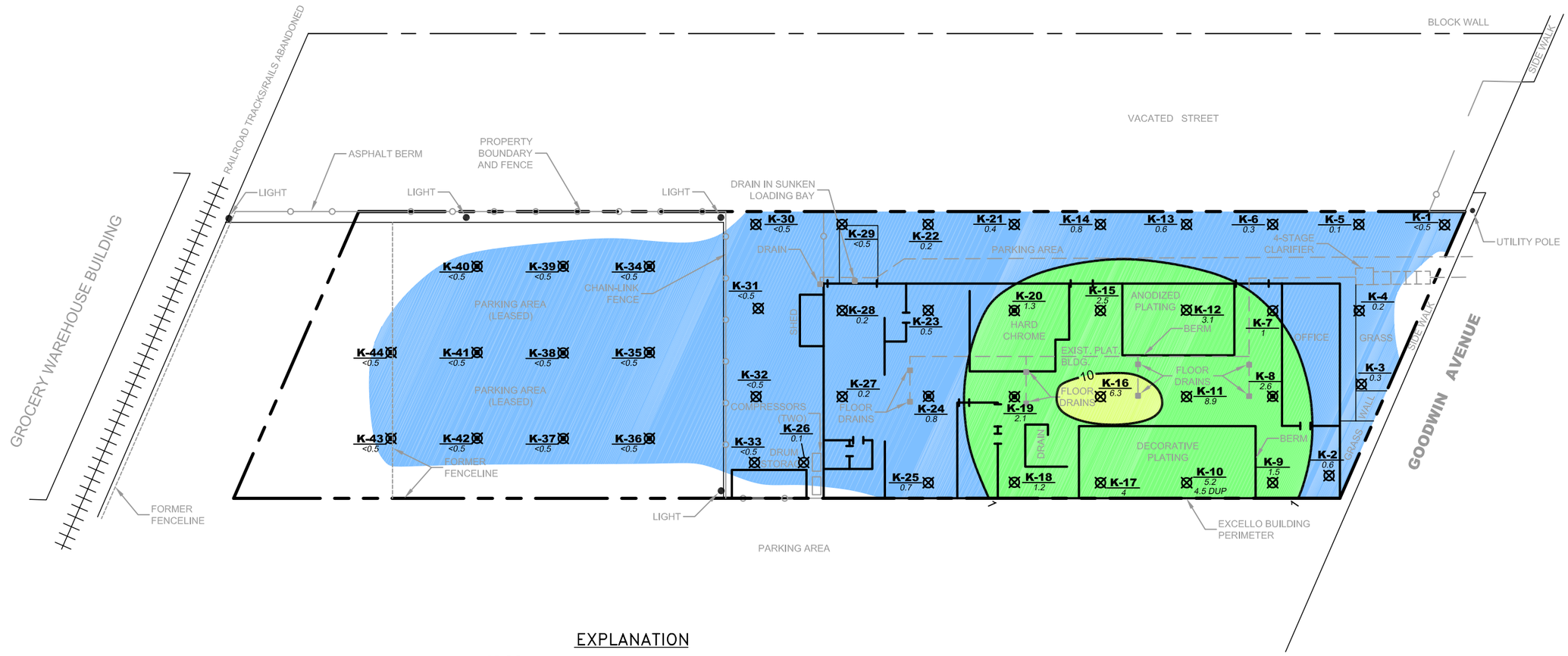
PROJECT NO.	98498
DRAWN:	11/21/08
DRAWN BY:	MRG
CHECKED BY:	PD
FILE NAME:	98498p8A_TCA-5FT.dwg

1,1,1-TCA IN SOIL VAPOR CONTOUR MAP - 5FT BGS

SPIRITO FAMILY TRUST PARCEL
4057 GOODWIN AVENUE
LOS ANGELES, CALIFORNIA

PLATE
8A

PLOTTED: 25 Nov 2008, 6:02pm, MGriffin
CAD FILE: U:\MGriffin\CADD\2008\98498\ LAYOUT: 8B
ATTACHED IMAGES:
ATTACHED XREFS:
DIAMOND BAR, CA



EXPLANATION

- **K-33** — KLEINFELDER VAPOR PROBE LOCATION
- **K-44** — KLEINFELDER SOIL BORING AND VAPOR PROBE LOCATION
- *14* — 1,1,1–TRICHLOROETHANE (1,1,1–TCA) CONCENTRATION IN MICROGRAMS PER LITER (µg/L)
- *4.5 DUP* — FIELD DUPLICATE SAMPLE
- 10 — ESTIMATED CONTOUR OF CONCENTRATION
- 10–100 µg/L
- 1–10 µg/L
- <1 µg/L

40 20 0 40
APPROXIMATE SCALE (feet)

The Information included on this graphic representation has been compiled from a variety of sources and is subject to change without notice. Kleinfelder makes no representations or warranties, express or implied, as to accuracy, completeness, timeliness, or rights to the use of such information. This document is not intended for use as a land survey product nor is it designed or intended as a construction design document. The use or misuse of the information contained on this graphic representation is at the sole risk of the party using or misusing the information.

KLEINFELDER
Bright People. Right Solutions.
www.kleinfelder.com

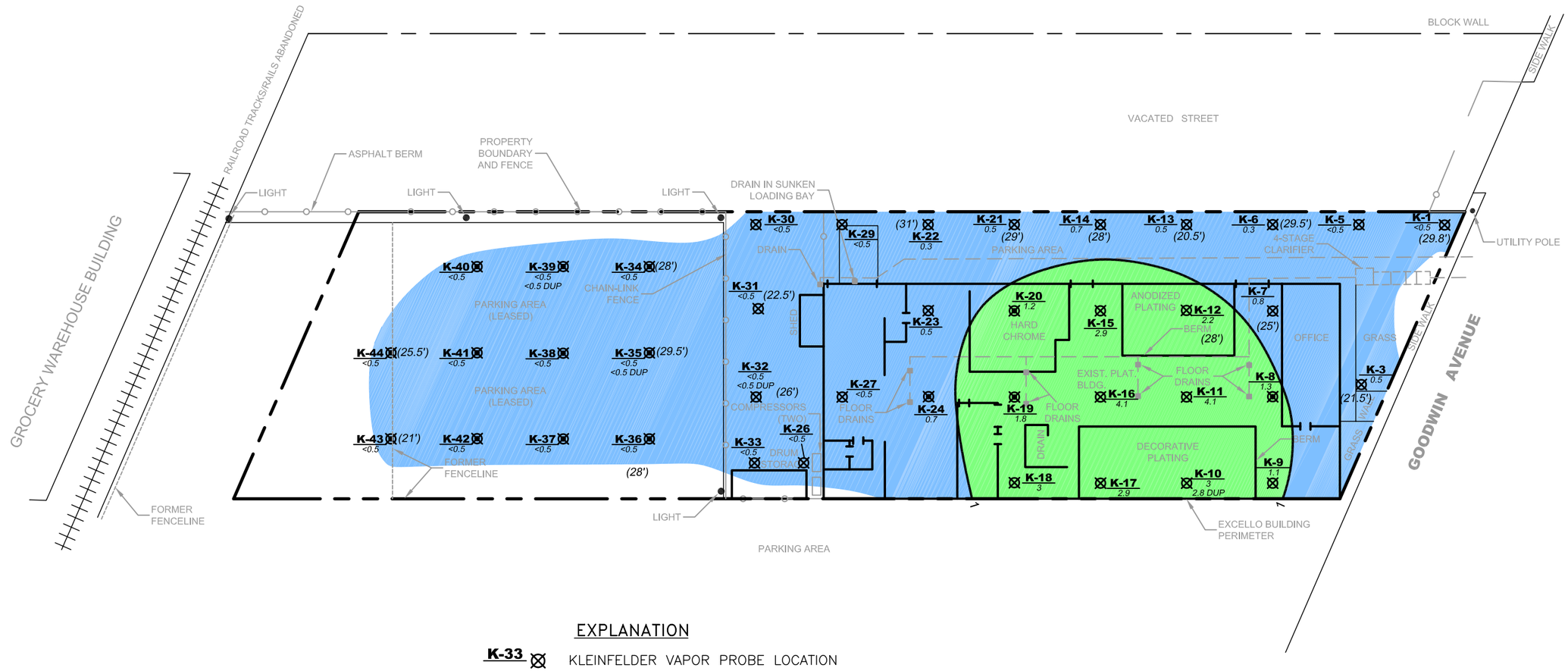
PROJECT NO.	98498
DRAWN:	11/21/08
DRAWN BY:	MRG
CHECKED BY:	PD
FILE NAME:	98498p8B_TCA-15FT.dwg

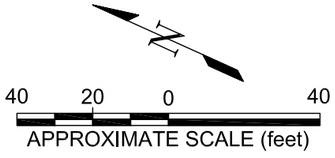
1,1,1-TCA IN SOIL VAPOR CONTOUR MAP - 15FT BGS

SPIRITO FAMILY TRUST PARCEL
4057 GOODWIN AVENUE
LOS ANGELES, CALIFORNIA

PLATE **8B**

PLOTTED: 25 Nov 2008, 6:03pm, MGriffin
CAD FILE: U:\MGriffin\CADD\2008\98498\ LAYOUT: 8C
ATTACHED IMAGES:
ATTACHED XREFS:
DIAMOND BAR, CA





EXPLANATION

- K-33 ⊠ KLEINFELDER VAPOR PROBE LOCATION
- K-44 ⊠ KLEINFELDER SOIL BORING AND VAPOR PROBE LOCATION
- *4.1* 1,1,1–TRICHLOROETHANE (1,1,1–TCA) CONCENTRATION IN MICROGRAMS PER LITER (µg/L)
- *(31')* DEPTH TOTAL OF BORING
- *2.8 DUP* FIELD DUPLICATE SAMPLE
- 10 ESTIMATED CONTOUR OF CONCENTRATION
- 1–10 µg/L
- <1 µg/L

The Information included on this graphic representation has been compiled from a variety of sources and is subject to change without notice. Kleinfelder makes no representations or warranties, express or implied, as to accuracy, completeness, timeliness, or rights to the use of such information. This document is not intended for use as a land survey product nor is it designed or intended as a construction design document. The use or misuse of the information contained on this graphic representation is at the sole risk of the party using or misusing the information.

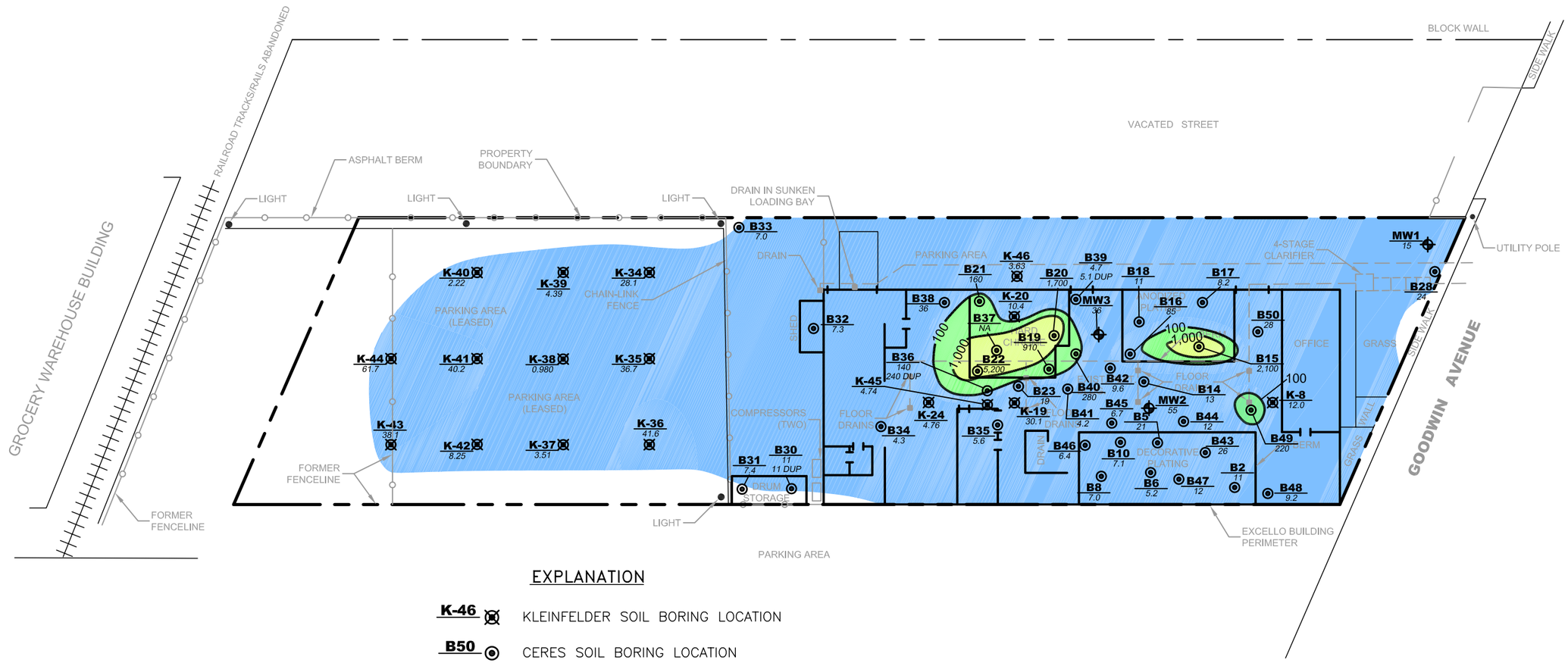
KLEINFELDER
Bright People. Right Solutions.
www.kleinfelder.com

PROJECT NO.	98498
DRAWN:	11/21/08
DRAWN BY:	MRG
CHECKED BY:	PD
FILE NAME:	98498p8C_TCA-30FT.dwg

1,1,1-TCA IN SOIL VAPOR CONTOUR MAP - 30FT BGS

SPIRITO FAMILY TRUST PARCEL
4057 GOODWIN AVENUE
LOS ANGELES, CALIFORNIA

PLATE
8C



EXPLANATION

- **K-46** — KLEINFELDER SOIL BORING LOCATION
- **B50** — CERES SOIL BORING LOCATION
- **MW-3** — MONITORING WELL LOCATION
- *5,200* — TOTAL CHROME CONCENTRATION IN MILLIGRAMS PER KILOGRAM (mg/kg)
- *240 DUP* — FIELD DUPLICATE SAMPLE
- *NA* — NOT ANALYZED
- 100 — ESTIMATED CONTOUR OF CONCENTRATION
- 1,000–10,000 mg/kg
- 100–1,000 mg/kg
- <100 mg/kg

40 20 0 40

APPROXIMATE SCALE (feet)

The information included on this graphic representation has been compiled from a variety of sources and is subject to change without notice. Kleinfelder makes no representations or warranties, express or implied, as to accuracy, completeness, timeliness, or rights to the use of such information. This document is not intended for use as a land survey product nor is it designed or intended as a construction design document. The use or misuse of the information contained on this graphic representation is at the sole risk of the party using or misusing the information.

KLEINFELDER
Bright People. Right Solutions.
www.kleinfelder.com

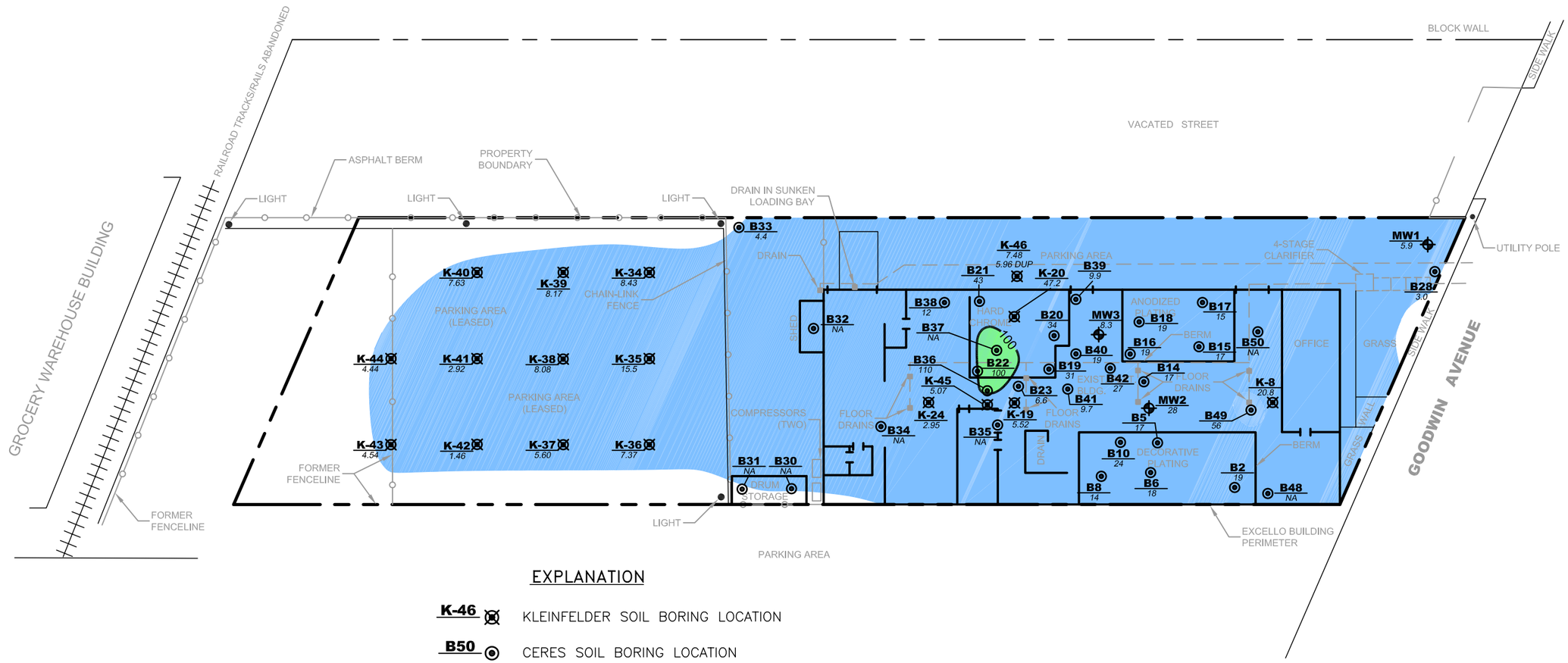
PROJECT NO.	98498
DRAWN:	11/25/08
DRAWN BY:	MRG
CHECKED BY:	PD
FILE NAME:	98498p9A_Tot.Cr.-5FT.dwg

TOTAL CHROME IN SOIL CONTOUR MAP - 5FT BGS

THE SPIRITO FAMILY TRUST PARCEL
4057 GOODWIN AVENUE
LOS ANGELES, CALIFORNIA

PLATE **9A**

PLOTTED: 25 Nov 2008, 6:04pm, MGriffin
CAD FILE: U:\MGriffin\CADD\2008\98498\ LAYOUT: 9A
ATTACHED IMAGES:
ATTACHED XREFS:
DIAMOND BAR, CA



EXPLANATION

- **K-46** — KLEINFELDER SOIL BORING LOCATION
- **B50** — CERES SOIL BORING LOCATION
- **MW-3** — MONITORING WELL LOCATION
- *110* — TOTAL CHROME CONCENTRATION IN MILLIGRAMS PER KILOGRAM (mg/kg)
- *5.96 DUP* — FIELD DUPLICATE SAMPLE
- *NA* — NOT ANALYZED
- 100 — ESTIMATED CONTOUR OF CONCENTRATION
- 100–1,000 mg/kg
- <100 mg/kg

40 20 0 40

APPROXIMATE SCALE (feet)

The information included on this graphic representation has been compiled from a variety of sources and is subject to change without notice. Kleinfelder makes no representations or warranties, express or implied, as to accuracy, completeness, timeliness, or rights to the use of such information. This document is not intended for use as a land survey product nor is it designed or intended as a construction design document. The use or misuse of the information contained on this graphic representation is at the sole risk of the party using or misusing the information.

KLEINFELDER
Bright People. Right Solutions.
www.kleinfelder.com

PROJECT NO.	98498
DRAWN:	11/25/08
DRAWN BY:	MRG
CHECKED BY:	PD
FILE NAME:	98498p9B_Tot.Cr.-15FT.dwg

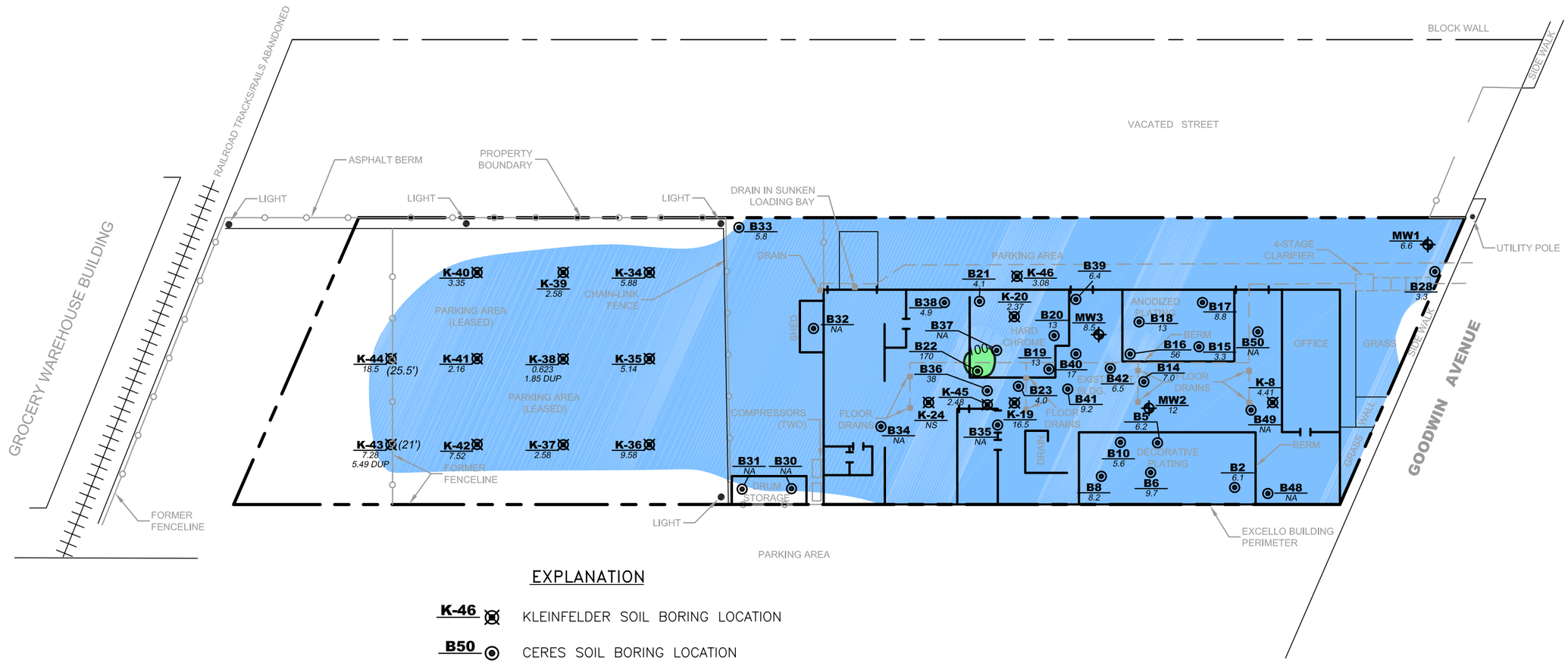
TOTAL CHROME IN SOIL CONTOUR MAP - 15FT BGS

THE SPIRITO FAMILY TRUST PARCEL
4057 GOODWIN AVENUE
LOS ANGELES, CALIFORNIA

PLATE **9B**

PLOTTED: 25 Nov 2008, 6:05pm, MGriffin
CAD FILE: U:\MGriffin\CADD\2008\98498\ LAYOUT: 9B
ATTACHED IMAGES:
ATTACHED XREFS:
DIAMOND BAR, CA

PLOTTED: 25 Nov 2008, 6:05pm, MGriffin
CAD FILE: U:\MGriffin\CADD\2008\98498\ LAYOUT: 9C
ATTACHED IMAGES:
ATTACHED XREFS:
DIAMOND BAR, CA



EXPLANATION

K-46	KLEINFELDER SOIL BORING LOCATION
B50	CERES SOIL BORING LOCATION
MW-3	MONITORING WELL LOCATION
170	TOTAL CHROME CONCENTRATION IN MILLIGRAMS PER KILOGRAM (mg/kg)
(25.5')	DEPTH TOTAL OF BORING
5.49 DUP	FIELD DUPLICATE SAMPLE
NA	NOT ANALYZED
NS	NOT SAMPLED
100	ESTIMATED CONTOUR OF CONCENTRATION
	100–1,000 mg/kg
	<100 mg/kg

40 20 0 40
APPROXIMATE SCALE (feet)

The information included on this graphic representation has been compiled from a variety of sources and is subject to change without notice. Kleinfelder makes no representations or warranties, express or implied, as to accuracy, completeness, timeliness, or rights to the use of such information. This document is not intended for use as a land survey product nor is it designed or intended as a construction design document. The use or misuse of the information contained on this graphic representation is at the sole risk of the party using or misusing the information.

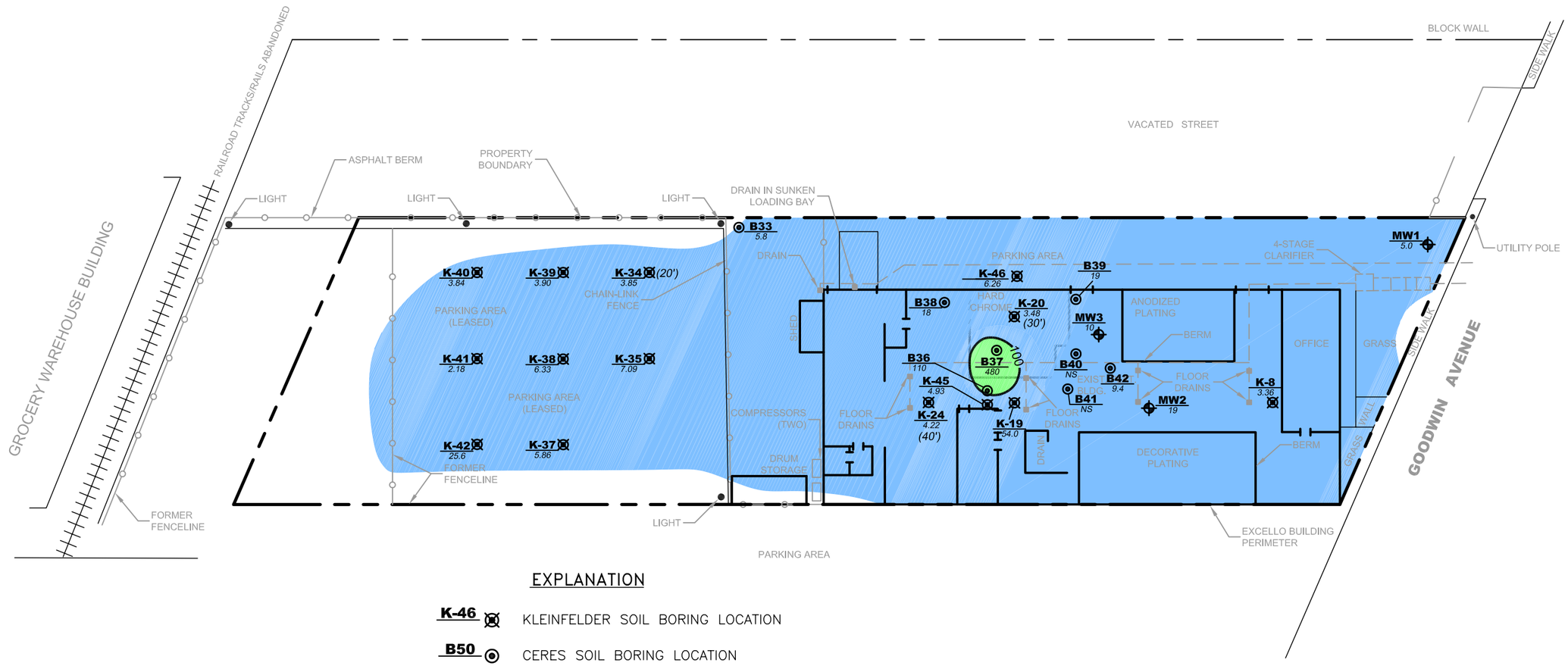
KLEINFELDER
Bright People. Right Solutions.
www.kleinfelder.com

PROJECT NO.	98498
DRAWN:	11/25/08
DRAWN BY:	MRG
CHECKED BY:	PD
FILE NAME:	98498p9C_Tot.Cr.-25FT.dwg

TOTAL CHROME IN SOIL CONTOUR MAP - 25FT BGS

THE SPIRITO FAMILY TRUST PARCEL
4057 GOODWIN AVENUE
LOS ANGELES, CALIFORNIA

PLATE
9C



EXPLANATION

K-46	KLEINFELDER SOIL BORING LOCATION
B50	CERES SOIL BORING LOCATION
MW-3	MONITORING WELL LOCATION
111	TOTAL CHROME CONCENTRATION IN MILLIGRAMS PER KILOGRAM (mg/kg)
(40')	DEPTH TOTAL OF BORING
NS	NOT SAMPLED
100	ESTIMATED CONTOUR OF CONCENTRATION
	100–1,000 mg/kg
	<100 mg/kg

The Information included on this graphic representation has been compiled from a variety of sources and is subject to change without notice. Kleinfelder makes no representations or warranties, express or implied, as to accuracy, completeness, timeliness, or rights to the use of such information. This document is not intended for use as a land survey product nor is it designed or intended as a construction design document. The use or misuse of the information contained on this graphic representation is at the sole risk of the party using or misusing the information.

KLEINFELDER
Bright People. Right Solutions.
www.kleinfelder.com

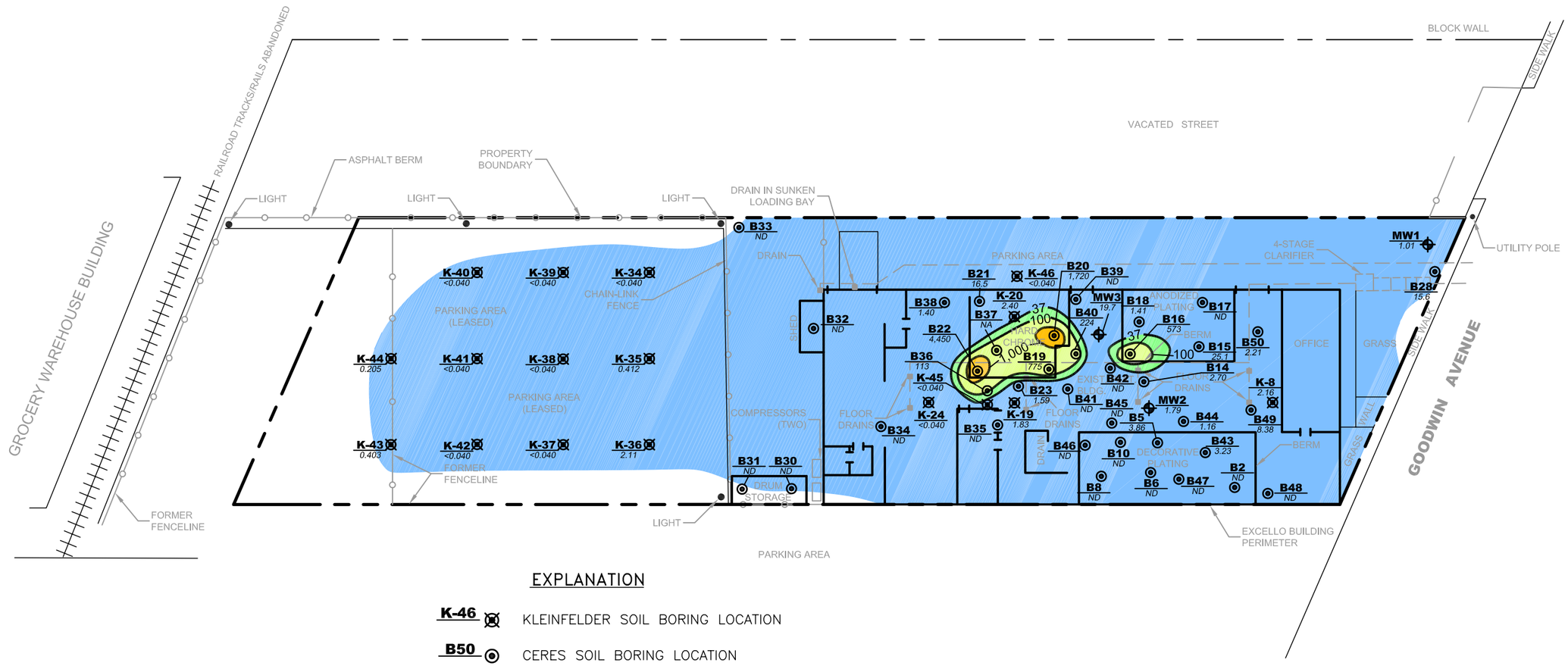
PROJECT NO.	98498
DRAWN:	11/25/08
DRAWN BY:	MRG
CHECKED BY:	PD
FILE NAME:	98498p9D_Tot.Cr.-35FT.dwg

TOTAL CHROME IN SOIL CONTOUR MAP - 35FT BGS

THE SPIRITO FAMILY TRUST PARCEL
4057 GOODWIN AVENUE
LOS ANGELES, CALIFORNIA

PLATE **9D**

PLOTTED: 25 Nov 2008, 6:06pm, MGriffin
LAYOUT: 9D
CAD FILE: U:\MGriffin\CADD\2008\98498\
ATTACHED IMAGES:
ATTACHED XREFS:
DIAMOND BAR, CA



EXPLANATION

K-46	KLEINFELDER SOIL BORING LOCATION
B50	CERES SOIL BORING LOCATION
MW-3	MONITORING WELL LOCATION
4,450	CHROME VI CONCENTRATION IN MILLIGRAMS PER KILOGRAM (mg/kg)
NA	NOT ANALYZED
ND	NOT DETECTED
100	ESTIMATED CONTOUR OF CONCENTRATION
	1,000–10,000 mg/kg
	100–1,000 mg/kg
	37–100 mg/kg
	<37 mg/kg

40 20 0 40

APPROXIMATE SCALE (feet)

The Information included on this graphic representation has been compiled from a variety of sources and is subject to change without notice. Kleinfelder makes no representations or warranties, express or implied, as to accuracy, completeness, timeliness, or rights to the use of such information. This document is not intended for use as a land survey product nor is it designed or intended as a construction design document. The use or misuse of the information contained on this graphic representation is at the sole risk of the party using or misusing the information.

KLEINFELDER
Bright People. Right Solutions.
www.kleinfelder.com

PROJECT NO.	98498
DRAWN:	11/25/08
DRAWN BY:	MRG
CHECKED BY:	PD
FILE NAME:	98498p10A_Cr.VI-5FT.dwg

CHROME VI IN SOIL CONTOUR MAP - 5FT BGS

THE SPIRITO FAMILY TRUST PARCEL
4057 GOODWIN AVENUE
LOS ANGELES, CALIFORNIA

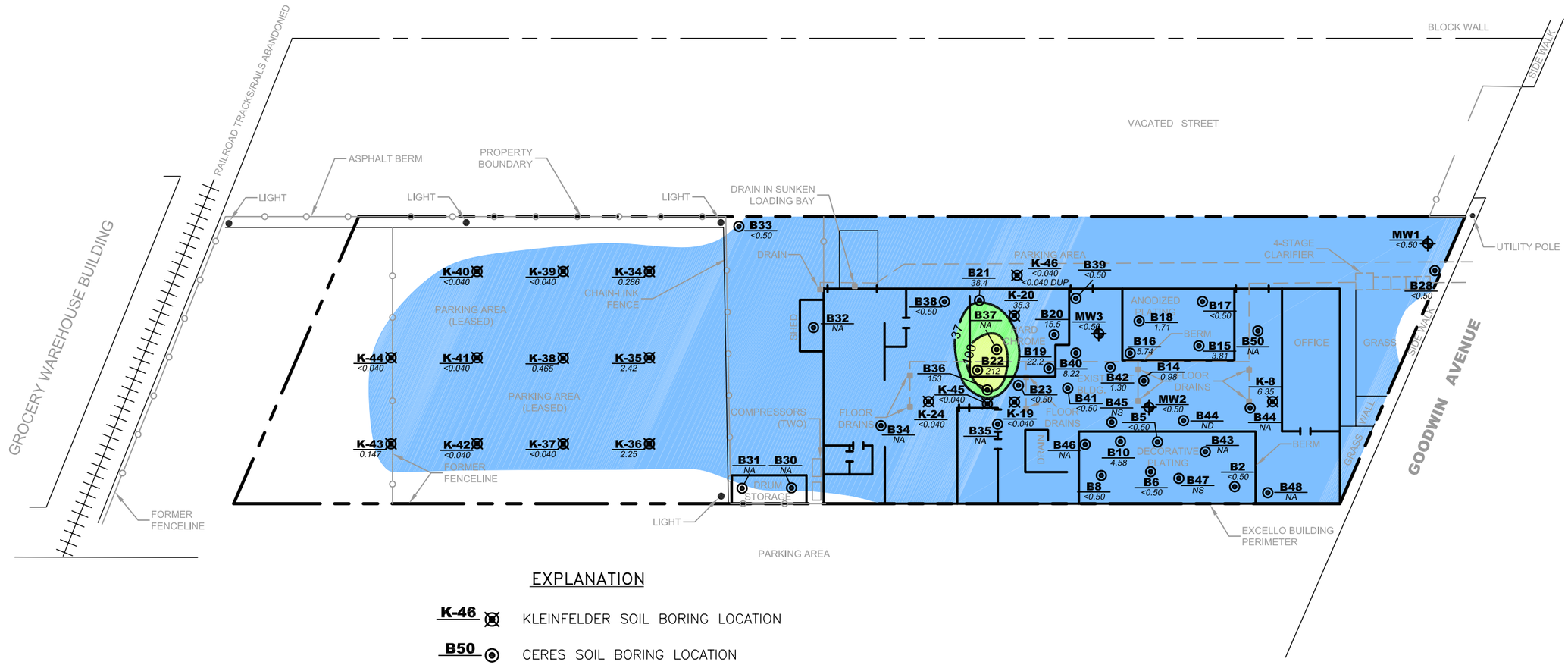
PLATE **10A**

PLOTTED: 25 Nov 2008, 6:07pm, MGriffin
LAYOUT: 10A
CAD FILE: U:\MGriffin\CADD\2008\98498\
ATTACHED IMAGES:
ATTACHED XREFS:
DIAMOND BAR, CA

PLOTTED: 25 Nov 2008, 6:07pm, MGriffin

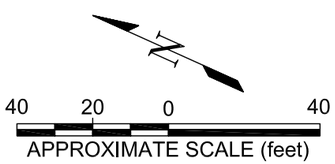
CAD FILE: U:\MGriffin\CADD\2008\98498\ LAYOUT: 10B

ATTACHED IMAGES:
ATTACHED XREFS:
DIAMOND BAR, CA



EXPLANATION

K-46	KLEINFELDER SOIL BORING LOCATION
B50	CERES SOIL BORING LOCATION
MW-3	MONITORING WELL LOCATION
212	CHROME VI CONCENTRATION IN MILLIGRAMS PER KILOGRAM (mg/kg)
NA	NOT ANALYZED
ND	NOT DETECTED
NS	NOT SAMPLED
<0.040 DUP	FIELD DUPLICATE SAMPLE
100	ESTIMATED CONTOUR OF CONCENTRATION
	100–1,000 mg/kg
	37–100 mg/kg
	<37 mg/kg



The information included on this graphic representation has been compiled from a variety of sources and is subject to change without notice. Kleinfelder makes no representations or warranties, express or implied, as to accuracy, completeness, timeliness, or rights to the use of such information. This document is not intended for use as a land survey product nor is it designed or intended as a construction design document. The use or misuse of the information contained on this graphic representation is at the sole risk of the party using or misusing the information.

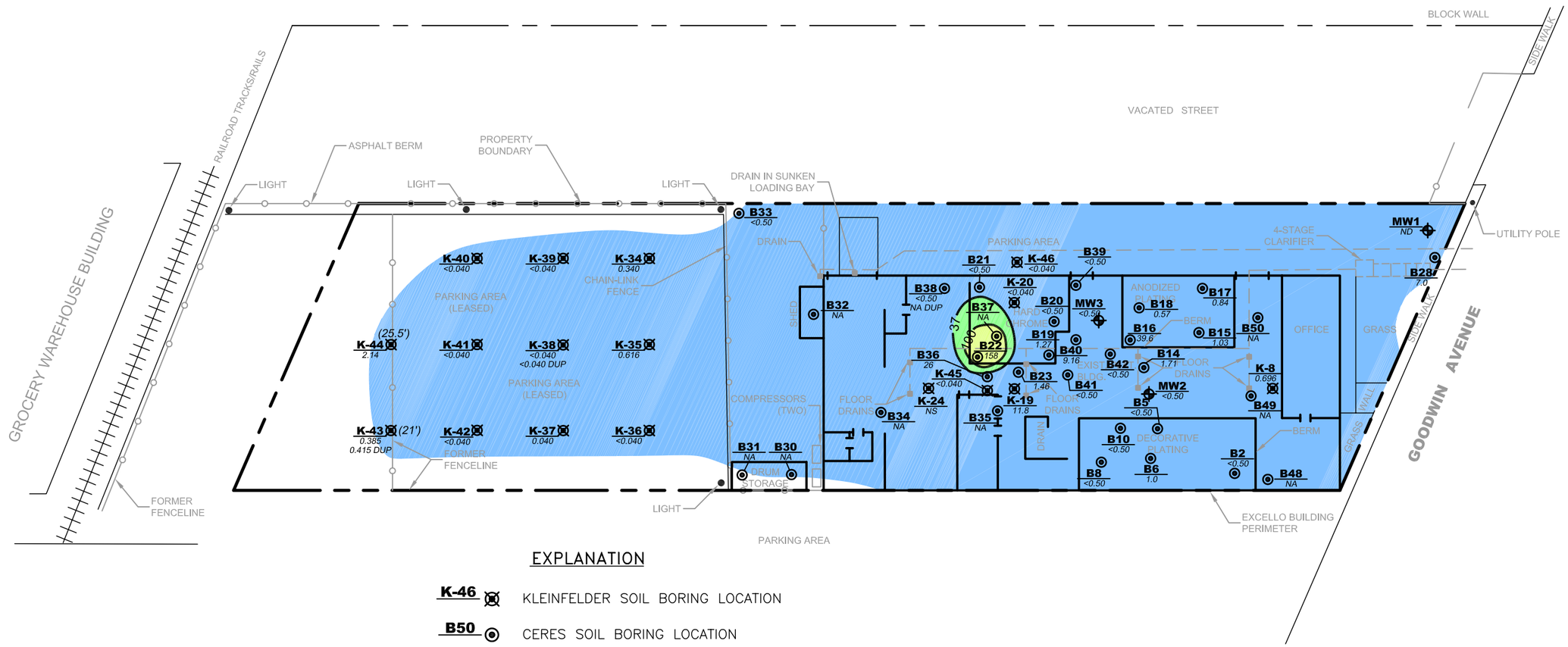
KLEINFELDER
Bright People. Right Solutions.
www.kleinfelder.com

PROJECT NO.	98498
DRAWN:	11/25/08
DRAWN BY:	MRG
CHECKED BY:	PD
FILE NAME:	98498p10B_Cr.VI-15FT.dwg

CHROME VI IN SOIL CONTOUR MAP - 15FT BGS

THE SPIRITO FAMILY TRUST PARCEL
4057 GOODWIN AVENUE
LOS ANGELES, CALIFORNIA

PLATE
10B



EXPLANATION

K-46	KLEINFELDER SOIL BORING LOCATION
B50	CERES SOIL BORING LOCATION
MW-3	MONITORING WELL LOCATION
0.84	CHROME VI CONCENTRATION IN MILLIGRAMS PER KILOGRAM (mg/kg)
(25.5')	DEPTH TOTAL OF BORING
NA	NOT ANALYZED
ND	NOT DETECTED
NS	NOT SAMPLED
0.415 DUP	FIELD DUPLICATE SAMPLE
100	ESTIMATED CONTOUR OF CONCENTRATION
	100–1,000 mg/kg
	37–100 mg/kg
	<37 mg/kg

40 20 0 40

APPROXIMATE SCALE (feet)

The information included on this graphic representation has been compiled from a variety of sources and is subject to change without notice. Kleinfelder makes no representations or warranties, express or implied, as to accuracy, completeness, timeliness, or rights to the use of such information. This document is not intended for use as a land survey product nor is it designed or intended as a construction design document. The use or misuse of the information contained on this graphic representation is at the sole risk of the party using or misusing the information.

KLEINFELDER
Bright People. Right Solutions.
www.kleinfelder.com

PROJECT NO.	98498
DRAWN:	11/25/08
DRAWN BY:	MRG
CHECKED BY:	PD
FILE NAME:	98498p10C_Cr.VI-25FT.dwg

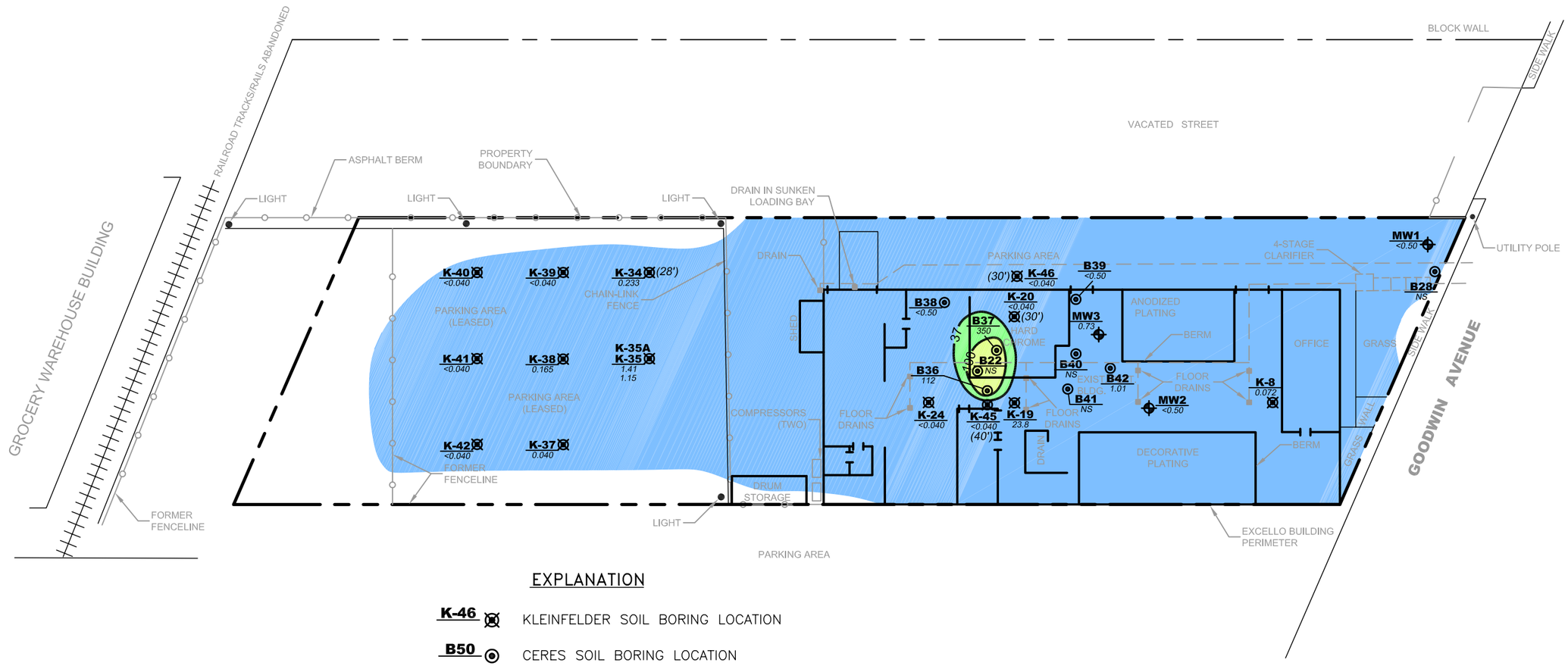
CHROME VI IN SOIL CONTOUR MAP - 25FT BGS

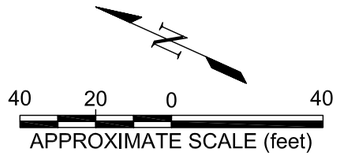
THE SPIRITO FAMILY TRUST PARCEL
4057 GOODWIN AVENUE
LOS ANGELES, CALIFORNIA

PLATE **10C**

PLOTTED: 25 Nov 2008, 8:33am, MGriffin
CAD FILE: U:\MGriffin\CADD\2008\98498\ LAYOUT: 10C
ATTACHED IMAGES:
ATTACHED XREFS:
DIAMOND BAR, CA

PLOTTED: 25 Nov 2008, 6:09pm, MGriffin
LAYOUT: 10D
CAD FILE: U:\MGriffin\CADD\2008\98498\
ATTACHED IMAGES:
ATTACHED XREFS:
DIAMOND BAR, CA





EXPLANATION

K-46	KLEINFELDER SOIL BORING LOCATION
B50	CERES SOIL BORING LOCATION
MW-3	MONITORING WELL LOCATION
350	CHROME VI CONCENTRATION IN MILLIGRAMS PER KILOGRAM (mg/kg)
(40')	DEPTH TOTAL OF BORING
NA	NOT ANALYZED
NS	NOT SAMPLED
100	ESTIMATED CONTOUR OF CONCENTRATION
	100–1,000 mg/kg
	37–100 mg/kg
	<37 mg/kg

The Information included on this graphic representation has been compiled from a variety of sources and is subject to change without notice. Kleinfelder makes no representations or warranties, express or implied, as to accuracy, completeness, timeliness, or rights to the use of such information. This document is not intended for use as a land survey product nor is it designed or intended as a construction design document. The use or misuse of the information contained on this graphic representation is at the sole risk of the party using or misusing the information.

KLEINFELDER
Bright People. Right Solutions.
www.kleinfelder.com

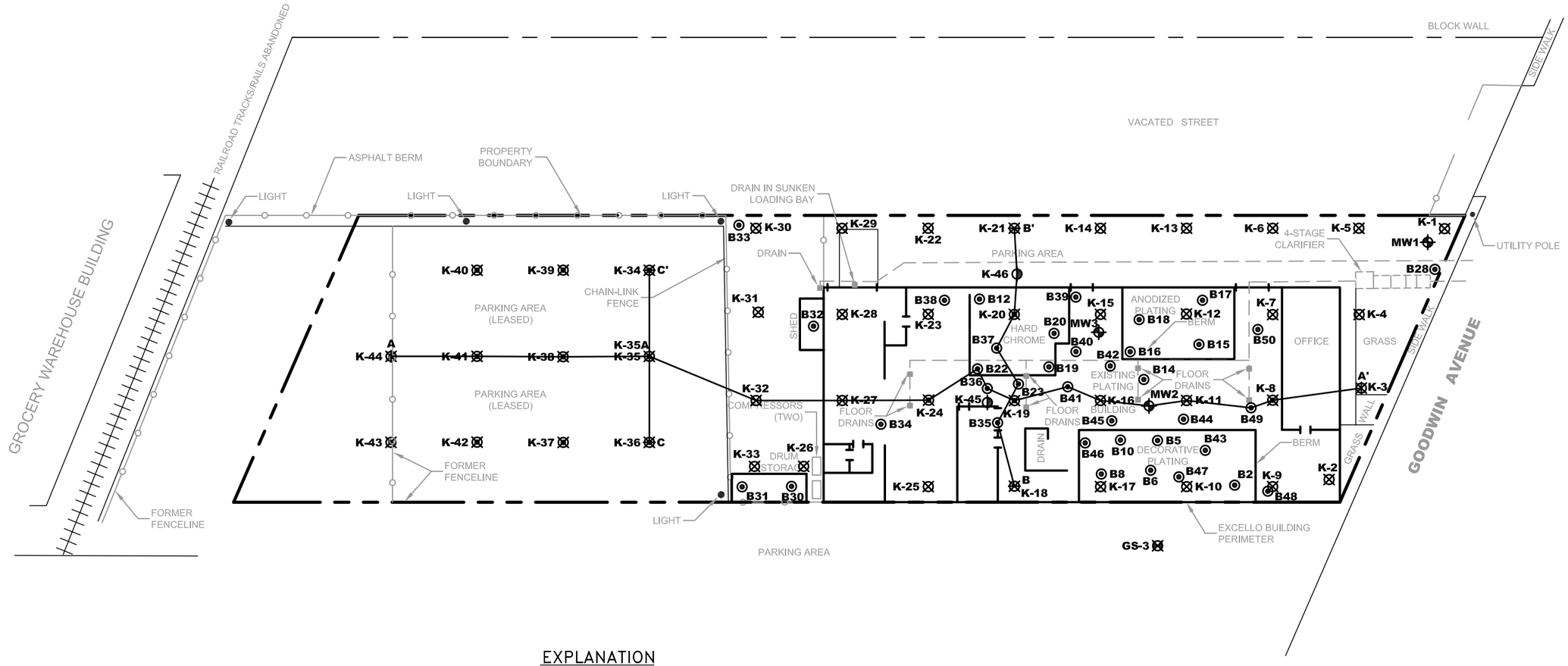
PROJECT NO.	98498
DRAWN:	11/25/08
DRAWN BY:	MRG
CHECKED BY:	PD
FILE NAME:	98498p10D_Cr.VI-35FT.dwg

CHROME VI IN SOIL CONTOUR MAP - 35FT BGS

THE SPIRITO FAMILY TRUST PARCEL
4057 GOODWIN AVENUE
LOS ANGELES, CALIFORNIA

PLATE
10D

PLOTTED: 25 Nov 2008, 6:09pm, MGriffin
CAD FILE: U:\MGriffin\CADD\2008\98498\ LAYOUT: 11
ATTACHED IMAGES:
ATTACHED XREFS:
DIAMOND BAR, CA



EXPLANATION

MW2	MONITORING WELL LOCATION
K-33	KLEINFELDER VAPOR PROBE LOCATION
B50	CERES SOIL BORING LOCATION
K-44	KLEINFELDER SOIL BORING AND VAPOR PROBE LOCATION
K-46	KLEINFELDER SOIL BORING LOCATION
GS-3	EXTRACTION WELL LOCATION
C C'	CROSS-SECTION LOCATION

N

40 20 0 40

APPROXIMATE SCALE (feet)

The information included on this graphic representation has been compiled from a variety of sources and is subject to change without notice. Kleinfelder makes no representations or warranties, express or implied, as to accuracy, completeness, timeliness, or rights to the use of such information. This document is not intended for use as a land survey product nor is it designed or intended as a construction design document. The use or misuse of the information contained on this graphic representation is at the sole risk of the party using or misusing the information.

KLEINFELDER
Bright People. Right Solutions.
www.kleinfelder.com

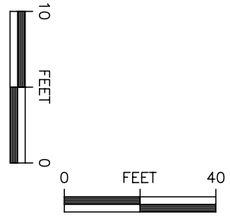
PROJECT NO.	98498
DRAWN:	11/25/08
DRAWN BY:	MRG
CHECKED BY:	PD
FILE NAME:	98498p11_CS-LM.dwg

CROSS-SECTION LOCATION MAP

THE SPIRITO FAMILY TRUST PARCEL
4057 GOODWIN AVENUE
LOS ANGELES, CALIFORNIA

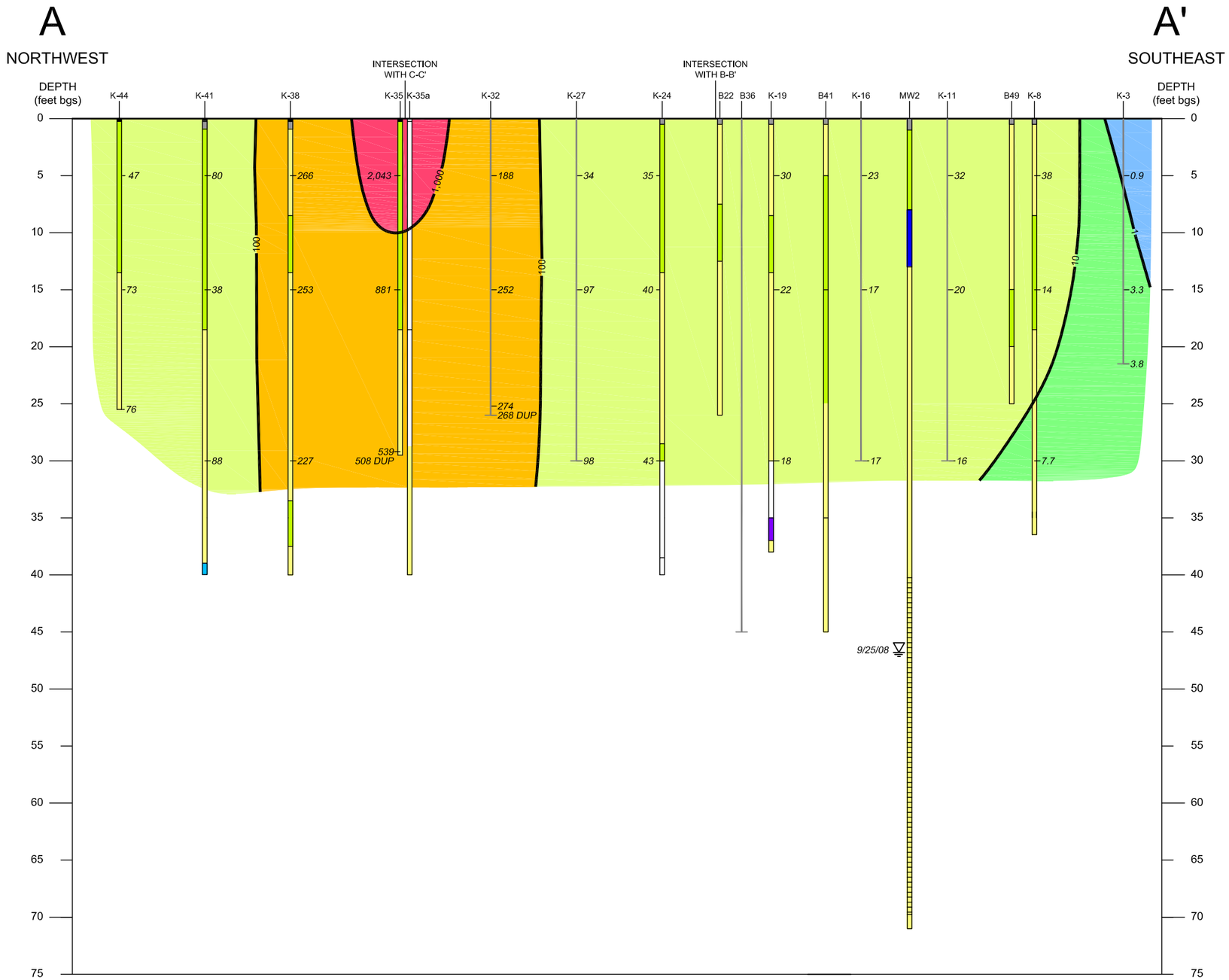
PLATE
11

PLOTTED: 25 Nov 2008, 4:52pm, MGriffin
CAD FILE: U:\MGriffin\CADD\2008\98498\ LAYOUT: 12A
ATTACHED IMAGES:
ATTACHED XREFS:
DIAMOND BAR, CA



EXPLANATION

- ASPHALT AND PAVEMENT
- BORING OR VAPOR PROBE
- MONITORING WELL SCREEN INTERVAL
- 9/25/08 DEPTH TO GROUNDWATER ON SEPTEMBER 25, 2008 (CCI, 2008)
- ASPHALT CONCRETE PAVEMENT
- CONCRETE
- (SM) SILTY SAND
- (SP) SAND
- (CL) SILTY CLAY
- (SC) CLAYEY SAND
- (ML) CLAYEY SILT
- 47 TRICHLOROETHENE (TCE) CONCENTRATION IN MICROGRAMS PER LITER (µg/L)
- 508 DUP FIELD DUPLICATE SAMPLE
- 1,000 ESTIMATED CONTOUR OF CONCENTRATION
- >1,000 µg/L
- 100–1,000 µg/L
- 10–100 µg/L
- 1–10 µg/L
- <1 µg/L



The information included on this graphic representation has been compiled from a variety of sources and is subject to change without notice. Kleinfelder makes no representations or warranties, express or implied, as to accuracy, completeness, timeliness, or rights to the use of such information. This document is not intended for use as a land survey product nor is it designed or intended as a construction design document. The use or misuse of the information contained on this graphic representation is at the sole risk of the party using or misusing the information.

KLEINFELDER
Bright People. Right Solutions.
www.kleinfelder.com

PROJECT NO.	98498
DRAWN:	11/25/2008
DRAWN BY:	MRG
CHECKED BY:	PD
FILE NAME:	98498p12A_TCE-CS-A-A'.dwg

TCE IN SOIL VAPOR CROSS SECTION A-A'

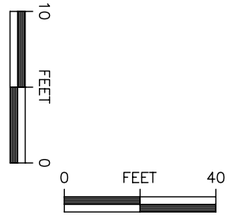
THE SPIRITO FAMILY TRUST PARCEL
4057 GOODWIN AVENUE
LOS ANGELES, CALIFORNIA

PLATE
12A

PLOTTED: 25 Nov 2008, 4:58pm, MGriffin

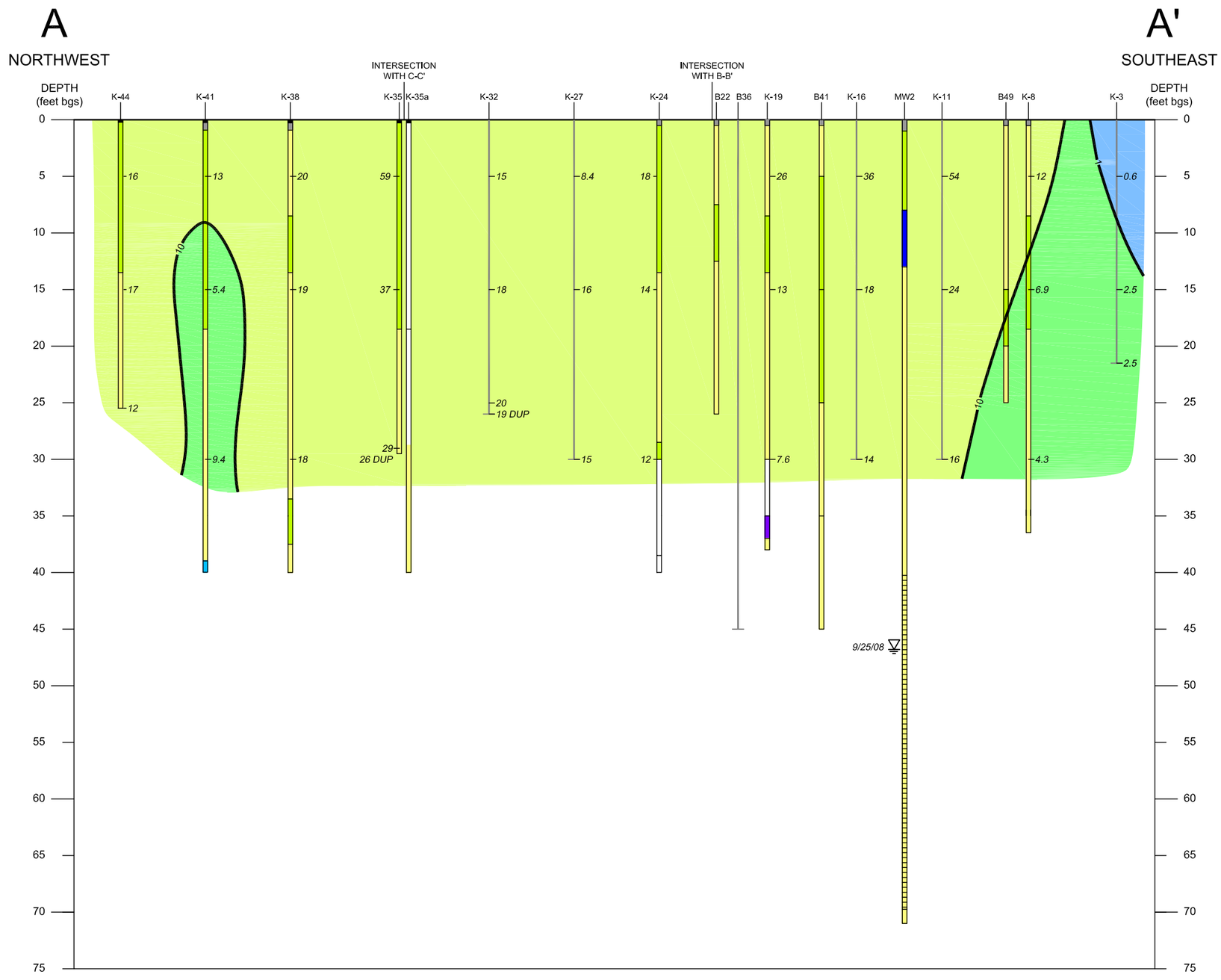
CAD FILE: U:\MGriffin\CADD\2008\98498\ LAYOUT: 12B

ATTACHED IMAGES:
ATTACHED XREFS:
DIAMOND BAR, CA



EXPLANATION

- ASPHALT AND PAVEMENT
- BORING OR VAPOR PROBE
- MONITORING WELL SCREEN INTERVAL
- 9/25/08 DEPTH TO GROUNDWATER ON SEPTEMBER 25, 2008 (CCI, 2008)
- ASPHALT CONCRETE PAVEMENT
- CONCRETE
- (SM) SILTY SAND
- (SP) SAND
- (CL) SILTY CLAY
- (SC) CLAYEY SAND
- (ML) CLAYEY SILT
- 16 TETRACHLOROETHENE (PCE) CONCENTRATION IN MICROGRAMS PER LITER (µg/L)
- 26 DUP FIELD DUPLICATE SAMPLE
- 10 ESTIMATED CONTOUR OF CONCENTRATION
- 10–100 µg/L
- 1–10 µg/L
- <1 µg/L



The information included on this graphic representation has been compiled from a variety of sources and is subject to change without notice. Kleinfelder makes no representations or warranties, express or implied, as to accuracy, completeness, timeliness, or rights to the use of such information. This document is not intended for use as a land survey product nor is it designed or intended as a construction design document. The use or misuse of the information contained on this graphic representation is at the sole risk of the party using or misusing the information.

KLEINFELDER
Bright People. Right Solutions.
www.kleinfelder.com

PROJECT NO.	98498
DRAWN:	11/25/2008
DRAWN BY:	MRG
CHECKED BY:	PD
FILE NAME:	98498p12B_PCE-CS-A-A'.dwg

PCE IN SOIL VAPOR CROSS SECTION A-A'

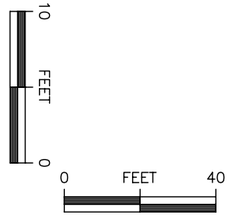
THE SPIRITO FAMILY TRUST PARCEL
4057 GOODWIN AVENUE
LOS ANGELES, CALIFORNIA

PLATE
12B

PLOTTED: 25 Nov 2008, 4:59pm, MGriffin

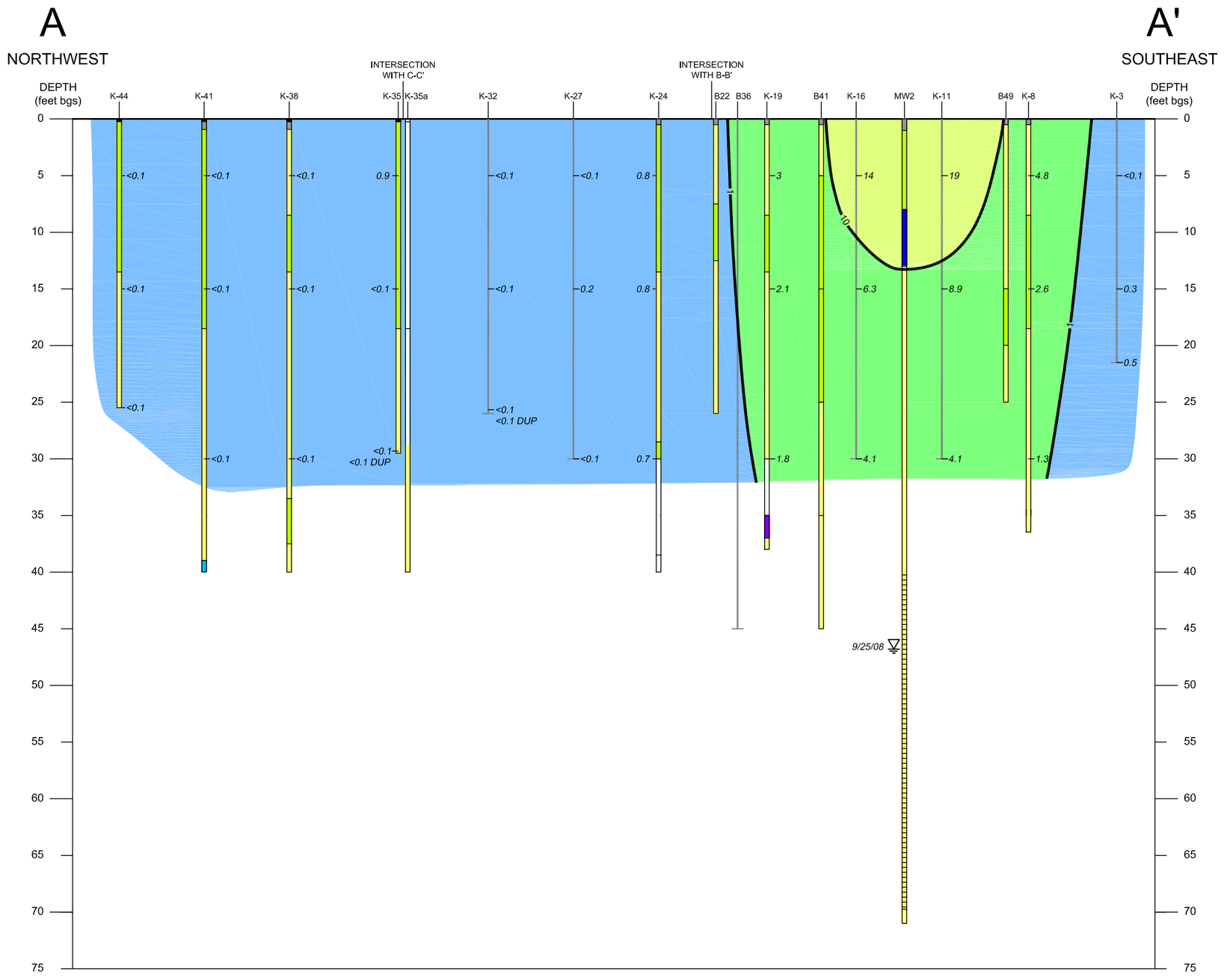
CAD FILE: U:\MGriffin\CADD\2008\98498\ LAYOUT: 12C

ATTACHED IMAGES:
ATTACHED XREFS:
DIAMOND BAR, CA



EXPLANATION

- ASPHALT AND PAVEMENT
- BORING OR VAPOR PROBE
- MONITORING WELL SCREEN INTERVAL
- 9/25/08 DEPTH TO GROUNDWATER ON SEPTEMBER 25, 2008 (CCI, 2008)
- ASPHALT CONCRETE PAVEMENT
- CONCRETE
- (SM) SILTY SAND
- (SP) SAND
- (CL) SILTY CLAY
- (SC) CLAYEY SAND
- (ML) CLAYEY SILT
- <0.1 1,1,1–TRICHLOROETHANE (1,1,1–TCA) CONCENTRATION IN MICROGRAMS PER LITER (µg/L)
- <0.1 DUP FIELD DUPLICATE SAMPLE
- 10 ESTIMATED CONTOUR OF CONCENTRATION
- 10–100 µg/L
- 1–10 µg/L
- <1 µg/L



The information included on this graphic representation has been compiled from a variety of sources and is subject to change without notice. Kleinfelder makes no representations or warranties, express or implied, as to accuracy, completeness, timeliness, or rights to the use of such information. This document is not intended for use as a land survey product nor is it designed or intended as a construction design document. The use or misuse of the information contained on this graphic representation is at the sole risk of the party using or misusing the information.

KLEINFELDER
Bright People. Right Solutions.
www.kleinfelder.com

PROJECT NO.	98498
DRAWN:	11/25/08
DRAWN BY:	MRG
CHECKED BY:	PD
FILE NAME:	98498p12C_TCA-CS-A-A'.dwg

1,1,1-TCA IN SOIL VAPOR CROSS SECTION A-A'

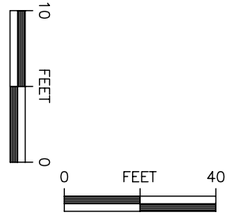
THE SPIRITO FAMILY TRUST PARCEL
4057 GOODWIN AVENUE
LOS ANGELES, CALIFORNIA

PLATE
12C

PLOTTED: 25 Nov 2008, 4:58pm, MGriffin

CAD FILE: U:\MGriffin\CADD\2008\98498\ LAYOUT: 12D

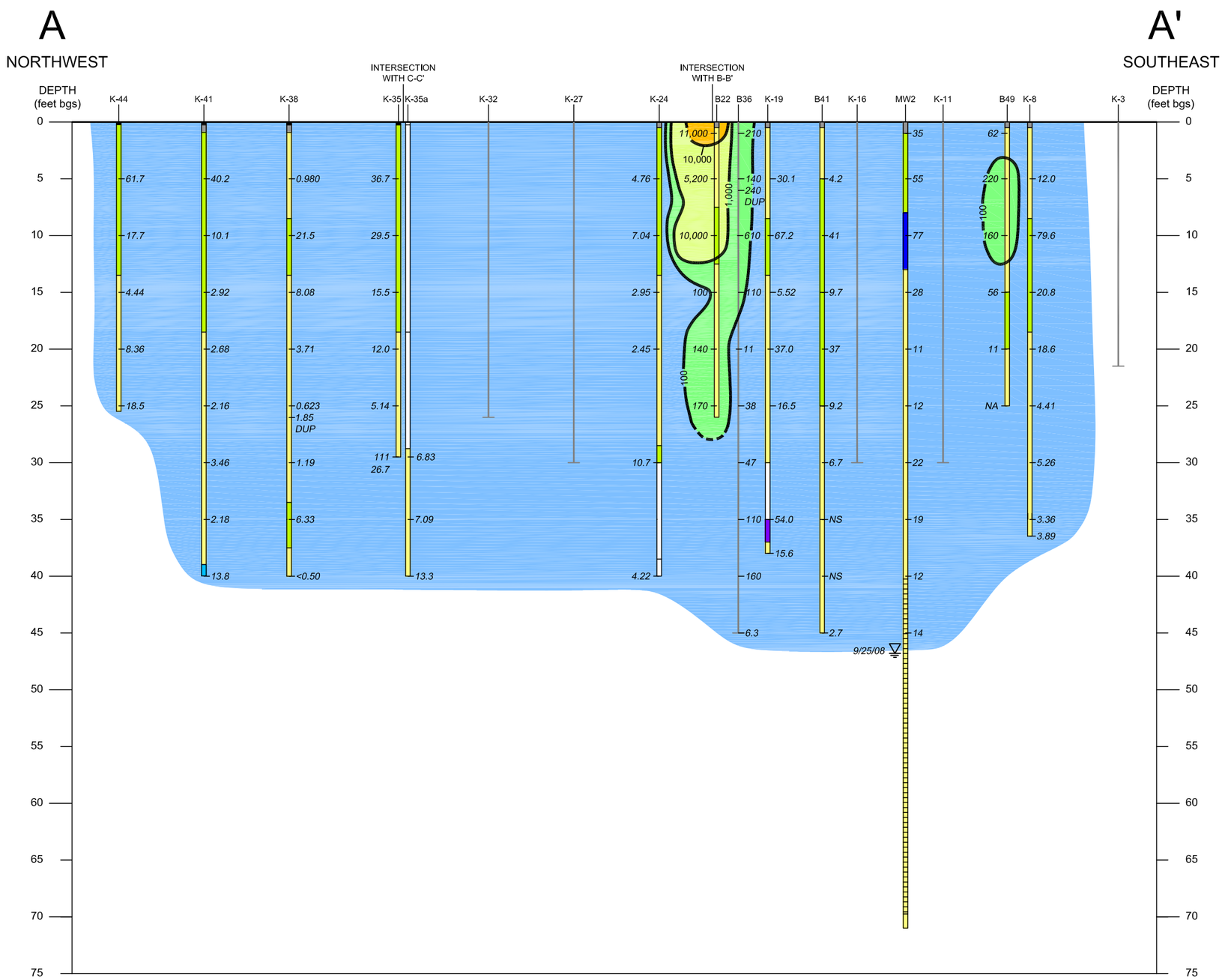
ATTACHED IMAGES:
ATTACHED XREFS:
DIAMOND BAR, CA



EXPLANATION

- ASPHALT AND PAVEMENT
- BORING OR VAPOR PROBE
- MONITORING WELL SCREEN INTERVAL
- 9/25/08 — DEPTH TO GROUNDWATER ON SEPTEMBER 25, 2008 (CCI, 2008)
- ASPHALT CONCRETE PAVEMENT
- CONCRETE
- (SM) SILTY SAND
- (SP) SAND
- (CL) SILTY CLAY
- (SC) CLAYEY SAND
- (ML) CLAYEY SILT
- *NS* — NOT SAMPLED
- *NA* — NOT ANALYZED
- *<0.50* — NOT DETECTED ABOVE THE PRACTICAL QUANTITATION LIMIT (PQL)
- *11,000* — TOTAL CHROME CONCENTRATION IN MILLIGRAMS PER KILOGRAM (mg/kg)
- *1.85 DUP* — FIELD DUPLICATE SAMPLE
- 10,000 — ESTIMATED CONTOUR OF CONCENTRATION
- 10,000–100,000 mg/kg
- 1,000–10,000 mg/kg
- 100–1,000 mg/kg
- <100 mg/kg

The information included on this graphic representation has been compiled from a variety of sources and is subject to change without notice. Kleinfelder makes no representations or warranties, express or implied, as to accuracy, completeness, timeliness, or rights to the use of such information. This document is not intended for use as a land survey product nor is it designed or intended as a construction design document. The use or misuse of the information contained on this graphic representation is at the sole risk of the party using or misusing the information.



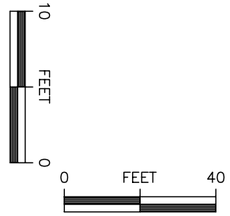
PROJECT NO.	98498
DRAWN:	11/25/08
DRAWN BY:	MRG
CHECKED BY:	PD
FILE NAME:	98498p12D_T.Cr-CS-A-A'.dwg

KLEINFELDER
Bright People. Right Solutions.
www.kleinfelder.com

TOTAL CHROME IN SOIL CROSS SECTION A-A'

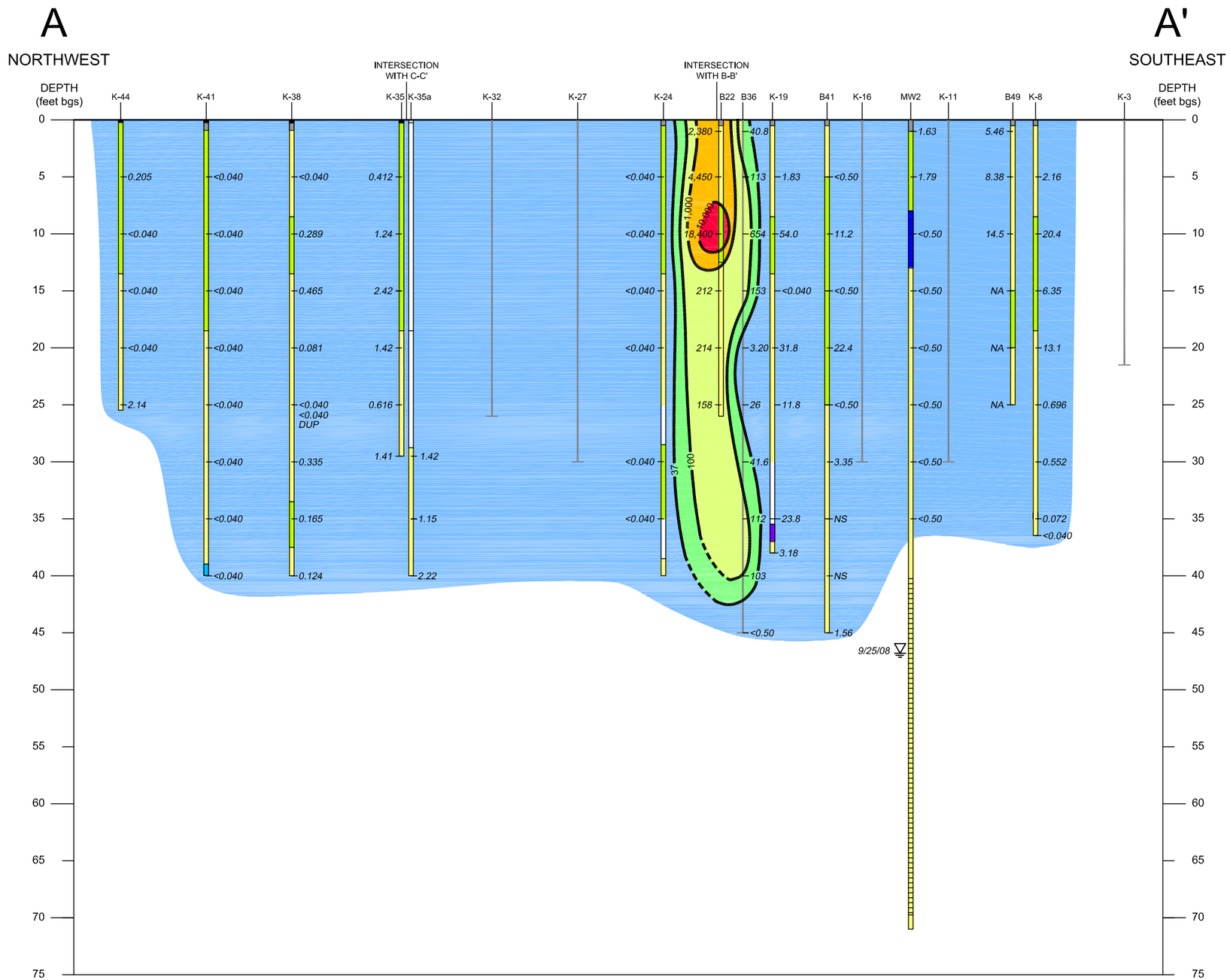
THE SPIRITO FAMILY TRUST PARCEL
4057 GOODWIN AVENUE
LOS ANGELES, CALIFORNIA

PLATE
12D



EXPLANATION

- ASPHALT AND PAVEMENT
- BORING OR VAPOR PROBE
- MONITORING WELL SCREEN INTERVAL
- 9/25/08 DEPTH TO GROUNDWATER ON SEPTEMBER 25, 2008 (CCI, 2008)
- ASPHALT CONCRETE PAVEMENT
- CONCRETE
- (SM) SILTY SAND
- (SP) SAND
- (CL) SILTY CLAY
- (SC) CLAYEY SAND
- (ML) CLAYEY SILT
- NA NOT ANALYZED
- NS NOT SAMPLED
- 8,400 CHROME VI CONCENTRATION IN MILLIGRAMS PER KILOGRAM (mg/kg)
- <0.040 NOT DETECTED ABOVE THE PRACTICAL QUANTITATION LIMIT (PQL)
- <0.040 DUP FIELD DUPLICATE SAMPLE
- 10,000 ESTIMATED CONTOUR OF CONCENTRATION
- >10,000 mg/kg
- 1,000–10,000 mg/kg
- 100–1,000 mg/kg
- 37–100 mg/kg
- <37 mg/kg



The information included on this graphic representation has been compiled from a variety of sources and is subject to change without notice. Kleinfelder makes no representations or warranties, express or implied, as to accuracy, completeness, timeliness, or rights to the use of such information. This document is not intended for use as a land survey product nor is it designed or intended as a construction design document. The use or misuse of the information contained on this graphic representation is at the sole risk of the party using or misusing the information.

KLEINFELDER
Bright People. Right Solutions.
www.kleinfelder.com

PROJECT NO.	98498
DRAWN:	11/25/08
DRAWN BY:	MRG
CHECKED BY:	PD
FILE NAME:	98498p12E_CrVI-CS-A-A'.dwg

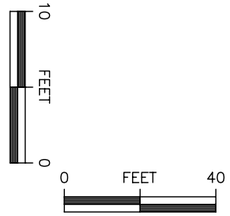
CHROME VI IN SOIL
CROSS SECTION A-A'

THE SPIRITO FAMILY TRUST PARCEL
4057 GOODWIN AVENUE
LOS ANGELES, CALIFORNIA

PLATE
12E

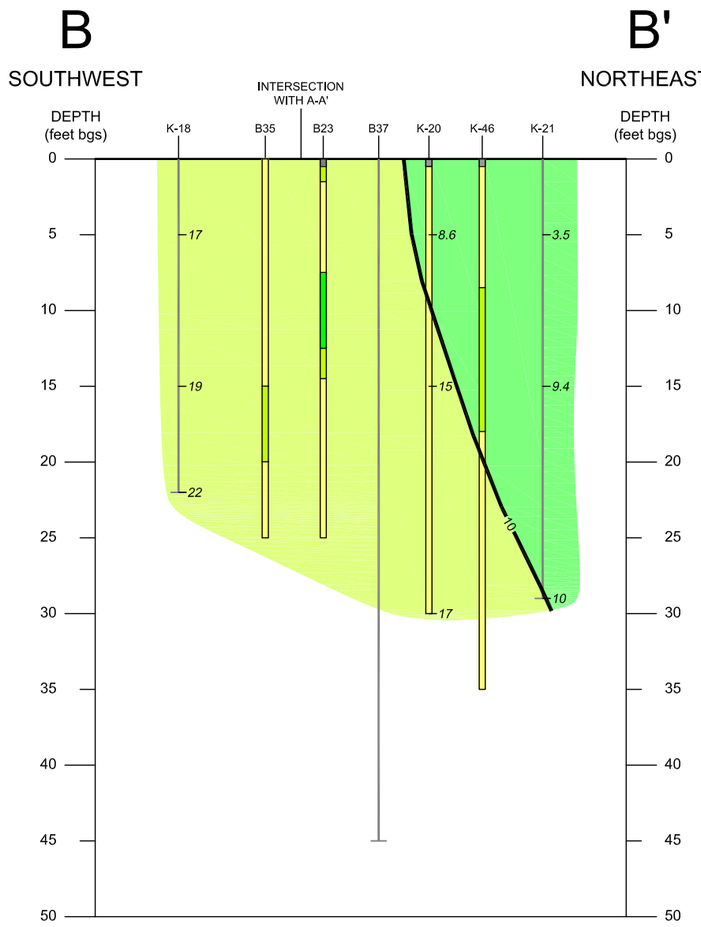
PLOTTED: 25 Nov 2008, 5:04pm, MGriffin
CAD FILE: U:\MGriffin\CADD\2008\98498\ LAYOUT: 12E
ATTACHED IMAGES:
ATTACHED XREFS:
DIAMOND BAR, CA

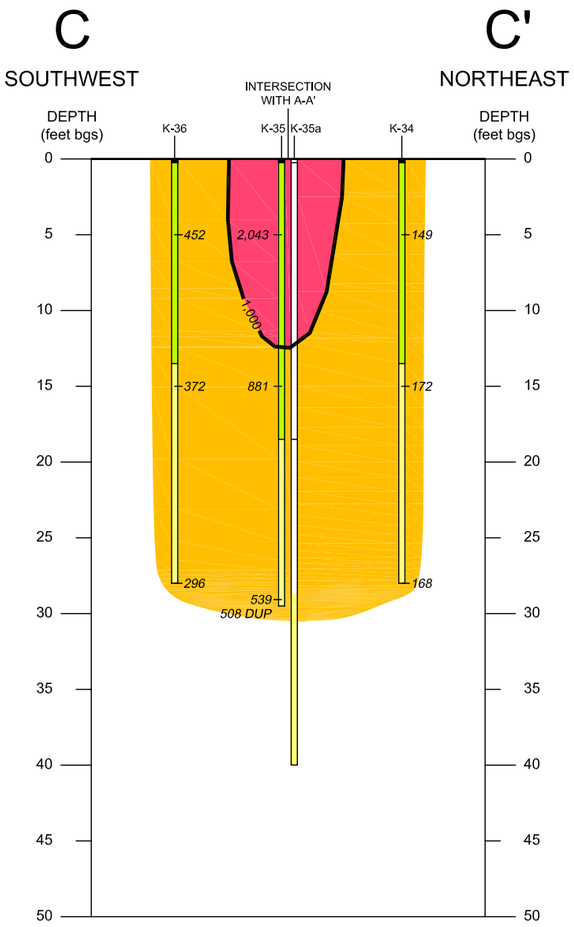
PLOTTED: 25 Nov 2008, 5:05pm, MGriffin
CAD FILE: U:\MGriffin\CADD\2008\98498\ LAYOUT: 13A
ATTACHED IMAGES:
ATTACHED XREFS:
DIAMOND BAR, CA



EXPLANATION

- ASPHALT AND PAVEMENT
- BORING OR VAPOR PROBE
- ASPHALT CONCRETE PAVEMENT
- CONCRETE
- (SM) SILTY SAND
- (SP) SAND
- *17* — TRICHLOROETHENE (TCE) CONCENTRATION IN MICROGRAMS PER LITER (µg/L)
- *539 DUP* — FIELD DUPLICATE SAMPLE
- 1,000 — ESTIMATED CONTOUR OF CONCENTRATION
- >1,000 µg/L
- 100–1,000 µg/L
- 10–100 µg/L
- 1–10 µg/L





The information included on this graphic representation has been compiled from a variety of sources and is subject to change without notice. Kleinfelder makes no representations or warranties, express or implied, as to accuracy, completeness, timeliness, or rights to the use of such information. This document is not intended for use as a land survey product nor is it designed or intended as a construction design document. The use or misuse of the information contained on this graphic representation is at the sole risk of the party using or misusing the information.

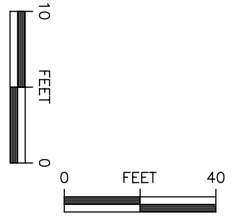
KLEINFELDER
Bright People. Right Solutions.
www.kleinfelder.com

PROJECT NO.	98498
DRAWN:	11/25/08
DRAWN BY:	MRG
CHECKED BY:	PD
FILE NAME:	98498p13A_TCE-CS-B&C.dwg

TCE IN SOIL VAPOR
CROSS SECTIONS B-B' AND C-C'

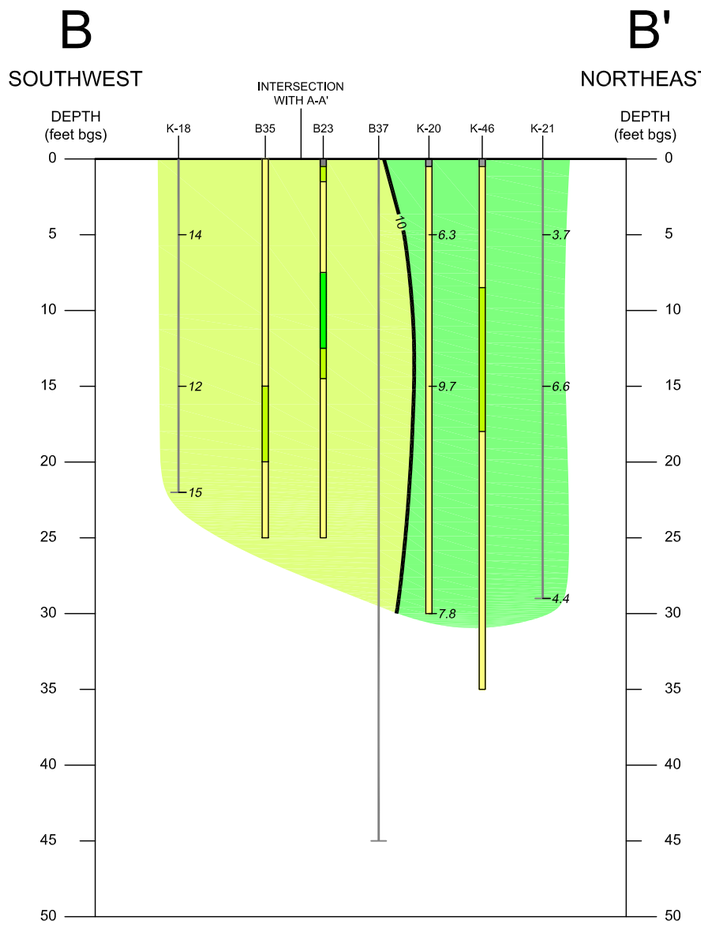
THE SPIRITO FAMILY TRUST PARCEL
4057 GOODWIN AVENUE
LOS ANGELES, CALIFORNIA

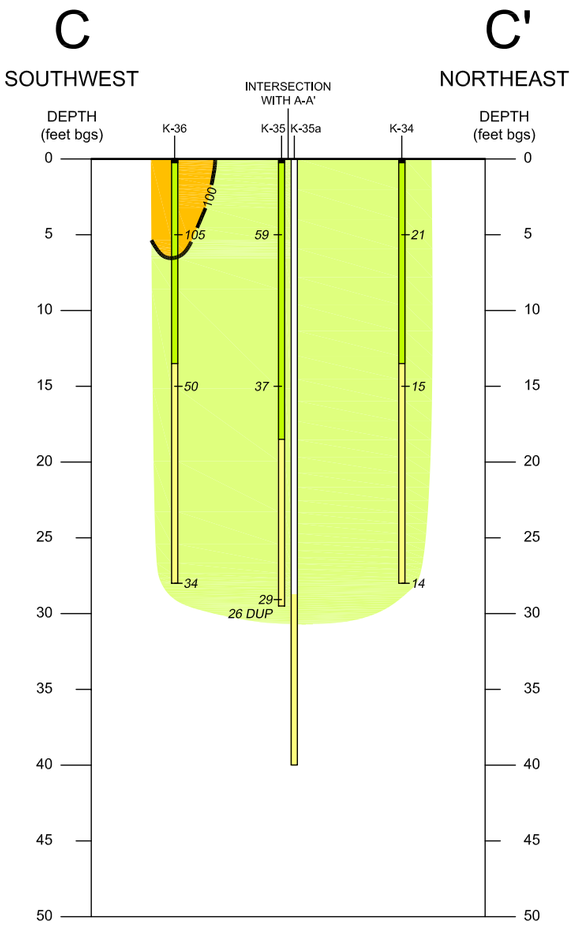
PLATE
13A



EXPLANATION

- ASPHALT AND PAVEMENT
- BORING OR VAPOR PROBE
- ASPHALT CONCRETE PAVEMENT
- CONCRETE
- (SM) SILTY SAND
- (SP) SAND
- *14* — TETRACHLOROETHENE (PCE) CONCENTRATION IN MICROGRAMS PER LITER (µg/L)
- *508 DUP* — FIELD DUPLICATE SAMPLE
- 100 — ESTIMATED CONTOUR OF CONCENTRATION
- 100–1,000 µg/L
- 10–100 µg/L
- 1–10 µg/L





The Information included on this graphic representation has been compiled from a variety of sources and is subject to change without notice. KleinFelder makes no representations or warranties, express or implied, as to accuracy, completeness, timeliness, or rights to the use of such information. This document is not intended for use as a land survey product nor is it designed or intended as a construction design document. The use or misuse of the information contained on this graphic representation is at the sole risk of the party using or misusing the information.

KLEINFELDER
Bright People. Right Solutions.
www.kleinfelder.com

PROJECT NO.	98498
DRAWN:	11/25/08
DRAWN BY:	MRG
CHECKED BY:	PD
FILE NAME:	98498p13B_PCE-CS-B&C.dwg

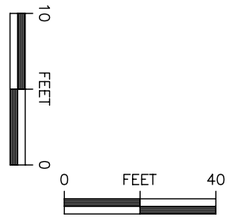
PCE IN SOIL VAPOR
CROSS SECTIONS B-B' AND C-C'

THE SPIRITO FAMILY TRUST PARCEL
4057 GOODWIN AVENUE
LOS ANGELES, CALIFORNIA

PLATE
13B

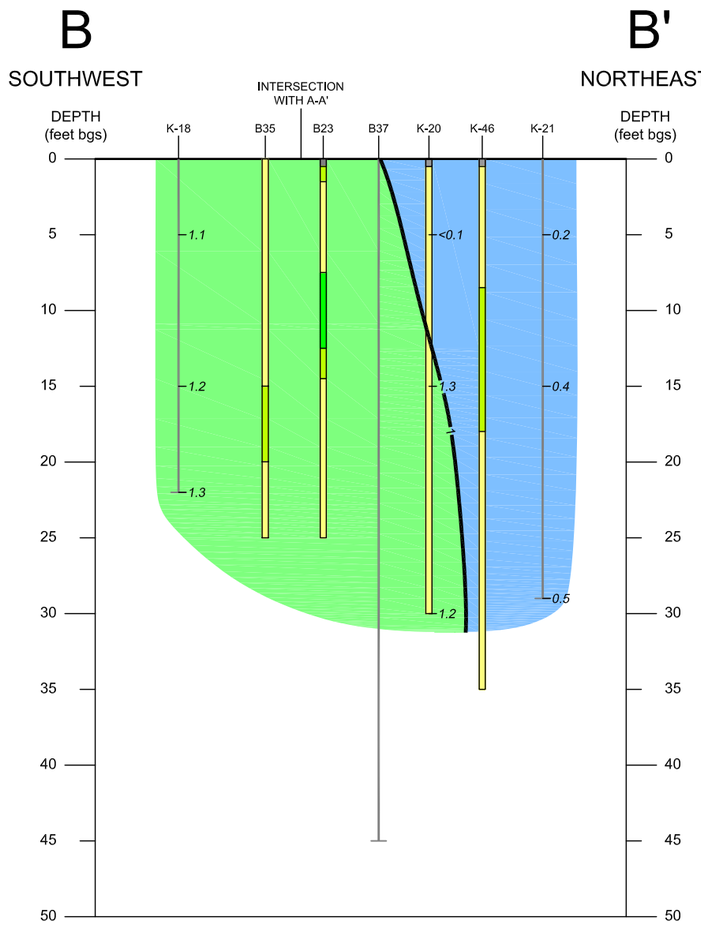
PLOTTED: 25 Nov 2008, 3:49pm, MGriffin
LAYOUT: 13B
CAD FILE: U:\MGriffin\CADD\2008\98498\
ATTACHED IMAGES: Images: New 14A-C (old 14C-E)_Page_2.jpg
ATTACHED XREFS:
DIAMOND BAR, CA

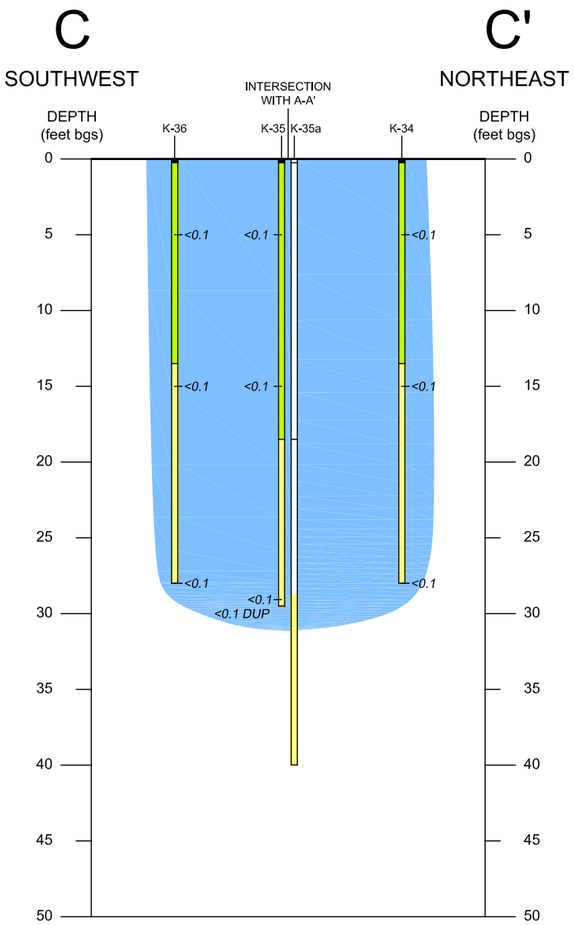
PLOTTED: 25 Nov 2008, 5:18pm, MGriffin
CAD FILE: U:\MGriffin\CADD\2008\98498\ LAYOUT: 13C
ATTACHED IMAGES:
ATTACHED XREFS:
DIAMOND BAR, CA



EXPLANATION

- ASPHALT AND PAVEMENT
- BORING OR VAPOR PROBE
- ASPHALT CONCRETE PAVEMENT
- CONCRETE
- (SM) SILTY SAND
- (SP) SAND
- *1.1* — 1,1,1–TRICHLOROETHANE (1,1,1–TCA) CONCENTRATION IN MICROGRAMS PER LITER (µg/L)
- *<0.1* — NOT DETECTED AT OR ABOVE THE INDICATED REPORTING LIMIT
- *<0.1 DUP* — FIELD DUPLICATE SAMPLE
- 1 — ESTIMATED CONTOUR OF CONCENTRATION
- 1–10 µg/L
- <1 µg/L





The information included on this graphic representation has been compiled from a variety of sources and is subject to change without notice. Kleinfelder makes no representations or warranties, express or implied, as to accuracy, completeness, timeliness, or rights to the use of such information. This document is not intended for use as a land survey product nor is it designed or intended as a construction design document. The use or misuse of the information contained on this graphic representation is at the sole risk of the party using or misusing the information.

KLEINFELDER
Bright People. Right Solutions.
www.kleinfelder.com

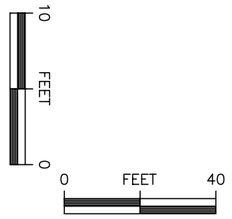
PROJECT NO.	98498
DRAWN:	11/25/08
DRAWN BY:	MRG
CHECKED BY:	PD
FILE NAME:	98498p13C_TCA-CS-B&C.dwg

1,1,1-TCA IN SOIL VAPOR
CROSS SECTIONS B-B' AND C-C'

THE SPIRITO FAMILY TRUST PARCEL
4057 GOODWIN AVENUE
LOS ANGELES, CALIFORNIA

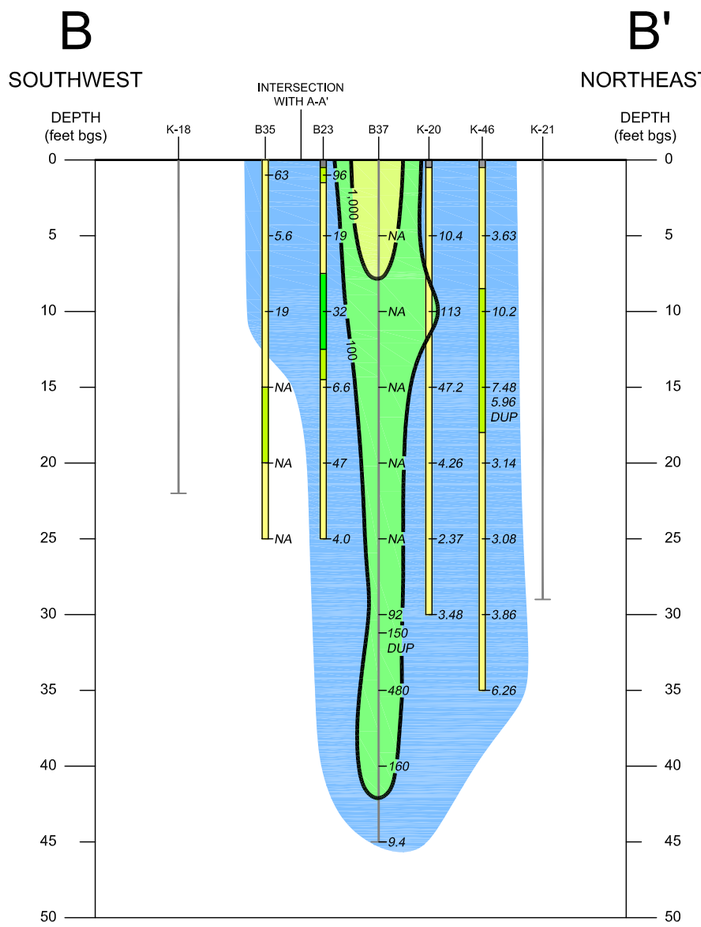
PLATE
13C

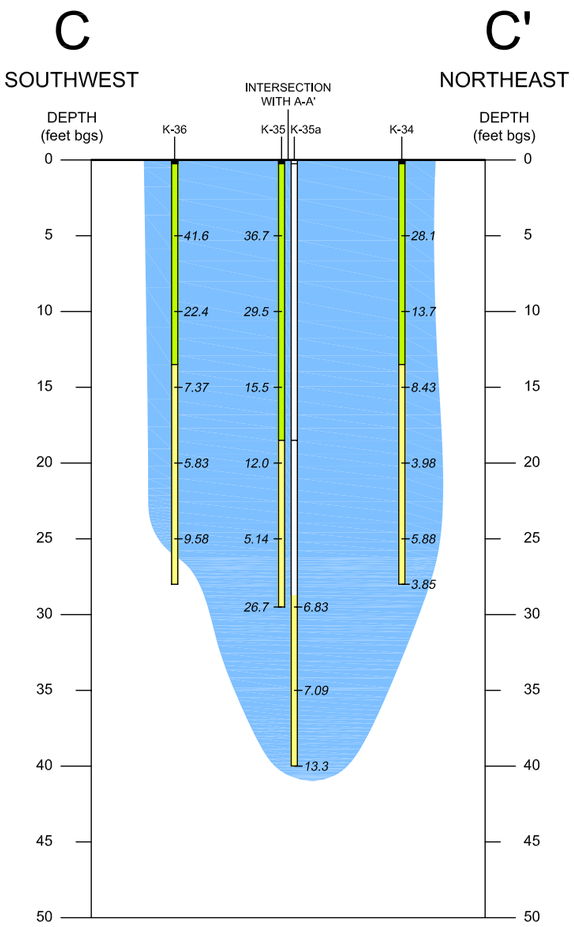
PLOTTED: 25 Nov 2008, 3:57pm, MGriffin
CAD FILE: U:\MGriffin\CADD\2008\98498\ LAYOUT: 13D
ATTACHED IMAGES:
ATTACHED XREFS:
DIAMOND BAR, CA



EXPLANATION

- ASPHALT AND PAVEMENT
- BORING OR VAPOR PROBE
- ASPHALT CONCRETE PAVEMENT
- CONCRETE
- (SM) SILTY SAND
- (SP) SAND
- *5.6* — TOTAL CHROM CONCENTRATION IN MILLIGRAMS PER KILOGRAM (mg/kg)
- *NA* — NOT ANALYZED
- *1.85 DUP* — FIELD DUPLICATE SAMPLE
- 1,000 — ESTIMATED CONTOUR OF CONCENTRATION
- 1,000–10,000 mg/kg
- 100–1,000 mg/kg
- <100 mg/kg





The information included on this graphic representation has been compiled from a variety of sources and is subject to change without notice. Kleinfelder makes no representations or warranties, express or implied, as to accuracy, completeness, timeliness, or rights to the use of such information. This document is not intended for use as a land survey product nor is it designed or intended as a construction design document. The use or misuse of the information contained on this graphic representation is at the sole risk of the party using or misusing the information.

KLEINFELDER
Bright People. Right Solutions.
www.kleinfelder.com

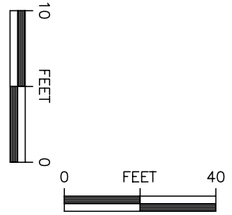
PROJECT NO.	98498
DRAWN:	11/25/08
DRAWN BY:	MRG
CHECKED BY:	PD
FILE NAME:	98498p13D_T.Cr-CS-B&C.dwg

TOTAL CHROME IN SOIL
CROSS SECTIONS B-B' AND C-C'

THE SPIRITO FAMILY TRUST PARCEL
4057 GOODWIN AVENUE
LOS ANGELES, CALIFORNIA

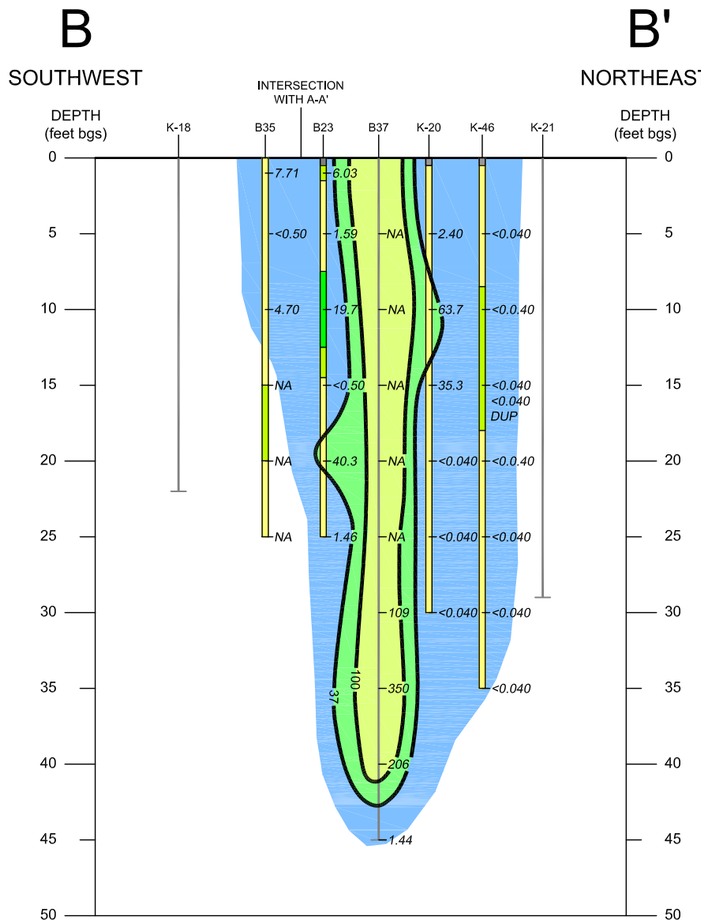
PLATE
13D

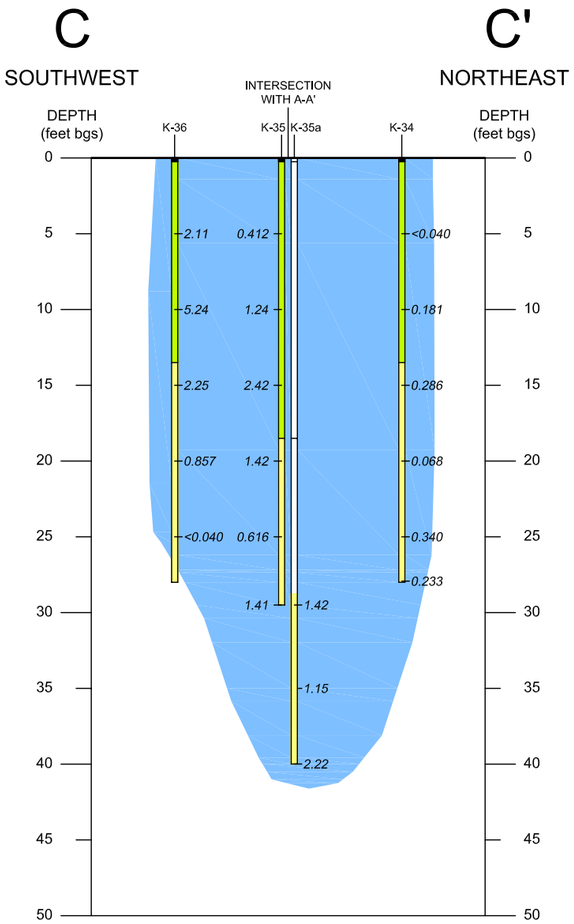
PLOTTED: 25 Nov 2008, 4:01pm, MGriffin
CAD FILE: U:\MGriffin\CADD\2008\98498\ LAYOUT: 13E
ATTACHED IMAGES:
ATTACHED XREFS:
DIAMOND BAR, CA



EXPLANATION

- ASPHALT AND PAVEMENT
- BORING CONCENTRATION (mg/kg)
- ASPHALT CONCRETE PAVEMENT
- CONCRETE
- (SM) SILTY SAND
- (SP) SAND
- *7.71* — CHROME VI CONCENTRATION IN MILLIGRAMS PER KILOGRAM (mg/kg)
- *NA* — NOT ANALYZED
- *<0.50* — NOT DETECTED AT OR ABOVE THE INDICATED REPORTING LIMIT
- *<0.040 DUP* — FIELD DUPLICATE SAMPLE
- 100 — ESTIMATED CONTOUR OF CONCENTRATION
- 100–1,000 mg/kg
- 37–100 mg/kg
- <37 mg/kg





The Information included on this graphic representation has been compiled from a variety of sources and is subject to change without notice. Kleinfelder makes no representations or warranties, express or implied, as to accuracy, completeness, timeliness, or rights to the use of such information. This document is not intended for use as a land survey product nor is it designed or intended as a construction design document. The use or misuse of the information contained on this graphic representation is at the sole risk of the party using or misusing the information.

KLEINFELDER
Bright People. Right Solutions.
www.kleinfelder.com

PROJECT NO.	98498
DRAWN:	11/25/08
DRAWN BY:	MRG
CHECKED BY:	PD
FILE NAME:	98498p13E_CrVI-CS-B&C.dwg

CHROME VI IN SOIL
CROSS SECTIONS B-B' AND C-C'

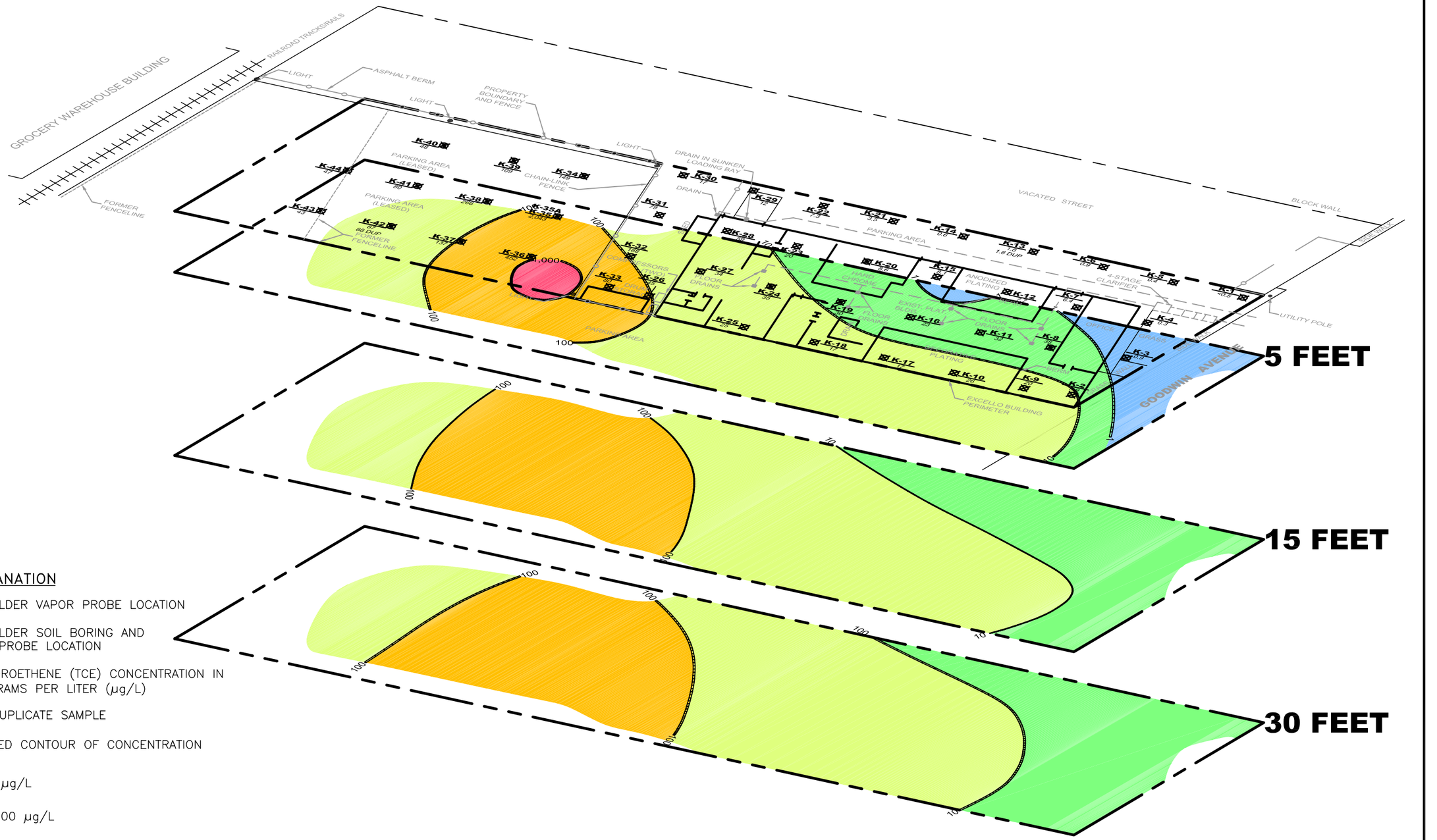
THE SPIRITO FAMILY TRUST PARCEL
4057 GOODWIN AVENUE
LOS ANGELES, CALIFORNIA

PLATE
13E

PLOTTED: 25 Nov 2008, 9:16am, MGriffin

CAD FILE: U:\MGriffin\CADD\2008\98498\Concepual\ LAYOUT: TCE

ATTACHED IMAGES:
ATTACHED XREFS:
DIAMOND BAR, CA



EXPLANATION

- **K-33** — KLEINFELDER VAPOR PROBE LOCATION
- **K-44** — KLEINFELDER SOIL BORING AND VAPOR PROBE LOCATION
- *2,043* — TRICHLOROETHENE (TCE) CONCENTRATION IN MICROGRAMS PER LITER (µg/L)
- *1.8 DUP* — FIELD DUPLICATE SAMPLE
- 1,000 — ESTIMATED CONTOUR OF CONCENTRATION
- >1,000 µg/L
- 100–1,000 µg/L
- 10–100 µg/L
- 1–10 µg/L
- <1 µg/L

The information included on this graphic representation has been compiled from a variety of sources and is subject to change without notice. Kleinfelder makes no representations or warranties, express or implied, as to accuracy, completeness, timeliness, or rights to the use of such information. This document is not intended for use as a land survey product nor is it designed or intended as a construction design document. The use or misuse of the information contained on this graphic representation is at the sole risk of the party using or misusing the information.

N

40 20 0 40

APPROXIMATE SCALE (feet)

KLEINFELDER
Bright People. Right Solutions.
www.kleinfelder.com

PROJECT NO.	98498
DRAWN:	11/25/08
DRAWN BY:	MRG
CHECKED BY:	PD
FILE NAME:	98498p14A_TCE_CSM.dwg

CONCEPTUAL SITE MODEL - TCE

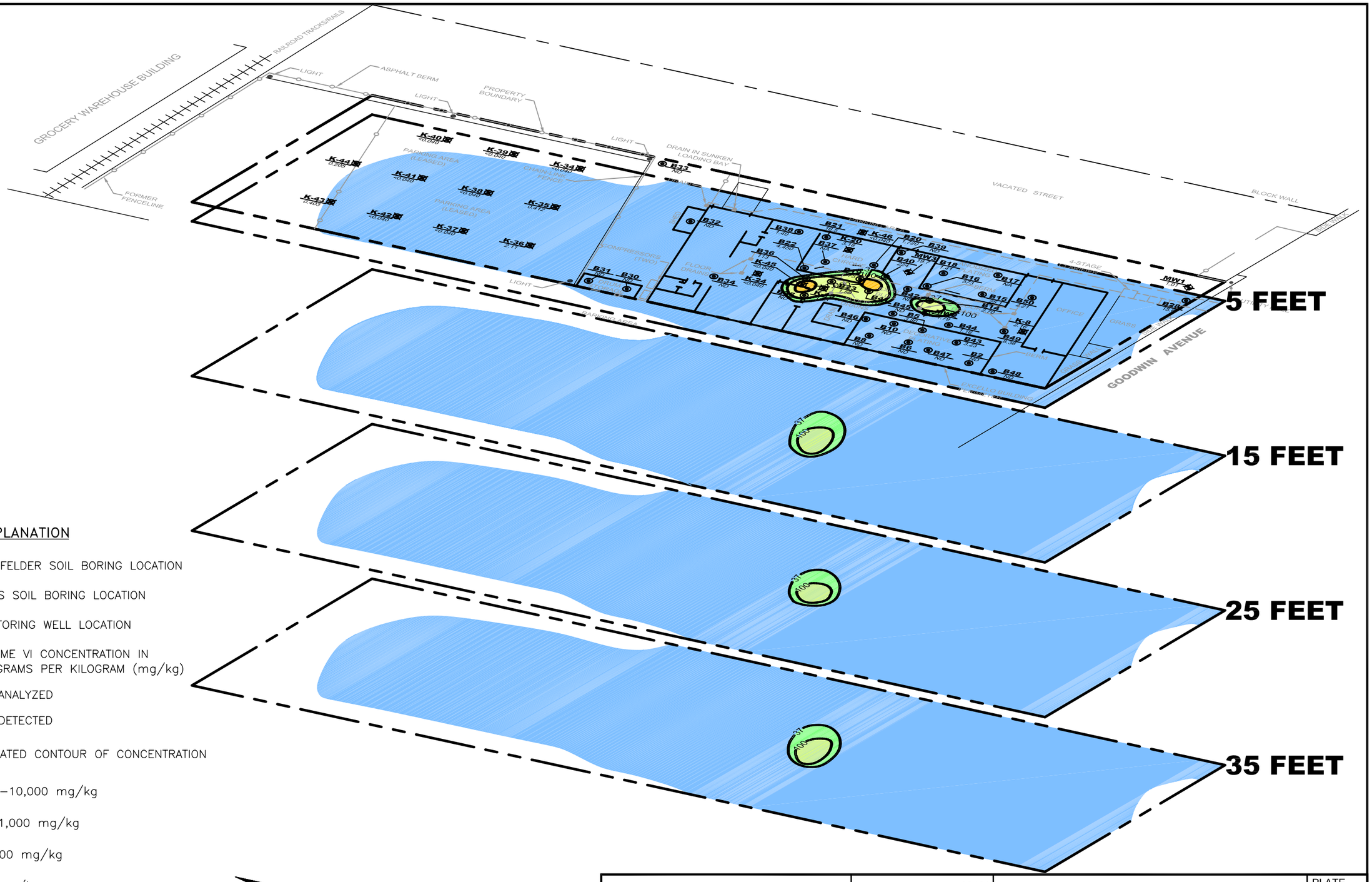
THE SPIRITO FAMILY TRUST PARCEL
4057 GOODWIN AVENUE
LOS ANGELES, CALIFORNIA

PLATE **14A**

PLOTTED: 25 Nov 2008, 9:19am, MGriffin

CAD FILE: U:\MGriffin\CADD\2008\98498\Concepual\ LAYOUT: 7A

ATTACHED IMAGES:
ATTACHED XREFS:
DIAMOND BAR, CA



EXPLANATION

- K-46 — KLEINFELDER SOIL BORING LOCATION
- B50 — CERES SOIL BORING LOCATION
- MW-3 — MONITORING WELL LOCATION
- 4,450 — CHROME VI CONCENTRATION IN MILLIGRAMS PER KILOGRAM (mg/kg)
- NA — NOT ANALYZED
- ND — NOT DETECTED
- 100 — ESTIMATED CONTOUR OF CONCENTRATION
- 1,000–10,000 mg/kg
- 100–1,000 mg/kg
- 37–100 mg/kg
- <37 mg/kg

The information included on this graphic representation has been compiled from a variety of sources and is subject to change without notice. Kleinfelder makes no representations or warranties, express or implied, as to accuracy, completeness, timeliness, or rights to the use of such information. This document is not intended for use as a land survey product nor is it designed or intended as a construction design document. The use or misuse of the information contained on this graphic representation is at the sole risk of the party using or misusing the information.

40 20 0 40
APPROXIMATE SCALE (feet)

KLEINFELDER
Bright People. Right Solutions.
www.kleinfelder.com

PROJECT NO.	98498
DRAWN:	11/25/08
DRAWN BY:	MRG
CHECKED BY:	PD
FILE NAME:	98498p14B_Cr.VI_CSM.dwg

CONCEPTUAL SITE MODEL - CHROME VI

THE SPIRITO FAMILY TRUST PARCEL
4057 GOODWIN AVENUE
LOS ANGELES, CALIFORNIA

PLATE
14B

APPENDIX H

TABLES 1 THROUGH 3 FROM 2008 SUPPLEMENTAL SITE ASSESSMENT

TABLE 1
SOIL VAPOR ANALYTICAL RESULTS (GC/MS)
The Spirito Family Trust Parcel
4057 Goodwin Avenue
Los Angeles, California 90039

Location	Soil Vapor Sample ID	Date Sampled	Sample Depth (ft bgs)	TCE	PCE	1,1-DCE	Chloroform	1,1,1-TCA	1,1-DCA	1,2-DCE	Other VOCs
				(Results in µg/L)							
K-1	KSV1-5	23-Oct-08	5	<0.1	**0.2**	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1-0.5
	KSV1-15	23-Oct-08	15	**1.1**	**0.9**	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1-0.5
	KSV1-30	23-Oct-08	29.5	**2.1**	**1.3**	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1-0.5
K-2	KSV2-5	23-Oct-08	5	**9.9**	**5.1**	<0.1	<0.1	**0.6**	<0.1	<0.1	<0.1-0.5
	KSV2-15	23-Oct-08	15	**6.4**	**5**	<0.1	<0.1	**0.6**	<0.1	<0.1	<0.1-0.5
K-3	KSV3-5	24-Oct-08	5	**0.9**	**0.6**	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1-0.5
	KSV3-15	24-Oct-08	15	**3.3**	**2.5**	<0.1	<0.1	**0.3**	<0.1	<0.1	<0.1-0.5
	KSV3-30	24-Oct-08	21.5	**3.8**	**2.5**	<0.1	<0.1	**0.5**	<0.1	<0.1	<0.1-0.5
K-4	KSV4-5	24-Oct-08	5	**0.3**	**0.5**	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1-0.5
	KSV4-15	24-Oct-08	15	**2**	**1.9**	<0.1	<0.1	**0.2**	<0.1	<0.1	<0.1-0.5
K-5	KSV5-5	24-Oct-08	5	**0.4**	**1**	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1-0.5
	KSV5-15	24-Oct-08	15	**2.6**	**1.9**	<0.1	<0.1	**0.1**	<0.1	<0.1	<0.1-0.5
	KSV5-30	24-Oct-08	30	**3.8**	**2.5**	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1-0.5
K-6	KSV6-5	24-Oct-08	5	**0.9**	**1.6**	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1-0.5
	KSV6-15	24-Oct-08	15	**3.8**	**3.9**	<0.1	<0.1	**0.3**	<0.1	<0.1	<0.1-0.5
	KSV6-30	24-Oct-08	29.5	**5.4**	**4.2**	<0.1	<0.1	**0.3**	<0.1	<0.1	<0.1-0.5
K-7	KSV7-5	23-Oct-08	5	**6.4**	**6.4**	<0.1	<0.1	**1**	<0.1	<0.1	<0.1-0.5
	KSV7-15	23-Oct-08	15	**6.4**	**6.1**	<0.1	<0.1	**1**	<0.1	<0.1	<0.1-0.5
	KSV7-25	23-Oct-08	25	**6.3**	**5.3**	<0.1	<0.1	**0.8**	<0.1	<0.1	<0.1-0.5
K-8	KSV8-5	28-Oct-08	5	**38**	**12**	<0.1	**0.2**	**4.8**	<0.1	<0.1	<0.1-0.5
	KSV8-15	28-Oct-08	15	**14**	**6.9**	<0.1	**0.2**	**2.6**	<0.1	<0.1	<0.1-0.5
	KSV8-30	28-Oct-08	30	**7.7**	**4.3**	<0.1	<0.1	**1.3**	<0.1	<0.1	<0.1-0.5
K-9	KSV9-5	23-Oct-08	5	**20**	**11**	<0.1	<0.1	**2.1**	<0.1	<0.1	<0.1-0.5
	KSV9-15	23-Oct-08	15	**9.2**	**5.8**	**0.4**	**0.1**	**1.5**	<0.1	<0.1	<0.1-0.5
	KSV9-30	23-Oct-08	30	**8.8**	**5.8**	**0.4**	<0.1	**1.1**	<0.1	<0.1	<0.1-0.5
K-10	KSV10-5	23-Oct-08	5	**26**	**25**	**0.5**	**0.5**	**6.8**	<0.1	<0.1	<0.1-0.5
	KSV10-15	23-Oct-08	15	**15**	**12**	**0.3**	**0.3**	**5.2**	<0.1	<0.1	<0.1-0.5
	KSV10-15 dup	23-Oct-08	15	**13**	**14**	**0.2**	**0.3**	**4.5**	<0.1	<0.1	<0.1-0.5
	KSV10-30	23-Oct-08	30	**12**	**10**	**0.8**	**0.1**	**3**	<0.1	<0.1	<0.1-0.5
	KSV10-30 dup	23-Oct-08	30	**11**	**9.2**	**0.6**	**0.1**	**2.8**	<0.1	<0.1	<0.1-0.5
K-11	KSV11-5	23-Oct-08	5	**32**	**54**	**0.9**	**0.8**	**19**	<0.1	<0.1	<0.1-0.5
	KSV11-15	23-Oct-08	15	**20**	**24**	**1.1**	**0.4**	**8.9**	<0.1	<0.1	<0.1-0.5
	KSV11-30	23-Oct-08	30	**16**	**16**	**1.2**	**0.3**	**4.1**	<0.1	<0.1	<0.1-0.5
K-12	KSV12-5	23-Oct-08	5	**7.7**	**11**	<0.1	<0.1	**2.8**	<0.1	<0.1	<0.1-0.5
	KSV12-15	23-Oct-08	15	**9.1**	**8.1**	<0.1	<0.1	**3.1**	<0.1	<0.1	<0.1-0.5
	KSV12-28	23-Oct-08	28	**11**	**9.8**	**0.4**	**0.2**	**2.2**	<0.1	<0.1	<0.1-0.5
K-13	KSV13-5	24-Oct-08	5	**1.8**	**3.1**	<0.1	<0.1	**0.3**	<0.1	<0.1	<0.1-0.5
	KSV13-5 dup	24-Oct-08	5	**1.8**	**3.1**	<0.1	<0.1	**0.2**	<0.1	<0.1	<0.1-0.5
	KSV13-15	24-Oct-08	15	**5.4**	**5.3**	**0.7**	<0.1	**0.6**	<0.1	<0.1	<0.1-0.5
	KSV13-30	24-Oct-08	20.5	**5.3**	**3.3**	**0.3**	<0.1	**0.5**	<0.1	<0.1	<0.1-0.5
K-14	KSV14-5	24-Oct-08	5	**0.6**	**2.4**	<0.1	<0.1	**0.2**	<0.1	<0.1	<0.1-0.5
	KSV14-15	24-Oct-08	15	**8.6**	**8.3**	<0.1	<0.1	**0.8**	**0.1**	<0.1	<0.1-0.5
	KSV14-28	24-Oct-08	28	**8.1**	**6**	<0.1	<0.1	**0.7**	<0.1	<0.1	<0.1-0.5
K-15	KSV15-5	28-Oct-08	5	**8.1**	**8.4**	**0.3**	<0.1	**2.2**	<0.1	<0.1	<0.1-0.5
	KSV15-15	28-Oct-08	15	**12**	**10**	**1**	**0.2**	**2.5**	<0.1	<0.1	<0.1-0.5
	KSV15-30	28-Oct-08	30	**12**	**9**	**1**	**0.1**	**2.2**	<0.1	<0.1	<0.1-0.5
K-16	KSV16-5	23-Oct-08	5	**23**	**36**	**0.6**	**0.5**	**14**	<0.1	<0.1	<0.1-0.5
	KSV16-15	23-Oct-08	15	**17**	**18**	**1.3**	**0.4**	**6.3**	<0.1	**0.4**	<0.1-0.5
	KSV16-28	23-Oct-08	30	**17**	**14**	**1.3**	**0.3**	**4.1**	<0.1	<0.1	<0.1-0.5
K-17	KSV17-5	23-Oct-08	5	**17**	**20**	<0.1	**0.4**	**4.5**	<0.1	<0.1	<0.1-0.5
	KSV17-15	23-Oct-08	15	**13**	**10**	<0.1	**0.2**	**4**	<0.1	<0.1	<0.1-0.5
	KSV17-28	23-Oct-08	30	**13**	**11**	<0.1	**0.2**	**2.9**	<0.1	<0.1	<0.1-0.5
K-18	KSV18-5	28-Oct-08	5	**17**	**14**	<0.1	**0.2**	**1.1**	<0.1	<0.1	<0.1-0.5
	KSV18-15	28-Oct-08	15	**19**	**12**	<0.1	**0.2**	**1.2**	<0.1	<0.1	<0.1-0.5
	KSV18-30	28-Oct-08	22	**22**	**15**	<0.1	**0.2**	**1.3**	<0.1	<0.1	<0.1-0.5
K-19	KSV19-5	28-Oct-08	5	**30**	**26**	**0.5**	**0.3**	**3**	<0.1	<0.1	<0.1-0.5
	KSV19-15	28-Oct-08	15	**22**	**13**	**0.8**	**0.2**	**2.1**	<0.1	<0.1	<0.1-0.5
	KSV19-30	28-Oct-08	30	**18**	**7.6**	**0.8**	**0.1**	**1.8**	<0.1	<0.1	<0.1-0.5
K-20	KSV20-5	29-Oct-08	5	**8.6**	**6.3**	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1-0.5
	KSV20-15	29-Oct-08	15	**15**	**9.7**	**0.7**	<0.1	**1.3**	<0.1	<0.1	<0.1-0.5
	KSV20-30	29-Oct-08	30	**17**	**7.8**	**1**	<0.1	**1.2**	<0.1	<0.1	<0.1-0.5

Copyright 2008 Kleinfelder

TABLE 1
SOIL VAPOR ANALYTICAL RESULTS (GC/MS)
The Spirito Family Trust Parcel
4057 Goodwin Avenue
Los Angeles, California 90039

Location	Soil Vapor Sample ID	Date Sampled	Sample Depth (ft bgs)	TCE	PCE	1,1-DCE	Chloroform	1,1,1-TCA	1,1-DCA	1,2-DCE	Other VOCs
				(Results in µg/L)							
K-21	KSV21-5	24-Oct-08	5	**3.5**	**3.7**	<0.1	<0.1	**0.2**	<0.1	<0.1	<0.1-0.5
	KSV21-15	24-Oct-08	15	**9.4**	**6.6**	**0.2**	**0.1**	**0.4**	<0.1	<0.1	<0.1-0.5
	KSV21-30	24-Oct-08	29	**10**	**4.4**	<0.1	**0.1**	**0.5**	<0.1	<0.1	<0.1-0.5
K-22	KSV22-5	24-Oct-08	5	**7.3**	**4.9**	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1-0.5
	KSV22-15	24-Oct-08	15	**16**	**7**	**0.6**	<0.1	**0.2**	<0.1	<0.1	<0.1-0.5
	KSV22-30	24-Oct-08	31	**22**	**8.6**	**1.3**	<0.1	**0.3**	<0.1	<0.1	<0.1-0.5
K-23	KSV23-5	29-Oct-08	5	**20**	**9.3**	**0.3**	<0.1	**0.5**	<0.1	<0.1	<0.1-0.5
	KSV23-15	29-Oct-08	15	**29**	**11**	**0.7**	<0.1	**0.5**	<0.1	<0.1	<0.1-0.5
	KSV23-30	29-Oct-08	20.5	**30**	**10**	**0.8**	<0.1	**0.5**	<0.1	<0.1	<0.1-0.5
K-24	KSV24-5	29-Oct-08	5	**35**	**18**	<0.1	<0.1	**0.8**	<0.1	<0.1	<0.1-0.5
	KSV24-15	29-Oct-08	15	**40**	**14**	<0.1	<0.1	**0.8**	<0.1	<0.1	<0.1-0.5
	KSV24-30	29-Oct-08	30	**43**	**12**	<0.1	<0.1	**0.7**	<0.1	<0.1	<0.1-0.5
K-25	KSV25-5	29-Oct-08	5	**25**	**14**	<0.1	<0.1	**0.4**	<0.1	<0.1	<0.1-0.5
	KSV25-15	29-Oct-08	15	**34**	**18**	<0.1	<0.1	**0.7**	<0.1	<0.1	<0.1-0.5
K-26	KSV26-5	28-Oct-08	5	**45**	**7**	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1-0.5
	KSV26-15	28-Oct-08	15	**123**	**20**	**0.5**	<0.1	**0.1**	<0.1	<0.1	<0.1-0.5
	KSV26-30	28-Oct-08	30	**132**	**14**	**0.6**	<0.1	<0.1	<0.1	<0.1	<0.1-0.5
K-27	KSV27-5	29-Oct-08	5	**34**	**8.4**	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1-0.5
	KSV27-15	29-Oct-08	15	**97**	**16**	<0.1	<0.1	**0.2**	<0.1	<0.1	<0.1-0.5
	KSV27-30	29-Oct-08	30	**98**	**15**	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1-0.5
K-28	KSV28-5	29-Oct-08	5	**59**	**11**	**0.2**	<0.1	**0.2**	<0.1	<0.1	<0.1-0.5
	KSV28-15	29-Oct-08	14.5	**61**	**8.4**	**0.3**	<0.1	**0.2**	<0.1	<0.1	<0.1-0.5
K-29	KSV29-5	24-Oct-08	5	**12**	**4**	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1-0.5
	KSV29-15	24-Oct-08	15	**32**	**8.2**	**0.2**	**0.2**	<0.1	<0.1	<0.1	<0.1-0.5
	KSV29-30	24-Oct-08	30	**37**	**9.9**	**0.4**	<0.1	<0.1	<0.1	<0.1	<0.1-0.5
K-30	KSV30-5	28-Oct-08	5	**17**	**4**	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1-0.5
	KSV30-15	28-Oct-08	15	**52**	**8.8**	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1-0.5
	KSV30-30	28-Oct-08	30	**69**	**9.8**	<0.1	**0.2**	<0.1	<0.1	<0.1	<0.1-0.5
K-31	KSV31-5	28-Oct-08	5	**79**	**8**	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1-0.5
	KSV31-15	28-Oct-08	15	**180**	**16**	<0.1	**0.2**	<0.1	<0.1	<0.1	<0.1-0.5
	KSV31-30	28-Oct-08	22.5	**218**	**18**	<0.1	**0.2**	<0.1	<0.1	<0.1	<0.1-0.5
K-32	KSV32-5	28-Oct-08	5	**188**	**15**	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1-0.5
	KSV32-15	28-Oct-08	15	**252**	**18**	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1-0.5
	KSV32-26	28-Oct-08	26	**274**	**20**	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1-0.5
	KSV32-26 dup	28-Oct-08	26	**268**	**19**	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1-0.5
K-33	KSV33-5	28-Oct-08	5	**80**	**16**	<0.1	**0.2**	<0.1	<0.1	<0.1	<0.1-0.5
	KSV33-15	28-Oct-08	15	**181**	**26**	<0.1	**0.2**	<0.1	<0.1	<0.1	<0.1-0.5
	KSV33-30	28-Oct-08	30	**212**	**26**	<0.1	**0.1**	<0.1	<0.1	<0.1	<0.1-0.5
K-34	KSV34-5	29-Oct-08	5	**149**	**21**	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1-0.5
	KSV34-15	29-Oct-08	15	**172**	**15**	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1-0.5
	KSV34-28	29-Oct-08	28	**168**	**14**	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1-0.5
K-35	KSV35-5	29-Oct-08	5	**2043**	**59**	<0.1	**0.9**	<0.1	<0.1	<0.1	<0.1-0.5
	KSV35-15	29-Oct-08	15	**881**	**37**	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1-0.5
	KSV35-30	29-Oct-08	29.5	**539**	**29**	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1-0.5
	KSV35-30 dup	29-Oct-08	29.5	**508**	**26**	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1-0.5
K-36	KSV36-5	29-Oct-08	5	**452**	**105**	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1-0.5
	KSV36-15	29-Oct-08	15	**372**	**50**	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1-0.5
	KSV36-28	29-Oct-08	28	**296**	**34**	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1-0.5
K-37	KSV37-5	30-Oct-08	5	**137**	**23**	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1-0.5
	KSV37-15	30-Oct-08	15	**207**	**28**	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1-0.5
	KSV37-30	30-Oct-08	30	**192**	**15**	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1-0.5
K-38	KSV38-5	29-Oct-08	5	**266**	**20**	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1-0.5
	KSV38-15	29-Oct-08	15	**253**	**19**	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1-0.5
	KSV38-30	29-Oct-08	30	**227**	**18**	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1-0.5
K-39	KSV39-5	29-Oct-08	5	**109**	**11**	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1-0.5
	KSV39-15	29-Oct-08	15	**126**	**13**	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1-0.5
	KSV39-30	29-Oct-08	30	**116**	**10**	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1-0.5
	KSV39-30 dup	29-Oct-08	30	**116**	**9.8**	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1-0.5
K-40	KSV40-5	30-Oct-08	5	**48**	**7.7**	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1-0.5
	KSV40-15	30-Oct-08	15	**62**	**8.4**	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1-0.5
	KSV40-30	30-Oct-08	30	**70**	**8.1**	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1-0.5

Copyright 2008 Kleinfelder

TABLE 1
SOIL VAPOR ANALYTICAL RESULTS (GC/MS)
The Spirito Family Trust Parcel
4057 Goodwin Avenue
Los Angeles, California 90039

Location	Soil Vapor Sample ID	Date Sampled	Sample Depth (ft bgs)	TCE	PCE	1,1-DCE	Chloroform	1,1,1-TCA	1,1-DCA	1,2-DCE	Other VOCs
				(Results in µg/L)							
K-41	KSV41-5	30-Oct-08	5	**80**	**13**	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1-0.5
	KSV41-15	30-Oct-08	15	**38**	**5.4**	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1-0.5
	KSV41-30	30-Oct-08	30	**88**	**9.4**	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1-0.5
K-42	KSV42-5	30-Oct-08	5	**87**	**18**	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1-0.5
	KSV42-5 dup	30-Oct-08	5	**88**	**17**	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1-0.5
	KSV42-15	30-Oct-08	15	**95**	**16**	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1-0.5
	KSV42-30	30-Oct-08	30	**103**	**17**	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1-0.5
K-43	KSV43-5	30-Oct-08	5	**43**	**18**	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1-0.5
	KSV43-15	30-Oct-08	15	**61**	**19**	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1-0.5
	KSV43-21	30-Oct-08	21	**63**	**17**	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1-0.5
K-44	KSV44-5	30-Oct-08	5	**47**	**16**	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1-0.5
	KSV44-15	30-Oct-08	15	**73**	**17**	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1-0.5
	KSV44-30	30-Oct-08	25.5	**76**	**12**	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1-0.5
CHHSL (Commercial/Industrial Land Use)				1.77	0.603	NV	NV	2,790	NV	cis - 44.4 trans - 88.7	Vary by analyte

Notes:

Samples analyzed by gas chromatography/mass spectroscopy (GC/MS) using methodology similar to United States Environmental Protection Agency (US EPA) Method 8260B, modified for soil gas

TCE Trichloroethene
PCE Tetrachloroethene
1,1-DCE 1,1-Dichloroethylene
1,1,1-TCA 1,1,1-Trichloroethane
1,1-DCA 1,1-Dochloroethane
1,2-DCE 1,2-Dichloroethene
ID Identification
ft bgs Feet below ground surface
µg/L Micrograms per liter
CHHSL California Human Health Screening Level
< Not detected at or above the indicated reporting limit
NV No value

Bold values indicate detected concentrations

Only constituents detected above the reporting limits are shown; analytical results for unlisted compounds are provided in the laboratory report

Equipment blank samples were collected by the Hydrogeospectrum Chemist on each day of a sampling event. Analysis of equipment blank samples are provided in the laboratory report.

Copyright 2008 Kleinfelder

Table 2
SOIL ANALYTICAL RESULTS
VOCs
The Spirito Family Trust Parcel
4057 Goodwin Avenue
Los Angeles, California 90039

Boring Number	Sample Number	Date Sampled	Sample Depth	Trichloroethene (TCE)	Tetrachloroethene (PCE)	1,1-Dichloroethene	Chloroform	1,1,1-Trichloroethane	1,1-Dichloroethane	cis-1,2-Dichloroethene	trans-1,2-Dichloroethene	Other VOCs
			(feet)	8260B	8260B	8260B	8260B	8260B	8260B	8260B	8260B	8260B
				(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)
K-19	K-19-25	24-Oct-08	25	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005-0.020
K-24	K-24-30	24-Oct-08	30	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005-0.020
K-39	K-39-30	14-Oct-08	30	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005-0.020
K-42	K-42-40	23-Oct-08	40	**0.016**	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005-0.020
K-45	K-45-35	24-Oct-08	35	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005-0.020
US EPA Industrial RSL				14	2.7	1,100	1.5	39,000	17	10,000	500	Vary
US EPA Groundwater Protection MCL-based SSL				0.0019	0.0024	0.0026	NL	0.072	NL	0.021	0.032	Vary

Notes:

VOCs	Volatile organic compounds
8260B	United States Environmental Protection Agency Analytical Method Number
mg/kg	Milligrams per kilogram
<	Not detected above the practical quantitation limit (PQL)
US EPA	United States Environmental Protection Agency
RSL	Regional Screening Level (US EPA 2008)
SSL	US EPA Groundwater Protection Maximum Contaminant Level (MCL)-based Soil Screening Level (US EPA, 2008)
NL	No listed value

Bold values indicate detected concentrations

Listed compounds are those detected in soil samples, plus those others detected in soil vapor samples but not in soil samples

Analytical results for unlisted compounds are provided in the laboratory reports

Coyright 2008 Kleinfelder

Table 3
SOIL ANALYTICAL RESULTS
TITLE 22 METALS
The Spirito Family Trust Parcel
4057 Goodwin Avenue
Los Angeles, California 90039

Boring Number	Sample Number	Date Sampled	Sample Depth	Antimony	Arsenic	Barium	Beryllium	Cadmium	Chromium	Chromium VI	Cobalt	Copper	Lead	Mercury	Molybdenum	Nickel	Selenium	Silver	Thallium	Vanadium	Zinc
			(feet)	6010B	6010B	6010B	6010B	6010B	6010B	7199	6010B	6010B	6010B	7471A	6010B	6010B	6010B	6010B	6010B	6010B	6010B
				(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)
K-8	K-8-5	24-Oct-08	5	<1.00	<0.30	**35.9**	<0.50	<0.50	**12.0**	**2.16**	**1.55**	**4.01**	<0.50	<0.01	<5.00	**2.75**	<1.00	<1.00	<1.00	**10.3**	**17.9**
	K-8-10	24-Oct-08	10	<1.00	<0.30	**155**	<0.50	<0.50	**79.6**	**20.4**	**7.97**	**13.9**	**3.07**	<0.01	<5.00	**10.4**	<1.00	<1.00	<1.00	**45.0**	**77.9**
	K-8-10	24-Oct-08	10	--	--	--	--	--	**4.50***	--	--	--	--	--	--	--	--	--	--	--	--
	K-8-15	24-Oct-08	15	<1.00	<0.30	**84.3**	<0.50	<0.50	**20.8**	**6.35**	**4.18**	**6.83**	**1.55**	<0.01	<5.00	**5.27**	<1.00	<1.00	<1.00	**25.5**	**40.3**
	K-8-20	24-Oct-08	20	<1.00	<0.30	**73.1**	<0.50	<0.50	**18.6**	**13.1**	**3.15**	**4.21**	**1.01**	<0.01	<5.00	**4.13**	<1.00	<1.00	<1.00	**20.3**	**33.8**
	K-8-25	24-Oct-08	25	<1.00	<0.30	**36.5**	<0.50	<0.50	**4.41**	**0.696**	**1.32**	**2.11**	<0.50	<0.01	<5.00	<2.50	<1.00	<1.00	<1.00	**10.2**	**17.1**
	K-8-30	24-Oct-08	30	<1.00	<0.30	**58.7**	<0.50	<0.50	**5.26**	**0.552**	**1.63**	**1.68**	<0.50	<0.01	<5.00	<2.50	<1.00	<1.00	<1.00	**13.5**	**25.7**
	K-8-35	24-Oct-08	35	<1.00	<0.30	**34.9**	<0.50	<0.50	**3.36**	**0.072**	**1.40**	**2.44**	**0.719**	<0.01	<5.00	<2.50	<1.00	<1.00	<1.00	**11.0**	**21.7**
	K-8-37	24-Oct-08	37	<1.00	<0.30	**52.7**	<0.50	<0.50	**3.89**	<0.040	**1.86**	**3.48**	**0.953**	<0.01	<5.00	**3.06**	<1.00	<1.00	<1.00	**14.2**	**22.9**
K-19	K-19-5	24-Oct-08	5	<1.00	<0.30	**40.0**	<0.50	<0.50	**30.1**	**1.83**	**2.21**	**4.72**	**0.919**	<0.01	<5.00	**3.76**	<1.00	<1.00	<1.00	**14.2**	**20.3**
	K-19-10	24-Oct-08	10	<1.00	<0.30	**136**	<0.50	<0.50	**67.2**	**54.0**	**6.47**	**9.29**	**1.75**	<0.01	<5.00	**8.59**	<1.00	<1.00	<1.00	**37.6**	**69.1**
	K-19-10	24-Oct-08	10	--	--	--	--	--	**4.53***	--	--	--	--	--	--	--	--	--	--	--	--
	K-19-15	24-Oct-08	15	<1.00	<0.30	**63.3**	<0.50	<0.50	**5.52**	<0.040	**23.9**	**4.58**	**0.948**	<0.01	<5.00	**3.67**	<1.00	<1.00	<1.00	**17.4**	**31.0**
	K-19-20	24-Oct-08	20	<1.00	<0.30	**125**	<0.50	<0.50	**37.0**	**31.8**	**3.27**	**3.57**	<0.50	<0.01	<5.00	<2.50	<1.00	<1.00	<1.00	**23.3**	**26.6**
	K-19-25	24-Oct-08	25	<1.00	<0.30	**44.1**	<0.50	<0.50	**16.5**	**11.8**	**1.51**	**2.51**	**0.726**	<0.01	<5.00	<2.50	<1.00	<1.00	<1.00	**9.99**	**19.5**
	K-19-35	24-Oct-08	35	<1.00	<0.30	**133**	<0.50	<0.50	**54.0**	**23.8**	**7.61**	**11.4**	**2.36**	<0.01	<5.00	**9.10**	<1.00	<1.00	<1.00	**46.1**	**76.1**
	K-19-35	24-Oct-08	35	--	--	--	--	--	**0.590***	--	--	--	--	--	--	--	--	--	--	--	--
	K-19-38	24-Oct-08	38	<1.00	<0.30	**54.3**	<0.50	<0.50	**15.6**	**3.18**	**1.71**	**2.00**	**0.503**	<0.01	<5.00	**4.55**	<1.00	<1.00	<1.00	**15.8**	**25.9**
K-20	K-20-5	24-Oct-08	5	<1.00	<0.30	**35.9**	<0.50	<0.50	**10.4**	**2.40**	**1.73**	**2.20**	**3.79**	<0.01	<5.00	<2.50	<1.00	<1.00	<1.00	**10.5**	**19.5**
	K-20-10	24-Oct-08	10	<1.00	<0.30	**105**	<0.50	<0.50	**113**	**63.7**	**4.77**	**6.64**	**2.00**	<0.01	<5.00	**6.07**	<1.00	<1.00	<1.00	**28.0**	**48.8**
	K-20-10	24-Oct-08	10	--	--	--	--	--	**7.47***	**7.49***	--	--	--	--	--	--	--	--	--	--	--
	K-20-15	24-Oct-08	15	<1.00	<0.30	**63.5**	<0.50	<0.50	**47.2**	**35.3**	**2.93**	**4.04**	**2.47**	<0.01	<5.00	**3.80**	<1.00	<1.00	<1.00	**17.9**	**33.8**
	K-20-20	24-Oct-08	20	<1.00	<0.30	**43.0**	<0.50	<0.50	**4.26**	<0.040	**1.81**	**2.58**	**0.860**	<0.01	<5.00	<2.50	<1.00	<1.00	<1.00	**11.3**	**21.1**
	K-20-25	24-Oct-08	25	<1.00	<0.30	**38.3**	<0.50	<0.50	**2.37**	<0.040	**1.25**	**1.52**	**0.551**	<0.01	<5.00	<2.50	<1.00	<1.00	<1.00	**9.94**	**21.3**
	K-20-30	24-Oct-08	30	<1.00	<0.30	**45.5**	<0.50	<0.50	**3.48**	<0.040	**1.67**	**2.40**	**0.610**	<0.01	<5.00	<2.50	<1.00	<1.00	<1.00	**12.7**	**23.3**
K-24	K-24-5	24-Oct-08	5	<1.00	<0.30	**53.5**	<0.50	<0.50	**4.76**	<0.040	**2.58**	**4.20**	**0.910**	<0.01	<5.00	**3.25**	<1.00	<1.00	<1.00	**16.6**	**27.7**
	K-24-10	24-Oct-08	10	<1.00	<0.30	**79.7**	<0.50	<0.50	**7.04**	<0.040	**3.53**	**3.61**	**1.05**	<0.01	<5.00	**4.78**	<1.00	<1.00	<1.00	**21.6**	**37.2**
	K-24-15	24-Oct-08	15	<1.00	<0.30	**40.7**	<0.50	<0.50	**2.95**	<0.040	**1.67**	**2.34**	<0.50	<0.01	<5.00	<2.50	<1.00	<1.00	<1.00	**10.9**	**21.3**
	K-24-20	24-Oct-08	20	<1.00	<0.30	**31.7**	<0.50	<0.50	**2.45**	<0.040	**1.19**	**2.39**	**0.811**	<0.01	<5.00	<2.50	<1.00	<1.00	<1.00	**8.78**	**17.3**
	K-24-30	24-Oct-08	30	<1.00	<0.30	**112**	<0.50	<0.50	**10.7**	<0.040	**5.40**	**8.29**	**1.38**	<0.01	<5.00	**7.24**	<1.00	<1.00	<1.00	**33.8**	**59.7**
	K-24-40	24-Oct-08	40	<1.00	<0.30	**52.2**	<0.50	<0.50	**4.22**	<0.040	**1.52**	**4.54**	**1.23**	<0.01	<5.00	<2.50	<1.00	<1.00	<1.00	**15.2**	**23.8**
K-34	K-34-5	13-Oct-08	5	<1.00	<0.30	**48.0**	<0.50	<0.50	**28.1**	<0.040	**2.44**	**4.37**	**0.828**	<0.01	<5.00	**17.9**	<1.00	<1.00	<1.00	**14.8**	**24.5**
	K-34-10	13-Oct-08	10	<1.00	<0.30	**116**	<0.50	<0.50	**13.7**	**0.181**	**5.83**	**8.14**	**2.20**	<0.01	<5.00	**20.7**	<1.00	<1.00	<1.00	**35.4**	**54.6**
	K-34-15	13-Oct-08	15	<1.00	<0.30	**70.2**	<0.50	<0.50	**8.43**	**0.286**	**3.44**	**4.07**	**1.22**	<0.01	<5.00	**4.42**	<1.00	<1.00	<1.00	**20.7**	**32.5**
	K-34-20	13-Oct-08	20	<1.00	**0.363**	**35.6**	<0.50	<0.50	**3.98**	**0.068**	<1.00	**3.38**	<0.50	<0.01	<5.00	<2.50	<1.00	<1.00	<1.00	**9.48**	**17.5**
	K-34-25	13-Oct-08	25	<1.00	**0.577**	**36.9**	<0.50	<0.50	**5.88**	**0.340**	<1.00	**3.13**	**0.883**	<0.01	<5.00	**3.23**	<1.00	<1.00	<1.00	**10.3**	**21.8**
	K-34-28	13-Oct-08	28	<1.00	<0.30	**39.9**	<0.50	<0.50	**3.85**	**0.233**	<1.00	**2.14**	**0.831**	<0.01	<5.00	**2.62**	<1.00	<1.00	<1.00	**9.62**	**22.3**

Coyright 2008 Kleinfelder

Table 3
SOIL ANALYTICAL RESULTS
TITLE 22 METALS
The Spirito Family Trust Parcel
4057 Goodwin Avenue
Los Angeles, California 90039

Boring Number	Sample Number	Date Sampled	Sample Depth	Antimony	Arsenic	Barium	Beryllium	Cadmium	Chromium	Chromium VI	Cobalt	Copper	Lead	Mercury	Molybdenum	Nickel	Selenium	Silver	Thallium	Vanadium	Zinc
			(feet)	6010B	6010B	6010B	6010B	6010B	6010B	7199	6010B	6010B	6010B	7471A	6010B	6010B	6010B	6010B	6010B	6010B	6010B
				(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)
K-35	K-35-5	13-Oct-08	5	<1.00	<0.30	**62.4**	<0.50	<0.50	**36.7**	**0.412**	**3.13**	**4.20**	**1.10**	<0.01	<5.00	**10.9**	<1.00	<1.00	<1.00	**19.5**	**30.8**
	K-35-10	13-Oct-08	10	<1.00	**0.537**	**164**	<0.50	<0.50	**29.5**	**1.24**	**7.30**	**11.3**	**3.26**	<0.01	<5.00	**15.1**	<1.00	<1.00	<1.00	**42.9**	**69.6**
	K-35-15	13-Oct-08	15	<1.00	<0.30	**82.7**	<0.50	<0.50	**15.5**	**2.42**	**3.97**	**5.58**	**1.63**	<0.01	<5.00	**7.66**	<1.00	<1.00	<1.00	**23.9**	**39.2**
	K-35-20	13-Oct-08	20	<1.00	<0.30	**70.1**	<0.50	<0.50	**12.0**	**1.42**	**3.08**	**4.91**	**0.990**	<0.01	<5.00	**3.69**	<1.00	<1.00	<1.00	**19.4**	**33.1**
	K-35-25	13-Oct-08	25	<1.00	**0.332**	**39.5**	<0.50	<0.50	**5.14**	**0.616**	<1.00	**2.63**	**0.745**	<0.01	<5.00	<2.50	<1.00	<1.00	<1.00	**10.4**	**19.3**
	K-35-29.5	13-Oct-08	29.5	<1.00	**1.31**	**56.2**	<0.50	<0.50	**111**	**1.41**	**2.50**	**3.20**	**2.17**	<0.01	<5.00	**3.55**	<1.00	<1.00	<1.00	**15.7**	**28.8**
	K-35-29.5	13-Oct-08	29.5	--	--	--	--	--	**0.407***	--	--	--	--	--	--	--	--	--	--	--	--
	K-35-29.5	13-Oct-08	29.5	--	--	--	--	--	**26.7****	--	--	--	--	--	--	--	--	--	--	--	--
K-35a	K-35a-29.5	23-Oct-08	29.5	<1.00	<0.30	**31.6**	<0.50	<0.50	**6.83**	**1.42**	<1.00	**1.59**	<0.50	<0.01	<5.00	<2.50	<1.00	<1.00	<1.00	**8.42**	**17.8**
	K-35a-35	23-Oct-08	35	<1.00	<0.30	**36.2**	<0.50	<0.50	**7.09**	**1.15**	<1.00	**1.6**	<0.50	<0.01	<5.00	<2.50	<1.00	<1.00	<1.00	**10.3**	**16.3**
	K-35a-40	23-Oct-08	40	<1.00	<0.30	**35.7**	<0.50	<0.50	**13.3**	**2.22**	**1.13**	**2.68**	<0.50	<0.01	<5.00	<2.50	<1.00	<1.00	<1.00	**8.23**	**19.5**
K-36	K-36-5	13-Oct-08	5	<1.00	<0.30	**83.1**	<0.50	<0.50	**41.6**	**2.11**	**3.96**	**7.24**	**1.49**	<0.01	<5.00	**5.04**	<1.00	<1.00	<1.00	**25.1**	**38.4**
	K-36-10	13-Oct-08	10	<1.00	<0.30	**133**	<0.50	<0.50	**22.4**	**5.24**	**6.04**	**8.78**	**2.39**	<0.01	<5.00	**7.53**	<1.00	<1.00	<1.00	**36.5**	**54.7**
	K-36-15	13-Oct-08	15	<1.00	**0.309**	**40.8**	<0.50	<0.50	**7.37**	**2.25**	**1.79**	**3.05**	**0.914**	<0.01	<5.00	<2.50	<1.00	<1.00	<1.00	**12.0**	**19.5**
	K-36-20	13-Oct-08	20	<1.00	**0.549**	**43.6**	<0.50	<0.50	**5.83**	**0.857**	**1.75**	**2.62**	**0.827**	<0.01	<5.00	<2.50	<1.00	<1.00	<1.00	**11.5**	**20.1**
	K-36-25	13-Oct-08	25	<1.00	**1.19**	**39.7**	<0.50	<0.50	**9.58**	<0.040	**3.38**	**2.85**	**0.986**	<0.01	<5.00	<2.50	<1.00	<1.00	<1.00	**11.2**	**19.7**
K-37	K-37-5	23-Oct-08	5	<1.00	<0.30	**38.7**	<0.50	<0.50	**3.51**	<0.040	**1.16**	**2.05**	<0.50	<0.01	<5.00	<2.50	<1.00	<1.00	<1.00	**11.6**	**18.9**
	K-37-10	23-Oct-08	10	<1.00	<0.30	**126**	<0.50	<0.50	**12.4**	<0.040	**5.64**	**9.4**	**1.33**	<0.01	<5.00	**7.33**	<1.00	<1.00	<1.00	**37.4**	**54.9**
	K-37-15	23-Oct-08	15	<1.00	<0.30	**53.6**	<0.50	<0.50	**5.60**	<0.040	**2.08**	**3.69**	<0.50	<0.01	<5.00	**3.14**	<1.00	<1.00	<1.00	**17.1**	**27.7**
	K-37-20	23-Oct-08	20	<1.00	<0.30	**58.3**	<0.50	<0.50	**5.40**	<0.040	**1.95**	**3.33**	<0.50	<0.01	<5.00	**3.06**	<1.00	<1.00	<1.00	**16.1**	**28.0**
	K-37-25	23-Oct-08	25	<1.00	<0.30	**36.6**	<0.50	<0.50	**2.58**	<0.040	<1.00	**2.09**	<0.50	<0.01	<5.00	<2.50	<1.00	<1.00	<1.00	**11.4**	**18.3**
	K-37-30	23-Oct-08	30	<1.00	<0.30	**33.1**	<0.50	<0.50	**2.08**	<0.040	**1.01**	**2.33**	<0.50	<0.01	<5.00	<2.50	<1.00	<1.00	<1.00	**10.1**	**18.1**
	K-37-35	23-Oct-08	35	<1.00	<0.30	**46.0**	<0.50	<0.50	**5.86**	**0.040**	<1.00	<1.00	<0.50	<0.01	<5.00	**2.65**	<1.00	<1.00	<1.00	**11.2**	**23.6**
	K-37-40	23-Oct-08	40	<1.00	<0.30	**90.9**	<0.50	<0.50	**19.7**	**0.419**	**6.71**	**9.23**	**1.9**	<0.01	<5.00	**8.21**	<1.00	<1.00	<1.00	**31.8**	**45.7**
K-38	K-38-5	14-Oct-08	5	<1.00	<0.30	<5.00	<0.50	<0.50	**0.980**	<0.040	<1.00	<1.00	<0.50	<0.01	<5.00	**12.9**	<1.00	<1.00	<1.00	<5.00	**6.07**
	K-38-10	14-Oct-08	10	<1.00	<0.30	**131**	<0.50	<0.50	**21.5**	**0.289**	**6.20**	**9.86**	**2.34**	<0.01	<5.00	**7.86**	<1.00	<1.00	<1.00	**38.3**	**62.2**
	K-38-15	14-Oct-08	15	<1.00	<0.30	**64.5**	<0.50	<0.50	**8.08**	**0.465**	**3.24**	**4.18**	**1.06**	<0.01	<5.00	**4.05**	<1.00	<1.00	<1.00	**18.6**	**34.1**
	K-38-20	14-Oct-08	20	<1.00	<0.30	**36.1**	<0.50	<0.50	**3.71**	**0.081**	<1.00	**9.23**	**0.813**	<0.01	<5.00	<2.50	<1.00	<1.00	<1.00	**10.8**	**23.9**
	K-38-25	14-Oct-08	25	<1.00	<0.30	**7.16**	<0.50	<0.50	**0.623**	<0.040	<1.00	<1.00	<0.50	<0.01	<5.00	<2.50	<1.00	<1.00	<1.00	<5.00	**6.94**
	K-38-25DUP	14-Oct-08	25	<1.00	<0.30	**22.4**	<0.50	<0.50	**1.85**	<0.040	<1.00	**1.37**	<0.50	<0.01	<5.00	<2.50	<1.00	<1.00	<1.00	**6.75**	**13.0**
	K-38-30	14-Oct-08	30	<1.00	<0.30	**6.82**	<0.50	<0.50	**1.19**	**0.335**	<1.00	<1.00	<0.50	<0.01	<5.00	<2.50	<1.00	<1.00	<1.00	<5.00	**6.57**
	K-38-35	14-Oct-08	35	<1.00	<0.30	**22.6**	<0.50	<0.50	**6.33**	**0.165**	<1.00	**2.48**	**0.774**	<0.01	<5.00	<2.50	<1.00	<1.00	<1.00	<5.00	**16.4**
	K-38-40	14-Oct-08	40	<1.00	<0.30	**6.49**	<0.50	<0.50	<0.50	**0.124**	<1.00	<1.00	<0.50	<0.01	<5.00	<2.50	<1.00	<1.00	<1.00	<5.00	**7.22**
K-39	K-39-5	14-Oct-08	5	<1.00	<0.30	**53.2**	<0.50	<0.50	**4.39**	<0.040	<1.00	**3.67**	**0.876**	<0.01	<5.00	**2.92**	<1.00	<1.00	<1.00	**15.3**	**25.2**
	K-39-10	14-Oct-08	10	<1.00	<0.30	**120**	<0.50	<0.50	**11.3**	<0.040	**5.71**	**9.29**	**2.33**	<0.01	<5.00	**7.37**	<1.00	<1.00	<1.00	**34.9**	**55.3**
	K-39-15	14-Oct-08	15	<1.00	<0.30	**78.4**	<0.50	<0.50	**8.17**	<0.040	**3.88**	**5.46**	**1.70**	<0.01	<5.00	**5.05**	<1.00	<1.00	<1.00	**22.9**	**37.3**
	K-39-20	14-Oct-08	20	<1.00	<0.30	**41.1**	<0.50	<0.50	**3.85**	<0.040	<1.00	**3.23**	**0.857**	<0.01	<5.00	<2.50	<1.00	<1.00	<1.00	**11.7**	**22.5**
	K-39-25	14-Oct-08	25	<1.00	<0.30	**23.5**	<0.50	<0.50	**2.58**	<0.040	<1.00	**1.89**	**0.554**	<0.01	<5.00	<2.50	<1.00	<1.00	<1.00	**7.63**	**15.7**
	K-39-30	14-Oct-08	30	<1.00	<0.30	**37.7**	<0.50	<0.50	**3.10**	<0.040	<1.00	**7.39**	**0.558**	<0.01	<5.00	<2.50	<1.00	<1.00	<1.00	**10.2**	**18.3**
	K-39-35	14-Oct-08	35	<1.00	<0.30	**41.1**	<0.50	<0.50	**3.90**	<0.040	<1.00	**2.99**	**1.10**	<0.01	<5.00	<2.50	<1.00	<1.00	<1.00	**8.53**	**34.1**
	K-39-40	14-Oct-08	40	<1.00	<0.30	**77.9**	<0.50	<0.50	**8.80**	<0.040	**3.56**	**5.12**	**1.59**	<0.01	<5.00	**4.92**	<1.00	<1.00	<1.00	**26.7**	**38.8**

Copyright 2008 Kleinfelder

Table 3
SOIL ANALYTICAL RESULTS
TITLE 22 METALS
The Spirito Family Trust Parcel
4057 Goodwin Avenue
Los Angeles, California 90039

Boring Number	Sample Number	Date Sampled	Sample Depth	Antimony	Arsenic	Barium	Beryllium	Cadmium	Chromium	Chromium VI	Cobalt	Copper	Lead	Mercury	Molybdenum	Nickel	Selenium	Silver	Thallium	Vanadium	Zinc
			(feet)	6010B	6010B	6010B	6010B	6010B	6010B	7199	6010B	6010B	6010B	7471A	6010B	6010B	6010B	6010B	6010B	6010B	6010B
				(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)
K-40	K-40-5	23-Oct-08	5	<1.00	<0.30	**32.8**	<0.50	<0.50	**2.22**	<0.040	<1.00	**1.08**	<0.50	<0.01	<5.00	<2.50	<1.00	<1.00	<1.00	**8.85**	**15.2**
	K-40-10	23-Oct-08	10	<1.00	<0.30	**105**	<0.50	<0.50	**9.42**	<0.040	**4.51**	**7.61**	<0.50	<0.01	<5.00	**5.87**	<1.00	<1.00	<1.00	**31.5**	**47.7**
	K-40-15	23-Oct-08	15	<1.00	<0.30	**64.4**	<0.50	<0.50	**7.63**	<0.040	**2.33**	**3.40**	<0.50	<0.01	<5.00	**4.39**	<1.00	<1.00	<1.00	**19.3**	**33.7**
	K-40-20	23-Oct-08	20	<1.00	<0.30	**88.8**	<0.50	<0.50	**8.78**	<0.040	**3.91**	**6.04**	<0.50	<0.01	<5.00	**5.37**	<1.00	<1.00	<1.00	**26.1**	**44.9**
	K-40-25	23-Oct-08	25	<1.00	<0.30	**43.2**	<0.50	<0.50	**3.35**	<0.040	**1.07**	**2.37**	<0.50	<0.01	<5.00	<2.50	<1.00	<1.00	<1.00	**11.5**	**18.4**
	K-40-30	23-Oct-08	30	<1.00	<0.30	**31.0**	<0.50	<0.50	**4.71**	<0.040	<1.00	**1.27**	<0.50	<0.01	<5.00	<2.50	<1.00	<1.00	<1.00	**8.49**	**14.9**
	K-40-35	23-Oct-08	35	<1.00	<0.30	**28.7**	<0.50	<0.50	**3.84**	<0.040	<1.00	**1.50**	<0.50	<0.01	<5.00	<2.50	<1.00	<1.00	<1.00	**9.25**	**18.2**
	K-40-40	23-Oct-08	40	<1.00	<0.30	**38.2**	<0.50	<0.50	**2.23**	<0.040	<1.00	**1.49**	<0.50	<0.01	<5.00	<2.50	<1.00	<1.00	<1.00	**9.04**	**21.1**
K-41	K-41-5	23-Oct-08	5	<1.00	<0.30	**83.2**	<0.50	**16.7**	**40.2**	<0.040	**2.77**	**50.2**	<0.50	<0.01	<5.00	**51.7**	<1.00	<1.00	<1.00	**25.0**	**44.1**
	K-41-5	23-Oct-08	5	--	--	--	--	**18.7****	--	--	--	--	--	--	--	--	--	--	--	--	--
	K-41-5	23-Oct-08	5	--	--	--	--	**1.48***	--	--	--	--	--	--	--	--	--	--	--	--	--
	K-41-10	23-Oct-08	10	<1.00	<0.30	**107**	<0.50	**168**	**10.1**	<0.040	**6.84**	**9.17**	**0.722**	<0.01	<5.00	**14.6**	<1.00	<1.00	<1.00	**33.6**	**119**
	K-41-10	23-Oct-08	10	--	--	--	--	**167****	--	--	--	--	--	--	--	--	--	--	--	--	--
	K-41-10	23-Oct-08	10	--	--	--	--	**16.4***	--	--	--	--	--	--	--	--	--	--	--	--	--
	K-41-15	23-Oct-08	15	<1.00	<0.30	**31.1**	<0.50	**21.7**	**2.92**	<0.040	<1.00	**2.09**	<0.50	<0.01	<5.00	**3.66**	<1.00	<1.00	<1.00	**9.01**	**21.6**
	K-41-15	23-Oct-08	15	--	--	--	--	**23.1****	--	--	--	--	--	--	--	--	--	--	--	--	--
	K-41-15	23-Oct-08	15	--	--	--	--	**1.68***	--	--	--	--	--	--	--	--	--	--	--	--	--
	K-41-20	23-Oct-08	20	<1.00	<0.30	**36.3**	<0.50	<0.50	**2.68**	<0.040	**1.06**	**1.36**	<0.50	<0.01	<5.00	<2.50	<1.00	<1.00	<1.00	**10.1**	**16.8**
	K-41-25	23-Oct-08	25	<1.00	<0.30	**37.4**	<0.50	<0.50	**2.16**	<0.040	**0.874**	**2.03**	<0.50	<0.01	<5.00	<2.50	<1.00	<1.00	<1.00	**9.96**	**16.0**
	K-41-30	23-Oct-08	30	<1.00	<0.30	**46.3**	<0.50	<0.50	**3.46**	<0.040	**1.33**	**2.43**	<0.50	<0.01	<5.00	<2.50	<1.00	<1.00	<1.00	**13.0**	**23.1**
	K-41-35	23-Oct-08	35	<1.00	<0.30	**19.9**	<0.50	<0.50	**2.18**	<0.040	<1.00	<1.00	<0.50	<0.01	<5.00	<2.50	<1.00	<1.00	<1.00	**5.09**	**9.52**
	K-41-40	23-Oct-08	40	<1.00	<0.30	**98.6**	<0.50	<0.50	**13.8**	<0.040	**6.27**	**6.62**	**1.34**	<0.01	<5.00	**7.84**	<1.00	<1.00	<1.00	**38.0**	**54.0**
K-42	K-42-5	23-Oct-08	5	<1.00	<0.30	**104**	<0.50	<0.50	**8.25**	<0.040	**3.99**	**8.48**	**0.951**	<0.01	<5.00	**8.14**	<1.00	<1.00	<1.00	**28.0**	**46.6**
	K-42-10	23-Oct-08	10	<1.00	<0.30	**108**	<0.50	<0.50	**9.68**	<0.040	**4.82**	**8.13**	**1.03**	<0.01	<5.00	**6.45**	<1.00	<1.00	<1.00	**33.1**	**50.4**
	K-42-15	23-Oct-08	15	<1.00	<0.30	**24.6**	<0.50	<0.50	**1.46**	<0.040	<1.00	**1.33**	<0.50	<0.01	<5.00	<2.50	<1.00	<1.00	<1.00	**6.92**	**12.6**
	K-42-20	23-Oct-08	20	<1.00	<0.30	**42.2**	<0.50	<0.50	**3.76**	<0.040	**1.54**	**2.60**	<0.50	<0.01	<5.00	<2.50	<1.00	<1.00	<1.00	**12.9**	**21.3**
	K-42-20DUP	23-Oct-08	20	<1.00	<0.30	**47.4**	<0.50	<0.50	**4.30**	<0.040	**2.36**	**2.87**	**0.901**	<0.01	<5.00	**4.32**	<1.00	<1.00	<1.00	**14.9**	**26.1**
	K-42-25	23-Oct-08	25	<1.00	<0.30	**71.8**	<0.50	<0.50	**7.52**	<0.040	**2.87**	**4.85**	<0.50	<0.01	<5.00	**4.28**	<1.00	<1.00	<1.00	**20.4**	**35.2**
	K-42-30	23-Oct-08	30	<1.00	<0.30	**78.2**	<0.50	<0.5	**7.33**	<0.040	**4.05**	**5.62**	<0.50	<0.01	<5.00	**19.7**	<1.00	<1.00	<1.00	**23.4**	**52.5**
	K-42-35	23-Oct-08	35	<1.00	<0.30	**33.3**	<0.50	<0.50	**25.6**	<0.040	<1.00	**3.94**	<0.50	<0.01	<5.00	**4.29**	<1.00	<1.00	<1.00	**8.02**	**16.3**
	K-42-40	23-Oct-08	40	<1.00	<0.30	**50.7**	<0.50	<0.50	**4.95**	**0.058**	**3.20**	**4.27**	<0.50	<0.01	<5.00	**3.21**	<1.00	<1.00	<1.00	**23.2**	**29.6**
K-43	K-43-5	13-Oct-08	5	<1.00	<0.30	**82.0**	<0.50	<0.50	**38.1**	**0.403**	**3.94**	**5.14**	**1.26**	<0.01	<5.00	**4.87**	<1.00	<1.00	<1.00	**23.6**	**40.1**
	K-43-10	13-Oct-08	10	<1.00	<0.30	**152**	<0.50	<0.50	**39.5**	**1.09**	**7.38**	**12.1**	**3.39**	<0.01	<5.00	**9.07**	<1.00	<1.00	<1.00	**44.7**	**72.0**
	K-43-15	13-Oct-08	15	<1.00	**0.399**	**33.6**	<0.50	<0.50	**4.54**	**0.147**	<1.00	**2.00**	**0.708**	<0.01	<5.00	<2.50	<1.00	<1.00	<1.00	**9.70**	**17.4**
	K-43-21	13-Oct-08	21	<1.00	<0.30	**43.1**	<0.50	<0.50	**7.28**	**0.385**	**1.95**	**2.78**	**0.919**	<0.01	<5.00	<2.50	<1.00	<1.00	<1.00	**12.1**	**21.5**
	K-43-21DUP	13-Oct-08	21	<1.00	**0.428**	**33.7**	<0.50	<0.50	**5.49**	**0.415**	**1.42**	**2.28**	**0.675**	<0.01	<5.00	<2.50	<1.00	<1.00	<1.00	**9.45**	**16.4**

Copyright 2008 Kleinfelder

Table 3
SOIL ANALYTICAL RESULTS
TITLE 22 METALS
The Spirito Family Trust Parcel
4057 Goodwin Avenue
Los Angeles, California 90039

Boring Number	Sample Number	Date Sampled	Sample Depth	Antimony	Arsenic	Barium	Beryllium	Cadmium	Chromium	Chromium VI	Cobalt	Copper	Lead	Mercury	Molybdenum	Nickel	Selenium	Silver	Thallium	Vanadium	Zinc
			(feet)	6010B	6010B	6010B	6010B	6010B	6010B	7199	6010B	6010B	6010B	7471A	6010B	6010B	6010B	6010B	6010B	6010B	6010B
				(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)
K-44	K-44-5	13-Oct-08	5	<1.00	<0.30	**92.7**	<0.50	<0.50	**61.7**	**0.205**	**4.90**	**10.6**	**1.67**	<0.01	<5.00	**7.31**	<1.00	<1.00	<1.00	**27.9**	**62.0**
	K-44-5	13-Oct-08	5	--	--	--	--	--	**1.02**	--	--	--	--	--	--	--	--	--	--	--	--
	K-44-10	13-Oct-08	10	<1.00	**0.716**	**102**	<0.50	<0.50	**17.7**	<0.040	**6.23**	**11.3**	**3.16**	<0.01	<5.00	**7.80**	<1.00	<1.00	<1.00	**36.0**	**62.9**
	K-44-15	13-Oct-08	15	<1.00	<0.30	**36.3**	<0.50	<0.50	**4.44**	<0.040	<1.00	**2.04**	**0.621**	<0.01	<5.00	<2.50	<1.00	<1.00	<1.00	**10.6**	**18.4**
	K-44-20	13-Oct-08	20	<1.00	**0.875**	**79.5**	<0.50	<0.50	**8.36**	<0.040	**3.81**	**5.26**	**0.955**	<0.01	<5.00	**4.81**	<1.00	<1.00	<1.00	**23.3**	**39.9**
	K-44-25.5	13-Oct-08	25.5	<1.00	<0.30	**39.7**	<0.50	<0.50	**18.5**	**2.14**	**1.78**	**2.39**	**0.798**	<0.01	<5.00	**2.99**	<1.00	<1.00	<1.00	**11.7**	**22.9**
K-45	K-45-5	24-Oct-08	5	<1.00	<0.30	**48.6**	<0.50	<0.50	**4.74**	<0.040	**2.17**	**3.37**	**0.521**	<0.01	<5.00	**2.69**	<1.00	<1.00	<1.00	**14.2**	**23.5**
	K-45-10	24-Oct-08	10	<1.00	<0.30	**92.6**	<0.50	<0.50	**8.26**	<0.040	**4.42**	**6.04**	**1.03**	<0.01	<5.00	**5.61**	<1.00	<1.00	<1.00	**26.1**	**45.7**
	K-45-15	24-Oct-08	15	<1.00	<0.30	**59.6**	<0.50	<0.50	**5.07**	<0.040	**2.69**	**4.82**	**1.02**	<0.01	<5.00	**3.36**	<1.00	<1.00	<1.00	**16.7**	**30.6**
	K-45-20	24-Oct-08	20	<1.00	<0.30	**47.4**	<0.50	<0.50	**4.72**	**0.070**	**2.11**	**3.83**	**0.678**	<0.01	<5.00	**2.84**	<1.00	<1.00	<1.00	**13.8**	**24.7**
	K-45-20DUP	24-Oct-08	20	<1.00	<0.30	**28.3**	<0.50	<0.50	**3.47**	**0.397**	**1.09**	**1.93**	**0.620**	<0.01	<5.00	<2.50	<1.00	<1.00	<1.00	**8.69**	**16.6**
	K-45-25	24-Oct-08	25	<1.00	<0.30	**44.9**	<0.50	<0.50	**2.48**	<0.040	**1.05**	**2.32**	**0.583**	<0.01	<5.00	<2.50	<1.00	<1.00	<1.00	**8.76**	**18.1**
	K-45-30	24-Oct-08	30	<1.00	<0.30	**37.7**	<0.50	<0.50	**18.3**	<0.040	**1.10**	**6.16**	<0.50	<0.01	<5.00	**3.98**	<1.00	<1.00	<1.00	**9.66**	**142**
	K-45-35	24-Oct-08	35	<1.00	<0.30	**56.5**	<0.50	<0.50	**4.93**	<0.040	**3.29**	**3.88**	**0.954**	<0.01	<5.00	**3.12**	<1.00	<1.00	<1.00	**18.5**	**30.9**
	K-45-40	24-Oct-08	40	<1.00	<0.30	**153**	<0.50	<0.50	**19.2**	<0.040	**10.9**	**19.7**	**4.76**	<0.01	<5.00	**12.5**	<1.00	<1.00	<1.00	**51.0**	**68.2**
K-46	K-46-5	23-Oct-08	5	<1.00	<0.30	**41.6**	<0.50	<0.50	**3.63**	<0.040	**1.40**	**2.32**	<0.50	<0.01	<5.00	<2.50	<1.00	<1.00	<1.00	**13.0**	**20.1**
	K-46-10	23-Oct-08	10	<1.00	<0.30	**112**	<0.50	<0.50	**10.2**	<0.040	**5.50**	**8.85**	**2.12**	<0.01	<5.00	**6.93**	<1.00	<1.00	<1.00	**31.9**	**52.6**
	K-46-15	23-Oct-08	15	<1.00	<0.30	**67.3**	<0.50	<0.50	**7.48**	<0.040	**3.23**	**4.33**	**1.26**	<0.01	<5.00	**4.88**	<1.00	<1.00	<1.00	**19.7**	**33.8**
	K-46-15DUP	23-Oct-08	15	<1.00	<0.30	**56.9**	<0.50	<0.50	**5.96**	<0.040	**3.27**	**4.17**	**1.31**	<0.01	<5.00	**4.14**	<1.00	<1.00	<1.00	**18.3**	**33.1**
	K-46-20	23-Oct-08	20	<1.00	<0.30	**42.2**	<0.50	<0.50	**3.14**	<0.040	**1.65**	**2.54**	**0.673**	<0.01	<5.00	**2.34**	<1.00	<1.00	<1.00	**10.1**	**19.7**
	K-46-25	23-Oct-08	25	<1.00	<0.30	**41.2**	<0.50	<0.50	**3.08**	<0.040	**1.79**	**2.48**	**0.841**	<0.01	<5.00	**1.91**	<1.00	<1.00	<1.00	**12.0**	**20.7**
	K-46-30	23-Oct-08	30	<1.00	<0.30	**48.8**	<0.50	<0.50	**3.86**	<0.040	**2.27**	**1.91**	**2.33**	<0.01	<5.00	<2.50	<1.00	<1.00	<1.00	**14.5**	**24.9**
	K-46-35	23-Oct-08	35	<1.00	<0.30	**58.9**	<0.50	<0.50	**6.26**	<0.040	**1.94**	**2.90**	**1.09**	<0.01	<5.00	**2.83**	<1.00	<1.00	<1.00	**12.6**	**27.4**
TTLC				500	500	10,000	75	100	2,500	500	8,000	2,500	1,000	20	3,500	2,000	100	500	700	2,400	5,000
STLC				15	5.0	100	0.75	1.0	560/5***	5	80	25	5.0	0.2	350	20	1.0	5.0	7.0	24	250
US EPA Industrial RSL				410	1.6	190,000	2,000	810	1,400	NNL	300	41,000	800	28	5,100	20,000	5,100	5,100	66	5,200	310,000
Commercial CHHSL				380	0.24	63,000	1,700	7.5	100,000****	37	3,200	38,000	3,500	180	4,800	16,000	4,800	4,800	63	6,700	100,000
US EPA Groundwater Protection MCL-based SSL				0.27	0.29	82	3.2	0.38	NL	NL	NL	46	14	0.1	NL	NL	0.26	NL	0.14	NL	NL

Notes:

6010B	United States Environmental Protection Agency (US EPA) Analytical Method Number
mg/kg	milligrams per kilogram
<	Not detected above the practical quantitation limit (PQL)
--	Not analyzed for this constituent
TTLC	Total Threshold Limit Concentration
STLC	Soluble Threshold Limit Concentration
CHHSL	California Human Health Screening Level
NL	No listed value
*	STLC analysis value. Concentration reported in milligrams per liter (mg/L)
**	TTLC Re-analysis value
***	Must meet both the STLC Limit of 560 and EPA-TCLP Limit of 5
****	Chrome III value
US EPA	United States Environmental Protection Agency
RSL	Regional Screening Level
SSL	US EPA Groundwater Protection Maximum Contaminant Level (MCL)-based Soil Screening Level (US EPA, 2008)

Bold values indicate detected concentrations

Coyright 2008 Kleinfelder

APPENDIX I

SITE-SPECIFIC SOIL SCREENING LEVEL CALCULATIONS

Equation #10 **Soil Screening Level (mg/kg) = C_w [K_d + ((θ_w + θ_a • H')/ρ_b)]**

Equation #11 **Dilution Factor (DAF) = 1 + [K • i • d] / I • L**

Equation #12 **d (m) = (0.012 • L^2)$^{0.5}$ + d_a • (1- exp[(-L • I)/(K • i • d_a])**

Parameter	Symbol	Units	Input Value	Source/Reference
Soil Texture (Particle Size Density)	ρ_s	kg/L	Equation #12	
Dry Bulk Density	ρ_b	kg/L	0	
Soil Porosity (liters pores per liters soil)	n	Lpore/ Lsoil		
Water Filled Porosity	W_w			
Soil Organic Content (fraction)	f_{oc}	g/g		
Henry's Law Constant	H'	unitless	Chemical Specific SSG, Appendix C	
Soil pH	pH		8.0	
Infiltration Rate	I	m/yr	0.07	
Aquifer Hydraulic Conductivity	K	m/yr	24157	
Hydraulic Gradient	i	m/m	0.0028	
Target Soil Leachate of COC	C_w	mg/L		
Soil/Water Partition Coefficient	K_d	L/kg		
Soil-Organic Carbon/ Water Partition Coefficient	K_{oc}	L/kg		
Water-Filled Soil Porosity	θw	Lwater/Lsoil		
Air-Filled Soil Porosity (liters air per liters soil)	θa	Lair/ Lsoil		

EQUATION #10 - SSLs CALCULATIONS

Total Chromium (as Cr 3+/Cr 6+)	C_w (mg/L)	SSL (mg/kg)	DAF (dimensionless)	**Clean-Up Goal in Soil (mg/kg)**
Scenario #1 (Cal EPA MCL)	0.005	4.3E+05	104	**4.5E+07**

Hexavalent Chromium (as Cr 6+)	C_w (mg/L)	SSL (mg/kg)	DAF (dimensionless)	**Clean-Up Goal in Soil (mg/kg)**
Scenario #1 Site-Specific SSL (Glendale Voluntary Cleanup Level; adjusted for site parameters)	0.005	0.07	104	**7.4**
Scenario #2 Site-Specific SSL (OEHHA PHG; adjusted for site-specific parameters)	0.00006	0.001	104	**0.1**

Cadmium	C_w (mg/L)	SSL (mg/kg)	DAF (dimensionless)	**Clean-Up Goal in Soil (mg/kg)**
Scenario #1 Site-Specific SSL (Adjusted for site-specific parameters)	0.005	21.5	104	**2236**

Nickel	C_w (mg/L)	SSL (mg/kg)	DAF (dimensionless)	**Clean-Up Goal in Soil (mg/kg)**
Scenario #1 Site-Specific SSL (Adjusted for site-specific parameters)	0.1	190	104	**19760**

EQUATION #11 - DAF CALCULATIONS

	K (m/yr)	DAF (unitless)
Scenario #1	24157	104

EQUATION #12 - MIXING ZONE

	K (m/yr)	d (m)
Scenario #1	24157	0.85

EQUATION #10

Soil Screening Level (mg/kg) = C_w [K_d + ((θ_w + θ_a • H')/ρ_b)]

C_w = Target soil leachate of COC (mg/L)
K_d = K_{oc} x f_{oc} Soil-water partition coefficient (L/kg)
K_{oc} = Soil-organic carbon/water partition coefficient (L/kg)
f_{oc} = fraction organic carbon in soil (g/g)
θ_w = Water-filled soil porosity (liters water per liters soil [L_{water}/L_{soil}])
θ_a = Air-filled soil porosity (liters air per liters soil L_{air}/ L_{soil}]) where $\theta_a = n - \theta_w$
ρ_b = Dry soil bulk density (kilograms per liter [kg/L])
n = Soil porosity (liters pores per liters soil [L_{pore}/ L_{soil}]) where $n = 1 – (\rho_b/\rho_s)$
ρ_s = Soil particle density (kg/L)
H' = Henry's law constant (dimensionless)

Total Chromium (as Cr 3+/Cr 6+)

	C_w (mg/L)	K_d (L/kg)	K_{OC} (L/kg)	Θ_W L_{H2O}/L_{soil}	f_{OC} (g/g)	Θ_a L_{Air}/L_{soil}	ρ_b kg/L	n L_{pore}/L_{soil}	ρ_s kg/L	H' Unitless	SSL (mg/kg)
Scenario #1 (US EPA MCL)	0.1	4.30E+06	NA	0.139	0.002	0.318	1.439	0.457108	2.65	0	430000

C_w	=	0.05	(EPA Website - Maximum Contaminant Levels and Regulatory Dates for Drinking Water USEPA vs. CalEPA, 11/08)
K_d	=	4.30E+06	(SSG, Appendix C - Chem. Properties and Regulatory/Human Health Benchmarks for SSL Calcs. @ pH = 8.0)
K_{OC}	=	NA	(SSG, Appendix C - Chemical Properties and Regulatory/Human Health Benchmarks for SSL Calcs.)
Θ_W	=	0.3	(Calculation following Laboratory Analysis for W_w)
f_{OC}	=	0.002	(Laboratory Analysis)
ρ_b	=	1.5	(Laboratory Analysis)
H'	=	0	(Assumed zero for metals)

Assumed Total Chromium = Cr 3+ only

Hexavalent Chromium (as Cr 6+)

	C_w (mg/L)	K_d (L/kg)	K_{OC} (L/kg)	Θ_W L_{H2O}/L_{soil}	f_{OC} (g/g)	Θ_a L_{Air}/L_{soil}	ρ_b kg/L	n L_{pore}/L_{soil}	ρ_s kg/L	H' Unitless	SSL (mg/kg)
Scenario #1 Site-Specific SSL	0.005	1.40E+01	NA	0.139	0.002	0.318	1.439	0.457	2.65	0	0.07

C_w	=	0.005	(Glendale Voluntary Cleanup Goal)
K_d	=	1.40E+01	(SSG, Appendix C - Chem. Properties and Regulatory/Human Health Benchmarks for SSL Calcs. @ pH = 8.0)
K_{OC}	=	NA	(SSG, Appendix C - Chemical Properties and Regulatory/Human Health Benchmarks for SSL Calcs.)
Θ_W	=	0.3	(Calculation following Laboratory Analysis for W_w)
f_{OC}	=	0.002	(Laboratory Analysis)
ρ_b	=	1.5	(Laboratory Analysis)
H'	=	0	(Assumed zero for metals)

Hexavalent Chromium (as Cr 6+)

	C_w (mg/L)	K_d (L/kg)	K_{OC} (L/kg)	Θ_W L_{H2O}/L_{soil}	f_{OC} (g/g)	Θ_a L_{Air}/L_{soil}	ρ_b kg/L	n L_{pore}/L_{soil}	ρ_s kg/L	H' Unitless	SSL (mg/kg)
Scenario #2 Site-Specific SSL	0.00006	1.40E+01	NA	0.139	0.002	0.318	1.439	0.457	2.65	0	0.001

C_w	=	0.00006	(OEHHA Draft PHG = 0.06 ppb [µg/L])
K_d	=	1.40E+01	(SSG, Appendix C - Chem. Properties and Regulatory/Human Health Benchmarks for SSL Calcs. @ pH = 8.0)
K_{OC}	=	NA	(SSG, Appendix C - Chemical Properties and Regulatory/Human Health Benchmarks for SSL Calcs.)
Θ_W	=	0.3	(Calculation following Laboratory Analysis for W_w)
f_{OC}	=	0.002	(Laboratory Analysis)
ρ_b	=	1.5	(Laboratory Analysis)
H'	=	0	(Assumed zero for metals)

Cadmium

	C_w (mg/L)	K_d (L/kg)	K_{OC} (L/kg)	Θ_W L_{H2O}/L_{soil}	f_{OC} (g/g)	Θ_a L_{Air}/L_{soil}	ρ_b kg/L	n L_{pore}/L_{soil}	ρ_s kg/L	H' Unitless	SSL (mg/kg)
Scenario #1 Site-Specific SSL	0.005	4.30E+03	NA	0.139	0.002	0.318108	1.439	0.457108	2.65	0	21.5

C_w	=	0.005	(EPA Website - Maximum Contaminant Levels and Regulatory Dates for Drinking Water USEPA vs. CalEPA, 11/08)
K_d	=	4.30E+03	(SSG, Appendix C - Chem. Properties and Regulatory/Human Health Benchmarks for SSL Calcs. @ pH = 8.0)
K_{OC}	=	NA	(SSG, Appendix C - Chemical Properties and Regulatory/Human Health Benchmarks for SSL Calcs.)
Θ_W	=	0.3	(Calculation following Laboratory Analysis for W_w)
f_{OC}	=	0.002	(Laboratory Analysis)
ρ_b	=	1.5	(Laboratory Analysis)
H'	=	0	(Assumed zero for metals)

Nickel

	C_w (mg/L)	K_d (L/kg)	K_{OC} (L/kg)	Θ_W L_{H2O}/L_{soil}	f_{OC} (g/g)	Θ_a L_{Air}/L_{soil}	ρ_b kg/L	n L_{pore}/L_{soil}	ρ_s kg/L	H' Unitless	SSL (mg/kg)
Scenario #1 Site-Specific SSL	0.1	1.90E+03	NA	0.139	0.002	0.318	1.439	0.457	2.65	0	190

C_w	=	0.1	(EPA Website - Maximum Contaminant Levels and Regulatory Dates for Drinking Water USEPA vs. CalEPA, 11/08)
K_d	=	1.90E+03	(SSG, Appendix C - Chem. Properties and Regulatory/Human Health Benchmarks for SSL Calcs. @ pH = 8.0)
K_{OC}	=	NA	(SSG, Appendix C - Chemical Properties and Regulatory/Human Health Benchmarks for SSL Calcs.)
Θ_W	=	0.3	(Calculation following Laboratory Analysis for W_w)
f_{OC}	=	0.002	(Laboratory Analysis)
ρ_b	=	1.5	(Laboratory Analysis)
H'	=	0	(Assumed zero for metals)

EQUATION #11

Dilution Factor = 1 + [K • i • d] / I • L

K = Aquifer hydraulic conductivity (m/yr)	24157
i = Hydraulic gradient (meter vertical per meter horizontal [m/m])	0.0028
d = Mixing zone depth (meters [m]) (from equation 12)	0.85
I = Infiltration rate (m/yr)	0.07
L = Source length parallel to groundwater flow (m)	8

	K (m/yr)	**i** (m/m)	**d** (m)	**I** (m/yr)	**L** (m)	**DAF** (Unitless)
Default #1	24157	0.0028	0.85	0.18	8	41
Scenario #1	24157	0.0028	0.85	0.07	8	104

KLEINFELDER
Bright People. Right Solutions.

EQUATION #12

$$d = (0.0112 \bullet L^2)^{0.5} + d_a \bullet (1 - \exp[(-L \bullet I)/(K \bullet i \bullet d_a)])$$

d = Mixing zone depth (m)	
L = Source length parallel to groundwater flow (m)	8.00
I = Infiltration rate (m/yr)	0.07
K = Aquifer hydraulic conductivity (m/yr)	24157
i = Hydraulic gradient (m/m)	0.0028
d_a = Aquifer thickness (m)	49

	L (m)	d_a (m)	I (m/yr)	K (m/yr)	i (m/m)	d (m)
Default	8.00	49	0.07	24157	0.0028	0.85
Scenario #1	8.00	49	0.07	24157	0.0028	0.85

Exhibit C-4

METAL K_d VALUES (L/kg) AS A FUNCTION OF pH*

pH	Arsenic	Barium	Beryllium	Cadmium	Chromium (+III)	Chromium (+VI)	Mercury	Nickel	Silver	Selenium	Thallium	Zinc
4.9	2.5E+01	1.1E+01	2.3E+01	1.5E+01	1.2E+03	3.1E+01	4.0E-02	1.6E+01	1.0E-01	1.8E+01	4.4E+01	1.6E+01
5.0	2.5E+01	1.2E+01	2.6E+01	1.7E+01	1.9E+03	3.1E+01	6.0E-02	1.8E+01	1.3E-01	1.7E+01	4.5E+01	1.8E+01
5.1	2.5E+01	1.4E+01	2.8E+01	1.9E+01	3.0E+03	3.0E+01	9.0E-02	2.0E+01	1.6E-01	1.6E+01	4.6E+01	1.9E+01
5.2	2.6E+01	1.5E+01	3.1E+01	2.1E+01	4.9E+03	2.9E+01	1.4E-01	2.2E+01	2.1E-01	1.5E+01	4.7E+01	2.1E+01
5.3	2.6E+01	1.7E+01	3.5E+01	2.3E+01	8.1E+03	2.8E+01	2.0E-01	2.4E+01	2.6E-01	1.4E+01	4.8E+01	2.3E+01
5.4	2.6E+01	1.9E+01	3.8E+01	2.5E+01	1.3E+04	2.7E+01	3.0E-01	2.6E+01	3.3E-01	1.3E+01	5.0E+01	2.5E+01
5.5	2.6E+01	2.1E+01	4.2E+01	2.7E+01	2.1E+04	2.7E+01	4.6E-01	2.8E+01	4.2E-01	1.2E+01	5.1E+01	2.6E+01
5.6	2.6E+01	2.2E+01	4.7E+01	2.9E+01	3.5E+04	2.6E+01	6.9E-01	3.0E+01	5.3E-01	1.1E+01	5.2E+01	2.8E+01
5.7	2.7E+01	2.4E+01	5.3E+01	3.1E+01	5.5E+04	2.5E+01	1.0E+00	3.2E+01	6.7E-01	1.1E+01	5.4E+01	3.0E+01
5.8	2.7E+01	2.6E+01	6.0E+01	3.3E+01	8.7E+04	2.5E+01	1.5E+00	3.4E+01	8.4E-01	9.8E+00	5.5E+01	3.2E+01
5.9	2.7E+01	2.8E+01	6.9E+01	3.5E+01	1.3E+05	2.4E+01	2.3E+00	3.6E+01	1.1E+00	9.2E+00	5.6E+01	3.4E+01
6.0	2.7E+01	3.0E+01	8.2E+01	3.7E+01	2.0E+05	2.3E+01	3.5E+00	3.8E+01	1.3E+00	8.6E+00	5.8E+01	3.6E+01
6.1	2.8E+01	3.1E+01	9.9E+01	4.0E+01	3.0E+05	2.3E+01	5.1E+00	4.0E+01	1.7E+00	8.0E+00	5.9E+01	3.9E+01
6.2	2.8E+01	3.3E+01	1.2E+02	4.2E+01	4.2E+05	2.2E+01	7.5E+00	4.2E+01	2.1E+00	7.5E+00	6.1E+01	4.2E+01
6.3	2.8E+01	3.5E+01	1.6E+02	4.4E+01	5.8E+05	2.2E+01	1.1E+01	4.5E+01	2.7E+00	7.0E+00	6.2E+01	4.4E+01
6.4	2.8E+01	3.6E+01	2.1E+02	4.6E+01	7.7E+05	2.1E+01	1.6E+01	4.7E+01	3.4E+00	6.5E+00	6.4E+01	4.7E+01
6.5	2.8E+01	3.7E+01	2.8E+02	5.2E+01	9.9E+05	2.0E+01	2.2E+01	5.0E+01	4.2E+00	6.1E+00	6.6E+01	5.1E+01
6.6	2.8E+01	3.9E+01	3.9E+02	5.7E+01	1.2E+06	2.0E+01	3.0E+01	5.4E+01	5.3E+00	5.7E+00	6.7E+01	5.4E+01
6.7	2.9E+01	4.0E+01	5.5E+02	6.4E+01	1.5E+06	1.9E+01	4.0E+01	5.8E+01	6.6E+00	5.3E+00	6.9E+01	5.8E+01
6.8	2.9E+01	4.1E+01	7.9E+02	7.5E+01	1.8E+06	1.9E+01	5.2E+01	6.5E+01	8.3E+00	5.0E+00	7.1E+01	6.2E+01
6.9	2.9E+01	4.2E+01	1.1E+03	9.1E+01	2.1E+06	1.8E+01	6.6E+01	7.4E+01	1.0E+01	4.7E+00	7.3E+01	6.8E+01
7.0	2.9E+01	4.2E+01	1.7E+03	1.1E+02	2.5E+06	1.8E+01	8.2E+01	8.6E+01	1.3E+01	4.3E+00	7.4E+01	7.5E+01
7.1	2.9E+01	4.3E+01	2.5E+03	1.5E+02	2.8E+06	1.7E+01	9.9E+01	1.1E+02	1.6E+01	4.1E+00	7.6E+01	8.3E+01
7.2	3.0E+01	4.4E+01	3.8E+03	2.0E+02	3.1E+06	1.7E+01	1.2E+02	1.4E+02	2.0E+01	3.8E+00	7.8E+01	9.5E+01
7.3	3.0E+01	4.4E+01	5.7E+03	2.8E+02	3.4E+06	1.6E+01	1.3E+02	1.8E+02	2.5E+01	3.5E+00	8.0E+01	1.1E+02
7.4	3.0E+01	4.5E+01	8.6E+03	4.0E+02	3.7E+06	1.6E+01	1.5E+02	2.5E+02	3.1E+01	3.3E+00	8.2E+01	1.3E+02
7.5	3.0E+01	4.6E+01	1.3E+04	5.9E+02	3.9E+06	1.6E+01	1.6E+02	3.5E+02	3.9E+01	3.1E+00	8.5E+01	1.6E+02
7.6	3.1E+01	4.6E+01	2.0E+04	8.7E+02	4.1E+06	1.5E+01	1.7E+02	4.9E+02	4.8E+01	2.9E+00	8.7E+01	1.9E+02
7.7	3.1E+01	4.7E+01	3.0E+04	1.3E+03	4.2E+06	1.5E+01	1.8E+02	7.0E+02	5.9E+01	2.7E+00	8.9E+01	2.4E+02
7.8	3.1E+01	4.9E+01	4.6E+04	1.9E+03	4.3E+06	1.4E+01	1.9E+02	9.9E+02	7.3E+01	2.5E+00	9.1E+01	3.1E+02
7.9	3.1E+01	5.0E+01	6.9E+04	2.9E+03	4.3E+06	1.4E+01	1.9E+02	1.4E+03	8.9E+01	2.4E+00	9.4E+01	4.0E+02
8.0	3.1E+01	5.2E+01	1.0E+05	4.3E+03	4.3E+06	1.4E+01	2.0E+02	1.9E+03	1.1E+02	2.2E+00	9.6E+01	5.3E+02

* Non pH-dependent inorganic K_d values for antimony, cyanide, and vanadium are 45, 9.9, and 1,000 (L/kg), respectively.

Generic Kd Values

Site-Specific Values

MAXIMUM CONTAMINANT LEVELS AND REGULATORY DATES FOR DRINKING WATER U.S. EPA VS CALIFORNIA

NOVEMBER 2008

Contaminant	U.S. EPA		California	
	MCL (mg/L)	Date[a]	MCL (mg/L)	Effective Date
Inorganics				
Aluminum	0.05 to 0.2[b]	1/91	1 0.2[b]	2/25/89 9/8/94
Antimony	0.006	7/92	0.006	9/8/94
Arsenic	0.05 0.010	eff: 6/24/77 eff: 1/23/06	0.05 0.010	77 11/28/08
Asbestos	7 MFL[c]	1/91	7 MFL[c]	9/8/94
Barium	1 2	eff: 6/24/77 1/91	1	77
Beryllium	0.004	7/92	0.004	9/8/94
Cadmium	0.010 0.005	eff: 6/24/77 1/91	0.010 0.005	77 9/8/94
Chromium	0.05 0.1	eff: 6/24/77 1/91	0.05	77
Copper	1.3[d]	6/91	1[b] 1.3[d]	77 12/11/95
Cyanide	0.2	7/92	0.2 0.15	9/8/94 6/12/03
Fluoride	4 2[b]	4/86 4/86	2	4/98
Lead	0.05[e] 0.015[d]	eff: 6/24/77 6/91	0.05[e] 0.015[d]	77 12/11/95
Mercury	0.002	eff: 6/24/77	0.002	77
Nickel	Remanded		0.1	9/8/94
Nitrate	(as N) 10	eff: 6/24/77	(as N03) 45	77
Nitrite (as N)	1	1/91	1	9/8/94
Total Nitrate/Nitrite (as N)	10	1/91	10	9/8/94
Perchlorate	-	-	0.006	10/18/07
Selenium	0.01 0.05	eff: 6/24/77 1/91	0.01 0.05	77 9/8/94
Thallium	0.002	7/92	0.002	9/8/94
Radionuclides				
Uranium	30 ug/L	12/7/00	20 pCi/L 20 pCi/L	1/1/89 6/11/06
Combined Radium - 226+228	5 pCi/L	eff: 6/24/77	5 pCi/L 5 pCi/L	77 6/11/06
Gross Alpha particle activity (excluding radon & uranium)	15 pCi/L	eff: 6/24/77	15 pCi/L 15 pCi/L	77 6/11/06
Gross Beta particle activity	4 millirem/yr	eff: 6/24/77	50 pCi/L[f] 4 millirem/yr	77 6/11/06
Strontium-90	8 pCi/L	eff: 6/24/77 now covered by Gross Beta	8 pCi/L[f] 8 pCi/L[f]	77 6/11/06
Tritium	20,000 pCi/L	eff: 6/24/77 now covered by Gross Beta	20,000 pCi/L[f] 20,000 pCi/L[f]	77 6/11/06

KLEINFELDER
Bright People. Right Solutions.

SUITE OF CORROSION TESTS

PROJECT:	Spirito Family Trust	Sampled By	FJJ	DATE	11/6/2009
	Physical Parameter Testing	Tested By	ELF	DATE	11/12/2009
NUMBER	101942/005	Reviewed By	SWH	DATE	11/16/2009

Boring	No.	Depth	Minimum Resisitvity	Sulphate Content		Chloride Content		Ph
			ohm-cm	ppm	%	ppm	%	
KLF-1	1236	22-23						7.9
KLF-1	1335	40-41						7.9
K:LF-2	1545	22-23						7.8
KLF-2	1615	41-42						8.2
						Average	=	8.0

KLEINFELDER
Bright People. Right Solutions.

MOISTURE CONTENT - DRY DENSITY TEST RESULTS

PROJECT:	Spirito Family Trust	Sampled By	FJJ	DATE	11/6/2009
	Physical Parameter Testing	Tested By	ELF	DATE	11/12/2009
NUMBER	101942/005	Reviewed By	SWH	DATE	11/16/2009

Boring	No.	Depth ft	USCS	Wet Density pcf	Moisture Content %	Dry Density pcf	Saturation %	Wet Density Minus Dry Density (pcf)	Θw
KLF-1	1236	22.0	ML	106.1	2.9	103.2	12.6	2.9	0.046
KLF-1	1236	22.5	ML	111.4	3.7	107.5	18.2	3.9	0.063
KLF-1	1335	40.0	SC	91.1	22.9	74.1	49.2	17.0	0.272
KLF-1	1335	40.5	SC	99.9	18.2	84.5	50.5	15.4	0.247
KLF-2	1545	22.0	SP-SM	85.5	6.4	80.4	15.9	5.1	0.082
KLF-2	1545	22.5	SP-SM	89.2	2.9	86.7	8.4	2.5	0.040
KLF-2	1615	41.0	SC	90.9	14.6	79.3	35.7	11.6	0.186
KLF-2	1615	41.5	SC	112.4	10.9	101.3	45.8	11.1	0.178

	pcf		pcf			0.139	Average Θw
	98.3	10.3	89.6	29.5	Average	0.058	Average Θw Saturation (<25')
	85.5	2.9	74.1	8.4	Minimum	0.221	Average Θw Saturation (>25')
	112.4	22.9	107.5	50.5	Maximum		
Average Moisture (<25')		4.0		13.8	Average Saturation (<25')		
Average Moisture (>25')		16.7		45.3	Average Saturation (>25')		

kg/L	kg/L*	
1.5781	1.4387	Average Dry Bulk Density
1.3724	1.1895	Minimum Dry Bulk Density
1.8042	1.7256	Maximum Bulk Density

* - Conversion of dry bulk density from pcf (lbs/ft^3) to (kg/L) as follows:

$kg/L = lbs/ft^3 \times (1\ kg/2.2\ lbs) \times (1\ ft^3/28.317\ L)$

Infiltration rate of rain (m/yr)

Infiltration rates are quite site-specific, and can vary substantially even within different areas of a site. There are believed to be no Site-specific infiltration data available, however, so Kleinfelder performed a literature search in an effort to identify a reasonable infiltration rate for the Site vicinity and identified the following reference:

Cutter, W.B., K.A. Baerenklau, A. DeWoody, R. Sharma and J. Lee, 2008. Costs and Benefits of Capturing Urban Runoff with Competitive Bidding for Decentralized BMPs. Water Resources Research 44, W09410, Appendix B: Parameter Ranges for Sensitivity Analysis, http://www.envisci.ucr.edu/downloads/baerenklau /Appendix%20B.pdf.

The above reference included hydrology information for five sites where stormwater management devices were installed by the Los Angeles and San Gabriels Rivers Watershed Council (LASGRWC) in the course of its Water Augmentation Study. The infiltration rates at the LASGRWC study sites were in general high, but most of the sites studied are in the San Fernando Valley area where soils reportedly generally have high infiltration rates. Based on these data, the above authors chose a "low" estimate of 25.4 millimeters per hour (mm/hr), a "baseline" estimate of 76.2 mm/hr, and a high estimate of 215.9 mm/hr. Converting these values to meters per year (m/yr) gives approximately 223 m/yr for the low estimate, 668 m/yr for the baseline estimate, and 1,893 m/yr for the high estimate. Kleinfelder selected the baseline value of 668 m/yr for use.

Source length parallel to groundwater flow (m)

Kleinfelder understands the "source length parallel to groundwater flow" variable to be the dimension of the areal extent of soil contamination in the direction of groundwater flow. This parameter can be determined Site-specifically providing there are adequate subsurface soil data from soil borings or monitoring well logs to assess the areal extent of subsurface soil contamination. The maximum "length" of the source parallel to the direction of groundwater flow should be used for this value. This value will vary depending on the Site contaminant, depth below ground surface (bgs), and minimum concentration selected for the evaluation. Based on Kleinfelder's evaluation of the Site assessment data, for hexavalent chromium at a depth of 10 feet bgs and minimum concentration of 2 milligrams per kilogram (mg/kg), a source length value of approximately 45 meters (m) appears to be reasonable, but at a depth of 40 feet bgs the source length for a minimum concentration of 2 mg/kg decreases to approximately 20 m. For TCE, a larger source length of 100 m appears reasonable.

Aquifer hydraulic conductivity (m/yr)

As indicated in an 11:24 AM December 1, 2009 e-mail from John Lindquist of CH2M HILL, that was forwarded to Herbert Vogler of Kleinfelder at 1:42 PM on December 1, 2009 by Bob Fitzgerald of the United States Envorinmental Protection Agency (US EPA), a "reasonable" hydraulic conductivity used in recent modeling is 217 feet per day. This value converts to approximately 24,157 m/yr.

Hydraulic gradient (m/m)

Hydraulic gradients were calculated by Kleinfelder based on data for on-Site Wells MW1 through MW3 plus off-Site Wells MW4 through MW6 in Excello site groundwater monitoring reports prepared by others. Kleinfelder evaluated the data for the two most recent monitoring events, as follows:

CCI, 2008. *Groundwater Monitoring Report Third Quarter 2008, Former Excello Plating Company, 4057 Goodwin Avenue, Los Angeles, California 90039, RWQCB File No. 113.5243* . October 15.

The calculated gradient using the above report's September 25, 2008 data is 0.0023 m vertical/m horizontal.

CCI, 2009. *Groundwater Monitoring Report First Semi-Annual 2009, Former Excello Plating Company, 4057 Goodwin Avenue, Los Angeles, California 90039, RWQCB File No. 113.5243* . June 30.

The calculated gradient using the above report's June 9, 2009 data is 0.0033 m vertical/m horizontal. Kleinfelder averaged these two values, to derive an average hydraulic gradient of 0.0028 m vertical/m horizontal.

Aquifer thickness (m)

The above-referenced December 1, 2009 e-mail from John Lindquist indicates that the current model assumes that the aquifer thickness is 161 feet, or approximately 1.7 to 1.8 times the screened interval of the Glendale South (GS) extraction wells. This thickness converts to approximately 49 m.

The following pages of this Appendix I are excerpts from the *Soil Screening Guidance Soil Screening Guidance* published by US EPA (US EPA, 1996a), and *Technical Background Document* also published by US EPA (US EPA, 1996b), as updated by the *Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites* (US EPA, 2002b). These pages include details regarding the derivation and use of Equations 10, 11, and 12 for the calculation of Site-Specific soil screening levels.

Equation 9: Derivation of the Soil Saturation Limit	
$C_{sat} = \frac{S}{\rho_b} (K_d \rho_b + \theta_w + H' \theta_a)$	
Parameter/Definition (units)	**Default**
C_{sat}/soil saturation concentration (mg/kg)	--
S/solubility in water (mg/L-water)	chemical-specific[a]
ρ_b/dry soil bulk density (kg/L)	**1.5**
K_d /soil-water partition coefficient (L/kg)	$K_{oc} \times f_{oc}$ (chemical-specific[a])
K_{oc} /soil organic carbon/water partition coefficient (L/kg)	chemical-specific[a]
f_{oc}/fraction organic carbon in soil (g/g)	**0.006 (0.6%)**
θ_w/water-filled soil porosity (L_{water}/L_{soil})	**0.15**
H′/dimensionless Henry's law constant	chemical-specific[a]
θ_a /air-filled soil porosity (L_{air}/L_{soil})	n - θ_w
n/total soil porosity (L_{pore}/L_{soil})	1 - (ρ_b /ρ_s)
ρ_s /soil particle density (kg/L)	2.65

[a]See Attachment C.

C_{sat} values represent chemical-physical limits in soil and are not risk based. However, since they represent the concentration at which soil pore air is saturated with a contaminant, volatile emissions reach their maximum at C_{sat}. In other words, at C_{sat} the emission flux from soil to air for a chemical reaches a plateau. Volatile emissions will not increase above this level no matter how much more chemical is added to the soil. Chemicals with VF-based SSLs above C_{sat} are not likely to present a significant volatile inhalation risk at any soil concentration. To illustrate this point, the TDB presents an analysis of the inhalation risk levels at C_{sat} for a number of chemicals commonly found at Superfund sites whose generic SSLs (calculated using the default parameters shown in Equation 9) are above C_{sat}.

The analysis indicates that these C_{sat} values are all well below the screening risk targets of a 10^{-6} cancer risk or an HQ of 1.

Although the inhalation risks appear to be negligible, C_{sat} does indicate a potential for nonaqueous phase liquid (NAPL) to be present in soil and a possible risk to ground water. Thus, EPA believes that further investigation is warranted. Table C-3 (Attachment C) provides the physical state, liquid or solid, of various compounds at ambient soil temperature. When an inhalation SSL exceeds C_{sat} for compounds that are liquid at ambient soil temperature, the SSL is set at C_{sat}. Where soil concentrations exceed a C_{sat}-based SSL, site managers should refer to EPA's guidance, *Estimating the Potential for Occurrence of DNAPL at Superfund Sites* (U.S. EPA, 1992c) for further information on determining the likelihood of dense nonaqueous phase liquid (DNAPL) in the subsurface. Note that free-phase contaminants may be present at concentrations below C_{sat} if multiple organic contaminants are present. The DNAPL guidance (U.S. EPA, 1992c) also provides tools for evaluating the potential for such multiple component mixtures in soil.

For organic compounds that are solid at ambient soil temperature, concentrations above C_{sat} do not pose a significant inhalation risk or a potential for NAPL occurrence. Thus, soil screening decisions should be based on the appropriate SSL for other site pathways (e.g., migration to ground water, direct ingestion).

Migration to Ground Water SSLs. The Soil Screening Guidance uses a simple linear equilibrium soil/water partition equation or a leach test to estimate contaminant release in soil leachate. It also uses a simple water-balance equation to calculate a dilution factor to account for reduction of soil leachate concentration from mixing in an aquifer.

The methodology for developing SSLs for the migration to ground water pathway was designed for use during the early stages of a site evaluation when information about subsurface conditions may be limited. Hence, the methodology is based on rather conservative, simplified assumptions about the release and transport of contaminants in the

subsurface (Exhibit 12). These assumptions are inherent in the SSL equations and should be reviewed for consistency with the conceptual site model (see Step 2) to determine the applicability of SSLs to the migration to ground water pathway.

Exhibit 12: Simplifying Assumptions for the SSL Migration to Ground Water Pathway

- Infinite source (i.e., steady-state concentrations are maintained over the exposure period)
- Uniformly distributed contamination from the surface to the top of the aquifer
- No contaminant attenuation (i.e., adsorption, biodegradation, chemical degradation) in soil
- Instantaneous and linear equilibrium soil/water partitioning
- Unconfined, unconsolidated aquifer with homogeneous and isotropic hydrologic properties
- Receptor well at the downgradient edge of the source and screened within the plume
- No contaminant attenuation in the aquifer
- No NAPLs present (if NAPLs are present, the SSLs do not apply).

To calculate SSLs for the migration to ground water pathway, multiply the acceptable ground water concentration by the dilution factor to obtain a target soil leachate concentration. For example, if the dilution factor is 10 and the acceptable ground water concentration is 0.05 mg/L, the target soil/water leachate concentration would be 0.5 mg/L. Next, the partition equation is used to calculate the total soil concentration (i.e., SSL) corresponding to this soil leachate concentration. Alternatively, if a leach test is used, compare the target soil leachate concentration to extract concentrations from the leach tests.

Equation 10: Soil Screening Level Partitioning Equation for Migration to Ground Water

$$\text{Screening Level in Soil (mg/kg)} = C_w \left[K_d + \frac{(\theta_w + \theta_a H')}{\rho_b} \right]$$

Parameter/Definition (units)	Default
C_w/target soil leachate concentration (mg/L)	nonzero MCLG, MCL, or HBL[a] × dilution factor
K_d/soil-water partition coefficient (L/kg)	chemical-specific[b]
K_{oc} /soil organic carbon/water partition coefficient (L/kg)	$K_{oc} \times f_{oc}$ (organics) chemical-specific[b]
f_{oc} /fraction organic carbon in soil (g/g)	**0.002 (0.2%)**
θ_w/water-filled soil porosity (L_{water}/L_{soil})	**0.3**
θ_a/air-filled soil porosity (L_{air}/L_{soil})	n - θ_w
ρ_b/dry soil bulk density (kg/L)	**1.5**
n/soil porosity (L_{pore}/L_{soil})	1-(ρ_b /ρ_s)
ρ_s/soil particle density (kg/L)	2.65
H′/dimensionless Henry's law constant	chemical-specific[b] (assume to be zero for inorganic contaminants except mercury)

[a]Chemical-specific (see Attachment D).

[b]See Attachment C.

Soil/Water Partition Equation. The soil/water partition equation (Equation 10) relates concentrations of contaminants adsorbed to soil organic carbon to soil leachate concentrations in the zone of contamination. It calculates SSLs corresponding to target soil leachate contaminant concentrations (C_w). An adjustment has been added to the equation to relate sorbed concentration in soil to the measured total soil concentration. This adjustment assumes that soil-water, solids, and gas are conserved during sampling. If soil gas is lost during sampling, θ_a should be assumed to be zero. Likewise, for inorganic contaminants except

mercury, there is no significant vapor pressure and H′ may be assumed to be zero.

The use of the soil/water partition equation to calculate SSLs assumes an infinite source of contaminants extending to the top of the aquifer. More detailed models may be used to calculate higher SSLs that are still protective in some situations. For example, contaminants at sites with shallow sources, thick unsaturated zones, degradable contaminants, or unsaturated zone characteristics (e.g., clay layers) may attenuate before they reach ground water. The TBD provides information on the use of unsaturated zone models for soil screening. The decision to use such models should be based on balancing the additional investigative and modeling costs required to apply the more complex models against the cost savings that will result from higher SSLs.

Leach Test. A leach test may be used instead of the soil/water partition equation. In some instances, a leach test may be more useful than the partitioning method, depending on the constituents of concern and the possible presence of RCRA wastes. If this option is chosen, soil parameters are not needed for this pathway. However, a dilution factor must still be calculated. This guidance suggests using the EPA Synthetic Precipitation Leaching Procedure (SPLP, EPA SW-846 Method 1312, U.S. EPA, 1994d). The SPLP was developed to model an acid rain leaching environment and is generally appropriate for a contaminated soil scenario. Like most leach tests, the SPLP may not be appropriate for all situations (e.g., soils contaminated with oily constituents may not yield suitable results). Therefore, apply the SPLP with discretion.

EPA is aware that many leach tests are available for application at hazardous waste sites, some of which may be appropriate in specific situations (e.g., the Toxicity Characteristic Leaching Procedure (TCLP) models leaching in a municipal landfill environment). It is beyond the scope of this document to discuss in detail leaching procedures and the appropriateness of their use.

Stabilization/Solidification of CERCLA and RCRA Wastes (U.S. EPA, 1989b) and the EPA SAB's review of leaching tests (U.S. EPA, 1991b) discuss the application of various leach tests to various waste disposal scenarios. Consult these documents for further information.

See Step 3 for guidance on collecting subsurface soil samples that can be used for leach tests. To ensure adequate precision of leach test results, leach tests should be conducted in triplicate.

Dilution Factor Model. As soil leachate moves through soil and ground water, contaminant concentrations are attenuated by adsorption and degradation. In the aquifer, dilution by clean ground water further reduces concentrations before contaminants reach receptor points (i.e., drinking water wells). This reduction in concentration can be expressed by a dilution attenuation factor (DAF), defined as the ratio of soil leachate concentration to receptor point concentration. The lowest possible DAF is 1, corresponding to the situation where there is no dilution or attenuation of a contaminant (i.e., when the concentration in the receptor well is equal to the soil leachate concentration). On the other hand, high DAF values correspond to a large reduction in contaminant concentration from the contaminated soil to the receptor well.

The Soil Screening Guidance addresses only one of these dilution-attenuation processes: contaminant dilution in ground water. A simple mixing zone equation derived from a water-balance relationship (Equation 11) is used to calculate a site-specific dilution factor. Mixing-zone depth is estimated from Equation 12, which relates it to aquifer thickness along with the other parameters from Equation 11. Mixing zone depth should not exceed aquifer thickness (i.e., use aquifer thickness as the upper limit for mixing zone depth).

Because of the uncertainty resulting from the wide variability in subsurface conditions that affect contaminant migration in ground water, defaults are not provided for the dilution model equations. Instead, a default DAF of 20 has been selected as protective for contaminated soil sources up to 0.5 acre in size. Analyses using the mass-limit models described below suggest that a DAF of 20 may be protective of larger sources as well; however, this hypothesis should be evaluated on a site-specific basis. A discussion of the basis for the default DAF and a description of the mass-limit analysis is found in the TBD. However, since migration to ground

water SSLs are most sensitive to the DAF, site-specific dilution factors should be calculated.

Equation 11: Derivation of Dilution Factor	
$$\text{dilution factor} = 1 + \frac{Kid}{IL}$$	
Parameter/Definition (units)	**Default**
dilution factor (unitless)	**20 (0.5-acre source)**
K/aquifer hydraulic conductivity (m/yr)	
i/hydraulic gradient (m/m)	
I/infiltration rate (m/yr)	
d/mixing zone depth (m)	
L/source length parallel to ground water flow (m)	

Equation 12: Estimation of Mixing Zone Depth
$$d = (0.0112\ L^2)^{0.5} + d_a\ \{1 - \exp[(-LI)/(Kid_a)]\}$$
Parameter/Definition (units)
d/mixing zone depth (m)
L/source length parallel to ground water flow (m)
I/infiltration rate (m/yr)
K/aquifer hydraulic conductivity (m/yr)
i/hydraulic gradient (m/m)
d_a/aquifer thickness (m)

Mass-Limit SSLs. Use of infinite source models to estimate volatilization and migration to ground water can violate mass balance considerations, especially for small sources. To address this concern, the Soil Screening Guidance includes models for calculating mass-limit SSLs for each of these pathways (Equations 13 and 14) that provide a lower limit to SSLs **when the area and depth (i.e., volume) of the source are known or can be estimated reliably.**

A mass-limit SSL represents the level of contaminant in the subsurface that is still protective when the entire volume of contamination either volatilizes or leaches over the 30-year exposure duration and the level of contaminant at the receptor does not exceed the health-based limit.

To use mass-limit SSLs, determine the area and depth of the source, calculate both standard and mass-limit SSLs, compare them for each chemical of concern and select the higher of the two values. Analyze the inhalation and migration to ground water pathways separately.

Equation 13: Mass-Limit Volatilization Factor	
$$VF = Q/C \times \frac{[\,T \times (3.15 \times 10^7\ s/yr)\,]}{(\rho_b \times d_s \times 10^6\ g/Mg)}$$	
Parameter/Definition (units)	**Default**
d_s/average source depth (m)	**site-specific**
T/exposure interval(yr)	30
Q/C/inverse of mean conc. at center of a square source (g/m^2-s per kg/m^3)	**68.81**
ρ_b/dry soil bulk density (kg/L or Mg/m^3)	**1.5**

Equation 14: Mass-Limit Soil Screening Level for Migration to Ground Water	
$$\text{Screening Level in Soil (mg/kg)} = \frac{(C_w \times I \times ED)}{\rho_b \times d_s}$$	
Parameter/Definition (units)	**Default**
C_w/target soil leachate concentration (mg/L)	(nonzero MCLG, MCL, or HBL)[a] × dilution factor
d_s/depth of source (m)	**site-specific**
I/infiltration rate (m/yr)	**0.18**
ED/exposure duration (yr)	70
ρ_b/dry soil bulk density (kg/L)	**1.5**

[a]Chemical-specific, see Attachment D.

Note that Equations 13 and 14 require a site-specific determination of the average depth of contamination in the source. Step 3 provides guidance for conducting subsurface sampling to determine source depth. Where the actual average depth of contamination is uncertain, a conservative estimate should be used (e.g., the maximum possible depth in the unsaturated zone). At many sites, the average water table depth may be used unless there is reason to believe that contamination extends below the water table. In this case SSLs do not apply and

further investigation of the source in question is needed.

Plant Uptake. Consumption of garden fruits and vegetables grown in contaminated residential soils can result in a risk to human health. This exposure pathway applies to both surface and subsurface soils.

The TBD includes an evaluation of the soil-plant-human pathway along with a discussion of the site-specific factors that influence plant uptake and plant contamination concentration. Generic screening levels are calculated for arsenic, cadmium, mercury, nickel, selenium, and zinc based on empirical data on the uptake (i.e., bioconcentration) of these inorganics into plants. In addition, levels of inorganics that have been reported to cause phytotoxicity (Will and Suter, 1994) are presented. Organic compounds are not addressed due to lack of empirical data.

The empirical data indicate that site-specific factors such as soil type, pH, plant type, and chemical form strongly influence the uptake of metals into plants. Where site conditions allow for the mobility and bioavailability of metals, the results of our generic analysis suggest that the soil-plant-human pathway may be of particular concern for sites with soils contaminated with cadmium and arsenic. However, the phytotoxicity of certain metals may limit the amount that can be bioconcentrated in plant tissues. The data on phytotoxicity suggest that, with the exception of arsenic, metal concentrations in soil that are considered toxic to plants are well below the levels that may impact human health through the soil-plant-human pathway. This implies that phytotoxic effects may prevent completion of this pathway for these metals. However, like plant uptake, phytotoxicity is also greatly influenced by the site-specific factors mentioned above. Thus, it is necessary to evaluate on a site-specific basis, the potential bioavailability of certain inorganics for the soil-plant-human pathway and the potential for phytotoxic effects in order to assess possible human health and ecological impacts through plant uptake.

2.5.3 Address Exposure to Multiple Chemicals.

The SSLs generally correspond to a 10^{-6} risk level for carcinogens and a hazard quotient of 1 for noncarcinogens. This "target" hazard quotient is used to calculate a soil concentration below which it is unlikely that sensitive populations will experience adverse health effects. The potential for additive effects has not been "built in" to the SSLs through apportionment. For carcinogens, EPA believes that setting a 10^{-6} risk level for individual chemicals and pathways generally will lead to cumulative site risks within the 10^{-4} to 10^{-6} risk range for the combinations of chemicals typically found at NPL sites.

For noncarcinogens, there is no widely accepted risk range, and EPA recognizes that cumulative risks from noncarcinogenic contaminants at a site could exceed the target hazard quotient. However, EPA also recognizes that **noncancer risks should be added only for those chemicals with the same toxic endpoint or mechanism of action.**

Ideally, chemicals would be grouped according to their exact mechanism of action, and effect-specific toxicity criteria would be available for chemicals exhibiting multiple effects. Instead, data are often limited to gross toxicological effects in an organ (e.g., increased liver weight) or an entire organ system (e.g., neurotoxicity), and RfDs/reference concentrations (RfCs) are available for just one of the several possible endpoints of toxicity for a chemical.

Given the currently available criteria, noncarcinogenic contaminants should be grouped according to the critical effect listed as the basis for the RfD/RfC. If more than one chemical detected at a site affects the same target organ/system, SSLs for those chemicals should be divided by the number of chemicals present in the group. Exhibit 13 lists several chemicals with noncarcinogenic affects in the same target organ/system. However, the list is limited, and a toxicologist should be consulted prior to using SSLs on a site-specific basis.

If additive risks are being considered in developing site-specific SSLs for subsurface soils, recognize that, for certain chemicals, SSLs may be based on a "ceiling limit" concentration (C_{sat}) instead of toxicity. Because they are not risk-based, C_{sat}-based SSLs should not be modified to account for additivity.

reasonable number that would be at the more conservative end of the range. This equates to a corrected threshold friction velocity of 0.625 m/s and an equivalent windspeed of 11.3 m/s at a height of 7 meters.

As with the VF model, Q/C values are needed to calculate the PEF (Equation 10); use the QC value in Table 3 that best represents a site's size and meteorologic conditions (i.e., the same value used to calculate the VF; see Section 2.4.2). Cowherd et al. (1985) describe how to obtain site-specific estimates of V, U_m, U_t, and F(x).

Unlike volatile contaminants, meteorologic conditions (i.e., the intensity and frequency of wind) affect both the dispersion and emissions of particulate matter. For this reason, a separate default Q/C value was derived for particulate matter [nominally 10 µm and less (PM_{10})] emissions for the generic SSLs. The PEF equation was used to calculate annual average concentrations for each of 29 sites across the country. To develop a reasonably conservative default Q/C for calculating generic SSLs, a default site (Minneapolis, MN) was selected that best approximated the 90th percentile concentration.

The results produced a revised default PEF Q/C value of 90.80 g/m^2-s per kg/m^3 for a 0.5-acre site (see Appendix D; EQ, 1994). The generic PEF derived using the default values in Equation 10 is 1.32 x 10^9 m^3/kg, which corresponds to a receptor point concentration of approximately 0.76 µg/m^3. This represents an annual average emission rate based on wind erosion that should be compared with chronic health criteria; it is **not** appropriate for evaluating the potential for more acute exposures.

Derivation of the Particulate Emission Factor

$$\text{PEF}\ (\text{m}^3/\text{kg}) = \text{Q/C} \times \frac{3{,}600\ \text{s/h}}{0.036 \times (1-\text{V}) \times (\text{U}_m/\text{U}_t)^3 \times \text{F(x)}} \qquad \textbf{(10)}$$

Parameter/Definition (units)	Default	Source
PEF/particulate emission factor (m^3/kg)	1.32 x 10^9	--
Q/C/inverse of mean conc. at center of square source (g/m^2-s per kg/m^3)	90.80	Table 3 (for 0.5-acre source in Minneapolis, MN)
V/fraction of vegetative cover (unitless)	0.5 (50%)	U.S. EPA, 1991b
U_m/mean annual windspeed (m/s)	4.69	EQ, 1994
U_t/equivalent threshold value of windspeed at 7 m (m/s)	11.32	U.S. EPA, 1991b
F(x)/function dependent on U_m/U_t derived using Cowherd et al. (1985) (unitless)	0.194	U.S. EPA, 1991b

2.5 Migration to Ground Water

The methodology for calculating SSLs for the migration to ground water pathway was developed to identify chemical concentrations in soil that have the potential to contaminate ground water.

Migration of contaminants from soil to ground water can be envisioned as a two-stage process: (1) release of contaminant in soil leachate and (2) transport of the contaminant through the underlying soil and aquifer to a receptor well. The SSL methodology considers both of these fate and transport mechanisms.

The methodology incorporates a standard linear equilibrium soil/water partition equation to estimate contaminant release in soil leachate (see Sections 2.5.1 through 2.5.4) and a simple water-balance equation that calculates a dilution factor to account for dilution of soil leachate in an aquifer (see Section 2.5.5). The dilution factor represents the reduction in soil leachate contaminant concentrations by mixing in the aquifer, expressed as the ratio of leachate concentration to the concentration in ground water at the receptor point (i.e., drinking water well). Because the infinite source assumption can result in mass-balance violations for soluble contaminants and small sources, mass-limit models are provided that limit the amount of contaminant migrating from soil to ground water to the total amount of contaminant present in the source (see Section 2.6).

SSLs are backcalculated from acceptable ground water concentrations (i.e., nonzero MCLGs, MCLs, or HBLs; see Section 2.1). First, the acceptable ground water concentration is multiplied by a dilution factor to obtain a target leachate concentration. For example, if the dilution factor is 10 and the acceptable ground water concentration is 0.05 mg/L, the target soil leachate concentration would be 0.5 mg/L. The partition equation is then used to calculate the total soil concentration (i.e., SSL) corresponding to this soil leachate concentration.

The methodology for calculating SSLs for the migration to ground water pathway was developed under the following constraints:

- Because of the large nationwide variability in ground water vulnerability, the methodology should be flexible, allowing adjustments for site-specific conditions if adequate information is available.

- To be appropriate for early-stage application, the methodology needs to be simple, requiring a minimum of site-specific data.

- The methodology should be consistent with current understanding of subsurface processes.

- The process of developing and applying SSLs should generate information that can be used and built upon as a site evaluation progresses.

Flexibility is achieved by using readily obtainable site-specific data in standardized equations; conservative default input parameters are also provided for use when site-specific data are not available. In addition, more complex unsaturated zone fate-and-transport models have been identified that can be used to calculate SSLs when more detailed site-specific information is available or can be obtained (see Part 3). These models can extend the applicability of SSLs to subsurface conditions that are not adequately addressed by the simple equations (e.g., deep water tables; clay layers or other unsaturated zone characteristics that can attenuate contaminants before they reach ground water).

The SSL methodology was designed for use during the early stages of a site evaluation when information about subsurface conditions may be limited. Because of this constraint, the methodology is based on conservative, simplifying assumptions about the release and transport of contaminants in the subsurface (see Highlight 2).

Highlight 2: Simplifying Assumptions for the Migration to Ground Water Pathway

- The source is infinite (i.e., steady-state concentrations will be maintained in ground water over the exposure period of interest).
- Contaminants are uniformly distributed throughout the zone of contamination.
- Soil contamination extends from the surface to the water table (i.e., adsorption sites are filled in the unsaturated zone beneath the area of contamination).
- There is no chemical or biological degradation in the unsaturated zone.
- Equilibrium soil/water partitioning is instantaneous and linear in the contaminated soil.
- The receptor well is at the edge of the source (i.e., there is no dilution from recharge downgradient of the site) and is screened within the plume.
- The aquifer is unconsolidated and unconfined (surficial).
- Aquifer properties are homogeneous and isotropic.
- There is no attenuation (i.e., adsorption or degradation) of contaminants in the aquifer.
- NAPLs are not present at the site.

Although simplified, the SSL methodology described in this section is theoretically and operationally consistent with the more sophisticated investigation and modeling efforts that are conducted to develop soil cleanup goals and cleanup levels for protection of ground water at Superfund sites. SSLs developed using this methodology can be viewed as evolving risk-based levels that can be refined as more site information becomes available. The early use of the methodology at a site will help focus further subsurface investigations on areas of true concern with respect to ground water quality and will provide information on soil characteristics, aquifer characteristics, and chemical properties that can be built upon as a site evaluation progresses.

2.5.1 Development of Soil/Water Partition Equation. The methodology used to estimate contaminant release in soil leachate is based on the Freundlich equation, which was developed to model sorption from liquids to solids. The basic Freundlich equation applied to the soil/water system is:

$$K_d = C_s / C_w^n \qquad \textbf{(11)}$$

where

K_d = Freundlich soil/water partition coefficient (L/kg)
C_s = concentration sorbed on soil (mg/kg)
C_w = solution concentration (mg/L)
n = Freundlich exponent (dimensionless).

Assuming that adsorption is linear with respect to concentration (n=1)* and rearranging to backcalculate a sorbed concentration (C_s):

$$C_s = (K_d)\, C_w \qquad \textbf{(12)}$$

For SSL calculation, C_w is the target soil leachate concentration.

Adjusting Sorbed Soil Concentrations to Total Concentrations. To develop a screening level for comparison with contaminated soil samples, the sorbed concentration derived above (C_s) must be related to the total concentration measured in a soil sample (C_t). In a soil sample, contaminants can be associated with the solid soil materials, the soil water, and the soil air as follows (Feenstra et al., 1991):

$$M_t = M_s + M_w + M_a \qquad \textbf{(13)}$$

where

M_t = total contaminant mass in sample (mg)
M_s = contaminant mass sorbed on soil materials (mg)
M_w = contaminant mass in soil water (mg)
M_a = contaminant mass in soil air (mg).

Furthermore,

$$M_t = C_t\, \rho_b\, V_{sp}\,, \qquad \textbf{(14)}$$

$$M_s = C_s\, \rho_b\, V_{sp}\,, \qquad \textbf{(15)}$$

$$M_w = C_w\, \theta_w\, V_{sp}\,, \qquad \textbf{(16)}$$

and

$$M_a = C_a\, \theta_a\, V_{sp}\,, \qquad \textbf{(17)}$$

where

ρ_b = dry soil bulk density (kg/L)
V_{sp} = sample volume (L)
θ_w = water-filled porosity (L_{water}/L_{soil})
C_a = concentration on soil pore air (mg/L_{soil})
θ_a = air-filled soil porosity (L_{air}/L_{soil}).

For contaminated soils (with concentrations below C_{sat}), C_a may be determined from C_w and the dimensionless Henry's law constant (H') using the following relationship:

$$C_a = C_w\, H' \qquad \textbf{(18)}$$

---

* The linear assumption will tend to overestimate sorption and underestimate desorption for most organics at higher concentrations (i.e., above 10^{-5} M for organics) (Piwoni and Banerjee, 1989).

thus

$$M_a = C_w H' \theta_a V_{sp} \quad \textbf{(19)}$$

Substituting into Equation 13:

$$C_t = \frac{C_s \rho_b + C_w \theta_w + C_w H' \theta_a}{\rho_b} \quad \textbf{(20)}$$

or

$$C_s = C_t - C_w \left(\frac{\theta_w + \theta_a H'}{\rho_b} \right) \quad \textbf{(21)}$$

Substituting into Equation 12 and rearranging:

Soil-Water Partition Equation for Migration to Ground Water Pathway: Inorganic Contaminants

$$C_t = C_w \left(K_d + \frac{\theta_w + \theta_a H'}{\rho_b} \right) \quad \textbf{(22)}$$

Parameter/Definition (units)	Default	Source
C_t/screening level in soil (mg/kg)	–	–
C_w/target soil leachate concentration (mg/L)	(nonzero MCLG, MCL, or HBL) × 20 DAF	Table 1 (nonzero MCLG, MCL); Section 2.5.6 (DAF for 0.5-acre source)
K_d/soil-water partition coefficient (L/kg)	chemical-specific	see Part 5
θ_w/water-filled soil porosity (L_{water}/L_{soil})	0.3 (30%)	U.S. EPA/ORD
θ_a/air-filled soil porosity (L_{air}/L_{soil})	0.13	n - θ_w
n/total soil porosity (L_{pore}/L_{soil})	0.43	1 - ρ_b/ρ_s
ρ_b/dry soil bulk density (kg/L)	1.5	U.S. EPA, 1991b
ρ_s/soil particle density (kg/L)	2.65	U.S. EPA, 1991b
H′/dimensionless Henry's law constant	H × 41, where 41 is a conversion factor	U.S. EPA, 1991b
H/Henry's law constant (atm-m^3/mol)	chemical-specific	see Part 5

Equation 22 is used to calculate SSLs (total soil concentrations, C_t) corresponding to soil leachate concentrations (C_w) equal to the target contaminant soil leachate concentration. The equation assumes that soil water, solids, and gas are conserved during sampling. If soil gas is lost during sampling, θ_a should be assumed to be zero. Likewise, for inorganic contaminants except mercury, there is no significant vapor pressure and H' may be assumed to be zero.

The User's Guide (U.S. EPA, 1996) describes how to develop site-specific estimates of the soil parameters needed to calculate SSLs. Default soil parameter values for the partition equation are the same as those used for the VF equation (see Section 2.4.2) except for average water-filled soil porosity (θ_w). A conservative value (0.15) was used in the VF equation because the model is most sensitive to this parameter. Because migration to ground water SSLs are not particularly sensitive to soil water content (see Section 2.5.7), a value that is more typical of subsurface conditions (0.30) was used. This value is between the mean field capacity (0.20) of Class B soils (Carsel et al., 1988) and the saturated volumetric water content for loam (0.43).

K_d varies by chemical and soil type. Because of different influences on K_d values, derivations of K_d values for organic compounds and metals were treated separately in the SSL methodology.

2.5.2 Organic Compounds—Partition Theory. Past research has demonstrated that, for hydrophobic organic chemicals, soil organic matter is the dominant sorbing component in soil and that K_d is linear with respect to soil organic carbon content (OC) as long as OC is above a critical level (Dragun, 1988). Thus, K_d can be normalized with respect to soil organic carbon to K_{oc}, a chemical-specific partitioning coefficient that is independent of soil type, as follows:

$$K_d = K_{oc}\, f_{oc} \qquad \textbf{(23)}$$

where

K_{oc} = organic carbon partition coefficient (L/kg)
f_{oc} = fraction of organic carbon in soil (mg/mg)

Substituting into Equation 22:

Soil-Water Partition Equation for Migration to Ground Water Pathway: Organic Contaminants

$$C_t = C_w \left((K_{oc}\, f_{oc}) + \frac{\theta_w + \theta_a H'}{\rho_b} \right) \qquad \textbf{(24)}$$

Parameter/Definition (units)	Default	Source
C_t/screening level in soil mg/kg)	–	–
C_w/target leachate concentration (mg/L)	(nonzero MCLG, MCL, or HBL) × 20 DAF	Table 1 (MCL, nonzero MCLG); Section 2.5.6 (DAF for a 0.5-acre source)
K_{oc}/soil organic carbon-water partition coefficient (L/kg)	chemical-specific	see Part 5
f_{oc}/organic carbon content of soil (kg/kg)	0.002 (0.2%)	Carsel et al., 1988
θ_w/water-filled soil porosity (L_{water}/L_{soil})	0.3 (30%)	U.S. EPA/ORD
θ_a/air-filled soil porosity (L_{air}/L_{soil})	0.13	$n - \theta_w$
n/total soil porosity (L_{pore}/L_{soil})	0.43	$1 - \rho_b/\rho_s$
ρ_b/dry soil bulk density (kg/L)	1.5	U.S. EPA, 1991b
ρ_s/soil particle density (kg/L)	2.65	U.S. EPA, 1991b
H′/dimensionless Henry's law constant	H × 41, where 41 is a conversion factor	U.S. EPA, 1991b
H/Henry's law constant (atm-m^3/mol)	chemical-specific	see Part 5

Part 5 of this document provides K_{oc} values for organic chemicals and describes their development.

The critical organic carbon content, f_{oc}^* , represents OC below which sorption to mineral surfaces begins to be significant. This level is likely to be variable and to depend on both the properties of the soil and of the chemical sorbate (Curtis et al., 1986). Attempts to quantitatively relate f_{oc}^* to such properties have been made (see McCarty et al., 1981), but at this time there is no reliable method for estimating f_{oc}^* for specific chemicals and soils. Nevertheless, research has demonstrated that, for volatile halogenated hydrocarbons, f_{oc}^* is about 0.001, or 0.1 percent OC, for many low-carbon soils and aquifer materials (Piwoni and Banerjee, 1989; Schwarzenbach and Westall, 1981).

If soil OC is below this critical level, Equation 24 should be used with caution. This is especially true if soils contain significant quantities of fine-grained minerals with high sorptive properties (e.g., clays). If sorption to minerals is significant, Equation 24 will underpredict sorption and overpredict contaminant concentrations in soil pore water. However, this f_{oc}^* level is by no means the case for all soils; Abdul et al. (1987) found that, for certain organic compounds and aquifer materials, sorption was linear and could be adequately modeled down to $f_{oc} = 0.0003$ by considering K_{oc} alone.

For soils with significant inorganic and organic sorption (i.e., soils with $f_{oc} < 0.001$), the following equation has been developed (McCarty et al., 1981; Karickhoff, 1984):

$$K_d = (K_{oc}\, f_{oc}) + (K_{io}\, f_{io}) \qquad \textbf{(25)}$$

where

K_{io} = soil inorganic partition coefficient
f_{io} = fraction of inorganic material
$f_{io} + f_{oc}$ = 1.

Although this equation is considered conceptually valid, K_{io} values are not available for the subject chemicals. Attempts to estimate K_{io} values by relating sorption on low-carbon materials to properties such as clay-size fraction, clay mineralogy, surface area, or iron-oxide content have not revealed any consistent correlations, and semiquantitative methods are probably years away (Piwoni and Banerjee, 1989). However, Piwoni and Banerjee developed the following empirical correlation (by linear regression, $r^2 = 0.85$) that can be used to estimate K_d values for hydrophobic organic chemicals from K_{ow} for low-carbon soils:

$$\log K_d = 1.01 \log K_{ow} - 0.36 \quad \textbf{(26)}$$

where

K_{ow} = octanol/water partition coefficient.

The authors indicate that this equation should provide a K_d estimate that is within a factor of 2 or 3 of the actual value for nonpolar sorbates with $\log K_{ow} < 3.7$. This K_d estimate can be used in Equation 22 for soils with f_{oc} values less than 0.001. If sorption to inorganics is not considered for low-carbon soils where it is significant, Equation 24 will underpredict sorption and overpredict contaminant concentrations in soil pore water (i.e., it will provide a conservative estimate).

The use of fixed K_{oc} values in Equation 24 is valid only for hydrophobic, nonionizing organic chemicals. Several of the organic chemicals of concern ionize in the soil environment, existing in both neutral and ionized forms within the normal soil pH range. The relative amounts of the ionized and neutral species are a function of pH. Because the sorptive properties of these two forms differ, it is important to consider the relative amounts of the neutral and ionized species when determining K_{oc} values at a particular pH. Lee et al. (1990) developed a theoretically based algorithm, developed from thermodynamic equilibrium equations, and demonstrated that the equation adequately predicts laboratory-measured K_{oc} values for pentachlorophenol (PCP) and other ionizing organic acids as a function of pH.

The equation assumes that sorbent organic carbon determines the extent of sorption for both the ionized and neutral species and predicts the overall sorption of a weak organic acid ($K_{oc,p}$) as follows:

$$K_{oc,p} = K_{oc,n}\, \Phi_n + K_{oc,i}\, (1 - \Phi_n) \quad \textbf{(27)}$$

where

$K_{oc,n}$, $K_{oc,i}$ = sorption coefficients for the neutral and ionized species (L/kg)
Φ_n = $(1 + 10^{pH - pKa})^{-1}$
pKa = acid dissociation constant.

This equation was used to develop K_{oc} values for ionizing organic acids as a function of pH, as described in Part 5. The User's Guide (U.S. EPA, 1996) provides guidance on conducting site-specific measurements of soil pH for estimating K_{oc} values for ionizing organic compounds. Because a national distribution of soil pH values is not available, a median U.S. ground water pH (6.8) from the STORET database (U.S. EPA, 1992a) is used as a default soil pH value that is representative of subsurface pH conditions.

2.5.3 Inorganics (Metals)—Partition Theory. Equation 22 is used to estimate SSLs for metals for the migration to ground water pathway. The derivation of K_d values is much more complicated for metals than for organic compounds. Unlike organic compounds, for which K_d values are largely controlled by a single parameter (soil organic carbon), K_d values for metals are significantly affected by a variety of soil conditions. The most significant parameters are pH, oxidation-reduction conditions, iron oxide content, soil organic matter content, cation exchange capacity, and major ion chemistry. The number of significant influencing parameters, their variability in the field, and differences in experimental methods result in a wide range of K_d values for individual metals reported in the literature (over 5 orders of magnitude). Thus, it is much more difficult to derive generic K_d values for metals than for organics.

The K_d values used to generate SSLs for Ag, Ba, Be, Cd, Cr^{+3}, Cu, Hg, Ni, and Zn were developed using an equilibrium geochemical speciation model (MINTEQ2). The values for As, Cr^{6+}, Se, and Th were taken from empirical, pH-dependent adsorption relationships developed by EPA/ORD. Metal K_d values for SSL application are presented in Part 5, along with a description of their development and limitations. As with the ionizing organics, K_d values are selected as a function of site-specific soil pH, and metal K_d values corresponding to a pH of 6.8 are used as defaults where site-specific pH measurements are not available.

2.5.4 Assumptions for Soil/Water Partition Theory. The following assumptions are implicit in the SSL partitioning methodology. *These assumptions and their implications for SSL accuracy should be read and understood before using this methodology to calculate SSLs.*

1. **There is no contaminant loss due to volatilization or degradation.** The source is considered to be infinite; i.e., these processes do not reduce soil leachate concentrations over time. This is a **conservative** assumption, especially for smaller sites.

2. **Adsorption is linear with concentration.** The methodology assumes that adsorption is independent of concentration (i.e., the Freundlich exponent = 1). This has been reported to be true for various halogenated hydrocarbons, polynuclear aromatic hydrocarbons, benzene, and chlorinated benzenes. In addition, this assumption is valid at low concentrations (e.g., at levels close to the MCL) for most chemicals. As concentrations increase, however, the adsorption isotherm can depart from the linear.

   Studies on trichloroethane (TCE) and chlorobenzene indicate that departure from linear is in the **nonconservative** direction, with adsorbed concentrations being lower than predicted by a linear isotherm. However, adequate information is not available to establish nonlinear adsorption isotherms for the chemicals of interest. Furthermore, since the SSLs are derived at relatively low target soil leachate concentrations, departures from the linear at high concentrations do not significantly influence the accuracy of the results.

3. **The system is at equilibrium with respect to adsorption.** This ignores adsorption/desorption kinetics by assuming that the soil and pore water concentrations are at equilibrium levels. In other words, the pore-water residence time is assumed to be longer than the time it takes for the system to reach equilibrium conditions.

   This assumption is **conservative**. If equilibrium conditions are not met, the concentration in the pore water will be less than that predicted by the methodology. The kinetics of adsorption are not adequately understood for a sufficient number of chemicals and site conditions to consider equilibrium kinetics in the methodology.

4. **Adsorption is reversible.** The methodology assumes that desorption processes operate in the same way as adsorption processes, since most of the K_{oc} values are measured by adsorption experiments rather than by desorption experiments. In actuality, desorption is slower to some degree than adsorption and, in some cases, organics can be irreversibly bound to the soil matrix. In general, the significance of this effect increases with K_{ow}.

   This assumption is **conservative**. Slower desorption rates and irreversible sorption will result in lower pore-water concentrations than that predicted by the methodology. Again, the level of knowledge on desorption processes is not sufficient to consider desorption kinetics and degree of reversibility for all of the subject chemicals.

2.5.5 Dilution/Attenuation Factor Development. As contaminants in soil leachate move through soil and ground water, they are subjected to physical, chemical, and biological processes that tend to reduce the eventual contaminant concentration at the receptor point (i.e., drinking water well). These processes include adsorption onto soil and aquifer media, chemical transformation (e.g., hydrolysis, precipitation), biological degradation, and dilution due to mixing of the leachate with ambient ground water. The reduction in concentration can be expressed succinctly by a DAF, which is defined as the ratio of contaminant concentration in soil leachate to the concentration in ground water at the receptor point. When calculating SSLs, a DAF is used to backcalculate the target soil leachate concentration from an acceptable ground water concentration (e.g., MCLG). For example, if the acceptable ground water concentration is 0.05 mg/L and the DAF is 10, the target leachate concentration would be 0.5 mg/L.

The SSL methodology addresses only one of these dilution-attenuation processes: contaminant dilution in ground water. A simple equation derived from a geohydrologic water-balance relationship has been developed for the methodology, as described in the following subsection. The ratio factor calculated by this equation is referred to as a dilution factor rather than a DAF because it does not consider processes that attenuate contaminants in the subsurface (i.e., adsorption and degradation processes). This simplifying assumption was necessary for several reasons.

First, the infinite source assumption results in all subsurface adsorption sites being eventually filled and no longer available to attenuate contaminants. Second, soil contamination extends to the water table, eliminating attenuation processes in the unsaturated zone. Additionally, the receptor well is assumed to be at the edge of the source, minimizing the opportunity for attenuation in the aquifer. Finally, chemical-specific biological and chemical degradation rates are not known for many of the SSL chemicals; where they are available they are usually based on laboratory studies under simplified, controlled conditions. Because natural subsurface conditions such as pH, redox conditions, soil mineralogy, and available nutrients have been shown to markedly affect natural chemical and biological degradation rates, and because the national variability in these properties is significant and has not been characterized, EPA does not believe that it is possible at this time to incorporate these degradation processes into the simple site-specific methodology for national application.

If adsorption or degradation processes are expected to significantly attenuate contaminant concentrations at a site (e.g., for sites with deep water tables or soil conditions that will attenuate contaminants), the site manager is encouraged to consider the option of using more sophisticated fate and transport models. Many of these models can consider adsorption and degradation processes and can model transient conditions necessary to consider a finite source size. Part 3 of this document presents information on the selection and use of such models for SSL application.

The dilution factor model assumes that the aquifer is unconfined and unconsolidated and has homogeneous and isotropic properties. Unconfined (surficial) aquifers are common across the country, are vulnerable to contamination, and can be used as drinking water sources by local residents. Dilution model results may not be applicable to fractured rock or karst aquifer types. The site manager should consider use of more appropriate models to calculate a dilution factor (or DAF) for such settings.

In addition, the simple dilution model does not consider facilitated transport. This ignores processes such as colloidal transport, transport via solvents other than water (e.g., NAPLs), and transport via dissolved organic matter (DOM). These processes have greater impact as K_{ow} (and hence, K_{oc}) increases. However, the transport via solvents other than water is operative only if certain site-specific conditions are present. Transport by DOM and colloids has been shown to be potentially significant under certain conditions in laboratory and field studies. Although much research is in progress on these processes, the current state of knowledge is not adequate to allow for their consideration in SSL calculations.

If there is the potential for the presence of NAPLs in soils at the site or site area in question, SSLs should not be used for this area (i.e., further investigation is required). The C_{sat} equation (Equation 9) presented in Section 2.4.4 can be used to estimate the contaminant concentration at which the presence of pure-phase NAPLs may be suspected for contaminants that are liquid at soil temperature. If NAPLs are suspected in site soils, refer to U.S. EPA (1992c) for additional guidance on how to estimate the potential for DNAPL occurrence in the subsurface.

Dilution Model Development. EPA evaluated four simple water balance models to adjust SSLs for dilution in the aquifer. Although written in different terms, all four options reviewed can be expressed as the same simple water balance equation to calculate a dilution factor, as follows:

Option 1 (ASTM):

$$\text{dilution factor} = (1 + U_{gw}\, d/IL) \qquad \textbf{(28)}$$

where

U_{gw}	=	Darcy ground water velocity (m/yr)
d	=	mixing zone depth (m)
I	=	infiltration rate (m/yr)
L	=	length of source parallel to flow (m).

For Darcy velocity:

$$U_{gw} = Ki \qquad \textbf{(29)}$$

where

K	=	aquifer hydraulic conductivity (m/yr)
i	=	hydraulic gradient (m/m).

Thus

$$\text{dilution factor} = 1 + (Kid/IL) \qquad \textbf{(30)}$$

Option 2 (EPA Ground Water Forum):

$$\text{dilution factor} = (Q_p + Q_A)/Q_p \quad \textbf{(31)}$$

where

Q_p = percolation flow rate (m^3/yr)
Q_A = aquifer flow rate (m^3/yr)

For percolation flow rate:

$$Q_p = IA \quad \textbf{(32)}$$

where

A = facility area (m^2) = WL.

For aquifer flow rate:

$$Q_A = WdKi \quad \textbf{(33)}$$

where

W = width of source perpendicular to flow (m)
d = mixing zone depth (m).

Thus

$$\text{dilution factor} = (IA + WdKi)/IWL$$

$$= 1 + (Kid/IL) \quad \textbf{(34)}$$

Option 3 (Summers Model):

$$C_w = (Q_p\, C_p)/(Q_p + Q_A) \quad \textbf{(35)}$$

where

C_w = ground water contaminant concentration (mg/L)
C_p = soil leachate concentration (mg/L)

given that

$$C_w = C_p/\text{dilution factor}$$

$$1/\text{dilution factor} = Q_p/(Q_p + Q_A)$$

or

$$\text{dilution factor} = (Q_p + Q_A)/Q_p \text{ (see } \textbf{Option 2}\text{)}$$

Option 4 (EPA ORD/RSKERL):

$$\text{dilution factor} = (Q_p + Q_A)/Q_p = RX/RL \quad \textbf{(36)}$$

where

R = recharge rate (m/yr) = infiltration rate (I, m/yr)
X = distance from receptor well to ground water divide (m)

(Note that the intermediate equation is the same as **Option 2**.)

This option is a longer-term option that is not considered further in this analysis because valid X values are not currently available either nationally or for specific sites. EPA is considering developing regional estimates for these parameters.

Dilution Model Input Parameters. As shown, all three options for calculating contaminant dilution in ground water can be expressed as the same equation:

Ground Water Dilution Factor

$$\text{dilution factor} = 1 + (Kid/IL) \quad \textbf{(37)}$$

Parameter/Definition (units)
K/aquifer hydraulic conductivity (m/yr)
i/hydraulic gradient (m/m)
d/mixing zone depth (m)
I/infiltration rate (m/yr)
L/source length parallel to ground water flow (m)

Mixing Zone Depth (d). Because of its dependence on the other variables, mixing zone depth is estimated with the method used for the MULTIMED model (Sharp-Hansen et al., 1990). The MULTIMED estimation method was selected to be consistent with that used by EPA's Office of Solid Waste for the EPA Composite Model for Landfills (EPACML). The equation for estimating mixing zone depth (d) is as follows:

$$d = (2\alpha_v L)^{0.5} + d_a \{1 - \exp[(-LI)/(V_s n_e d_a)]\} \quad \textbf{(38)}$$

where

α_v = vertical dispersivity (m/m)
V_s = horizontal seepage velocity (m/yr)
n_e = effective aquifer porosity ($L_{pore}/L_{aquifer}$)
d_a = aquifer depth (m).

The first term, $(2\alpha_v L)^{0.5}$, estimates the depth of mixing due to vertical dispersivity ($d_{\alpha v}$) along the length of ground water travel. Defining the point of compliance with ground water standards at the downgradient edge of the source, this travel distance becomes the length of the source parallel to flow L. Vertical dispersivity can be estimated by the following relationship (Gelhar and Axness, 1981):

$$\alpha_v = 0.056\ \alpha_L \quad \textbf{(39)}$$

where

α_L = longitudinal dispersivity = $0.1\ x_r$
x_r = horizontal distance to receptor (m).

Because the potential receptor is assumed to have a well at the edge of the facility, $x_r = L$ and

$$\alpha_v = 0.0056\ L \quad \textbf{(40)}$$

Thus

$$d_{\alpha v} = (0.0112\ L^2)^{0.5} \quad \textbf{(41)}$$

The second term, $d_a\ \{1 - \exp[(-LI) / (V_s n_e d_a)]\}$, estimates the depth of mixing due to the downward velocity of infiltrating water, d_{Iv}. In this equation, the following substitution may be made:

$$V_s = Ki/n_e \quad \textbf{(42)}$$

so

$$d_{Iv} = d_a\ \{1 - \exp[(-LI)/(Kid_a)]\} \quad \textbf{(43)}$$

Thus, mixing zone depth is calculated as follows:

$$d = d_{\alpha v} + d_{Iv} \quad \textbf{(44)}$$

Estimation of Mixing Zone Depth

$$d = (0.0112\ L^2)^{0.5} + d_a\ \{1 - \exp[(-LI)/(Kid_a)]\} \quad \textbf{(45)}$$

Parameter/Definition (units)
d/mixing zone depth (m)
L/source length parallel to ground water flow (m)
I/infiltration rate (m/yr)
K/aquifer hydraulic conductivity (m/yr)
d_a/aquifer thickness (m)

Incorporation of this equation for mixing zone depth into the SSL dilution equation results in five parameters that must be estimated to calculate dilution: source length (L), infiltration rate (I), aquifer hydraulic conductivity (K), aquifer hydraulic gradient (i), and aquifer thickness (d_a). Aquifer thickness also serves as a limit for mixing zone depth. The User's Guide (U.S. EPA, 1996) describes how to develop site-specific estimates for these parameters. Parameter definitions and defaults used to develop generic SSLs are as follows:

- **Source Length (L)** is the length of the source (i.e., area of contaminated soil) parallel to ground water flow and affects the flux of contaminant released in soil leachate (IL) as well as the depth of mixing in the aquifer. The default option for this parameter assumes a square, 0.5-acre contaminant source. This default was changed from 30 acres in response to comments to be more representative of actual contaminated soil sources (see Section 1.3.4). Increasing source area (and thereby area) may result in a lower dilution factor. Appendix A includes an analysis of the conservatism associated with the 0.5-acre source size.

- **Infiltration Rate (I)**. Infiltration rate times the source area determines the amount of contaminant (in soil leachate) that enters the aquifer over time. Thus, increasing infiltration decreases the dilution factor. Two options can be used to generate infiltration rate estimates for SSL calculation. The first assumes that infiltration rate is equivalent to recharge. This is generally true for uncontrolled contaminated soil sites but would be conservative for capped sites (infiltration < recharge) and nonconservative for sites with an additional source of infiltration, such as surface impoundments (infiltration > recharge). Recharge estimates for this option can be obtained from Aller et al. (1987) by hydrogeologic setting, as described in Section 2.5.6.

  The second option is to use the HELP model to estimate infiltration, as was done for OSW's EPACML and EPA's Composite Model for Leachate Migration with Transformation Products (EPACMTP) modeling efforts. The Soil Screening Guidance (U.S. EPA, 1995c) provides information on obtaining and using the HELP model to estimate site-specific infiltration rates.

- **Aquifer Parameters**. Aquifer parameters needed for the dilution factor model include hydraulic conductivity (K, m/yr), hydraulic gradient (i, m/m), and aquifer thickness (d_a, m). The User's Guide (U.S. EPA, 1996) describes how to develop aquifer parameter estimates for calculating a site-specific dilution factor.

2.5.6 Default Dilution-Attenuation Factor. EPA has selected a default DAF of 20 to account for contaminant dilution and attenuation during transport through the saturated zone to a compliance point (i.e., receptor well). At most sites, this adjustment will more accurately reflect a contaminant's threat to ground water resources than assuming a DAF of 1 (i.e., no dilution or attenuation). EPA selected a DAF of 20 using a "weight of evidence" approach. This approach

considers results from OSW's EPACMTP model as well as results from applying the SSL dilution model described in Section 2.5.5 to 300 ground water sites across the country.

The default DAF of 20 represents an adjustment from the DAF of 10 presented in the December 1994 draft Soil Screening Guidance (U.S. EPA, 1994h) to reflect a change in default source size from 30 acres to 0.05 acre. A DAF of 20 is protective for sources up to 0.5 acre in size. Analyses presented in Appendix A indicate that it can be protective of larger sources as well. However, this hypothesis should be examined on a case-by-case basis before applying a DAF of 20 to sources larger than 0.5 acre.

EPACMTP Modeling Effort. One model considered during selection of the default DAF is described in *Background Document for EPA's Composite Model for Leachate Migration with Transformation Products* (U.S. EPA, 1993a). EPACMTP has a three-dimensional module to simulate ground water flow that can account for mounding under waste sites. The model also has a three-dimensional transport module and both linear and nonlinear adsorption in the unsaturated and saturated zones and can simulate chain decay, thus allowing the simulation of the formation and the fate and transport of daughter (transformation) products of degrading chemicals. The model can also be used to simulate a finite source scenario.

EPACMTP is comprised of three main interconnected modules:

- An unsaturated zone flow and contaminant fate and transport module
- A saturated zone ground water flow and contaminant fate and transport module
- A Monte Carlo driver module, which generates model parameters from nationwide probability distributions.

The unsaturated and saturated zone modules simulate the migration of contaminants from initial release from the soil to a downgradient receptor well. More information on the EPACMTP model is provided in Appendix E.

EPA has extensively verified both the unsaturated and saturated zone modules of the EPACMTP against other available analytical and numerical models to ensure accuracy and efficiency. Both the unsaturated zone and the saturated zone modules of the EPACMTP have been reviewed by the EPA Science Advisory Board and found to be suitable for generic applications such as the derivation of nationwide DAFs.

EPACMTP Model Inputs (SSL Application). For nationwide Monte Carlo model applications, the input to the model is in the form of probability distributions of each of the model input parameters. The output from the model consists of the probability distribution of DAF values, representing the likelihood that the DAF will not be less than a certain value. For instance, a 90th percentile DAF of 10 means that the DAF will be 10 or higher in at least 90 percent of the cases.

For each model input parameter, a probability distribution is provided, describing the nationwide likelihood that the parameter has a certain value. The parameters are divided into four main groups:

- Source-specific parameters, e.g., area of the waste unit, infiltration rate
- Chemical-specific parameters, e.g., hydrolysis constants, organic carbon partition coefficient

- Unsaturated zone-specific parameters, e.g., depth to water table, soil hydraulic conductivity

- Saturated zone-specific parameters, e.g., saturated zone thickness, ambient ground water flow rate, location of nearest receptor well.

Probability distributions for each parameter used in the model have been derived from nationwide surveys of waste sites, such as EPA's landfill survey (53 FR 28692). During the Monte Carlo simulation, values for each model parameter are randomly drawn from their respective probability distributions. In the calculation of the DAFs for generic SSLs, site data from over 1,300 municipal landfill sites in OSW's Subtitle D Landfill Survey were used to define parameter ranges and distributions. Each combination of randomly drawn parameter values represents one out of a practically infinite universe of possible waste sites. The fate and transport modules are executed for the specific set of model parameters, yielding a corresponding DAF value. This procedure is repeated, typically on the order of several thousand times, to ensure that the entire universe of possible parameter combinations (waste sites) is adequately sampled. In the derivation of DAFs for generic SSLs, the model simulations were repeated 15,000 times for each scenario investigated. At the conclusion of the analysis, a cumulative frequency distribution of DAF values was constructed and plotted.

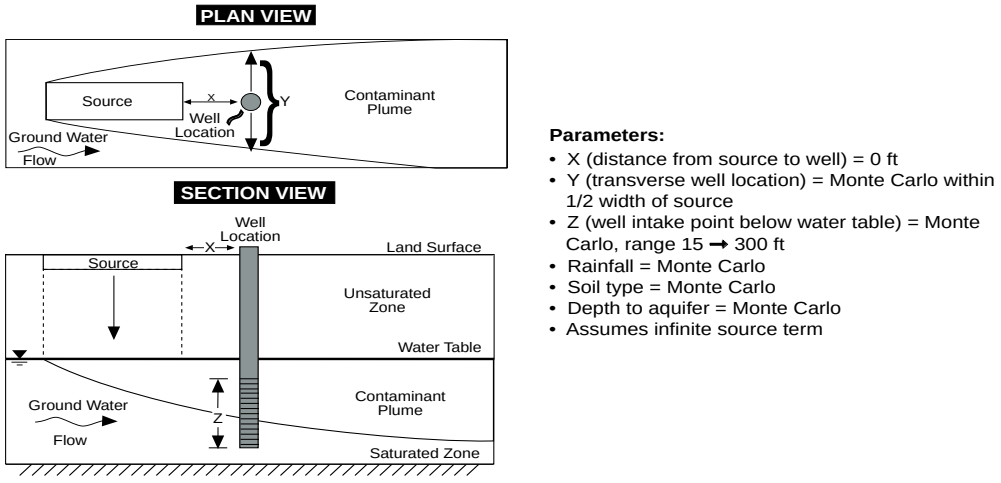


Figure 3. Migration to ground water pathway—EPACMTP modeling effort.

EPA assumed an infinite waste source of fixed area for the generic SSL modeling scenario. EPA chose this relatively conservative assumption because of limited information on the nationwide distribution of the volumes of contaminated soil sources. For the SSL modeling scenario, EPA performed a number of sensitivity analyses consisting of fixing one parameter at a time to determine the parameters that have the greatest impact on DAFs. The results of the sensitivity analyses indicate that the climate (net precipitation), soil types, and size of the contaminated area have the greatest effect on the DAFs. The EPA feels that the size of the contaminated area lends itself most readily to practical application to SSLs.

To calculate DAFs for the SSL scenario, the receptor point was taken to be a domestic drinking water well located on the downgradient edge of the contaminated area. The location of the intake point (receptor well screen) was assumed to vary between 15 and 300 feet below the water table (these

values are based on empirical data reflecting a national sample distribution of depth of residential drinking water wells). The location of the intake point allows for mixing within the aquifer. EPA believes that this is a reasonable assumption because there will always be some dilution attributed to the pumping of water for residential use from an aquifer. The horizontal placement of the well was assumed to vary uniformly along the center of the downgradient edge of the source within a width of one-half of the width of the source. Degradation and retardation of contaminants were not considered in this analysis. Figure 3 is a schematic showing aspects of the subsurface SSL conceptual model used in the EPACMTP modeling effort. Appendix E is the background document prepared by EPA/OSW for this modeling effort.

EPACMTP Model Results. The results of the EPACMTP analyses indicate a DAF of about 170 for a 0.5-acre source at the 90th percentile protection level (Table 5). If a 95th percentile protection level is used, a DAF of 7 is protective for a 0.5-acre source.

Table 5. Variation of DAF with Size of Source Area for SSL EPACMTP Modeling Effort

	DAF		
Area (acres)	85th	90th	95th
0.02	1.42E+07	2.09E+05	946
0.04	9.19E+05	2.83E+04	211
0.11	5.54E+04	2.74E+03	44
0.23	1.16E+04	644	15
0.50	2.50E+03	170	7.0
0.69	1.43E+03	120	4.5
1.1	668	60	3.1
1.6	417	38	2.5
1.8	350	33	2.3
3.4	159	18	1.7
4.6	115	13	1.6
11.5	41	5.5	1.2
23	21	3.5	1.2
30	16	3.0	1.1
46	12	2.4	1.1
69	8.7	2.0	1.1

Dilution Factor Modeling Effort. To gain further information on the national range and distribution of DAF values, EPA also applied the simple SSL water balance dilution model to ground water sites included in two large surveys of hydrogeologic site investigations. These were American Petroleum Institute's (API's) hydrogeologic database (HGDB) and EPA's database of conditions at Superfund sites contaminated with DNAPL.

The HGDB contains the results of a survey sponsored by API and the National Water Well Association (NWWA) to determine the national variability in simple hydrogeologic parameters (Newell et al., 1989). The survey was conducted to validate EPA's use of the EPACML model as a screening tool for the land disposal of hazardous wastes. The survey involved more than 400 ground

water professionals who submitted data on aquifer characteristics from field investigations at actual waste sites and other ground water projects. The information was compiled in HGDB, which is available from API and is included in OASIS, an EPA-sponsored ground water decision support system. Newell et al. (1990) also present these data as "national average" conditions and by hydrogeologic settings based on those defined by Aller et al. (1987) for the DRASTIC modeling effort. Aller et al. (1987) defined these settings within the overall framework defined by Heath's ground water regions (Heath, 1984). The HGDB estimates of hydraulic conductivity and hydraulic gradient show reasonable agreement with those in Aller et al. (1987), which serves as another source of estimates for these parameters.

The SSL dilution factor model (including the associated mixing zone depth model) requires estimates for five parameters:

d_a	=	aquifer thickness (m)
L	=	length of source parallel to flow (m)
I	=	infiltration rate (m/yr)
K	=	aquifer hydraulic conductivity (m/yr)
i	=	hydraulic gradient (m/m).

Dilution factors were calculated by individual HGDB or DNAPL site to retain as much site-correlated parameter information as possible. The HGDB contains estimates of aquifer thickness (d_a), aquifer hydraulic conductivity (K), and aquifer hydraulic gradient (i) for 272 ground water sites. The aquifer hydraulic conductivity estimates were examined for these sites, and sites with reported values less than 5×10^{-5} cm/s were culled from the database because formations with lower hydraulic conductivity values are not likely to be used as drinking water sources. In addition, sites in fractured rock or solution limestone settings were removed because the dilution factor model does not adequately address such aquifers. This resulted in 208 sites remaining in the HGDB. The DNAPL site database contains 92 site estimates of seepage velocity ($\bar{V}$), which can be related to hydraulic conductivity and hydraulic gradient by the following relationship:

$$\bar{V} = Ki / n_e \qquad \textbf{(46)}$$

where

n_e = effective porosity.

Effective porosity (n_e) was assumed to be 0.35, which is representative of sand and gravel aquifers (the most prevalent aquifer type in the HGDB). Thus, for the DNAPL sites, $0.35 \times \bar{V}$ was substituted for Ki in the dilution factor equation.

Estimates of the other parameters required for the modeling effort are described below. Site-specific values were used where available. Because the modeling effort uses a number of site-specific modeling results to determine a nationwide distribution of dilution factors, typical values were used to estimate parameters for sites without site-specific estimates.

Source Length (L). The contaminant source (i.e., area of soil contamination) was assumed to be square. This assumption may be conservative for sites with their longer dimensions perpendicular to ground water flow or nonconservative for sites with their longer dimensions parallel to ground water flow. The source length was calculated as the square root of the source area for the source sizes in question. To cover a range of contaminated soil source area sizes, five source sizes were modeled: 0.5 acre, 10 acres, 30 acres, 60 acres, and 100 acres.

Infiltration Rate (I). Infiltration rate estimates were not available in either database. Recharge estimates for individual hydrogeologic settings from Aller et al. (1987) were used as infiltration estimates (i.e., it was assumed that infiltration = recharge). Because of differences in database contents, it was necessary to use different approaches to obtaining recharge/infiltration estimates for the HGDB and DNAPL sites.

The HGDB places each of its sites in one of the hydrogeologic settings defined by Aller et al. (1987). A recharge estimate for each HGDB site was simply extracted for the appropriate setting from Aller et al. The median of the recharge range presented was used (Table 6).

The DNAPL database does not contain sufficient hydrogeologic information to place each site into the Aller et al. settings. Instead, each of the 92 DNAPL sites was placed in one of Heath's ground water regions. The sites were found to lie within five hydrogeologic regions: nonglaciated central, glaciated central, piedmont/blue ridge, northeast and superior uplands, and Atlantic/Gulf coastal plain. Recharge was estimated for each region by averaging the median recharge value from all hydrogeologic settings except for those with steep slopes. The appropriate Heath region recharge estimate was then used for each DNAPL site in the dilution factor calculations.

Aquifer Parameters. All aquifer parameters needed for the SSL dilution model are included in the HGDB. Because hydraulic conductivity and gradient are included in the seepage velocity estimates in the DNAPL site database, only aquifer thickness was unknown for these sites. Aquifer thickness for all DNAPL sites was set at 9.1 m, which is the median value for the "national average" condition in the HGDB (Newell et al., 1990).

Dilution Modeling Results. Table 7 presents summary statistics for the 92 DNAPL sites, the 208 HGDB sites, and all 300 sites. One can see that the HGDB sites generally have lower dilution factors than the DNAPL sites, although the absolute range in values is greater in the HGDB. However, the available information for these sites is insufficient to fully explain the differences in these data sets. The wide range of dilution factors for these sites reflects the nationwide variability in hydrogeologic conditions affecting this parameter. The large difference between the average and geometric mean statistics indicates a distribution skewed toward the lower dilution factor values. The geometric mean represents a better estimate of the central tendency of such skewed distributions. Appendix F presents the dilution modeling inputs and results for the HGDB and DNAPL sites, tabulated by individual site.

Selection of the Default DAF. The default DAF was selected considering the evidence of the national DAF and dilution factor estimates described above. A DAF of 10 was selected in the December 1994 draft Soil Screening Guidance to be protective of a 30-acre source size. The EPACMTP model results showed a DAF of 3 for 30 acres at the 90th percentile. The SSL dilution model results have geometric mean dilution factors for a 30-acre source of 10 and 7 for DNAPL sites and HGDB sites, respectively. In a weight of evidence approach, more weight was given to the results of the DNAPL sites because they are representative of the kind of sites to which SSLs are likely to be applied. Considering the conservative assumptions in the SSL dilution factor model (see Section 2.5.5), and the conservatism inherent in the soil partition methodology (see Section 2.5.4), EPA believes (1) that these results support the use of a DAF of 10 for a 30-acre source, and (2) that this DAF will protect human health from exposure through this pathway at most Superfund sites across the Nation

Table 6. Recharge Estimates for DNAPL Site Hydrogeologic Regions

Hydrogeologic setting	Recharge (m/yr) Min.	Max.	Avg.
Nonglaciated Central (Region 6)			
Alluvial Mountain Valleys	0.10	0.18	0.14
Alter. SS/LS/Sh., Thin Soil	0.10	0.18	0.14
Alter. SS/LS/Sh., Deep Regolith	0.10	0.18	0.14
Solution Limestone*	0.25	0.38	0.32
Alluvium w/ Overbank Deposits	0.18	0.25	0.22
Alluvium w/o Overbank Deposits	0.18	0.25	0.22
Braided River Deposits	0.10	0.18	0.14
Triassic Basins	0.10	0.18	0.14
Swamp/Marsh	0.10	0.18	0.14
Met./Ig. Domes & Fault Blocks	0.00	0.05	0.03
Unconsol./Semiconsol. Aquifers	0.00	0.05	0.03
	Overall Average:		*0.15*
Glaciated Central (Region 7)			
Glacial Till Over Bedded Rock	0.10	0.18	0.14
Glacial Till Over Outwash	0.10	0.18	0.14
Glacial Till Over Sol. Limestone	0.10	0.18	0.14
Glacial Till Over Sandstone	0.10	0.18	0.14
Glacial Till Over Shale	0.10	0.18	0.14
Outwash	0.18	0.25	0.22
Outwash Over Bedded Rock*	0.25	0.38	0.32
Outwash Over Solution Limestone*	0.25	0.38	0.32
Moraine	0.18	0.25	0.22
Buried Valley	0.18	0.25	0.22
Alluvium w/ Overbank Deposits	0.10	0.18	0.14
Alluvium w/o Overbank Deposits*	0.25	0.38	0.32
Glacial Lake Deposits	0.10	0.18	0.14
Thin Till Over Bedded Rock	0.18	0.25	0.22
Beaches, B. Ridges, Dunes*	0.25	0.38	0.32
Swamp/Marsh	0.10	0.18	0.14
	Overall Average:		*0.20*
Piedmont/Blue Ridge (Region 8)			
Alluvial Mountain Valleys	0.18	0.25	0.22
Regolith	0.10	0.18	0.14
River Alluvium	0.18	0.25	0.22
Mountain Crests	0.00	0.05	0.03
Swamp/Marsh	0.10	0.18	0.14
	Overall Average:		*0.15*
Northeast & Superior Uplands (Region 9)			
Alluvial Mountain Valleys	0.18	0.25	0.22
Till Over Crystalline Bedrock	0.18	0.25	0.22
Glacial Till Over Outwash	0.18	0.25	0.22
Outwash*	0.25	0.38	0.32
Moraine	0.18	0.25	0.22
Alluvium w/ Overbank Deposits	0.18	0.25	0.22
Alluvium w/o Overbank Deposits*	0.25	0.38	0.32
Swamp/Marsh	0.10	0.18	0.14
Bedrock Uplands	0.10	0.18	0.14
Glacial Lake/Marine Deposits	0.10	0.18	0.14
Beaches, B. Ridges, Dunes*	0.25	0.38	0.32
	Overall Average:		*0.22*
Atlantic/Gulf Coastal Plain (Region 10)			
Regional Aquifers	0.00	0.05	0.03
Un./Semiconsol. Surficial Aquifer*	0.25	0.38	0.32
Alluvium w/ Overbank Deposits	0.18	0.25	0.22
Alluvium w/o Overbank Deposits*	0.25	0.38	0.32
Swamp*	0.25	0.38	0.32
	Overall Average:		*0.24*

Source: Aller et al. (1987); hydrogeologic regions from Heath (1984).

** 0.25 m to 0.38 m (9.8 in to 15 in) used as recharge range for 25+ m setting values from Aller et al. (1987).*

Table 7. SSL Dilution Factor Model Results: DNAPL and HGDB Sites

	Source area (acres)				
	0.5	10	30	100	600
DNAPL Sites (92)					
Geomean	34	15	10	6	4
Average	321	138	80	44	19
10th percentile	3	2	1	1	1
25th percentile	8	4	3	2	1
Median	30	13	8	5	3
75th percentile	140	60	35	20	9
90th percentile	336	144	84	46	20
HGDB sites (208)					
Geomean	16	10	7	5	3
Average	958	829	561	371	159
10th percentile	2	1	1	1	1
25th percentile	3	2	1	1	1
Median	10	6	5	3	2
75th percentile	56	30	19	12	5
90th percentile	240	134	90	51	21
All 300 sites					
Geomean	20	11	8	6	3
Average	763	617	414	271	116
10th percentile	2	1	1	1	1
25th percentile	4	2	2	1	1
Median	15	8	5	4	2
75th percentile	70	35	23	13	6
90th percentile	292	144	88	49	21

DNAPL = DNAPL Site Survey (EPA/OERR).
HGDB = Hydrogeologic database (API).

To adjust the 30-acre DAF for a 0.5-acre source, EPA considered the geomean 0.5-acre dilution factors for the DNAPL sites (34), HGDB sites (16), and all 300 sites (20). A default DAF of 20 was selected as a conservative value for a 0.5-acre source size.

This value also reflects the ratio between 0.5-acre and 30-acre geomean and median dilution factors calculated for the HGDB sites (2.2 and 2.0, respectively). The HGDB data reflect the influence of source size on actual dilution factors more accurately than the DNAPL site data because the HGDB includes site-specific estimates of aquifer thickness. As shown in the following section, aquifer thickness has a strong influence on the effect of source size on the dilution factor since it provides an upper limit on mixing zone depth. Increasing source area increases infiltration, which lowers the dilution factor, but also increases mixing zone depth, which increases the dilution factor. For an infinitely thick aquifer, these effects tend to cancel each other, resulting in similar dilution factors for 0.5 and 30 acres. Thin aquifers limit mixing depth for larger sources; thus the added infiltration predominates and lowers the dilution factors for the larger source. Since the DNAPL dilution factor

analyses use a fixed aquifer depth, they tend to overestimate the reduction in dilution factors that result from a smaller source.

2.5.7 Sensitivity Analysis. A sensitivity analysis was conducted to examine the effects of site-specific parameters on migration to ground water SSLs. Both the partition equation and the dilution factor model were considered in this analysis. Because an adequate database of national distributions of these parameters was not available, a nominal range method was used to conduct the analysis. In this analysis, independent parameters were selected and each was taken to maximum and minimum values while keeping all other parameters at their nominal, or default, values.

Overall, SSLs are most sensitive to changes in the dilution factor. As shown in Table 7, the 10th to 90th percentile dilution factors vary from 2 to 292 for the 300 DNAPL and HGDB sites. Much of this variability can be attributed to the wide range of aquifer hydraulic conductivity across the Nation. In contrast, the most sensitive parameter in the partition equation (f_{oc}) only affects the SSL by a factor of 1.5.

Partition Equation. The partition equation requires the following site-specific inputs: fraction organic carbon, average annual soil moisture content, and soil bulk density. Although volumetric soil moisture content is somewhat dependent on bulk density (in terms of the porosity available to be filled with water), calculations were conducted to ensure that the parameter ranges selected do not result in impossible combinations of these parameters. Because the effects of the soil parameters on the SSLs are highly dependent on chemical properties, the analysis was conducted on four organic chemicals spanning the range of these properties: chloroform, trichloroethylene, naphthalene, and benzo(*a*)pyrene.

The range used for soil moisture conditions was 0.02 to 0.43 L water/L soil. The lower end of this range represents a likely residual moisture content value for sand, as might be found in the drier regions of the United States. The higher value (0.43) represents full saturation conditions for a loam soil. The range of bulk density (1.25 to 1.75) was obtained from the Patriot soils database, which contains bulk density measurements for over 20,000 soil series across the United States.

Establishing a range for subsurface organic carbon content (f_{oc}) was more difficult. In spite of an extensive literature review and contacts with soil scientists, very little information was found on the distribution of this parameter with depth in U.S. soils. The range used was 0.001 to 0.003 g carbon / g soil. The lower limit represents the critical organic carbon content below which the partition equation is no longer applicable. The upper limit was obtained from EPA's Environmental Research Laboratory in Ada, Oklahoma, as an expert opinion. Generally, soil organic carbon content falls off rapidly with depth. Since the typical value used as an SSL default for surface soils is 0.006, and 0.002 is used for subsurface soils, this limited range is consistent with the other default assumptions used in the Soil Screening Guidance.

The results of the partition equation sensitivity analysis are shown in Table 8.

For volatile chemicals, the model is somewhat sensitive to water content, with up to 54 and 19 percent change in SSLs for chloroform and trichloroethylene, respectively. The model is less sensitive to bulk density, with a high percent change of 18 for chloroform and 14 for trichloroethylene. Organic carbon content has the greatest effect on SSLs for all chemicals except chloroform. As expected, the effect of f_{oc} increases with increasing K_{oc}. The greatest effect was seen for benzo(*a*)pyrene whose SSL showed a 50 percent increase at an f_{oc} of 0.03. An f_{oc} of 0.005 will increase the benzo(*a*)pyrene SSL by 150 percent.

APPENDIX J

JOHNSON AND ETTINGER MODELING CALCULATIONS

On-Site Warehouse Scenario

Kleinfelder Project Number 101942

Subject: **Soil Gas Screening Levels for Remediation Goals for Future Commercial Building Construction TSFT-Former Excello Property 4057 and 4059 Goodwin Avenue Los Angeles, California**

Kleinfelder was retained to calculate site-specific soil vapor screening levels for volatile organic compounds (VOCs) detected in soil gas samples collected from The Spirito Family Trust – Former Excello site (TSFT site) located at 4057 and 4059 Goodwin Avenue in Los Angeles, California. Redevelopment of the site is being contemplated that may include a parking apron for trucks, a dry goods warehouse, or a perishable goods warehouse.

This report presents site-specific soil vapor screening levels that were calculated using the advanced version of the U.S. Environmental Protection Agency's (US EPA's) Johnson & Ettinger model for soil vapor. The purpose of the screening levels is to support decisions about appropriate remediation or mitigation measures during site redevelopment.

Johnson and Ettinger Modeling

The Johnson and Ettinger model is a one-dimensional analytical solution to advective and diffusive vapor transport into indoor spaces and provides an estimated attenuation coefficient that relates the vapor concentration in indoor air to the vapor concentration at the source of contamination. At the TSFT site, the primary sources of contamination include 1,1,1-TCA, TCE, and PCE. Site-specific inputs to the model included estimated soil temperature, the type of soil separating the soil vapor from the bottom of the building slab, the depths at which soil vapors may be encountered, and the dimensions of four hypothetical buildings consistent with redevelopment proposals (Tables 1 and 2).

Potential soil vapor sources were evaluated at three depths: 5, 15, and 40 feet below ground surface. The shallow depth (five feet) was selected to assess vapor sources closest to the proposed building foundations and the maximum depth (40 feet) was selected to address vapor sources just above the water table. The intermediate depth (15 feet) was selected to provide additional information for remedial design. The four building scenarios were: Small Office, Large Office, Warehouse with 45 foot Ceiling, and Warehouse with 80 foot Ceiling. Therefore, screening levels were calculated for twelve scenarios. All inputs to the models are provided in the model spreadsheets found in Attachment A. The Johnson and Ettinger model version used in this evaluation was SG-ADV (version 3.1; 02/04). Toxicity values for the model are those provided by the DTSC in its screening level Johnson and Ettinger SG model (DTSC, 2009). The soil temperature was estimated from guidance provided in the US EPA *User's Guide for Evaluating Subsurface Vapor Intrusion into Buildings* (EQM 2004). The model spreadsheets were modified to accommodate more than one chemical. The modification did not affect spreadsheet function.

As coded into an Excel spreadsheet, the version of the Johnson and Ettinger model used does not generate soil vapor concentrations based on a given level of cancer risk or noncancer hazard. Instead, the model generates estimates of cancer risk and noncancer hazard from estimated or measured soil vapor concentrations of chemicals. Therefore, site-specific screening values were generated by entering a nominal value for each chemical of concern (1 $\mu g/m^3$), then the resulting risk values were converted into concentrations that yield a cancer risk of 1×10^{-6} or a noncancer hazard of 1 (one). The equations used to calculate soil vapor screening levels using the Johnson and Ettinger model are presented below.

Screening Level ($\mu g/m^3$) =
For cancer risk;
1×10^{-6} / cancer risk from constituent concentration of 1 $\mu g/m^3$

For noncancer hazard;
1 / noncancer hazard from constituent concentration of 1 $\mu g/m^3$

The lesser of the soil vapor screening levels based on cancer risk and noncancer hazard screening levels was identified as the final screening level for each constituent in each scenario (Table 3).

Prior to identification of the lesser of the cancer risk and noncancer hazard screening levels, the potential contribution of each constituent to add to the cumulative cancer risk or noncancer hazard was addressed. Two of the three constituents are classified as carcinogens, TCE and PCE. Therefore, their screening levels were divided by two to account for potential additive cancer risks. Each of the three chemicals of concern may produce noncancerous health effects. However, the soil vapor screening level of two of those constituents, TCE and PCE, based upon cancer risks, were two orders of magnitude less than their screening levels for noncancer hazards. Remediation of the site to limit the cumulative cancer risk of TCE and PCE to 1×10^{-6} would also reduce their contribution to cumulative noncancer hazard to approximately 0.01. Therefore, there was no need to address the potential additivity for noncancer hazard.

Attachments

- References
- Tables 1 – 3
- Attachment A – Johnson and Ettinger Model Spreadsheets

REFERENCES

DTSC (Department of Toxic Substances Control). 2004. Interim Final Guidance for the Evaluation and Mitigation of Subsurface Vapor Intrusion to Indoor Air. December 15. Revised February 7, 2005.

DTSC. 2009. Screening-Level Model for Soil Gas Contamination. February 4. Downloaded on June 19, 2009 from: http://www.dtsc.ca.gov/AssessingRisk/JE_Models.cfm.

EPA. 1997. Exposure Factors Handbook. Office of Research and Development, National Center for Environmental Assessment, U.S. Environmental Protection Agency, Washington DC. EPA/600/P-95/002Fa, August.

EQM. 2004. User's Guide for Evaluating Subsurface Vapor Intrusion into Buildings. Prepared by Environmental Quality Management, Inc., Durham, North Carolina. Prepared for Industrial Economics Incorporated, Cambridge, Massachusetts under EPA contract 68-W-01-058. Revised February 2004.

OEHHA. 2005. Use of California Human Health Screening Levels (CHHSLs) in Evaluation of Contaminated Properties. Office of Environmental Health Hazard Assessment, California Environmental Protection Agency, Sacramento, California. January.

Table 1
Summary of Johnson and Ettinger Model Parameters
Parameters Common to Each Scenario
TSFT Site

Parameter	Value	Units	Comment
Groundwater temperature	19.4	°C	From EQM 2003
Stratum A - Soil type immediately beneath the building	S	NA	Sand, predominant soil type, from soil geophysical sample KLF-2 (22-23).
Depth below grade to bottom of enclosed space floor	15	cm	Default value for slab-on-grade construction.
Enclosed space slab thickness	18	cm	7 inch slab minimum in preliminary designs of warehouse.
Indoor air exchange rate	1	per hour	Commercial building default, DTSC 2004
Target risk for carcinogens	$1x10^{-6}$	NA	Considered the de minimis standard by U.S. EPA.
Target hazard index for noncarcinogens	1	NA	Considered the de minimis standard by the US EPA.
Averaging time for carcinogens	70	years	US EPA default value for commercial & industrial workers
Averaging time for noncarcinogens	25	years	US EPA default value for commercial & industrial workers
Exposure duration	25	years	US EPA default value for commercial & industrial workers
Exposure frequency	250	days/year	US EPA default value for commercial & industrial workers

Notes:
NA = Not Applicable
°C = degrees Celsius
cm = centimeters

Table 2
Summary of Johnson and Ettinger Model Parameters
Parameters Specific to Each Scenario
TSFT Site

Soil Gas Depth	Building Scenario	Stratum A thickness (cm)	Depth to soil gas (cm)	Enclosed space length (cm)	Enclosed space width (cm)	Enclosed space height (cm)
5 ft bgs	Small Office	152	152	610	305	244
5 ft bgs	Large Office	152	152	762	610	305
5 ft bgs	Warehouse 45 ft peak	152	152	7315	7315	1372
5 ft bgs	Warehouse 80 ft peak	152	152	7315	7315	2438
15 ft bgs	Small Office	457	457	610	305	244
15 ft bgs	Large Office	457	457	762	610	305
15 ft bgs	Warehouse 45 ft peak	457	457	7315	7315	1372
15 ft bgs	Warehouse 80 ft peak	457	457	7315	7315	2438
40 ft bgs	Small Office	1219	1219	610	305	244
40 ft bgs	Large Office	1219	1219	762	610	305
40 ft bgs	Warehouse 45 ft peak	1219	1219	7315	7315	1372
40 ft bgs	Warehouse 80 ft peak	1219	1219	7315	7315	2438

Notes:
ft bgs = feet below ground surface
cm = centimeters
Small Office = 20 feet floor length x 10 feet floor width x 8 feet ceiling height
Large Office = 25 feet floor length x 20 feet floor width x 10 feet ceiling height
Warehouse 45 ft peak = 240 feet floor length x 240 feet floor width x 45 feet ceiling height
Warehouse 80 ft peak = 240 feet floor length x 240 feet floor width x 80 feet ceiling height

Table 3
Summary of Site-Specific Screening Levels
TSFT Site

Site Specific Screening Levels (µg/m^3)				
Soil Gas Depth	**Building Scenario**	**1,1,1-TCA**	**TCE**	**PCE**
5 ft bgs	Small Office	7,400,000	1,000	370
5 ft bgs	Large Office	11,000,000	1,500	550
5 ft bgs	Warehouse 45 ft ceiling	230,000,000	33,000	11,000
5 ft bgs	Warehouse 80 ft ceiling	420,000,000	58,000	20,000
15 ft bgs	Small Office	19,000,000	2,700	990
15 ft bgs	Large Office	26,000,000	3,600	1,300
15 ft bgs	Warehouse 45 ft ceiling	300,000,000	42,000	15,000
15 ft bgs	Warehouse 80 ft ceiling	540,000,000	75,000	26,000
40 ft bgs	Small Office	49,000,000	6,800	2,500
40 ft bgs	Large Office	63,000,000	8,800	3,200
40 ft bgs	Warehouse 45 ft ceiling	470,000,000	65,000	23,000
40 ft bgs	Warehouse 80 ft ceiling	840,000,000	120,000	42,000

Notes:
µg/m^3 = micrograms per cubic meter
ft bgs = feet below ground surface
1,1,1-TCA = 1,1,1-Trichloroethane
TCE = Trichloroethylene
PCE = Tetrachloroethylene

ATTACHMENT A
JOHNSON AND ETTINGER MODEL SPREADSHEETS

SG-ADV
Version 3.1; 02/04

Reset to Defaults

Soil Gas Concentration Data

ENTER Chemical CAS No. (numbers only, no dashes)	ENTER Soil gas conc., C_g ($\mu g/m^3$)	OR	ENTER Soil gas conc., C_g (ppmv)	ENTER Soil gas sampling depth below grade, L_s (cm)	ENTER Totals must add up to value of Ls (cell F24) Thickness of soil stratum A, h_A (cm)	Thickness of soil stratum B, (Enter value or 0) h_B (cm)	Thickness of soil stratum C, (Enter value or 0) h_C (cm)	Chemical
71556	1			1219	1219	0	0	1,1,1-Trichloroethane
79016	1			1219	1219	0	0	Trichloroethylene
127184	1			1219	1219	0	0	Tetrachloroethylene

MORE ↓

ENTER Depth below grade to bottom of enclosed space floor, L_F (cm)	ENTER Average soil temperature, T_S (^oC)	ENTER Soil stratum A SCS soil type (used to estimate soil vapor permeability)	OR	ENTER User-defined stratum A soil vapor permeability, k_v (cm^2)
15	19.4	S		

MORE ↓

DO NOT CHANGE STRATUM A VALUES AUTO UPDATED BASED ON CELL "E64"

DO NOT CHANGE STRATUM B VALUES AUTO UPDATED BASED ON CELL "I64"

DO NOT CHANGE STRATUM C VALUES AUTO UPDATED BASED ON CELL "M64"

ENTER Stratum A SCS soil type	Stratum A soil dry bulk density, ρ_b^A (g/cm^3)	Stratum A soil total porosity, n^A (unitless)	Stratum A soil water-filled porosity, θ_w^A (cm^3/cm^3)	ENTER Stratum B SCS soil type	Stratum B soil dry bulk density, ρ_b^B (g/cm^3)	Stratum B soil total porosity, n^B (unitless)	Stratum B soil water-filled porosity, θ_w^B (cm^3/cm^3)	ENTER Stratum C SCS soil type	Stratum C soil dry bulk density, ρ_b^C (g/cm^3)	Stratum C soil total porosity, n^C (unitless)	Stratum C soil water-filled porosity, θ_w^C (cm^3/cm^3)
S	1.66	0.375	0.054	S	1.66	0.375	0.054	S	1.66	0.375	0.054

MORE ↓

ENTER Enclosed space floor thickness, L_{crack} (cm)	ENTER Soil-bldg. pressure differential, ΔP ($g/cm\text{-}s^2$)	ENTER Enclosed space floor length, L_B (cm)	ENTER Enclosed space floor width, W_B (cm)	ENTER Enclosed space height, H_B (cm)	ENTER Floor-wall seam crack width, w (cm)	ENTER Indoor air exchange rate, ER (1/h)	ENTER Average vapor flow rate into bldg. OR Leave blank to calculate Q_{soil} (L/m)
18	40	610	305	244	0.1	1	

ENTER Averaging time for carcinogens, AT_C (yrs)	ENTER Averaging time for noncarcinogens, AT_{NC} (yrs)	ENTER Exposure duration, ED (yrs)	ENTER Exposure frequency, EF (days/yr)
70	25	25	250

END

Small Office
Soil Vapor at 40 ft bgs
TSFT Site

CHEMICAL PROPERTIES SHEET

CAS No.	Chemical	Diffusivity in air, D_a (cm^2/s)	Diffusivity in water, D_w (cm^2/s)	Henry's law constant at reference temperature, H (atm-m^3/mol)	Henry's law constant reference temperature, T_R (^oC)	Enthalpy of vaporization at the normal boiling point, $\Delta H_{v,b}$ (cal/mol)	Normal boiling point, T_B (^oK)	Critical temperature, T_C (^oK)	Molecular weight, MW (g/mol)	Unit risk factor, URF ($\mu g/m^3)^{-1}$	Reference conc., RfC (mg/m^3)
71556	1,1,1-Trichloroethane	7.80E-02	8.80E-06	1.72E-02	25	7,136	347.24	545.00	133.40	0.0E+00	5.0E+00
79016	Trichloroethylene	7.90E-02	9.10E-06	1.03E-02	25	7,505	360.36	544.20	131.39	2.0E-06	6.0E-01
127184	Tetrachloroethylene	7.20E-02	8.20E-06	1.84E-02	25	8,288	394.40	620.20	165.83	5.9E-06	3.5E-02

Small Office
Soil Vapor at 40 ft bgs
TSFT Site

INTERMEDIATE CALCULATIONS SHEET

CAS No.	Chemical	Exposure duration, τ (sec)	Source-building separation, L_T (cm)	Stratum A soil air-filled porosity, θ_a^A (cm^3/cm^3)	Stratum B soil air-filled porosity, θ_a^B (cm^3/cm^3)	Stratum C soil air-filled porosity, θ_a^C (cm^3/cm^3)	Stratum A effective total fluid saturation, S_{te} (cm^3/cm^3)	Stratum A soil intrinsic permeability, k_i (cm^2)	Stratum A soil relative air permeability, k_{rg} (cm^2)	Stratum A soil effective vapor permeability, k_v (cm^2)	Floor-wall seam perimeter, X_{crack} (cm)	Soil gas conc. ($\mu g/m^3$)	Bldg. ventilation rate, $Q_{building}$ (cm^3/s)
71556	1,1,1-Trichloroethane	7.88E+08	1204	0.321	0.321	0.321	0.003	1.01E-07	0.998	1.01E-07	1,830	1.00E+00	1.26E+04
79016	Trichloroethylene	7.88E+08	1204	0.321	0.321	0.321	0.003	1.01E-07	0.998	1.01E-07	1,830	1.00E+00	1.26E+04
127184	Tetrachloroethylene	7.88E+08	1204	0.321	0.321	0.321	0.003	1.01E-07	0.998	1.01E-07	1,830	1.00E+00	1.26E+04

CAS No.	Chemical	Area of enclosed space below grade, A_B (cm^2)	Crack-to-total area ratio, η (unitless)	Crack depth below grade, Z_{crack} (cm)	Enthalpy of vaporization at ave. soil temperature, $\Delta H_{v,TS}$ (cal/mol)	Henry's law constant at ave. soil temperature, H_{TS} (atm-m^3/mol)	Henry's law constant at ave. soil temperature, H'_{TS} (unitless)	Vapor viscosity at ave. soil temperature, μ_{TS} (g/cm-s)	Stratum A effective diffusion coefficient, D^{eff}_A (cm^2/s)	Stratum B effective diffusion coefficient, D^{eff}_B (cm^2/s)	Stratum C effective diffusion coefficient, D^{eff}_C (cm^2/s)	Total overall effective diffusion coefficient, D^{eff}_T (cm^2/s)	Diffusion path length, L_d (cm)
71556	1,1,1-Trichloroethane	1.86E+05	9.84E-04	15	7,783	1.33E-02	5.56E-01	1.78E-04	1.26E-02	0.00E+00	0.00E+00	1.26E-02	1204
79016	Trichloroethylene	1.86E+05	9.84E-04	15	8,440	7.82E-03	3.26E-01	1.78E-04	1.28E-02	0.00E+00	0.00E+00	1.28E-02	1204
127184	Tetrachloroethylene	1.86E+05	9.84E-04	15	9,458	1.35E-02	5.63E-01	1.78E-04	1.16E-02	0.00E+00	0.00E+00	1.16E-02	1204

CAS No.	Chemical	Convection path length, L_p (cm)	Source vapor conc., C_{source} ($\mu g/m^3$)	Crack radius, r_{crack} (cm)	Average vapor flow rate into bldg., Q_{soil} (cm^3/s)	Crack effective diffusion coefficient, D^{crack} (cm^2/s)	Area of crack, A_{crack} (cm^2)	Exponent of equivalent foundation Peclet number, $exp(Pe^f)$ (unitless)	Infinite source indoor attenuation coefficient, α (unitless)	Infinite source bldg. conc., $C_{building}$ ($\mu g/m^3$)	Unit risk factor, URF $(\mu g/m^3)^{-1}$	Reference conc., RfC (mg/m^3)
71556	1,1,1-Trichloroethane	15	1.00E+00	0.10	4.55E+01	1.26E-02	1.83E+02	1.84E+154	1.48E-04	1.48E-04	NA	5.0E+00
79016	Trichloroethylene	15	1.00E+00	0.10	4.55E+01	1.28E-02	1.83E+02	2.05E+152	1.50E-04	1.50E-04	2.0E-06	6.0E-01
127184	Tetrachloroethylene	15	1.00E+00	0.10	4.55E+01	1.16E-02	1.83E+02	1.32E+167	1.37E-04	1.37E-04	5.9E-06	3.5E-02

END

RESULTS SHEET

INCREMENTAL RISK CALCULATIONS:

CAS No.	Chemical	Incremental risk from vapor intrusion to indoor air, carcinogen (unitless)	Hazard quotient from vapor intrusion to indoor air, noncarcinogen (unitless)
71556	1,1,1-Trichloroethane	NA	2.0E-08
79016	Trichloroethylene	7.3E-11	1.7E-07
127184	Tetrachloroethylene	2.0E-10	2.7E-06

SCROLL DOWN TO "END"

SG-ADV
Version 3.1; 02/04

Reset to Defaults

Soil Gas Concentration Data

ENTER Chemical CAS No. (numbers only, no dashes)	ENTER Soil gas conc., C_g ($\mu g/m^3$)	OR	ENTER Soil gas conc., C_g (ppmv)	ENTER Soil gas sampling depth below grade, L_s (cm)	ENTER Totals must add up to value of Ls (cell F24) Thickness of soil stratum A, h_A (cm)	ENTER Thickness of soil stratum B, (Enter value or 0) h_B (cm)	ENTER Thickness of soil stratum C, (Enter value or 0) h_C (cm)	Chemical
71556	1			1219	1219	0	0	1,1,1-Trichloroethane
79016	1			1219	1219	0	0	Trichloroethylene
127184	1			1219	1219	0	0	Tetrachloroethylene

MORE ↓

ENTER Depth below grade to bottom of enclosed space floor, L_F (cm)	ENTER Average soil temperature, T_S (^oC)	ENTER Soil stratum A SCS soil type (used to estimate soil vapor permeability)	OR	ENTER User-defined stratum A soil vapor permeability, k_v (cm^2)
15	19.4	S		

MORE ↓

DO NOT CHANGE STRATUM A VALUES AUTO UPDATED BASED ON CELL "E64"

DO NOT CHANGE STRATUM B VALUES AUTO UPDATED BASED ON CELL "I64"

DO NOT CHANGE STRATUM C VALUES AUTO UPDATED BASED ON CELL "M64"

ENTER Stratum A SCS soil type	Stratum A soil dry bulk density, ρ_b^A (g/cm^3)	Stratum A soil total porosity, n^A (unitless)	Stratum A soil water-filled porosity, θ_w^A (cm^3/cm^3)	ENTER Stratum B SCS soil type	Stratum B soil dry bulk density, ρ_b^B (g/cm^3)	Stratum B soil total porosity, n^B (unitless)	Stratum B soil water-filled porosity, θ_w^B (cm^3/cm^3)	ENTER Stratum C SCS soil type	Stratum C soil dry bulk density, ρ_b^C (g/cm^3)	Stratum C soil total porosity, n^C (unitless)	Stratum C soil water-filled porosity, θ_w^C (cm^3/cm^3)
S	1.66	0.375	0.054	S	1.66	0.375	0.054	S	1.66	0.375	0.054

MORE ↓

ENTER Enclosed space floor thickness, L_{crack} (cm)	ENTER Soil-bldg. pressure differential, ΔP ($g/cm\text{-}s^2$)	ENTER Enclosed space floor length, L_B (cm)	ENTER Enclosed space floor width, W_B (cm)	ENTER Enclosed space height, H_B (cm)	ENTER Floor-wall seam crack width, w (cm)	ENTER Indoor air exchange rate, ER (1/h)	ENTER Average vapor flow rate into bldg. OR Leave blank to calculate Q_{soil} (L/m)
18	40	7315	7315	1372	0.1	1	

ENTER Averaging time for carcinogens, AT_C (yrs)	ENTER Averaging time for noncarcinogens, AT_{NC} (yrs)	ENTER Exposure duration, ED (yrs)	ENTER Exposure frequency, EF (days/yr)
70	25	25	250

END

45 ft Peak Warehouse
Soil Vapor at 40 ft bgs
TSFT Site

CHEMICAL PROPERTIES SHEET

CAS No.	Chemical	Diffusivity in air, D_a (cm^2/s)	Diffusivity in water, D_w (cm^2/s)	Henry's law constant at reference temperature, H (atm-m^3/mol)	Henry's law constant reference temperature, T_R (^oC)	Enthalpy of vaporization at the normal boiling point, $\Delta H_{v,b}$ (cal/mol)	Normal boiling point, T_B (^oK)	Critical temperature, T_C (^oK)	Molecular weight, MW (g/mol)	Unit risk factor, URF ($\mu g/m^3)^{-1}$	Reference conc., RfC (mg/m^3)
71556	1,1,1-Trichloroethane	7.80E-02	8.80E-06	1.72E-02	25	7,136	347.24	545.00	133.40	0.0E+00	5.0E+00
79016	Trichloroethylene	7.90E-02	9.10E-06	1.03E-02	25	7,505	360.36	544.20	131.39	2.0E-06	6.0E-01
127184	Tetrachloroethylene	7.20E-02	8.20E-06	1.84E-02	25	8,288	394.40	620.20	165.83	5.9E-06	3.5E-02

45 ft Peak Warehouse
Soil Vapor at 40 ft bgs
TSFT Site

INTERMEDIATE CALCULATIONS SHEET

CAS No.	Chemical	Exposure duration, τ (sec)	Source-building separation, L_T (cm)	Stratum A soil air-filled porosity, θ_a^A (cm^3/cm^3)	Stratum B soil air-filled porosity, θ_a^B (cm^3/cm^3)	Stratum C soil air-filled porosity, θ_a^C (cm^3/cm^3)	Stratum A effective total fluid saturation, S_{te} (cm^3/cm^3)	Stratum A soil intrinsic permeability, k_i (cm^2)	Stratum A soil relative air permeability, k_{rg} (cm^2)	Stratum A soil effective vapor permeability, k_v (cm^2)	Floor-wall seam perimeter, X_{crack} (cm)	Soil gas conc. ($\mu g/m^3$)	Bldg. ventilation rate, $Q_{building}$ (cm^3/s)
71556	1,1,1-Trichloroethane	7.88E+08	1204	0.321	0.321	0.321	0.003	1.01E-07	0.998	1.01E-07	29,260	1.00E+00	2.04E+07
79016	Trichloroethylene	7.88E+08	1204	0.321	0.321	0.321	0.003	1.01E-07	0.998	1.01E-07	29,260	1.00E+00	2.04E+07
127184	Tetrachloroethylene	7.88E+08	1204	0.321	0.321	0.321	0.003	1.01E-07	0.998	1.01E-07	29,260	1.00E+00	2.04E+07

CAS No.	Chemical	Area of enclosed space below grade, A_B (cm^2)	Crack-to-total area ratio, η (unitless)	Crack depth below grade, Z_{crack} (cm)	Enthalpy of vaporization at ave. soil temperature, $\Delta H_{v,TS}$ (cal/mol)	Henry's law constant at ave. soil temperature, H_{TS} (atm-m^3/mol)	Henry's law constant at ave. soil temperature, H'_{TS} (unitless)	Vapor viscosity at ave. soil temperature, μ_{TS} (g/cm-s)	Stratum A effective diffusion coefficient, D^{eff}_A (cm^2/s)	Stratum B effective diffusion coefficient, D^{eff}_B (cm^2/s)	Stratum C effective diffusion coefficient, D^{eff}_C (cm^2/s)	Total overall effective diffusion coefficient, D^{eff}_T (cm^2/s)	Diffusion path length, L_d (cm)
71556	1,1,1-Trichloroethane	5.35E+07	5.47E-05	15	7,783	1.33E-02	5.56E-01	1.78E-04	1.26E-02	0.00E+00	0.00E+00	1.26E-02	1204
79016	Trichloroethylene	5.35E+07	5.47E-05	15	8,440	7.82E-03	3.26E-01	1.78E-04	1.28E-02	0.00E+00	0.00E+00	1.28E-02	1204
127184	Tetrachloroethylene	5.35E+07	5.47E-05	15	9,458	1.35E-02	5.63E-01	1.78E-04	1.16E-02	0.00E+00	0.00E+00	1.16E-02	1204

CAS No.	Chemical	Convection path length, L_p (cm)	Source vapor conc., C_{source} ($\mu g/m^3$)	Crack radius, r_{crack} (cm)	Average vapor flow rate into bldg., Q_{soil} (cm^3/s)	Crack effective diffusion coefficient, D^{crack} (cm^2/s)	Area of crack, A_{crack} (cm^2)	Exponent of equivalent foundation Peclet number, $\exp(Pe^f)$ (unitless)	Infinite source indoor attenuation coefficient, α (unitless)	Infinite source bldg. conc., $C_{building}$ ($\mu g/m^3$)	Unit risk factor, URF $(\mu g/m^3)^{-1}$	Reference conc., RfC (mg/m^3)
71556	1,1,1-Trichloroethane	15	1.00E+00	0.10	7.28E+02	1.26E-02	2.93E+03	1.84E+154	1.55E-05	1.55E-05	NA	5.0E+00
79016	Trichloroethylene	15	1.00E+00	0.10	7.28E+02	1.28E-02	2.93E+03	2.05E+152	1.56E-05	1.56E-05	2.0E-06	6.0E-01
127184	Tetrachloroethylene	15	1.00E+00	0.10	7.28E+02	1.16E-02	2.93E+03	1.32E+167	1.48E-05	1.48E-05	5.9E-06	3.5E-02

END

RESULTS SHEET

INCREMENTAL RISK CALCULATIONS:

CAS No.	Chemical	Incremental risk from vapor intrusion to indoor air, carcinogen (unitless)	Hazard quotient from vapor intrusion to indoor air, noncarcinogen (unitless)
71556	1,1,1-Trichloroethane	NA	2.1E-09
79016	Trichloroethylene	7.7E-12	1.8E-08
127184	Tetrachloroethylene	2.1E-11	2.9E-07

SCROLL DOWN TO "END"

END

SG-ADV
Version 3.1; 02/04

Reset to Defaults

Soil Gas Concentration Data

ENTER Chemical CAS No. (numbers only, no dashes)	ENTER Soil gas conc., C_g ($\mu g/m^3$)	OR	ENTER Soil gas conc., C_g (ppmv)	ENTER Soil gas sampling depth below grade, L_s (cm)	ENTER Totals must add up to value of Ls (cell F24) Thickness of soil stratum A, h_A (cm)	Thickness of soil stratum B, (Enter value or 0) h_B (cm)	Thickness of soil stratum C, (Enter value or 0) h_C (cm)	Chemical
71556	1			1219	1219	0	0	1,1,1-Trichloroethane
79016	1			1219	1219	0	0	Trichloroethylene
127184	1			1219	1219	0	0	Tetrachloroethylene

MORE ↓

ENTER Depth below grade to bottom of enclosed space floor, L_F (cm)	ENTER Average soil temperature, T_S (^oC)	ENTER Soil stratum A SCS soil type (used to estimate soil vapor permeability)	OR	ENTER User-defined stratum A soil vapor permeability, k_v (cm^2)
15	19.4	S		

MORE ↓

DO NOT CHANGE STRATUM A VALUES AUTO UPDATED BASED ON CELL "E64"

DO NOT CHANGE STRATUM B VALUES AUTO UPDATED BASED ON CELL "I64"

DO NOT CHANGE STRATUM C VALUES AUTO UPDATED BASED ON CELL "M64"

ENTER Stratum A SCS soil type	Stratum A soil dry bulk density, ρ_b^A (g/cm^3)	Stratum A soil total porosity, n^A (unitless)	Stratum A soil water-filled porosity, θ_w^A (cm^3/cm^3)	ENTER Stratum B SCS soil type	Stratum B soil dry bulk density, ρ_b^B (g/cm^3)	Stratum B soil total porosity, n^B (unitless)	Stratum B soil water-filled porosity, θ_w^B (cm^3/cm^3)	ENTER Stratum C SCS soil type	Stratum C soil dry bulk density, ρ_b^C (g/cm^3)	Stratum C soil total porosity, n^C (unitless)	Stratum C soil water-filled porosity, θ_w^C (cm^3/cm^3)
S	1.66	0.375	0.054	S	1.66	0.375	0.054	S	1.66	0.375	0.054

MORE ↓

ENTER Enclosed space floor thickness, L_{crack} (cm)	ENTER Soil-bldg. pressure differential, ΔP ($g/cm\text{-}s^2$)	ENTER Enclosed space floor length, L_B (cm)	ENTER Enclosed space floor width, W_B (cm)	ENTER Enclosed space height, H_B (cm)	ENTER Floor-wall seam crack width, w (cm)	ENTER Indoor air exchange rate, ER (1/h)	ENTER Average vapor flow rate into bldg. OR Leave blank to calculate Q_{soil} (L/m)
18	40	762	610	305	0.1	1	

ENTER Averaging time for carcinogens, AT_C (yrs)	ENTER Averaging time for noncarcinogens, AT_{NC} (yrs)	ENTER Exposure duration, ED (yrs)	ENTER Exposure frequency, EF (days/yr)
70	25	25	250

END

Large Office
Soil Vapor at 40 ft bgs
TSFT Site

CHEMICAL PROPERTIES SHEET

CAS No.	Chemical	Diffusivity in air, D_a (cm^2/s)	Diffusivity in water, D_w (cm^2/s)	Henry's law constant at reference temperature, H (atm-m^3/mol)	Henry's law constant reference temperature, T_R (^oC)	Enthalpy of vaporization at the normal boiling point, $\Delta H_{v,b}$ (cal/mol)	Normal boiling point, T_B (^oK)	Critical temperature, T_C (^oK)	Molecular weight, MW (g/mol)	Unit risk factor, URF $(\mu g/m^3)^{-1}$	Reference conc., RfC (mg/m^3)
71556	1,1,1-Trichloroethane	7.80E-02	8.80E-06	1.72E-02	25	7,136	347.24	545.00	133.40	0.0E+00	5.0E+00
79016	Trichloroethylene	7.90E-02	9.10E-06	1.03E-02	25	7,505	360.36	544.20	131.39	2.0E-06	6.0E-01
127184	Tetrachloroethylene	7.20E-02	8.20E-06	1.84E-02	25	8,288	394.40	620.20	165.83	5.9E-06	3.5E-02

Large Office
Soil Vapor at 40 ft bgs
TSFT Site

INTERMEDIATE CALCULATIONS SHEET

CAS No.	Chemical	Exposure duration, τ (sec)	Source-building separation, L_T (cm)	Stratum A soil air-filled porosity, θ_a^A (cm^3/cm^3)	Stratum B soil air-filled porosity, θ_a^B (cm^3/cm^3)	Stratum C soil air-filled porosity, θ_a^C (cm^3/cm^3)	Stratum A effective total fluid saturation, S_{te} (cm^3/cm^3)	Stratum A soil intrinsic permeability, k_i (cm^2)	Stratum A soil relative air permeability, k_{rg} (cm^2)	Stratum A soil effective vapor permeability, k_v (cm^2)	Floor-wall seam perimeter, X_{crack} (cm)	Soil gas conc. ($\mu g/m^3$)	Bldg. ventilation rate, $Q_{building}$ (cm^3/s)
71556	1,1,1-Trichloroethane	7.88E+08	1204	0.321	0.321	0.321	0.003	1.01E-07	0.998	1.01E-07	2,744	1.00E+00	3.94E+04
79016	Trichloroethylene	7.88E+08	1204	0.321	0.321	0.321	0.003	1.01E-07	0.998	1.01E-07	2,744	1.00E+00	3.94E+04
127184	Tetrachloroethylene	7.88E+08	1204	0.321	0.321	0.321	0.003	1.01E-07	0.998	1.01E-07	2,744	1.00E+00	3.94E+04

CAS No.	Chemical	Area of enclosed space below grade, A_B (cm^2)	Crack-to-total area ratio, η (unitless)	Crack depth below grade, Z_{crack} (cm)	Enthalpy of vaporization at ave. soil temperature, $\Delta H_{v,TS}$ (cal/mol)	Henry's law constant at ave. soil temperature, H_{TS} (atm-m^3/mol)	Henry's law constant at ave. soil temperature, H'_{TS} (unitless)	Vapor viscosity at ave. soil temperature, μ_{TS} (g/cm-s)	Stratum A effective diffusion coefficient, D^{eff}_A (cm^2/s)	Stratum B effective diffusion coefficient, D^{eff}_B (cm^2/s)	Stratum C effective diffusion coefficient, D^{eff}_C (cm^2/s)	Total overall effective diffusion coefficient, D^{eff}_T (cm^2/s)	Diffusion path length, L_d (cm)
71556	1,1,1-Trichloroethane	4.65E+05	5.90E-04	15	7,783	1.33E-02	5.56E-01	1.78E-04	1.26E-02	0.00E+00	0.00E+00	1.26E-02	1204
79016	Trichloroethylene	4.65E+05	5.90E-04	15	8,440	7.82E-03	3.26E-01	1.78E-04	1.28E-02	0.00E+00	0.00E+00	1.28E-02	1204
127184	Tetrachloroethylene	4.65E+05	5.90E-04	15	9,458	1.35E-02	5.63E-01	1.78E-04	1.16E-02	0.00E+00	0.00E+00	1.16E-02	1204

CAS No.	Chemical	Convection path length, L_p (cm)	Source vapor conc., C_{source} ($\mu g/m^3$)	Crack radius, r_{crack} (cm)	Average vapor flow rate into bldg., Q_{soil} (cm^3/s)	Crack effective diffusion coefficient, D^{crack} (cm^2/s)	Area of crack, A_{crack} (cm^2)	Exponent of equivalent foundation Peclet number, $exp(Pe^f)$ (unitless)	Infinite source indoor attenuation coefficient, α (unitless)	Infinite source bldg. conc., $C_{building}$ ($\mu g/m^3$)	Unit risk factor, URF ($\mu g/m^3)^{-1}$	Reference conc., RfC (mg/m^3)
71556	1,1,1-Trichloroethane	15	1.00E+00	0.10	6.83E+01	1.26E-02	2.74E+02	1.84E+154	1.15E-04	1.15E-04	NA	5.0E+00
79016	Trichloroethylene	15	1.00E+00	0.10	6.83E+01	1.28E-02	2.74E+02	2.05E+152	1.17E-04	1.17E-04	2.0E-06	6.0E-01
127184	Tetrachloroethylene	15	1.00E+00	0.10	6.83E+01	1.16E-02	2.74E+02	1.32E+167	1.07E-04	1.07E-04	5.9E-06	3.5E-02

END

RESULTS SHEET

INCREMENTAL RISK CALCULATIONS:

CAS No.	Chemical	Incremental risk from vapor intrusion to indoor air, carcinogen (unitless)	Hazard quotient from vapor intrusion to indoor air, noncarcinogen (unitless)
71556	1,1,1-Trichloroethane	NA	1.6E-08
79016	Trichloroethylene	5.7E-11	1.3E-07
127184	Tetrachloroethylene	1.5E-10	2.1E-06

SCROLL DOWN TO "END"

END

SG-ADV
Version 3.1; 02/04

Reset to Defaults

Soil Gas Concentration Data

ENTER Chemical CAS No. (numbers only, no dashes)	ENTER Soil gas conc., C_g ($\mu g/m^3$)	OR	ENTER Soil gas conc., C_g (ppmv)	ENTER Soil gas sampling depth below grade, L_s (cm)	ENTER Totals must add up to value of Ls (cell F24) Thickness of soil stratum A, h_A (cm)	Thickness of soil stratum B, (Enter value or 0) h_B (cm)	Thickness of soil stratum C, (Enter value or 0) h_C (cm)	Chemical
71556	1			457	457	0	0	1,1,1-Trichloroethane
79016	1			457	457	0	0	Trichloroethylene
127184	1			457	457	0	0	Tetrachloroethylene

MORE ↓

ENTER Depth below grade to bottom of enclosed space floor, L_F (cm)	ENTER Average soil temperature, T_S (^oC)	ENTER Soil stratum A SCS soil type (used to estimate soil vapor permeability)	OR	ENTER User-defined stratum A soil vapor permeability, k_v (cm^2)
15	19.4	S		

MORE ↓

DO NOT CHANGE STRATUM A VALUES AUTO UPDATED BASED ON CELL "E64"

DO NOT CHANGE STRATUM B VALUES AUTO UPDATED BASED ON CELL "I64"

DO NOT CHANGE STRATUM C VALUES AUTO UPDATED BASED ON CELL "M64"

ENTER Stratum A SCS soil type	Stratum A soil dry bulk density, ρ_b^A (g/cm^3)	Stratum A soil total porosity, n^A (unitless)	Stratum A soil water-filled porosity, θ_w^A (cm^3/cm^3)	ENTER Stratum B SCS soil type	Stratum B soil dry bulk density, ρ_b^B (g/cm^3)	Stratum B soil total porosity, n^B (unitless)	Stratum B soil water-filled porosity, θ_w^B (cm^3/cm^3)	ENTER Stratum C SCS soil type	Stratum C soil dry bulk density, ρ_b^C (g/cm^3)	Stratum C soil total porosity, n^C (unitless)	Stratum C soil water-filled porosity, θ_w^C (cm^3/cm^3)
S	1.66	0.375	0.054	S	1.66	0.375	0.054	S	1.66	0.375	0.054

MORE ↓

ENTER Enclosed space floor thickness, L_{crack} (cm)	ENTER Soil-bldg. pressure differential, ΔP ($g/cm\text{-}s^2$)	ENTER Enclosed space floor length, L_B (cm)	ENTER Enclosed space floor width, W_B (cm)	ENTER Enclosed space height, H_B (cm)	ENTER Floor-wall seam crack width, w (cm)	ENTER Indoor air exchange rate, ER (1/h)	ENTER Average vapor flow rate into bldg. OR Leave blank to calculate Q_{soil} (L/m)
18	40	7315	7315	2438	0.1	1	

ENTER Averaging time for carcinogens, AT_C (yrs)	ENTER Averaging time for noncarcinogens, AT_{NC} (yrs)	ENTER Exposure duration, ED (yrs)	ENTER Exposure frequency, EF (days/yr)
70	25	25	250

END

80 ft Peak Warehouse
Soil Vapor at 15 ft bgs
TSFT Site

CHEMICAL PROPERTIES SHEET

CAS No.	Chemical	Diffusivity in air, D_a (cm^2/s)	Diffusivity in water, D_w (cm^2/s)	Henry's law constant at reference temperature, H (atm-m^3/mol)	Henry's law constant reference temperature, T_R (^oC)	Enthalpy of vaporization at the normal boiling point, $\Delta H_{v,b}$ (cal/mol)	Normal boiling point, T_B (^oK)	Critical temperature, T_C (^oK)	Molecular weight, MW (g/mol)	Unit risk factor, URF ($\mu g/m^3)^{-1}$	Reference conc., RfC (mg/m^3)
71556	1,1,1-Trichloroethane	7.80E-02	8.80E-06	1.72E-02	25	7,136	347.24	545.00	133.40	0.0E+00	5.0E+00
79016	Trichloroethylene	7.90E-02	9.10E-06	1.03E-02	25	7,505	360.36	544.20	131.39	2.0E-06	6.0E-01
127184	Tetrachloroethylene	7.20E-02	8.20E-06	1.84E-02	25	8,288	394.40	620.20	165.83	5.9E-06	3.5E-02

80 ft Peak Warehouse
Soil Vapor at 15 ft bgs
TSFT Site

INTERMEDIATE CALCULATIONS SHEET

CAS No.	Chemical	Exposure duration, τ (sec)	Source-building separation, L_T (cm)	Stratum A soil air-filled porosity, θ_a^A (cm^3/cm^3)	Stratum B soil air-filled porosity, θ_a^B (cm^3/cm^3)	Stratum C soil air-filled porosity, θ_a^C (cm^3/cm^3)	Stratum A effective total fluid saturation, S_{te} (cm^3/cm^3)	Stratum A soil intrinsic permeability, k_i (cm^2)	Stratum A soil relative air permeability, k_{rg} (cm^2)	Stratum A soil effective vapor permeability, k_v (cm^2)	Floor-wall seam perimeter, X_{crack} (cm)	Soil gas conc. ($\mu g/m^3$)	Bldg. ventilation rate, $Q_{building}$ (cm^3/s)
71556	1,1,1-Trichloroethane	7.88E+08	442	0.321	0.321	0.321	0.003	1.01E-07	0.998	1.01E-07	29,260	1.00E+00	3.62E+07
79016	Trichloroethylene	7.88E+08	442	0.321	0.321	0.321	0.003	1.01E-07	0.998	1.01E-07	29,260	1.00E+00	3.62E+07
127184	Tetrachloroethylene	7.88E+08	442	0.321	0.321	0.321	0.003	1.01E-07	0.998	1.01E-07	29,260	1.00E+00	3.62E+07

CAS No.	Chemical	Area of enclosed space below grade, A_B (cm^2)	Crack-to-total area ratio, η (unitless)	Crack depth below grade, Z_{crack} (cm)	Enthalpy of vaporization at ave. soil temperature, $\Delta H_{v,TS}$ (cal/mol)	Henry's law constant at ave. soil temperature, H_{TS} (atm-m^3/mol)	Henry's law constant at ave. soil temperature, H'_{TS} (unitless)	Vapor viscosity at ave. soil temperature, μ_{TS} (g/cm-s)	Stratum A effective diffusion coefficient, D^{eff}_A (cm^2/s)	Stratum B effective diffusion coefficient, D^{eff}_B (cm^2/s)	Stratum C effective diffusion coefficient, D^{eff}_C (cm^2/s)	Total overall effective diffusion coefficient, D^{eff}_T (cm^2/s)	Diffusion path length, L_d (cm)
71556	1,1,1-Trichloroethane	5.35E+07	5.47E-05	15	7,783	1.33E-02	5.56E-01	1.78E-04	1.26E-02	0.00E+00	0.00E+00	1.26E-02	442
79016	Trichloroethylene	5.35E+07	5.47E-05	15	8,440	7.82E-03	3.26E-01	1.78E-04	1.28E-02	0.00E+00	0.00E+00	1.28E-02	442
127184	Tetrachloroethylene	5.35E+07	5.47E-05	15	9,458	1.35E-02	5.63E-01	1.78E-04	1.16E-02	0.00E+00	0.00E+00	1.16E-02	442

CAS No.	Chemical	Convection path length, L_p (cm)	Source vapor conc., C_{source} ($\mu g/m^3$)	Crack radius, r_{crack} (cm)	Average vapor flow rate into bldg., Q_{soil} (cm^3/s)	Crack effective diffusion coefficient, D^{crack} (cm^2/s)	Area of crack, A_{crack} (cm^2)	Exponent of equivalent foundation Peclet number, $\exp(Pe^f)$ (unitless)	Infinite source indoor attenuation coefficient, α (unitless)	Infinite source bldg. conc., $C_{building}$ ($\mu g/m^3$)	Unit risk factor, URF ($\mu g/m^3)^{-1}$	Reference conc., RfC (mg/m^3)
71556	1,1,1-Trichloroethane	15	1.00E+00	0.10	7.28E+02	1.26E-02	2.93E+03	1.84E+154	1.36E-05	1.36E-05	NA	5.0E+00
79016	Trichloroethylene	15	1.00E+00	0.10	7.28E+02	1.28E-02	2.93E+03	2.05E+152	1.37E-05	1.37E-05	2.0E-06	6.0E-01
127184	Tetrachloroethylene	15	1.00E+00	0.10	7.28E+02	1.16E-02	2.93E+03	1.32E+167	1.32E-05	1.32E-05	5.9E-06	3.5E-02

END

RESULTS SHEET

INCREMENTAL RISK CALCULATIONS:

CAS No.	Chemical	Incremental risk from vapor intrusion to indoor air, carcinogen (unitless)	Hazard quotient from vapor intrusion to indoor air, noncarcinogen (unitless)
71556	1,1,1-Trichloroethane	NA	1.9E-09
79016	Trichloroethylene	6.7E-12	1.6E-08
127184	Tetrachloroethylene	1.9E-11	2.6E-07

SCROLL DOWN TO "END"

END

DATA ENTRY SHEET

Small Office
Soil Vapor at 15 ft bgs
TSFT Site

SG-ADV
Version 3.1; 02/04

Reset to Defaults

Soil Gas Concentration Data

ENTER Chemical CAS No. (numbers only, no dashes)	ENTER Soil gas conc., C_g ($\mu g/m^3$)	OR	ENTER Soil gas conc., C_g (ppmv)	ENTER Soil gas sampling depth below grade, L_s (cm)	ENTER Totals must add up to value of Ls (cell F24) Thickness of soil stratum A, h_A (cm)	Thickness of soil stratum B, (Enter value or 0) h_B (cm)	Thickness of soil stratum C, (Enter value or 0) h_C (cm)	Chemical
71556	1			457	457	0	0	1,1,1-Trichloroethane
79016	1			457	457	0	0	Trichloroethylene
127184	1			457	457	0	0	Tetrachloroethylene

MORE ↓

ENTER Depth below grade to bottom of enclosed space floor, L_F (cm)	ENTER Average soil temperature, T_S (°C)	ENTER Soil stratum A SCS soil type (used to estimate soil vapor permeability)	OR	ENTER User-defined stratum A soil vapor permeability, k_v (cm^2)
15	19.4	S		

MORE ↓

DO NOT CHANGE STRATUM A VALUES AUTO UPDATED BASED ON CELL "E64"

DO NOT CHANGE STRATUM B VALUES AUTO UPDATED BASED ON CELL "I64"

DO NOT CHANGE STRATUM C VALUES AUTO UPDATED BASED ON CELL "M64"

ENTER Stratum A SCS soil type	Stratum A soil dry bulk density, ρ_b^A (g/cm^3)	Stratum A soil total porosity, n^A (unitless)	Stratum A soil water-filled porosity, θ_w^A (cm^3/cm^3)	ENTER Stratum B SCS soil type	Stratum B soil dry bulk density, ρ_b^B (g/cm^3)	Stratum B soil total porosity, n^B (unitless)	Stratum B soil water-filled porosity, θ_w^B (cm^3/cm^3)	ENTER Stratum C SCS soil type	Stratum C soil dry bulk density, ρ_b^C (g/cm^3)	Stratum C soil total porosity, n^C (unitless)	Stratum C soil water-filled porosity, θ_w^C (cm^3/cm^3)
S	1.66	0.375	0.054	S	1.66	0.375	0.054	S	1.66	0.375	0.054

MORE ↓

ENTER Enclosed space floor thickness, L_{crack} (cm)	ENTER Soil-bldg. pressure differential, ΔP ($g/cm\text{-}s^2$)	ENTER Enclosed space floor length, L_B (cm)	ENTER Enclosed space floor width, W_B (cm)	ENTER Enclosed space height, H_B (cm)	ENTER Floor-wall seam crack width, w (cm)	ENTER Indoor air exchange rate, ER (1/h)	ENTER Average vapor flow rate into bldg. OR Leave blank to calculate Q_{soil} (L/m)
18	40	610	305	244	0.1	1	

ENTER Averaging time for carcinogens, AT_C (yrs)	ENTER Averaging time for noncarcinogens, AT_{NC} (yrs)	ENTER Exposure duration, ED (yrs)	ENTER Exposure frequency, EF (days/yr)
70	25	25	250

END

Small Office
Soil Vapor at 15 ft bgs
TSFT Site

CHEMICAL PROPERTIES SHEET

CAS No.	Chemical	Diffusivity in air, D_a (cm^2/s)	Diffusivity in water, D_w (cm^2/s)	Henry's law constant at reference temperature, H (atm-m^3/mol)	Henry's law constant reference temperature, T_R (^oC)	Enthalpy of vaporization at the normal boiling point, $\Delta H_{v,b}$ (cal/mol)	Normal boiling point, T_B (^oK)	Critical temperature, T_C (^oK)	Molecular weight, MW (g/mol)	Unit risk factor, URF $(\mu g/m^3)^{-1}$	Reference conc., RfC (mg/m^3)
71556	1,1,1-Trichloroethane	7.80E-02	8.80E-06	1.72E-02	25	7,136	347.24	545.00	133.40	0.0E+00	5.0E+00
79016	Trichloroethylene	7.90E-02	9.10E-06	1.03E-02	25	7,505	360.36	544.20	131.39	2.0E-06	6.0E-01
127184	Tetrachloroethylene	7.20E-02	8.20E-06	1.84E-02	25	8,288	394.40	620.20	165.83	5.9E-06	3.5E-02

Small Office
Soil Vapor at 15 ft bgs
TSFT Site

INTERMEDIATE CALCULATIONS SHEET

CAS No.	Chemical	Exposure duration, τ (sec)	Source-building separation, L_T (cm)	Stratum A soil air-filled porosity, θ_a^A (cm^3/cm^3)	Stratum B soil air-filled porosity, θ_a^B (cm^3/cm^3)	Stratum C soil air-filled porosity, θ_a^C (cm^3/cm^3)	Stratum A effective total fluid saturation, S_{te} (cm^3/cm^3)	Stratum A soil intrinsic permeability, k_i (cm^2)	Stratum A soil relative air permeability, k_{rg} (cm^2)	Stratum A soil effective vapor permeability, k_v (cm^2)	Floor-wall seam perimeter, X_{crack} (cm)	Soil gas conc. ($\mu g/m^3$)	Bldg. ventilation rate, $Q_{building}$ (cm^3/s)
71556	1,1,1-Trichloroethane	7.88E+08	442	0.321	0.321	0.321	0.003	1.01E-07	0.998	1.01E-07	1,830	1.00E+00	1.26E+04
79016	Trichloroethylene	7.88E+08	442	0.321	0.321	0.321	0.003	1.01E-07	0.998	1.01E-07	1,830	1.00E+00	1.26E+04
127184	Tetrachloroethylene	7.88E+08	442	0.321	0.321	0.321	0.003	1.01E-07	0.998	1.01E-07	1,830	1.00E+00	1.26E+04

CAS No.	Chemical	Area of enclosed space below grade, A_B (cm^2)	Crack-to-total area ratio, η (unitless)	Crack depth below grade, Z_{crack} (cm)	Enthalpy of vaporization at ave. soil temperature, $\Delta H_{v,TS}$ (cal/mol)	Henry's law constant at ave. soil temperature, H_{TS} (atm-m^3/mol)	Henry's law constant at ave. soil temperature, H'_{TS} (unitless)	Vapor viscosity at ave. soil temperature, μ_{TS} (g/cm-s)	Stratum A effective diffusion coefficient, D^{eff}_A (cm^2/s)	Stratum B effective diffusion coefficient, D^{eff}_B (cm^2/s)	Stratum C effective diffusion coefficient, D^{eff}_C (cm^2/s)	Total overall effective diffusion coefficient, D^{eff}_T (cm^2/s)	Diffusion path length, L_d (cm)
71556	1,1,1-Trichloroethane	1.86E+05	9.84E-04	15	7,783	1.33E-02	5.56E-01	1.78E-04	1.26E-02	0.00E+00	0.00E+00	1.26E-02	442
79016	Trichloroethylene	1.86E+05	9.84E-04	15	8,440	7.82E-03	3.26E-01	1.78E-04	1.28E-02	0.00E+00	0.00E+00	1.28E-02	442
127184	Tetrachloroethylene	1.86E+05	9.84E-04	15	9,458	1.35E-02	5.63E-01	1.78E-04	1.16E-02	0.00E+00	0.00E+00	1.16E-02	442

CAS No.	Chemical	Convection path length, L_p (cm)	Source vapor conc., C_{source} ($\mu g/m^3$)	Crack radius, r_{crack} (cm)	Average vapor flow rate into bldg., Q_{soil} (cm^3/s)	Crack effective diffusion coefficient, D^{crack} (cm^2/s)	Area of crack, A_{crack} (cm^2)	Exponent of equivalent foundation Peclet number, $\exp(Pe^f)$ (unitless)	Infinite source indoor attenuation coefficient, α (unitless)	Infinite source bldg. conc., $C_{building}$ ($\mu g/m^3$)	Unit risk factor, URF ($\mu g/m^3)^{-1}$	Reference conc., RfC (mg/m^3)
71556	1,1,1-Trichloroethane	15	1.00E+00	0.10	4.55E+01	1.26E-02	1.83E+02	1.84E+154	3.77E-04	3.77E-04	NA	5.0E+00
79016	Trichloroethylene	15	1.00E+00	0.10	4.55E+01	1.28E-02	1.83E+02	2.05E+152	3.81E-04	3.81E-04	2.0E-06	6.0E-01
127184	Tetrachloroethylene	15	1.00E+00	0.10	4.55E+01	1.16E-02	1.83E+02	1.32E+167	3.51E-04	3.51E-04	5.9E-06	3.5E-02

END

RESULTS SHEET

INCREMENTAL RISK CALCULATIONS:

CAS No.	Chemical	Incremental risk from vapor intrusion to indoor air, carcinogen (unitless)	Hazard quotient from vapor intrusion to indoor air, noncarcinogen (unitless)
71556	1,1,1-Trichloroethane	NA	5.2E-08
79016	Trichloroethylene	1.9E-10	4.4E-07
127184	Tetrachloroethylene	5.1E-10	6.9E-06

SCROLL DOWN TO "END"

END

SG-ADV
Version 3.1; 02/04

Reset to Defaults

Soil Gas Concentration Data

ENTER Chemical CAS No. (numbers only, no dashes)	ENTER Soil gas conc., C_g ($\mu g/m^3$)	OR	ENTER Soil gas conc., C_g (ppmv)	ENTER Soil gas sampling depth below grade, L_s (cm)	ENTER Totals must add up to value of Ls (cell F24) Thickness of soil stratum A, h_A (cm)	Thickness of soil stratum B, (Enter value or 0) h_B (cm)	Thickness of soil stratum C, (Enter value or 0) h_C (cm)	Chemical
71556	1			457	457	0	0	1,1,1-Trichloroethane
79016	1			457	457	0	0	Trichloroethylene
127184	1			457	457	0	0	Tetrachloroethylene

MORE ↓

ENTER Depth below grade to bottom of enclosed space floor, L_F (cm)	ENTER Average soil temperature, T_S (^oC)	ENTER Soil stratum A SCS soil type (used to estimate soil vapor permeability)	OR	ENTER User-defined stratum A soil vapor permeability, k_v (cm^2)
15	19.4	S		

MORE ↓

DO NOT CHANGE STRATUM A VALUES AUTO UPDATED BASED ON CELL "E64"

DO NOT CHANGE STRATUM B VALUES AUTO UPDATED BASED ON CELL "I64"

DO NOT CHANGE STRATUM C VALUES AUTO UPDATED BASED ON CELL "M64"

ENTER Stratum A SCS soil type	Stratum A soil dry bulk density, ρ_b^A (g/cm^3)	Stratum A soil total porosity, n^A (unitless)	Stratum A soil water-filled porosity, θ_w^A (cm^3/cm^3)	ENTER Stratum B SCS soil type	Stratum B soil dry bulk density, ρ_b^B (g/cm^3)	Stratum B soil total porosity, n^B (unitless)	Stratum B soil water-filled porosity, θ_w^B (cm^3/cm^3)	ENTER Stratum C SCS soil type	Stratum C soil dry bulk density, ρ_b^C (g/cm^3)	Stratum C soil total porosity, n^C (unitless)	Stratum C soil water-filled porosity, θ_w^C (cm^3/cm^3)
S	1.66	0.375	0.054	S	1.66	0.375	0.054	S	1.66	0.375	0.054

MORE ↓

ENTER Enclosed space floor thickness, L_{crack} (cm)	ENTER Soil-bldg. pressure differential, ΔP ($g/cm\text{-}s^2$)	ENTER Enclosed space floor length, L_B (cm)	ENTER Enclosed space floor width, W_B (cm)	ENTER Enclosed space height, H_B (cm)	ENTER Floor-wall seam crack width, w (cm)	ENTER Indoor air exchange rate, ER (1/h)	ENTER Average vapor flow rate into bldg. OR Leave blank to calculate Q_{soil} (L/m)
18	40	7315	7315	1372	0.1	1	

ENTER Averaging time for carcinogens, AT_C (yrs)	ENTER Averaging time for noncarcinogens, AT_{NC} (yrs)	ENTER Exposure duration, ED (yrs)	ENTER Exposure frequency, EF (days/yr)
70	25	25	250

END

45 ft Peak Warehouse
Soil Vapor at 15 ft bgs
TSFT Site

CHEMICAL PROPERTIES SHEET

CAS No.	Chemical	Diffusivity in air, D_a (cm^2/s)	Diffusivity in water, D_w (cm^2/s)	Henry's law constant at reference temperature, H (atm-m^3/mol)	Henry's law constant reference temperature, T_R (^oC)	Enthalpy of vaporization at the normal boiling point, $\Delta H_{v,b}$ (cal/mol)	Normal boiling point, T_B (^oK)	Critical temperature, T_C (^oK)	Molecular weight, MW (g/mol)	Unit risk factor, URF ($\mu g/m^3)^{-1}$	Reference conc., RfC (mg/m^3)
71556	1,1,1-Trichloroethane	7.80E-02	8.80E-06	1.72E-02	25	7,136	347.24	545.00	133.40	0.0E+00	5.0E+00
79016	Trichloroethylene	7.90E-02	9.10E-06	1.03E-02	25	7,505	360.36	544.20	131.39	2.0E-06	6.0E-01
127184	Tetrachloroethylene	7.20E-02	8.20E-06	1.84E-02	25	8,288	394.40	620.20	165.83	5.9E-06	3.5E-02

45 ft Peak Warehouse
Soil Vapor at 15 ft bgs
TSFT Site

INTERMEDIATE CALCULATIONS SHEET

CAS No.	Chemical	Exposure duration, τ (sec)	Source-building separation, L_T (cm)	Stratum A soil air-filled porosity, θ_a^A (cm^3/cm^3)	Stratum B soil air-filled porosity, θ_a^B (cm^3/cm^3)	Stratum C soil air-filled porosity, θ_a^C (cm^3/cm^3)	Stratum A effective total fluid saturation, S_{te} (cm^3/cm^3)	Stratum A soil intrinsic permeability, k_i (cm^2)	Stratum A soil relative air permeability, k_{rg} (cm^2)	Stratum A soil effective vapor permeability, k_v (cm^2)	Floor-wall seam perimeter, X_{crack} (cm)	Soil gas conc. ($\mu g/m^3$)	Bldg. ventilation rate, $Q_{building}$ (cm^3/s)
71556	1,1,1-Trichloroethane	7.88E+08	442	0.321	0.321	0.321	0.003	1.01E-07	0.998	1.01E-07	29,260	1.00E+00	2.04E+07
79016	Trichloroethylene	7.88E+08	442	0.321	0.321	0.321	0.003	1.01E-07	0.998	1.01E-07	29,260	1.00E+00	2.04E+07
127184	Tetrachloroethylene	7.88E+08	442	0.321	0.321	0.321	0.003	1.01E-07	0.998	1.01E-07	29,260	1.00E+00	2.04E+07

CAS No.	Chemical	Area of enclosed space below grade, A_B (cm^2)	Crack-to-total area ratio, η (unitless)	Crack depth below grade, Z_{crack} (cm)	Enthalpy of vaporization at ave. soil temperature, $\Delta H_{v,TS}$ (cal/mol)	Henry's law constant at ave. soil temperature, H_{TS} (atm-m^3/mol)	Henry's law constant at ave. soil temperature, H'_{TS} (unitless)	Vapor viscosity at ave. soil temperature, μ_{TS} (g/cm-s)	Stratum A effective diffusion coefficient, D^{eff}_A (cm^2/s)	Stratum B effective diffusion coefficient, D^{eff}_B (cm^2/s)	Stratum C effective diffusion coefficient, D^{eff}_C (cm^2/s)	Total overall effective diffusion coefficient, D^{eff}_T (cm^2/s)	Diffusion path length, L_d (cm)
71556	1,1,1-Trichloroethane	5.35E+07	5.47E-05	15	7,783	1.33E-02	5.56E-01	1.78E-04	1.26E-02	0.00E+00	0.00E+00	1.26E-02	442
79016	Trichloroethylene	5.35E+07	5.47E-05	15	8,440	7.82E-03	3.26E-01	1.78E-04	1.28E-02	0.00E+00	0.00E+00	1.28E-02	442
127184	Tetrachloroethylene	5.35E+07	5.47E-05	15	9,458	1.35E-02	5.63E-01	1.78E-04	1.16E-02	0.00E+00	0.00E+00	1.16E-02	442

CAS No.	Chemical	Convection path length, L_p (cm)	Source vapor conc., C_{source} ($\mu g/m^3$)	Crack radius, r_{crack} (cm)	Average vapor flow rate into bldg., Q_{soil} (cm^3/s)	Crack effective diffusion coefficient, D^{crack} (cm^2/s)	Area of crack, A_{crack} (cm^2)	Exponent of equivalent foundation Peclet number, $\exp(Pe^f)$ (unitless)	Infinite source indoor attenuation coefficient, α (unitless)	Infinite source bldg. conc., $C_{building}$ ($\mu g/m^3$)	Unit risk factor, URF ($\mu g/m^3)^{-1}$	Reference conc., RfC (mg/m^3)
71556	1,1,1-Trichloroethane	15	1.00E+00	0.10	7.28E+02	1.26E-02	2.93E+03	1.84E+154	2.42E-05	2.42E-05	NA	5.0E+00
79016	Trichloroethylene	15	1.00E+00	0.10	7.28E+02	1.28E-02	2.93E+03	2.05E+152	2.43E-05	2.43E-05	2.0E-06	6.0E-01
127184	Tetrachloroethylene	15	1.00E+00	0.10	7.28E+02	1.16E-02	2.93E+03	1.32E+167	2.35E-05	2.35E-05	5.9E-06	3.5E-02

END

RESULTS SHEET

INCREMENTAL RISK CALCULATIONS:

CAS No.	Chemical	Incremental risk from vapor intrusion to indoor air, carcinogen (unitless)	Hazard quotient from vapor intrusion to indoor air, noncarcinogen (unitless)
71556	1,1,1-Trichloroethane	NA	3.3E-09
79016	Trichloroethylene	1.2E-11	2.8E-08
127184	Tetrachloroethylene	3.4E-11	4.6E-07

SCROLL DOWN TO "END"

END

SG-ADV
Version 3.1; 02/04

Reset to Defaults

Soil Gas Concentration Data

ENTER Chemical CAS No. (numbers only, no dashes)	ENTER Soil gas conc., C_g ($\mu g/m^3$)	OR	ENTER Soil gas conc., C_g (ppmv)	ENTER Soil gas sampling depth below grade, L_s (cm)	ENTER Totals must add up to value of Ls (cell F24) Thickness of soil stratum A, h_A (cm)	Thickness of soil stratum B, (Enter value or 0) h_B (cm)	Thickness of soil stratum C, (Enter value or 0) h_C (cm)	Chemical
71556	1			457	457	0	0	1,1,1-Trichloroethane
79016	1			457	457	0	0	Trichloroethylene
127184	1			457	457	0	0	Tetrachloroethylene

MORE ↓

ENTER Depth below grade to bottom of enclosed space floor, L_F (cm)	ENTER Average soil temperature, T_S (^oC)	ENTER Soil stratum A SCS soil type (used to estimate soil vapor permeability)	OR	ENTER User-defined stratum A soil vapor permeability, k_v (cm^2)
15	19.4	S		

MORE ↓

DO NOT CHANGE STRATUM A VALUES AUTO UPDATED BASED ON CELL "E64"

DO NOT CHANGE STRATUM B VALUES AUTO UPDATED BASED ON CELL "I64"

DO NOT CHANGE STRATUM C VALUES AUTO UPDATED BASED ON CELL "M64"

ENTER Stratum A SCS soil type	Stratum A soil dry bulk density, ρ_b^A (g/cm^3)	Stratum A soil total porosity, n^A (unitless)	Stratum A soil water-filled porosity, θ_w^A (cm^3/cm^3)	ENTER Stratum B SCS soil type	Stratum B soil dry bulk density, ρ_b^B (g/cm^3)	Stratum B soil total porosity, n^B (unitless)	Stratum B soil water-filled porosity, θ_w^B (cm^3/cm^3)	ENTER Stratum C SCS soil type	Stratum C soil dry bulk density, ρ_b^C (g/cm^3)	Stratum C soil total porosity, n^C (unitless)	Stratum C soil water-filled porosity, θ_w^C (cm^3/cm^3)
S	1.66	0.375	0.054	S	1.66	0.375	0.054	S	1.66	0.375	0.054

MORE ↓

ENTER Enclosed space floor thickness, L_{crack} (cm)	ENTER Soil-bldg. pressure differential, ΔP ($g/cm\text{-}s^2$)	ENTER Enclosed space floor length, L_B (cm)	ENTER Enclosed space floor width, W_B (cm)	ENTER Enclosed space height, H_B (cm)	ENTER Floor-wall seam crack width, w (cm)	ENTER Indoor air exchange rate, ER (1/h)	ENTER Average vapor flow rate into bldg. OR Leave blank to calculate Q_{soil} (L/m)
18	40	762	610	305	0.1	1	

ENTER Averaging time for carcinogens, AT_C (yrs)	ENTER Averaging time for noncarcinogens, AT_{NC} (yrs)	ENTER Exposure duration, ED (yrs)	ENTER Exposure frequency, EF (days/yr)
70	25	25	250

END

Large Office
Soil Vapor at 15 ft bgs
TSFT Site

CHEMICAL PROPERTIES SHEET

CAS No.	Chemical	Diffusivity in air, D_a (cm^2/s)	Diffusivity in water, D_w (cm^2/s)	Henry's law constant at reference temperature, H (atm-m^3/mol)	Henry's law constant reference temperature, T_R (^oC)	Enthalpy of vaporization at the normal boiling point, $\Delta H_{v,b}$ (cal/mol)	Normal boiling point, T_B (^oK)	Critical temperature, T_C (^oK)	Molecular weight, MW (g/mol)	Unit risk factor, URF ($\mu g/m^3)^{-1}$	Reference conc., RfC (mg/m^3)
71556	1,1,1-Trichloroethane	7.80E-02	8.80E-06	1.72E-02	25	7,136	347.24	545.00	133.40	0.0E+00	5.0E+00
79016	Trichloroethylene	7.90E-02	9.10E-06	1.03E-02	25	7,505	360.36	544.20	131.39	2.0E-06	6.0E-01
127184	Tetrachloroethylene	7.20E-02	8.20E-06	1.84E-02	25	8,288	394.40	620.20	165.83	5.9E-06	3.5E-02

Large Office
Soil Vapor at 15 ft bgs
TSFT Site

INTERMEDIATE CALCULATIONS SHEET

CAS No.	Chemical	Exposure duration, τ (sec)	Source-building separation, L_T (cm)	Stratum A soil air-filled porosity, θ_a^A (cm^3/cm^3)	Stratum B soil air-filled porosity, θ_a^B (cm^3/cm^3)	Stratum C soil air-filled porosity, θ_a^C (cm^3/cm^3)	Stratum A effective total fluid saturation, S_{te} (cm^3/cm^3)	Stratum A soil intrinsic permeability, k_i (cm^2)	Stratum A soil relative air permeability, k_{rg} (cm^2)	Stratum A soil effective vapor permeability, k_v (cm^2)	Floor-wall seam perimeter, X_{crack} (cm)	Soil gas conc. ($\mu g/m^3$)	Bldg. ventilation rate, $Q_{building}$ (cm^3/s)
71556	1,1,1-Trichloroethane	7.88E+08	442	0.321	0.321	0.321	0.003	1.01E-07	0.998	1.01E-07	2,744	1.00E+00	3.94E+04
79016	Trichloroethylene	7.88E+08	442	0.321	0.321	0.321	0.003	1.01E-07	0.998	1.01E-07	2,744	1.00E+00	3.94E+04
127184	Tetrachloroethylene	7.88E+08	442	0.321	0.321	0.321	0.003	1.01E-07	0.998	1.01E-07	2,744	1.00E+00	3.94E+04

CAS No.	Chemical	Area of enclosed space below grade, A_B (cm^2)	Crack-to-total area ratio, η (unitless)	Crack depth below grade, Z_{crack} (cm)	Enthalpy of vaporization at ave. soil temperature, $\Delta H_{v,TS}$ (cal/mol)	Henry's law constant at ave. soil temperature, H_{TS} (atm-m^3/mol)	Henry's law constant at ave. soil temperature, H'_{TS} (unitless)	Vapor viscosity at ave. soil temperature, μ_{TS} (g/cm-s)	Stratum A effective diffusion coefficient, D^{eff}_A (cm^2/s)	Stratum B effective diffusion coefficient, D^{eff}_B (cm^2/s)	Stratum C effective diffusion coefficient, D^{eff}_C (cm^2/s)	Total overall effective diffusion coefficient, D^{eff}_T (cm^2/s)	Diffusion path length, L_d (cm)
71556	1,1,1-Trichloroethane	4.65E+05	5.90E-04	15	7,783	1.33E-02	5.56E-01	1.78E-04	1.26E-02	0.00E+00	0.00E+00	1.26E-02	442
79016	Trichloroethylene	4.65E+05	5.90E-04	15	8,440	7.82E-03	3.26E-01	1.78E-04	1.28E-02	0.00E+00	0.00E+00	1.28E-02	442
127184	Tetrachloroethylene	4.65E+05	5.90E-04	15	9,458	1.35E-02	5.63E-01	1.78E-04	1.16E-02	0.00E+00	0.00E+00	1.16E-02	442

CAS No.	Chemical	Convection path length, L_p (cm)	Source vapor conc., C_{source} ($\mu g/m^3$)	Crack radius, r_{crack} (cm)	Average vapor flow rate into bldg., Q_{soil} (cm^3/s)	Crack effective diffusion coefficient, D^{crack} (cm^2/s)	Area of crack, A_{crack} (cm^2)	Exponent of equivalent foundation Peclet number, $exp(Pe^f)$ (unitless)	Infinite source indoor attenuation coefficient, α (unitless)	Infinite source bldg. conc., $C_{building}$ ($\mu g/m^3$)	Unit risk factor, URF $(\mu g/m^3)^{-1}$	Reference conc., RfC (mg/m^3)
71556	1,1,1-Trichloroethane	15	1.00E+00	0.10	6.83E+01	1.26E-02	2.74E+02	1.84E+154	2.82E-04	2.82E-04	NA	5.0E+00
79016	Trichloroethylene	15	1.00E+00	0.10	6.83E+01	1.28E-02	2.74E+02	2.05E+152	2.85E-04	2.85E-04	2.0E-06	6.0E-01
127184	Tetrachloroethylene	15	1.00E+00	0.10	6.83E+01	1.16E-02	2.74E+02	1.32E+167	2.64E-04	2.64E-04	5.9E-06	3.5E-02

END

RESULTS SHEET

INCREMENTAL RISK CALCULATIONS:

CAS No.	Chemical	Incremental risk from vapor intrusion to indoor air, carcinogen (unitless)	Hazard quotient from vapor intrusion to indoor air, noncarcinogen (unitless)
71556	1,1,1-Trichloroethane	NA	3.9E-08
79016	Trichloroethylene	1.4E-10	3.3E-07
127184	Tetrachloroethylene	3.8E-10	5.2E-06

SCROLL DOWN TO "END"

END

SG-ADV
Version 3.1; 02/04

Reset to Defaults

Soil Gas Concentration Data

ENTER Chemical CAS No. (numbers only, no dashes)	ENTER Soil gas conc., C_g ($\mu g/m^3$)	OR	ENTER Soil gas conc., C_g (ppmv)	ENTER Soil gas sampling depth below grade, L_s (cm)	ENTER Totals must add up to value of Ls (cell F24) Thickness of soil stratum A, h_A (cm)	Thickness of soil stratum B, (Enter value or 0) h_B (cm)	Thickness of soil stratum C, (Enter value or 0) h_C (cm)	Chemical
71556	1			152	152	0	0	1,1,1-Trichloroethane
79016	1			152	152	0	0	Trichloroethylene
127184	1			152	152	0	0	Tetrachloroethylene

MORE ↓

ENTER Depth below grade to bottom of enclosed space floor, L_F (cm)	ENTER Average soil temperature, T_S (^oC)	ENTER Soil stratum A SCS soil type (used to estimate soil vapor permeability)	OR	ENTER User-defined stratum A soil vapor permeability, k_v (cm^2)
15	19.4	S		

MORE ↓

DO NOT CHANGE STRATUM A VALUES AUTO UPDATED BASED ON CELL "E64"

DO NOT CHANGE STRATUM B VALUES AUTO UPDATED BASED ON CELL "I64"

DO NOT CHANGE STRATUM C VALUES AUTO UPDATED BASED ON CELL "M64"

ENTER Stratum A SCS soil type	Stratum A soil dry bulk density, ρ_b^A (g/cm^3)	Stratum A soil total porosity, n^A (unitless)	Stratum A soil water-filled porosity, θ_w^A (cm^3/cm^3)	ENTER Stratum B SCS soil type	Stratum B soil dry bulk density, ρ_b^B (g/cm^3)	Stratum B soil total porosity, n^B (unitless)	Stratum B soil water-filled porosity, θ_w^B (cm^3/cm^3)	ENTER Stratum C SCS soil type	Stratum C soil dry bulk density, ρ_b^C (g/cm^3)	Stratum C soil total porosity, n^C (unitless)	Stratum C soil water-filled porosity, θ_w^C (cm^3/cm^3)
S	1.66	0.375	0.054	S	1.66	0.375	0.054	S	1.66	0.375	0.054

MORE ↓

ENTER Enclosed space floor thickness, L_{crack} (cm)	ENTER Soil-bldg. pressure differential, ΔP ($g/cm\text{-}s^2$)	ENTER Enclosed space floor length, L_B (cm)	ENTER Enclosed space floor width, W_B (cm)	ENTER Enclosed space height, H_B (cm)	ENTER Floor-wall seam crack width, w (cm)	ENTER Indoor air exchange rate, ER (1/h)	ENTER Average vapor flow rate into bldg. OR Leave blank to calculate Q_{soil} (L/m)
18	40	7315	7315	2438	0.1	1	

ENTER Averaging time for carcinogens, AT_C (yrs)	ENTER Averaging time for noncarcinogens, AT_{NC} (yrs)	ENTER Exposure duration, ED (yrs)	ENTER Exposure frequency, EF (days/yr)
70	25	25	250

END

80 ft Peak Warehouse
Soil Vapor at 5 ft bgs
TSFT Site

CHEMICAL PROPERTIES SHEET

CAS No.	Chemical	Diffusivity in air, D_a (cm^2/s)	Diffusivity in water, D_w (cm^2/s)	Henry's law constant at reference temperature, H (atm-m^3/mol)	Henry's law constant reference temperature, T_R (^oC)	Enthalpy of vaporization at the normal boiling point, $\Delta H_{v,b}$ (cal/mol)	Normal boiling point, T_B (^oK)	Critical temperature, T_C (^oK)	Molecular weight, MW (g/mol)	Unit risk factor, URF ($\mu g/m^3)^{-1}$	Reference conc., RfC (mg/m^3)
71556	1,1,1-Trichloroethane	7.80E-02	8.80E-06	1.72E-02	25	7,136	347.24	545.00	133.40	0.0E+00	5.0E+00
79016	Trichloroethylene	7.90E-02	9.10E-06	1.03E-02	25	7,505	360.36	544.20	131.39	2.0E-06	6.0E-01
127184	Tetrachloroethylene	7.20E-02	8.20E-06	1.84E-02	25	8,288	394.40	620.20	165.83	5.9E-06	3.5E-02

80 ft Peak Warehouse
Soil Vapor at 5 ft bgs
TSFT Site

INTERMEDIATE CALCULATIONS SHEET

CAS No.	Chemical	Exposure duration, τ (sec)	Source-building separation, L_T (cm)	Stratum A soil air-filled porosity, θ_a^A (cm^3/cm^3)	Stratum B soil air-filled porosity, θ_a^B (cm^3/cm^3)	Stratum C soil air-filled porosity, θ_a^C (cm^3/cm^3)	Stratum A effective total fluid saturation, S_{te} (cm^3/cm^3)	Stratum A soil intrinsic permeability, k_i (cm^2)	Stratum A soil relative air permeability, k_{rg} (cm^2)	Stratum A soil effective vapor permeability, k_v (cm^2)	Floor-wall seam perimeter, X_{crack} (cm)	Soil gas conc. ($\mu g/m^3$)	Bldg. ventilation rate, $Q_{building}$ (cm^3/s)
71556	1,1,1-Trichloroethane	7.88E+08	137	0.321	0.321	0.321	0.003	1.01E-07	0.998	1.01E-07	29,260	1.00E+00	3.62E+07
79016	Trichloroethylene	7.88E+08	137	0.321	0.321	0.321	0.003	1.01E-07	0.998	1.01E-07	29,260	1.00E+00	3.62E+07
127184	Tetrachloroethylene	7.88E+08	137	0.321	0.321	0.321	0.003	1.01E-07	0.998	1.01E-07	29,260	1.00E+00	3.62E+07

CAS No.	Chemical	Area of enclosed space below grade, A_B (cm^2)	Crack-to-total area ratio, η (unitless)	Crack depth below grade, Z_{crack} (cm)	Enthalpy of vaporization at ave. soil temperature, $\Delta H_{v,TS}$ (cal/mol)	Henry's law constant at ave. soil temperature, H_{TS} (atm-m^3/mol)	Henry's law constant at ave. soil temperature, H'_{TS} (unitless)	Vapor viscosity at ave. soil temperature, μ_{TS} (g/cm-s)	Stratum A effective diffusion coefficient, D^{eff}_A (cm^2/s)	Stratum B effective diffusion coefficient, D^{eff}_B (cm^2/s)	Stratum C effective diffusion coefficient, D^{eff}_C (cm^2/s)	Total overall effective diffusion coefficient, D^{eff}_T (cm^2/s)	Diffusion path length, L_d (cm)
71556	1,1,1-Trichloroethane	5.35E+07	5.47E-05	15	7,783	1.33E-02	5.56E-01	1.78E-04	1.26E-02	0.00E+00	0.00E+00	1.26E-02	137
79016	Trichloroethylene	5.35E+07	5.47E-05	15	8,440	7.82E-03	3.26E-01	1.78E-04	1.28E-02	0.00E+00	0.00E+00	1.28E-02	137
127184	Tetrachloroethylene	5.35E+07	5.47E-05	15	9,458	1.35E-02	5.63E-01	1.78E-04	1.16E-02	0.00E+00	0.00E+00	1.16E-02	137

CAS No.	Chemical	Convection path length, L_p (cm)	Source vapor conc., C_{source} ($\mu g/m^3$)	Crack radius, r_{crack} (cm)	Average vapor flow rate into bldg., Q_{soil} (cm^3/s)	Crack effective diffusion coefficient, D^{crack} (cm^2/s)	Area of crack, A_{crack} (cm^2)	Exponent of equivalent foundation Peclet number, $exp(Pe^f)$ (unitless)	Infinite source indoor attenuation coefficient, α (unitless)	Infinite source bldg. conc., $C_{building}$ ($\mu g/m^3$)	Unit risk factor, URF $(\mu g/m^3)^{-1}$	Reference conc., RfC (mg/m^3)
71556	1,1,1-Trichloroethane	15	1.00E+00	0.10	7.28E+02	1.26E-02	2.93E+03	1.84E+154	1.75E-05	1.75E-05	NA	5.0E+00
79016	Trichloroethylene	15	1.00E+00	0.10	7.28E+02	1.28E-02	2.93E+03	2.05E+152	1.75E-05	1.75E-05	2.0E-06	6.0E-01
127184	Tetrachloroethylene	15	1.00E+00	0.10	7.28E+02	1.16E-02	2.93E+03	1.32E+167	1.73E-05	1.73E-05	5.9E-06	3.5E-02

END

RESULTS SHEET

INCREMENTAL RISK CALCULATIONS:

CAS No.	Chemical	Incremental risk from vapor intrusion to indoor air, carcinogen (unitless)	Hazard quotient from vapor intrusion to indoor air, noncarcinogen (unitless)
71556	1,1,1-Trichloroethane	NA	2.4E-09
79016	Trichloroethylene	8.6E-12	2.0E-08
127184	Tetrachloroethylene	2.5E-11	3.4E-07

SCROLL DOWN TO "END"

END

DATA ENTRY SHEET

Small Office
Soil Vapor at 5 ft bgs
TSFT Site

SG-ADV
Version 3.1; 02/04

Reset to Defaults

Soil Gas Concentration Data

ENTER Chemical CAS No. (numbers only, no dashes)	ENTER Soil gas conc., C_g ($\mu g/m^3$)	OR	ENTER Soil gas conc., C_g (ppmv)	ENTER Soil gas sampling depth below grade, L_s (cm)	ENTER Totals must add up to value of Ls (cell F24) Thickness of soil stratum A, h_A (cm)	Thickness of soil stratum B, (Enter value or 0) h_B (cm)	Thickness of soil stratum C, (Enter value or 0) h_C (cm)	Chemical
71556	1			152	152	0	0	1,1,1-Trichloroethane
79016	1			152	152	0	0	Trichloroethylene
127184	1			152	152	0	0	Tetrachloroethylene

MORE ↓

ENTER Depth below grade to bottom of enclosed space floor, L_F (cm)	ENTER Average soil temperature, T_S (^oC)	ENTER Soil stratum A SCS soil type (used to estimate soil vapor permeability)	OR	ENTER User-defined stratum A soil vapor permeability, k_v (cm^2)
15	19.4	S		

MORE ↓

DO NOT CHANGE STRATUM A VALUES AUTO UPDATED BASED ON CELL "E64"

DO NOT CHANGE STRATUM B VALUES AUTO UPDATED BASED ON CELL "I64"

DO NOT CHANGE STRATUM C VALUES AUTO UPDATED BASED ON CELL "M64"

ENTER Stratum A SCS soil type	Stratum A soil dry bulk density, ρ_b^A (g/cm^3)	Stratum A soil total porosity, n^A (unitless)	Stratum A soil water-filled porosity, θ_w^A (cm^3/cm^3)	ENTER Stratum B SCS soil type	Stratum B soil dry bulk density, ρ_b^B (g/cm^3)	Stratum B soil total porosity, n^B (unitless)	Stratum B soil water-filled porosity, θ_w^B (cm^3/cm^3)	ENTER Stratum C SCS soil type	Stratum C soil dry bulk density, ρ_b^C (g/cm^3)	Stratum C soil total porosity, n^C (unitless)	Stratum C soil water-filled porosity, θ_w^C (cm^3/cm^3)
S	1.66	0.375	0.054	S	1.66	0.375	0.054	S	1.66	0.375	0.054

MORE ↓

ENTER Enclosed space floor thickness, L_{crack} (cm)	ENTER Soil-bldg. pressure differential, ΔP ($g/cm\text{-}s^2$)	ENTER Enclosed space floor length, L_B (cm)	ENTER Enclosed space floor width, W_B (cm)	ENTER Enclosed space height, H_B (cm)	ENTER Floor-wall seam crack width, w (cm)	ENTER Indoor air exchange rate, ER (1/h)	ENTER Average vapor flow rate into bldg. OR Leave blank to calculate Q_{soil} (L/m)
18	40	610	305	244	0.1	1	

ENTER Averaging time for carcinogens, AT_C (yrs)	ENTER Averaging time for noncarcinogens, AT_{NC} (yrs)	ENTER Exposure duration, ED (yrs)	ENTER Exposure frequency, EF (days/yr)
70	25	25	250

END

Small Office
Soil Vapor at 5 ft bgs
TSFT Site

CHEMICAL PROPERTIES SHEET

CAS No.	Chemical	Diffusivity in air, D_a (cm^2/s)	Diffusivity in water, D_w (cm^2/s)	Henry's law constant at reference temperature, H (atm-m^3/mol)	Henry's law constant reference temperature, T_R (^oC)	Enthalpy of vaporization at the normal boiling point, $\Delta H_{v,b}$ (cal/mol)	Normal boiling point, T_B (^oK)	Critical temperature, T_C (^oK)	Molecular weight, MW (g/mol)	Unit risk factor, URF ($\mu g/m^3)^{-1}$	Reference conc., RfC (mg/m^3)
71556	1,1,1-Trichloroethane	7.80E-02	8.80E-06	1.72E-02	25	7,136	347.24	545.00	133.40	0.0E+00	5.0E+00
79016	Trichloroethylene	7.90E-02	9.10E-06	1.03E-02	25	7,505	360.36	544.20	131.39	2.0E-06	6.0E-01
127184	Tetrachloroethylene	7.20E-02	8.20E-06	1.84E-02	25	8,288	394.40	620.20	165.83	5.9E-06	3.5E-02

Small Office
Soil Vapor at 5 ft bgs
TSFT Site

INTERMEDIATE CALCULATIONS SHEET

CAS No.	Chemical	Exposure duration, τ (sec)	Source-building separation, L_T (cm)	Stratum A soil air-filled porosity, θ_a^A (cm^3/cm^3)	Stratum B soil air-filled porosity, θ_a^B (cm^3/cm^3)	Stratum C soil air-filled porosity, θ_a^C (cm^3/cm^3)	Stratum A effective total fluid saturation, S_{te} (cm^3/cm^3)	Stratum A soil intrinsic permeability, k_i (cm^2)	Stratum A soil relative air permeability, k_{rg} (cm^2)	Stratum A soil effective vapor permeability, k_v (cm^2)	Floor-wall seam perimeter, X_{crack} (cm)	Soil gas conc. ($\mu g/m^3$)	Bldg. ventilation rate, $Q_{building}$ (cm^3/s)
71556	1,1,1-Trichloroethane	7.88E+08	137	0.321	0.321	0.321	0.003	1.01E-07	0.998	1.01E-07	1,830	1.00E+00	1.26E+04
79016	Trichloroethylene	7.88E+08	137	0.321	0.321	0.321	0.003	1.01E-07	0.998	1.01E-07	1,830	1.00E+00	1.26E+04
127184	Tetrachloroethylene	7.88E+08	137	0.321	0.321	0.321	0.003	1.01E-07	0.998	1.01E-07	1,830	1.00E+00	1.26E+04

CAS No.	Chemical	Area of enclosed space below grade, A_B (cm^2)	Crack-to-total area ratio, η (unitless)	Crack depth below grade, Z_{crack} (cm)	Enthalpy of vaporization at ave. soil temperature, $\Delta H_{v,TS}$ (cal/mol)	Henry's law constant at ave. soil temperature, H_{TS} (atm-m^3/mol)	Henry's law constant at ave. soil temperature, H'_{TS} (unitless)	Vapor viscosity at ave. soil temperature, μ_{TS} (g/cm-s)	Stratum A effective diffusion coefficient, D^{eff}_A (cm^2/s)	Stratum B effective diffusion coefficient, D^{eff}_B (cm^2/s)	Stratum C effective diffusion coefficient, D^{eff}_C (cm^2/s)	Total overall effective diffusion coefficient, D^{eff}_T (cm^2/s)	Diffusion path length, L_d (cm)
71556	1,1,1-Trichloroethane	1.86E+05	9.84E-04	15	7,783	1.33E-02	5.56E-01	1.78E-04	1.26E-02	0.00E+00	0.00E+00	1.26E-02	137
79016	Trichloroethylene	1.86E+05	9.84E-04	15	8,440	7.82E-03	3.26E-01	1.78E-04	1.28E-02	0.00E+00	0.00E+00	1.28E-02	137
127184	Tetrachloroethylene	1.86E+05	9.84E-04	15	9,458	1.35E-02	5.63E-01	1.78E-04	1.16E-02	0.00E+00	0.00E+00	1.16E-02	137

CAS No.	Chemical	Convection path length, L_p (cm)	Source vapor conc., C_{source} ($\mu g/m^3$)	Crack radius, r_{crack} (cm)	Average vapor flow rate into bldg., Q_{soil} (cm^3/s)	Crack effective diffusion coefficient, D^{crack} (cm^2/s)	Area of crack, A_{crack} (cm^2)	Exponent of equivalent foundation Peclet number, $\exp(Pe^f)$ (unitless)	Infinite source indoor attenuation coefficient, α (unitless)	Infinite source bldg. conc., $C_{building}$ ($\mu g/m^3$)	Unit risk factor, URF $(\mu g/m^3)^{-1}$	Reference conc., RfC (mg/m^3)
71556	1,1,1-Trichloroethane	15	1.00E+00	0.10	4.55E+01	1.26E-02	1.83E+02	1.84E+154	9.87E-04	9.87E-04	NA	5.0E+00
79016	Trichloroethylene	15	1.00E+00	0.10	4.55E+01	1.28E-02	1.83E+02	2.05E+152	9.96E-04	9.96E-04	2.0E-06	6.0E-01
127184	Tetrachloroethylene	15	1.00E+00	0.10	4.55E+01	1.16E-02	1.83E+02	1.32E+167	9.31E-04	9.31E-04	5.9E-06	3.5E-02

END

RESULTS SHEET

INCREMENTAL RISK CALCULATIONS:

CAS No.	Chemical	Incremental risk from vapor intrusion to indoor air, carcinogen (unitless)	Hazard quotient from vapor intrusion to indoor air, noncarcinogen (unitless)
71556	1,1,1-Trichloroethane	NA	1.4E-07
79016	Trichloroethylene	4.9E-10	1.1E-06
127184	Tetrachloroethylene	1.3E-09	1.8E-05

SCROLL DOWN TO "END"

END

SG-ADV
Version 3.1; 02/04

Reset to Defaults

Soil Gas Concentration Data

ENTER Chemical CAS No. (numbers only, no dashes)	ENTER Soil gas conc., C_g ($\mu g/m^3$)	OR	ENTER Soil gas conc., C_g (ppmv)	ENTER Soil gas sampling depth below grade, L_s (cm)	ENTER Totals must add up to value of Ls (cell F24) Thickness of soil stratum A, h_A (cm)	Thickness of soil stratum B, (Enter value or 0) h_B (cm)	Thickness of soil stratum C, (Enter value or 0) h_C (cm)	Chemical
71556	1			152	152	0	0	1,1,1-Trichloroethane
79016	1			152	152	0	0	Trichloroethylene
127184	1			152	152	0	0	Tetrachloroethylene

MORE ↓

ENTER Depth below grade to bottom of enclosed space floor, L_F (cm)	ENTER Average soil temperature, T_S (^oC)	ENTER Soil stratum A SCS soil type (used to estimate soil vapor permeability)	OR	ENTER User-defined stratum A soil vapor permeability, k_v (cm^2)
15	19.4	S		

MORE ↓

DO NOT CHANGE STRATUM A VALUES AUTO UPDATED BASED ON CELL "E64"

DO NOT CHANGE STRATUM B VALUES AUTO UPDATED BASED ON CELL "I64"

DO NOT CHANGE STRATUM C VALUES AUTO UPDATED BASED ON CELL "M64"

ENTER Stratum A SCS soil type	Stratum A soil dry bulk density, ρ_b^A (g/cm^3)	Stratum A soil total porosity, n^A (unitless)	Stratum A soil water-filled porosity, θ_w^A (cm^3/cm^3)	ENTER Stratum B SCS soil type	Stratum B soil dry bulk density, ρ_b^B (g/cm^3)	Stratum B soil total porosity, n^B (unitless)	Stratum B soil water-filled porosity, θ_w^B (cm^3/cm^3)	ENTER Stratum C SCS soil type	Stratum C soil dry bulk density, ρ_b^C (g/cm^3)	Stratum C soil total porosity, n^C (unitless)	Stratum C soil water-filled porosity, θ_w^C (cm^3/cm^3)
S	1.66	0.375	0.054	S	1.66	0.375	0.054	S	1.66	0.375	0.054

MORE ↓

ENTER Enclosed space floor thickness, L_{crack} (cm)	ENTER Soil-bldg. pressure differential, ΔP ($g/cm\text{-}s^2$)	ENTER Enclosed space floor length, L_B (cm)	ENTER Enclosed space floor width, W_B (cm)	ENTER Enclosed space height, H_B (cm)	ENTER Floor-wall seam crack width, w (cm)	ENTER Indoor air exchange rate, ER (1/h)	ENTER Average vapor flow rate into bldg. OR Leave blank to calculate Q_{soil} (L/m)
18	40	7315	7315	1372	0.1	1	

ENTER Averaging time for carcinogens, AT_C (yrs)	ENTER Averaging time for noncarcinogens, AT_{NC} (yrs)	ENTER Exposure duration, ED (yrs)	ENTER Exposure frequency, EF (days/yr)
70	25	25	250

END

45 ft Peak Warehouse
Soil Vapor at 5 ft bgs
TSFT Site

CHEMICAL PROPERTIES SHEET

CAS No.	Chemical	Diffusivity in air, D_a (cm^2/s)	Diffusivity in water, D_w (cm^2/s)	Henry's law constant at reference temperature, H (atm-m^3/mol)	Henry's law constant reference temperature, T_R (^oC)	Enthalpy of vaporization at the normal boiling point, $\Delta H_{v,b}$ (cal/mol)	Normal boiling point, T_B (^oK)	Critical temperature, T_C (^oK)	Molecular weight, MW (g/mol)	Unit risk factor, URF ($\mu g/m^3)^{-1}$	Reference conc., RfC (mg/m^3)
71556	1,1,1-Trichloroethane	7.80E-02	8.80E-06	1.72E-02	25	7,136	347.24	545.00	133.40	0.0E+00	5.0E+00
79016	Trichloroethylene	7.90E-02	9.10E-06	1.03E-02	25	7,505	360.36	544.20	131.39	2.0E-06	6.0E-01
127184	Tetrachloroethylene	7.20E-02	8.20E-06	1.84E-02	25	8,288	394.40	620.20	165.83	5.9E-06	3.5E-02

45 ft Peak Warehouse
Soil Vapor at 5 ft bgs
TSFT Site

INTERMEDIATE CALCULATIONS SHEET

CAS No.	Chemical	Exposure duration, τ (sec)	Source-building separation, L_T (cm)	Stratum A soil air-filled porosity, θ_a^A (cm^3/cm^3)	Stratum B soil air-filled porosity, θ_a^B (cm^3/cm^3)	Stratum C soil air-filled porosity, θ_a^C (cm^3/cm^3)	Stratum A effective total fluid saturation, S_{te} (cm^3/cm^3)	Stratum A soil intrinsic permeability, k_i (cm^2)	Stratum A soil relative air permeability, k_{rg} (cm^2)	Stratum A soil effective vapor permeability, k_v (cm^2)	Floor-wall seam perimeter, X_{crack} (cm)	Soil gas conc. ($\mu g/m^3$)	Bldg. ventilation rate, $Q_{building}$ (cm^3/s)
71556	1,1,1-Trichloroethane	7.88E+08	137	0.321	0.321	0.321	0.003	1.01E-07	0.998	1.01E-07	29,260	1.00E+00	2.04E+07
79016	Trichloroethylene	7.88E+08	137	0.321	0.321	0.321	0.003	1.01E-07	0.998	1.01E-07	29,260	1.00E+00	2.04E+07
127184	Tetrachloroethylene	7.88E+08	137	0.321	0.321	0.321	0.003	1.01E-07	0.998	1.01E-07	29,260	1.00E+00	2.04E+07

CAS No.	Chemical	Area of enclosed space below grade, A_B (cm^2)	Crack-to-total area ratio, η (unitless)	Crack depth below grade, Z_{crack} (cm)	Enthalpy of vaporization at ave. soil temperature, $\Delta H_{v,TS}$ (cal/mol)	Henry's law constant at ave. soil temperature, H_{TS} (atm-m^3/mol)	Henry's law constant at ave. soil temperature, H'_{TS} (unitless)	Vapor viscosity at ave. soil temperature, μ_{TS} (g/cm-s)	Stratum A effective diffusion coefficient, D^{eff}_A (cm^2/s)	Stratum B effective diffusion coefficient, D^{eff}_B (cm^2/s)	Stratum C effective diffusion coefficient, D^{eff}_C (cm^2/s)	Total overall effective diffusion coefficient, D^{eff}_T (cm^2/s)	Diffusion path length, L_d (cm)
71556	1,1,1-Trichloroethane	5.35E+07	5.47E-05	15	7,783	1.33E-02	5.56E-01	1.78E-04	1.26E-02	0.00E+00	0.00E+00	1.26E-02	137
79016	Trichloroethylene	5.35E+07	5.47E-05	15	8,440	7.82E-03	3.26E-01	1.78E-04	1.28E-02	0.00E+00	0.00E+00	1.28E-02	137
127184	Tetrachloroethylene	5.35E+07	5.47E-05	15	9,458	1.35E-02	5.63E-01	1.78E-04	1.16E-02	0.00E+00	0.00E+00	1.16E-02	137

CAS No.	Chemical	Convection path length, L_p (cm)	Source vapor conc., C_{source} ($\mu g/m^3$)	Crack radius, r_{crack} (cm)	Average vapor flow rate into bldg., Q_{soil} (cm^3/s)	Crack effective diffusion coefficient, D^{crack} (cm^2/s)	Area of crack, A_{crack} (cm^2)	Exponent of equivalent foundation Peclet number, $\exp(Pe^f)$ (unitless)	Infinite source indoor attenuation coefficient, α (unitless)	Infinite source bldg. conc., $C_{building}$ ($\mu g/m^3$)	Unit risk factor, URF $(\mu g/m^3)^{-1}$	Reference conc., RfC (mg/m^3)
71556	1,1,1-Trichloroethane	15	1.00E+00	0.10	7.28E+02	1.26E-02	2.93E+03	1.84E+154	3.11E-05	3.11E-05	NA	5.0E+00
79016	Trichloroethylene	15	1.00E+00	0.10	7.28E+02	1.28E-02	2.93E+03	2.05E+152	3.12E-05	3.12E-05	2.0E-06	6.0E-01
127184	Tetrachloroethylene	15	1.00E+00	0.10	7.28E+02	1.16E-02	2.93E+03	1.32E+167	3.08E-05	3.08E-05	5.9E-06	3.5E-02

END

RESULTS SHEET

INCREMENTAL RISK CALCULATIONS:

CAS No.	Chemical	Incremental risk from vapor intrusion to indoor air, carcinogen (unitless)	Hazard quotient from vapor intrusion to indoor air, noncarcinogen (unitless)
71556	1,1,1-Trichloroethane	NA	4.3E-09
79016	Trichloroethylene	1.5E-11	3.6E-08
127184	Tetrachloroethylene	4.4E-11	6.0E-07

SCROLL DOWN TO "END"

END

SG-ADV
Version 3.1; 02/04

Reset to Defaults

Soil Gas Concentration Data

ENTER Chemical CAS No. (numbers only, no dashes)	ENTER Soil gas conc., C_g ($\mu g/m^3$)	OR	ENTER Soil gas conc., C_g (ppmv)	ENTER Soil gas sampling depth below grade, L_s (cm)	ENTER Totals must add up to value of Ls (cell F24) Thickness of soil stratum A, h_A (cm)	Thickness of soil stratum B, (Enter value or 0) h_B (cm)	Thickness of soil stratum C, (Enter value or 0) h_C (cm)	Chemical
71556	1			152	152	0	0	1,1,1-Trichloroethane
79016	1			152	152	0	0	Trichloroethylene
127184	1			152	152	0	0	Tetrachloroethylene

MORE ↓

ENTER Depth below grade to bottom of enclosed space floor, L_F (cm)	ENTER Average soil temperature, T_S (^oC)	ENTER Soil stratum A SCS soil type (used to estimate soil vapor permeability)	OR	ENTER User-defined stratum A soil vapor permeability, k_v (cm^2)
15	19.4	S		

MORE ↓

DO NOT CHANGE STRATUM A VALUES AUTO UPDATED BASED ON CELL "E64"

DO NOT CHANGE STRATUM B VALUES AUTO UPDATED BASED ON CELL "I64"

DO NOT CHANGE STRATUM C VALUES AUTO UPDATED BASED ON CELL "M64"

ENTER Stratum A SCS soil type	Stratum A soil dry bulk density, ρ_b^A (g/cm^3)	Stratum A soil total porosity, n^A (unitless)	Stratum A soil water-filled porosity, θ_w^A (cm^3/cm^3)	ENTER Stratum B SCS soil type	Stratum B soil dry bulk density, ρ_b^B (g/cm^3)	Stratum B soil total porosity, n^B (unitless)	Stratum B soil water-filled porosity, θ_w^B (cm^3/cm^3)	ENTER Stratum C SCS soil type	Stratum C soil dry bulk density, ρ_b^C (g/cm^3)	Stratum C soil total porosity, n^C (unitless)	Stratum C soil water-filled porosity, θ_w^C (cm^3/cm^3)
S	1.66	0.375	0.054	S	1.66	0.375	0.054	S	1.66	0.375	0.054

MORE ↓

ENTER Enclosed space floor thickness, L_{crack} (cm)	ENTER Soil-bldg. pressure differential, ΔP ($g/cm\text{-}s^2$)	ENTER Enclosed space floor length, L_B (cm)	ENTER Enclosed space floor width, W_B (cm)	ENTER Enclosed space height, H_B (cm)	ENTER Floor-wall seam crack width, w (cm)	ENTER Indoor air exchange rate, ER (1/h)	ENTER Average vapor flow rate into bldg. OR Leave blank to calculate Q_{soil} (L/m)
18	40	762	610	305	0.1	1	

ENTER Averaging time for carcinogens, AT_C (yrs)	ENTER Averaging time for noncarcinogens, AT_{NC} (yrs)	ENTER Exposure duration, ED (yrs)	ENTER Exposure frequency, EF (days/yr)
70	25	25	250

END

Large Office
Soil Vapor at 5 ft bgs
TSFT Site

CHEMICAL PROPERTIES SHEET

CAS No.	Chemical	Diffusivity in air, D_a (cm^2/s)	Diffusivity in water, D_w (cm^2/s)	Henry's law constant at reference temperature, H (atm-m^3/mol)	Henry's law constant reference temperature, T_R (^oC)	Enthalpy of vaporization at the normal boiling point, $\Delta H_{v,b}$ (cal/mol)	Normal boiling point, T_B (^oK)	Critical temperature, T_C (^oK)	Molecular weight, MW (g/mol)	Unit risk factor, URF ($\mu g/m^3)^{-1}$	Reference conc., RfC (mg/m^3)
71556	1,1,1-Trichloroethane	7.80E-02	8.80E-06	1.72E-02	25	7,136	347.24	545.00	133.40	0.0E+00	5.0E+00
79016	Trichloroethylene	7.90E-02	9.10E-06	1.03E-02	25	7,505	360.36	544.20	131.39	2.0E-06	6.0E-01
127184	Tetrachloroethylene	7.20E-02	8.20E-06	1.84E-02	25	8,288	394.40	620.20	165.83	5.9E-06	3.5E-02

Large Office
Soil Vapor at 5 ft bgs
TSFT Site

INTERMEDIATE CALCULATIONS SHEET

CAS No.	Chemical	Exposure duration, τ (sec)	Source-building separation, L_T (cm)	Stratum A soil air-filled porosity, θ_a^A (cm^3/cm^3)	Stratum B soil air-filled porosity, θ_a^B (cm^3/cm^3)	Stratum C soil air-filled porosity, θ_a^C (cm^3/cm^3)	Stratum A effective total fluid saturation, S_{te} (cm^3/cm^3)	Stratum A soil intrinsic permeability, k_i (cm^2)	Stratum A soil relative air permeability, k_{rg} (cm^2)	Stratum A soil effective vapor permeability, k_v (cm^2)	Floor-wall seam perimeter, X_{crack} (cm)	Soil gas conc. ($\mu g/m^3$)	Bldg. ventilation rate, $Q_{building}$ (cm^3/s)
71556	1,1,1-Trichloroethane	7.88E+08	137	0.321	0.321	0.321	0.003	1.01E-07	0.998	1.01E-07	2,744	1.00E+00	3.94E+04
79016	Trichloroethylene	7.88E+08	137	0.321	0.321	0.321	0.003	1.01E-07	0.998	1.01E-07	2,744	1.00E+00	3.94E+04
127184	Tetrachloroethylene	7.88E+08	137	0.321	0.321	0.321	0.003	1.01E-07	0.998	1.01E-07	2,744	1.00E+00	3.94E+04

CAS No.	Chemical	Area of enclosed space below grade, A_B (cm^2)	Crack-to-total area ratio, η (unitless)	Crack depth below grade, Z_{crack} (cm)	Enthalpy of vaporization at ave. soil temperature, $\Delta H_{v,TS}$ (cal/mol)	Henry's law constant at ave. soil temperature, H_{TS} (atm-m^3/mol)	Henry's law constant at ave. soil temperature, H'_{TS} (unitless)	Vapor viscosity at ave. soil temperature, μ_{TS} (g/cm-s)	Stratum A effective diffusion coefficient, D^{eff}_A (cm^2/s)	Stratum B effective diffusion coefficient, D^{eff}_B (cm^2/s)	Stratum C effective diffusion coefficient, D^{eff}_C (cm^2/s)	Total overall effective diffusion coefficient, D^{eff}_T (cm^2/s)	Diffusion path length, L_d (cm)
71556	1,1,1-Trichloroethane	4.65E+05	5.90E-04	15	7,783	1.33E-02	5.56E-01	1.78E-04	1.26E-02	0.00E+00	0.00E+00	1.26E-02	137
79016	Trichloroethylene	4.65E+05	5.90E-04	15	8,440	7.82E-03	3.26E-01	1.78E-04	1.28E-02	0.00E+00	0.00E+00	1.28E-02	137
127184	Tetrachloroethylene	4.65E+05	5.90E-04	15	9,458	1.35E-02	5.63E-01	1.78E-04	1.16E-02	0.00E+00	0.00E+00	1.16E-02	137

CAS No.	Chemical	Convection path length, L_p (cm)	Source vapor conc., C_{source} ($\mu g/m^3$)	Crack radius, r_{crack} (cm)	Average vapor flow rate into bldg., Q_{soil} (cm^3/s)	Crack effective diffusion coefficient, D^{crack} (cm^2/s)	Area of crack, A_{crack} (cm^2)	Exponent of equivalent foundation Peclet number, $\exp(Pe^f)$ (unitless)	Infinite source indoor attenuation coefficient, α (unitless)	Infinite source bldg. conc., $C_{building}$ ($\mu g/m^3$)	Unit risk factor, URF ($\mu g/m^3)^{-1}$	Reference conc., RfC (mg/m^3)
71556	1,1,1-Trichloroethane	15	1.00E+00	0.10	6.83E+01	1.26E-02	2.74E+02	1.84E+154	6.68E-04	6.68E-04	NA	5.0E+00
79016	Trichloroethylene	15	1.00E+00	0.10	6.83E+01	1.28E-02	2.74E+02	2.05E+152	6.73E-04	6.73E-04	2.0E-06	6.0E-01
127184	Tetrachloroethylene	15	1.00E+00	0.10	6.83E+01	1.16E-02	2.74E+02	1.32E+167	6.35E-04	6.35E-04	5.9E-06	3.5E-02

END

RESULTS SHEET

INCREMENTAL RISK CALCULATIONS:

CAS No.	Chemical	Incremental risk from vapor intrusion to indoor air, carcinogen (unitless)	Hazard quotient from vapor intrusion to indoor air, noncarcinogen (unitless)
71556	1,1,1-Trichloroethane	NA	9.1E-08
79016	Trichloroethylene	3.3E-10	7.7E-07
127184	Tetrachloroethylene	9.2E-10	1.2E-05

SCROLL DOWN TO "END"

END

SG-ADV
Version 3.1; 02/04

Reset to Defaults

Soil Gas Concentration Data

ENTER Chemical CAS No. (numbers only, no dashes)	ENTER Soil gas conc., C_g ($\mu g/m^3$)	OR	ENTER Soil gas conc., C_g (ppmv)	ENTER Soil gas sampling depth below grade, L_s (cm)	ENTER Totals must add up to value of Ls (cell F24) Thickness of soil stratum A, h_A (cm)	Thickness of soil stratum B, (Enter value or 0) h_B (cm)	Thickness of soil stratum C, (Enter value or 0) h_C (cm)	Chemical
71556	1			1219	1219	0	0	1,1,1-Trichloroethane
79016	1			1219	1219	0	0	Trichloroethylene
127184	1			1219	1219	0	0	Tetrachloroethylene

MORE ↓

ENTER Depth below grade to bottom of enclosed space floor, L_F (cm)	ENTER Average soil temperature, T_S (^oC)	ENTER Soil stratum A SCS soil type (used to estimate soil vapor permeability)	OR	ENTER User-defined stratum A soil vapor permeability, k_v (cm^2)
15	19.4	S		

MORE ↓

DO NOT CHANGE STRATUM A VALUES AUTO UPDATED BASED ON CELL "E64"

DO NOT CHANGE STRATUM B VALUES AUTO UPDATED BASED ON CELL "I64"

DO NOT CHANGE STRATUM C VALUES AUTO UPDATED BASED ON CELL "M64"

ENTER Stratum A SCS soil type	Stratum A soil dry bulk density, ρ_b^A (g/cm^3)	Stratum A soil total porosity, n^A (unitless)	Stratum A soil water-filled porosity, θ_w^A (cm^3/cm^3)	ENTER Stratum B SCS soil type	Stratum B soil dry bulk density, ρ_b^B (g/cm^3)	Stratum B soil total porosity, n^B (unitless)	Stratum B soil water-filled porosity, θ_w^B (cm^3/cm^3)	ENTER Stratum C SCS soil type	Stratum C soil dry bulk density, ρ_b^C (g/cm^3)	Stratum C soil total porosity, n^C (unitless)	Stratum C soil water-filled porosity, θ_w^C (cm^3/cm^3)
S	1.66	0.375	0.054	S	1.66	0.375	0.054	S	1.66	0.375	0.054

MORE ↓

ENTER Enclosed space floor thickness, L_{crack} (cm)	ENTER Soil-bldg. pressure differential, ΔP ($g/cm\text{-}s^2$)	ENTER Enclosed space floor length, L_B (cm)	ENTER Enclosed space floor width, W_B (cm)	ENTER Enclosed space height, H_B (cm)	ENTER Floor-wall seam crack width, w (cm)	ENTER Indoor air exchange rate, ER (1/h)	ENTER Average vapor flow rate into bldg. OR Leave blank to calculate Q_{soil} (L/m)
18	40	7315	7315	2438	0.1	1	

ENTER Averaging time for carcinogens, AT_C (yrs)	ENTER Averaging time for noncarcinogens, AT_{NC} (yrs)	ENTER Exposure duration, ED (yrs)	ENTER Exposure frequency, EF (days/yr)
70	25	25	250

END

80 ft Peak Warehouse
Soil Vapor at 40 ft bgs
TSFT Site

CHEMICAL PROPERTIES SHEET

CAS No.	Chemical	Diffusivity in air, D_a (cm^2/s)	Diffusivity in water, D_w (cm^2/s)	Henry's law constant at reference temperature, H ($atm\text{-}m^3/mol$)	Henry's law constant reference temperature, T_R (^oC)	Enthalpy of vaporization at the normal boiling point, $\Delta H_{v,b}$ (cal/mol)	Normal boiling point, T_B (^oK)	Critical temperature, T_C (^oK)	Molecular weight, MW (g/mol)	Unit risk factor, URF $(\mu g/m^3)^{-1}$	Reference conc., RfC (mg/m^3)
71556	1,1,1-Trichloroethane	7.80E-02	8.80E-06	1.72E-02	25	7,136	347.24	545.00	133.40	0.0E+00	5.0E+00
79016	Trichloroethylene	7.90E-02	9.10E-06	1.03E-02	25	7,505	360.36	544.20	131.39	2.0E-06	6.0E-01
127184	Tetrachloroethylene	7.20E-02	8.20E-06	1.84E-02	25	8,288	394.40	620.20	165.83	5.9E-06	3.5E-02

80 ft Peak Warehouse
Soil Vapor at 40 ft bgs
TSFT Site

INTERMEDIATE CALCULATIONS SHEET

CAS No.	Chemical	Exposure duration, τ (sec)	Source-building separation, L_T (cm)	Stratum A soil air-filled porosity, θ_a^A (cm^3/cm^3)	Stratum B soil air-filled porosity, θ_a^B (cm^3/cm^3)	Stratum C soil air-filled porosity, θ_a^C (cm^3/cm^3)	Stratum A effective total fluid saturation, S_{te} (cm^3/cm^3)	Stratum A soil intrinsic permeability, k_i (cm^2)	Stratum A soil relative air permeability, k_{rg} (cm^2)	Stratum A soil effective vapor permeability, k_v (cm^2)	Floor-wall seam perimeter, X_{crack} (cm)	Soil gas conc. ($\mu g/m^3$)	Bldg. ventilation rate, $Q_{building}$ (cm^3/s)
71556	1,1,1-Trichloroethane	7.88E+08	1204	0.321	0.321	0.321	0.003	1.01E-07	0.998	1.01E-07	29,260	1.00E+00	3.62E+07
79016	Trichloroethylene	7.88E+08	1204	0.321	0.321	0.321	0.003	1.01E-07	0.998	1.01E-07	29,260	1.00E+00	3.62E+07
127184	Tetrachloroethylene	7.88E+08	1204	0.321	0.321	0.321	0.003	1.01E-07	0.998	1.01E-07	29,260	1.00E+00	3.62E+07

CAS No.	Chemical	Area of enclosed space below grade, A_B (cm^2)	Crack-to-total area ratio, η (unitless)	Crack depth below grade, Z_{crack} (cm)	Enthalpy of vaporization at ave. soil temperature, $\Delta H_{v,TS}$ (cal/mol)	Henry's law constant at ave. soil temperature, H_{TS} (atm-m^3/mol)	Henry's law constant at ave. soil temperature, H'_{TS} (unitless)	Vapor viscosity at ave. soil temperature, μ_{TS} (g/cm-s)	Stratum A effective diffusion coefficient, D^{eff}_A (cm^2/s)	Stratum B effective diffusion coefficient, D^{eff}_B (cm^2/s)	Stratum C effective diffusion coefficient, D^{eff}_C (cm^2/s)	Total overall effective diffusion coefficient, D^{eff}_T (cm^2/s)	Diffusion path length, L_d (cm)
71556	1,1,1-Trichloroethane	5.35E+07	5.47E-05	15	7,783	1.33E-02	5.56E-01	1.78E-04	1.26E-02	0.00E+00	0.00E+00	1.26E-02	1204
79016	Trichloroethylene	5.35E+07	5.47E-05	15	8,440	7.82E-03	3.26E-01	1.78E-04	1.28E-02	0.00E+00	0.00E+00	1.28E-02	1204
127184	Tetrachloroethylene	5.35E+07	5.47E-05	15	9,458	1.35E-02	5.63E-01	1.78E-04	1.16E-02	0.00E+00	0.00E+00	1.16E-02	1204

CAS No.	Chemical	Convection path length, L_p (cm)	Source vapor conc., C_{source} ($\mu g/m^3$)	Crack radius, r_{crack} (cm)	Average vapor flow rate into bldg., Q_{soil} (cm^3/s)	Crack effective diffusion coefficient, D^{crack} (cm^2/s)	Area of crack, A_{crack} (cm^2)	Exponent of equivalent foundation Peclet number, $\exp(Pe^f)$ (unitless)	Infinite source indoor attenuation coefficient, α (unitless)	Infinite source bldg. conc., $C_{building}$ ($\mu g/m^3$)	Unit risk factor, URF ($\mu g/m^3)^{-1}$	Reference conc., RfC (mg/m^3)
71556	1,1,1-Trichloroethane	15	1.00E+00	0.10	7.28E+02	1.26E-02	2.93E+03	1.84E+154	8.74E-06	8.74E-06	NA	5.0E+00
79016	Trichloroethylene	15	1.00E+00	0.10	7.28E+02	1.28E-02	2.93E+03	2.05E+152	8.80E-06	8.80E-06	2.0E-06	6.0E-01
127184	Tetrachloroethylene	15	1.00E+00	0.10	7.28E+02	1.16E-02	2.93E+03	1.32E+167	8.35E-06	8.35E-06	5.9E-06	3.5E-02

END

RESULTS SHEET

INCREMENTAL RISK CALCULATIONS:

CAS No.	Chemical	Incremental risk from vapor intrusion to indoor air, carcinogen (unitless)	Hazard quotient from vapor intrusion to indoor air, noncarcinogen (unitless)
71556	1,1,1-Trichloroethane	NA	1.2E-09
79016	Trichloroethylene	4.3E-12	1.0E-08
127184	Tetrachloroethylene	1.2E-11	1.6E-07

SCROLL DOWN TO "END"

END

Off-Site Resident Scenario

Kleinfelder Project Number 101942

Subject: **Vapor Intrusion Evaluation for Adjacent Residential Property**
TSFT-Former Excello Property
4057 and 4059 Goodwin Avenue
Los Angeles, California

The Spirito Family Trust retained Kleinfelder to evaluate the adverse human health effects to adjacent residential properties that may result from the off-site migration and residential building intrusion of sub-surface soil vapors from the former Excello site. The Spirito Family Trust – Former Excello site (TSFT site) is located at 4057 and 4059 Goodwin Avenue in Los Angeles, California (Plate 1). Redevelopment of the TSFT site is being contemplated that may include a parking apron for trucks, a dry goods warehouse, or a perishable goods warehouse.

In October 2008 (Kleinfelder, 2008), volatile organic compounds (VOCs) in soil vapor at the TSFT site were reported at concentrations that exceeded California Human Health Screening Levels (CHHSLs) for soil vapor in a commercial or industrial exposure scenario (OEHHA, 2005). The California Department of Toxic Substances Control (DTSC) guidance for the evaluation of vapor intrusion (DTSC, 2004) states vapor intrusion is not expected at buildings greater than 100 feet from a source of soil vapors. Because soil vapor concentrations exceed CHHSLs beneath the contemplated on-site building, remediation or mitigation is being contemplated for soil vapors that exceed commercial/industrial vapor intrusion screening levels in order to protect on-site commercial or industrial workers. Residential buildings are located within approximately 65 feet of the southern boundary of the TSFT site and within 100 feet of VOCs detected in soil vapor at sample locations K-1 through K-5, K-8, and K-9 (Plate 2). Therefore, because a residential structure is within 100 feet of the subject site, the evaluation of vapor intrusion in off-site residential buildings adjacent to the TSFT site is consistent with DTSC policy.

This report presents an evaluation of cancer risk and non-cancer hazard to residents under the assumption that a residential structure is present on the TSFT site. The evaluation was conducted using the advanced version of the U.S.

Environmental Protection Agency's (US EPA's) Johnson & Ettinger model for soil vapor. The purpose of the evaluation was to support decisions about appropriate soil vapor remediation or mitigation measures during contemplated site redevelopment. Therefore, two off-site residential vapor intrusion exposure scenarios were evaluated: "Current conditions" using soil vapor concentrations measured in October 2008 (Kleinfelder, 2008); and, "Post-remediation" using soil vapor concentrations that do not exceed California Human Health Screening Levels (CHHSLs) under commercial/industrial land use.

CHHSLs are chemical-specific concentrations in soil vapor that are not expected to result in adverse health effects under a given land use. CHHSLs are based on target levels of cancer risk (i.e., one in one million [10^{-6}]) or noncancer hazard (i.e., a hazard quotient of 1). CHHSLs are considered to be protective of humans (including sensitive groups) over a lifetime of exposure because conservative assumptions are incorporated into the equations used to calculate the screening values.

Johnson and Ettinger Modeling

The Johnson and Ettinger model is a one-dimensional analytical solution to advective and diffusive vapor transport into indoor spaces. The US EPA's version of the Johnson and Ettinger model spreadsheets can also be used to characterize risks using site-specific toxicity factors and exposure parameters. Site-specific inputs to the model included estimated soil temperature, the type of soil separating the soil vapor from the bottom of the building slab, the assumed depth at which soil vapors may be encountered, VOC concentrations for the post-remediation exposure scenario, and toxicity factors applicable to sites in California as provided by the DTSC (DTSC, 2009). The site-specific inputs (excluding toxicity factors) are presented in Tables 1 and 2. The toxicity factors provided by DTSC are presented in Attachments A.

For the post-remediation scenario, model input concentrations were the commercial/industrial soil vapor CHHSLs or the maximum soil vapor concentration, whichever was lowest. The maximum soil vapor concentrations of TCE (38,000 µg/m^3) and PCE (12,000 µg/m^3) exceeded commercial/industrial soil vapor CHHSLs (TCE = 1,770 µg/m^3 and PCE = 603 µg/m^3). Therefore the post-remediation scenario concentrations of TCE and PCE were assumed to be equal to the soil

vapor CHHSLs. The maximum soil vapor concentration 1,1,1-TCA was less than the CHHSL for that compound, therefore, the maximum concentration was used as the model input concentration under the current and post-remediation scenarios. A CHHSL is not available for 1,1-DCE or chloroform so the maximum concentration was also used for the current and post-remediation scenarios.

The Johnson and Ettinger model inputs for the off-site residential building included default values for the residential building dimensions and air exchange rate. The Johnson and Ettinger model evaluates migration of vapors in the vertical dimension, not in the horizontal dimension. Therefore, for the purpose of this vapor intrusion evaluation, the off-site residential building was conservatively assumed to be directly over vapor sources at the TSFT site. The off-site residential building was assumed to be constructed slab-on-grade (i.e. not with a basement). All soil vapor concentrations were assumed to occur at five feet bgs regardless of actual depth. The Johnson and Ettinger model version used in this evaluation was SG-ADV (version 3.1; 02/04). Toxicity values for the model are those provided by the DTSC in its screening level Johnson and Ettinger SG model (DTSC, 2009). The soil temperature was estimated from guidance provided in the US EPA *User's Guide for Evaluating Subsurface Vapor Intrusion into Buildings* (EQM, 2004). The model spreadsheets were modified to accommodate more than one chemical. The modification did not affect spreadsheet function. All Johnson and Ettinger model inputs and results are provided in the model spreadsheets found in Attachment A .

RISK CHARACTERIZATION

The purpose of the risk characterization is to quantify the potential health hazard associated with VOCs detected at the site under defined exposure conditions. Based on the results of the Johnson and Ettinger model for estimated indoor air concentrations, the potential health hazards for each exposure scenario are estimated in the risk characterization.

Quantifying Cancer Risk

Estimates of cancer risk were developed based on an incremental lifetime excess cancer risk (ILCR). A cumulative ILCR of 1×10^{-6} (one in one million) indicates that, in a population of one million individuals, one case of cancer in addition to the background rate of cancer attributable to all causes may occur as a result of exposure to the chemicals of concern in this evaluation. The background rate of

cancer in the United States is about one in three, for all causes. The ILCR is the product of an estimated daily intake and a toxicity value, known as an inhalation unit risk, which quantifies the carcinogenicity of a given compound. The estimated daily intake is calculated from the results of the Johnson and Ettinger model and exposure parameters input to the model spreadsheets. The toxicity values were identified from the DTSC version of the Johnson and Ettinger model (DTSC, 2009).

The ILCR is the upper-bound incremental probability of an individual developing cancer during their lifetime as a result of exposure to one or more of the VOCs identified for exposure scenario. Assuming the linearized multistage model for carcinogenesis, the ILCR is calculated by the Johnson and Ettinger model spreadsheet by multiplying the average daily intake of a COC by the cancer slope factor, as indicated below:

$$ILCR = IUR \times CI$$

where:

ILCR	=	the probability of an individual developing cancer (unitless)
CI	=	estimated daily COC intake in micrograms per cubic meter ($\mu g/ m^3$); assuming an inhalation rate of 20 m^3 per day
IUR	=	inhalation unit risk $(\mu g/m^3)^{-1}$

Cal/EPA and EPA guidance for the evaluation of cancer risk associated with simultaneous exposure to multiple carcinogens assumes that incremental cancer risks are additive, even though the physiological interaction between COCs may be synergistic, antagonistic, or none at all (EPA, 1989; DTSC, 1992). The total ILCR is estimated as follows:

$$ILCR_T = \sum ILCR_i$$

where:

$ILCR_T$	=	total incremental lifetime cancer risk
$ILCR_i$	=	the cancer risk estimate for the i-th toxicant

Cal/EPA and EPA policy should be considered when interpreting the significance of cancer risk estimates. Cal/EPA policy indicates that the point of departure for risk

management decisions is an ILCR of 1 x 10^{-6}; thus cancer risks below that level generally do not warrant further investigation or remediation. In the National Contingency Plan (NCP) (40 CFR Part 300) (EPA, 1990), the EPA states that, "... *for known or suspected carcinogens, acceptable exposure levels are generally concentration levels that represent an excess upper-bound lifetime cancer risk to an individual of between 1 x 10^{-4} to 1 x 10^{-6}*." Current EPA guidance states that, where cumulative site risk to an individual based on reasonable maximum exposure is less than 1 x 10^{-4} (one in ten thousand), and non-cancer hazards and ecological effects are not a concern, action generally is not warranted (EPA, 1991).

Quantifying Non-cancer Hazard

The likelihood of off-site residents developing noncancerous health effects due to exposures to TSFT site VOCs was evaluated by calculating a hazard quotient (HQ). The HQ is the ratio of the estimated daily intake for a given VOC and the noncancer reference concentration (RfC) for that VOC. The RfC is an estimate of a daily human intake in milligrams per cubic meter assuming an inhalation rate of 20 m^3 per day that is likely to be without an appreciable noncarcinogenic hazard of deleterious effects during a lifetime or a portion of a lifetime (EPA, 1989). RfCs are established by the EPA and Cal/EPA and are designed to be protective of sensitive populations, including children, the elderly, and the infirm. If the estimated constituent intake exceeds the RfC, the hazard quotient will exceed 1. This is an indication that the estimated intake may represent a level of concern. The hazard quotient, however, is not a measure of the probability of a health effect occurring. Because of the conservatism or uncertainty inherent in the RfC, a hazard quotient greater than 1 does not necessarily mean that an adverse effect will occur, only that additional evaluation is required by Cal/EPA policy.

Non-cancer effects of VOCs are evaluated by dividing the estimated daily constituent intake by the RfC for that constituent. The resulting value is referred to as the "hazard quotient," as indicated on the following page:

Non-cancer Hazard Quotient = Estimated Daily VOC Intake/RfC

To evaluate potential noncancerous health hazards posed by simultaneous exposure to multiple constituents, the hazard quotients for each VOC within a given exposure pathway are summed. The resulting value is referred to as the hazard

index (HI) for that pathway. The summation of hazard quotients to obtain the HI assumes additivity of toxic effects and generally is appropriate only for constituents with similar toxic endpoints (e.g., liver toxicity) and those that have no antagonistic or synergistic effects between or among them.

The HI is expressed as follows:

$$HI = E_1/RfC_1 + E_2/RfC_2 + ... + E_i/RfC_i$$

where:

E_i = constituent intake for the i-th toxicant (mg/m^3)

RfC_i = reference dose for the i-th toxicant (mg/m^3)

If the cumulative HI is less than 1, adverse non-cancerous health effects are not expected. If the sum is greater than 1, additional evaluation of potential non-cancerous health hazards may be warranted. Such additional evaluations may include the consideration of specific target organ(s) and mechanism(s) of action for VOCs that pose a significant portion of the hazard. Exposure assumptions and exposure concentrations used to estimate adverse health effects should also be examined.

Post-Remediation Vapor Intrusion Risk Characterization

The evaluation of vapor intrusion under the post-remediation scenario assumed that concentrations of VOCs measured at sample points K-1 through K-5, K-8, and K-9 in October 2008, were at their maximum detected concentration or remediated to commercial/industrial soil vapor CHHSLs and were present in soil vapor at five feet bgs directly under a residential building.

Based upon these assumptions for the post-remediation scenario and the Johnson and Ettinger SG model, the off-site residential cancer risk (ILCR) was 4×10^{-6} and the non-cancer hazard (HI) was 0.03 (Table 3).

Uncertainties

The actual non-cancer hazard and cancer risk for the current conditions and post-remediation scenarios are likely to be less than estimated using the Johnson and Ettinger SG model because several simplifying conservative assumptions were

made to avoid what is known in statistics as a Type II error (false negative result). A false negative result in vapor intrusion evaluation would mean that the actual non-cancer hazard or cancer risk, or both, exceed an acceptable level when the evaluation indicates that non-cancer hazard or cancer risk, or both, are less than an acceptable level.

The site-specific simplifying assumptions include:

- Maximum detected concentrations were used to represent the soil vapor concentrations. This assumption will tend to over-estimate the actual concentrations of each VOC to which receptors are exposed as it is based on a point concentration at the upper end of the range of concentrations reported.

- The measured soil concentrations were assumed to be present directly beneath an off-site residential building located approximately 65 feet from the TSFT site boundary. This assumption will tend to over-estimate the actual concentrations as it does not account for potential subsurface features that may inhibit horizontal soil vapor migration (i.e., utility trenches) or the loss of VOCs from shallow soil vapor to ambient air.

- The post-remediation concentrations at 5 feet bgs were assumed to be the maximum concentration detected in 2008 or to be reduced to commercial/industrial soil vapor CHHSLs. This assumption will tend to over-estimate the actual concentrations as soil vapor remediation technologies are not chemical-specific and are likely to result in reduced concentrations of all VOCs, not only the VOCs that exceed CHHSLs.

- The post-remediation exposure scenario assumed soil vapor VOC concentrations at 5 feet bgs were reduced to commercial/industrial soil vapor CHHSLs. In the development of the soil vapor CHHSLs, OEHHA assumed the depth to sources of VOCs in soil vapor was 19.5 inches below ground surface (bgs). If the post-remediation soil vapor VOC concentrations are reduced to CHHLs at depths shallower than 5 feet bgs, the actual cancer risks and noncancer hazards may be greater than the values estimated in this vapor intrusion evaluation.

- Soil vapor concentrations were assumed to remain constant the duration of exposure (30 years for residential exposure scenarios). No degradation or dilution of VOC concentrations over the duration of exposure was assumed in the calculation of cancer risk and noncancer hazard. This assumption is expected to result in an overestimate of the actual cancer risk and noncancer hazard.

- The Johnson and Ettinger model describing the migration of constituents from a source medium (soil vapor) to an exposure point (off-site residential building) is based upon conservative assumptions provided by EPA or Cal/EPA. Actual site conditions that affect vapor migration may differ from the input model parameters such that actual cancer risk and noncancer hazard may be greater or less than the values calculated in this vapor intrusion evaluation.

Vapor Intrusion Evaluation Conclusions

Two off-site resident vapor intrusion exposure scenarios were evaluated: current conditions using the maximum soil vapor concentrations measured in October 2008 at locations within 100 feet of an off-site residential building; and, post-remediation conditions that assume maximum soil vapor concentrations within 100 feet of the off-site residential building have been reduced to the commercial/industrial soil vapor CHHSL value.

Based upon the current conditions scenario, the non-cancer HI of 0.5 is less than the level that triggers non-cancer hazard management decisions under Cal/EPA policy (1). The ILCR of 7×10^{-5} is greater than the level that triggers risk management decisions under Cal/EPA policy (1×10^{-6}) but does not exceed the level (1×10^{-4}) at which the US EPA considers remedial or mitigation measures to be warranted.

Based upon the post-remediation conditions scenario, the non-cancer HI of 0.03 is less than the level that triggers risk management decisions under Cal/EPA policy (1). The ILCR of 4×10^{-6} is greater than the level that triggers risk management decisions under Cal/EPA policy (1×10^{-6}) but does not exceed the level (1×10^{-4}) at which the US EPA considers remedial or mitigation actions to be warranted.

Attachments

References

Tables 1 – 3

Plates

Attachment A - Post Remediation Conditions Johnson and Ettinger Model Spreadsheets

REFERENCES

Department of Toxic Substances Control (DTSC), 1992. Supplemental Guidance for Human Health Multimedia Risk Assessments of Hazardous Waste Sites and Permitted Facilities. State of California, Environmental Protection Agency, Department of Toxic Substances Control, Sacramento, California. July, reprinted September 1993, corrected and reprinted August 1996.

DTSC, 2004. Interim Final Guidance for the Evaluation and Mitigation of Subsurface Vapor Intrusion to Indoor Air. December 15. Revised February 7, 2005.

DTSC, 2009. Screening-Level Model for Soil Gas Contamination. February 4. Downloaded on June 19, 2009 from: http://www.dtsc.ca.gov/AssessingRisk/JE_Models.cfm.

EPA, 1989. Risk Assessment Guidance for Superfund, Volume I, Human Health Evaluation Manual (Part A). Office of Emergency and Remedial Response, U.S. Environmental Protection Agency, Washington DC, EPA/540/1-89/002, December.

EPA, 1990. National Oil and Hazardous Substances Pollution Contingency Plan, Final Rule. 40 CFR Part 300

EPA, 1991. Role of the Baseline Risk Assessment in Superfund Remedy Selection Decisions. OSWER Directive 9355.0-30. Office of Solid Waste and Emergency Response, U.S. Environmental Protection Agency. Washington DC. April 22.

EQM, 2004. User's Guide for Evaluating Subsurface Vapor Intrusion into Buildings. Prepared by Environmental Quality Management, Inc., Durham, North Carolina. Prepared for Industrial Economics Incorporated, Cambridge, Massachusetts under EPA contract 68-W-01-058. Revised February 2004.

Kleinfelder, 2008. Supplemental Site Assessment, The Spirito Family Trust Parcel, 4057 Goodwin Avenue, Los Angeles, California 90039. November 26.

OEHHA. 2005. Use of California Human Health Screening Levels (CHHSLs) in Evaluation of Contaminated Properties. Office of Environmental Health Hazard Assessment, California Environmental Protection Agency, Sacramento, California. January.

Table 1
Summary of Johnson and Ettinger Model Parameters
Parameters Common to Each Scenario
TSFT Site

Parameter	Value	Units	Comment
Groundwater temperature	19.4	°C	From EQM 2003
Stratum A - Soil type immediately beneath the building	LS	NA	Loamy Sand, based upon the 5 foot soil interval in boring log B-48, the boring closest to the adjacent residential property and assuming the most conservative amount of fines.
Stratum A thickness	152	cm	Model input soil vapor concentrations were assumed to be present at 5 feet bgs.
Depth below grade to bottom of enclosed space floor	15	cm	Default value for slab-on-grade construction, DTSC 2004.
Depth to soil gas depth of interest	152	cm	Model input soil vapor concentrations were assumed to be present at 5 feet bgs.
Enclosed space slab thickness	10	cm	Residential building default, EQM 2004
Enclosed space floor length	1000	cm	Residential building default, EQM 2004
Enclosed space floor width	1000	cm	Residential building default, EQM 2004
Enclosed space height	244	cm	Residential building default, EQM 2004
Indoor air exchange rate	0.5	per hour	Residential building default, EQM 2004
Average vapor flow rate into building	5	L/m	Residential building default, EQM 2004
Averaging time for carcinogens	70	years	Residential scenario default, EQM 2004
Averaging time for noncarcinogens	30	years	Residential scenario default, EQM 2004
Exposure duration	30	years	Residential scenario default, EQM 2004
Exposure frequency	350	days/year	Residential scenario default, EQM 2004

Notes:
NA = Not Applicable
°C = degrees Celsius
cm = centimeters
L/m = liters per minute

Table 2
Summary of Johnson and Ettinger Model Parameters
Vapor Concentrations for Post Remediation
TSFT Excello Site

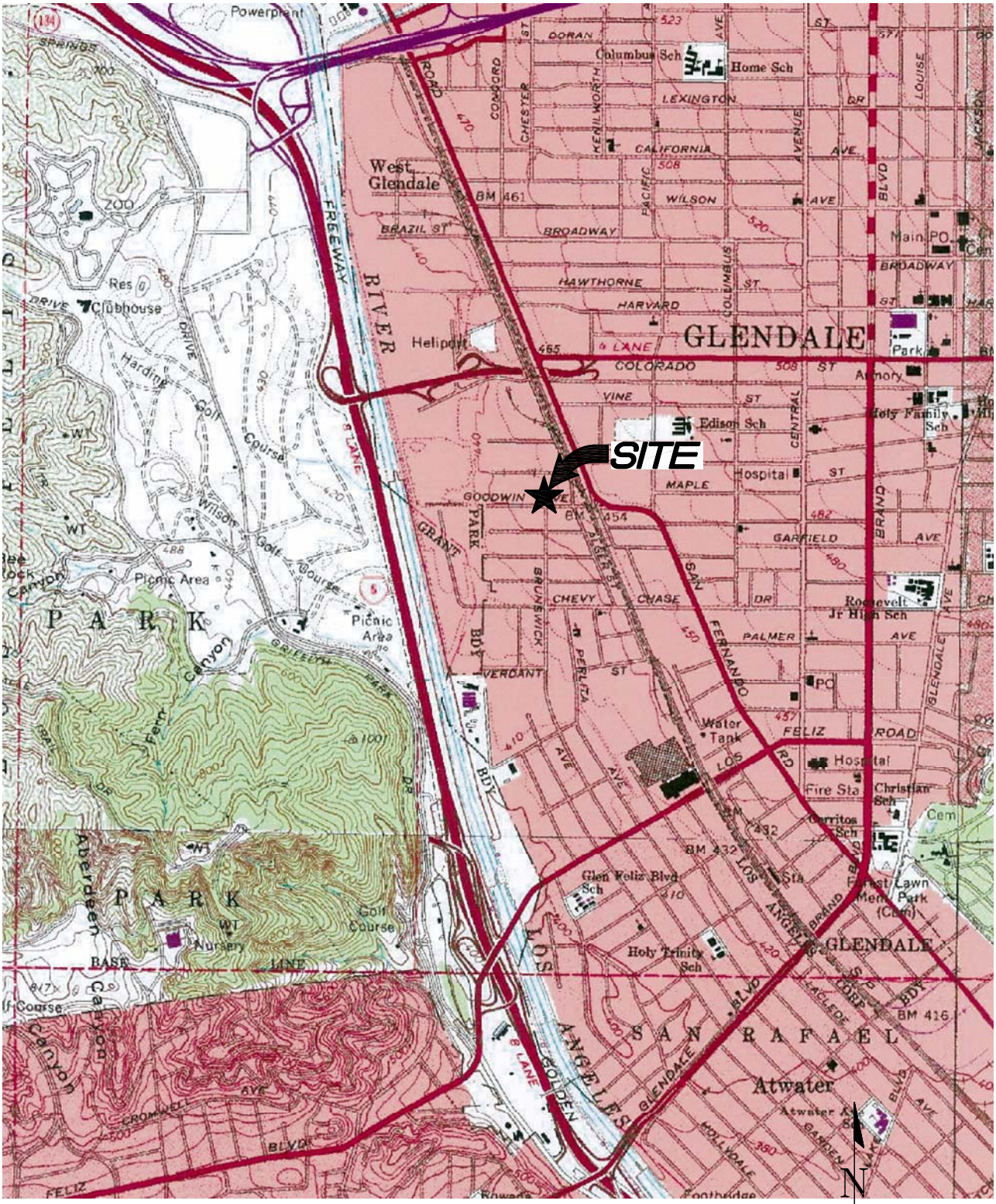
Constituent	Scenario	Input Concentration ($\mu g/m^3$)	Basis
1,1-Dichloroethene	Post-Remediation	400	Maximum detected
1,1,1-Trichloroethene	Post-Remediation	4,800	Maximum detected
Chloroform	Post-Remediation	200	Maximum detected
Tetrachloroethylene	Post-Remediation	603	CHHSL
Trichloroethylene	Post-Remediation	1,770	CHHSL

Notes:
$\mu g/m^3$ = micrograms per cubic meter
Maximum detected = Maximum detected concentration in soil vapor collected at all depths at sample locations K-1, K-2, K-3, K-4, K-5, K-8, and K-9
CHHSL = CHHSL soil vapor screening level for commercial or industrial exposure scenarios
Input Concentration = Scenario input concentration for calculating cancer risk and noncancer hazard
Current Conditions = Soil vapor concentrations measured in October 2008
Post-Remediation = Soil vapor concentrations identified from the minimum of soil vapor CHHSLs and maximum detected concentrations

Table 3
Risk Characterization Summary
TSFT Excello Site

Constituent	Exposure Scenario	Cancer Risk	Noncancer Hazard
1,1-Dichloroethene	Post-Remediation	NA	0.007
1,1,1-Trichloroethane	Post-Remediation	NA	0.001
Chloroform	Post-Remediation	6×10^{-7}	0.0009
Tetrachloroethene	Post-Remediation	2×10^{-6}	0.02
Trichloroethene	Post-Remediation	2×10^{-6}	0.004
ILCR or HI	**Post-Remediation**	**4×10^{-6}**	**0.03**

Notes:
Cancer risks and noncancer hazards are rounded to one significant figure.
ILCR = Incidental Lifetime Cancer Risk, sum of the cancer risks for each constituent.
HI = Hazard Index, sum of the noncancer hazards for each constituent.



SOURCE: U.S.G.S. 7.5' topographic series, Burbank, California quadrangle dated 1966, photorevised 1972.

The Information included on this graphic representation has been compiled from a variety of sources and is subject to change without notice. Kleinfelder makes no representations or warranties, express or implied, as to accuracy, completeness, timeliness, or rights to the use of such information. This document is not intended for use as a land survey product nor is it designed or intended as a construction design document. The use or misuse of the information contained on this graphic representation is at the sole risk of the party using or misusing the information.

KLEINFELDER
Bright People. Right Solutions.
www.kleinfelder.com

PROJECT NO.	101942
DRAWN:	9/2010
DRAWN BY:	MRG
CHECKED BY:	PD
FILE NAME:	101942p1.dwg

SITE VICINITY MAP

EXCELLO PLATING CO., INC.
4057 AND 4059 GOODWIN AVENUE
LOS ANGELES, CALIFORNIA

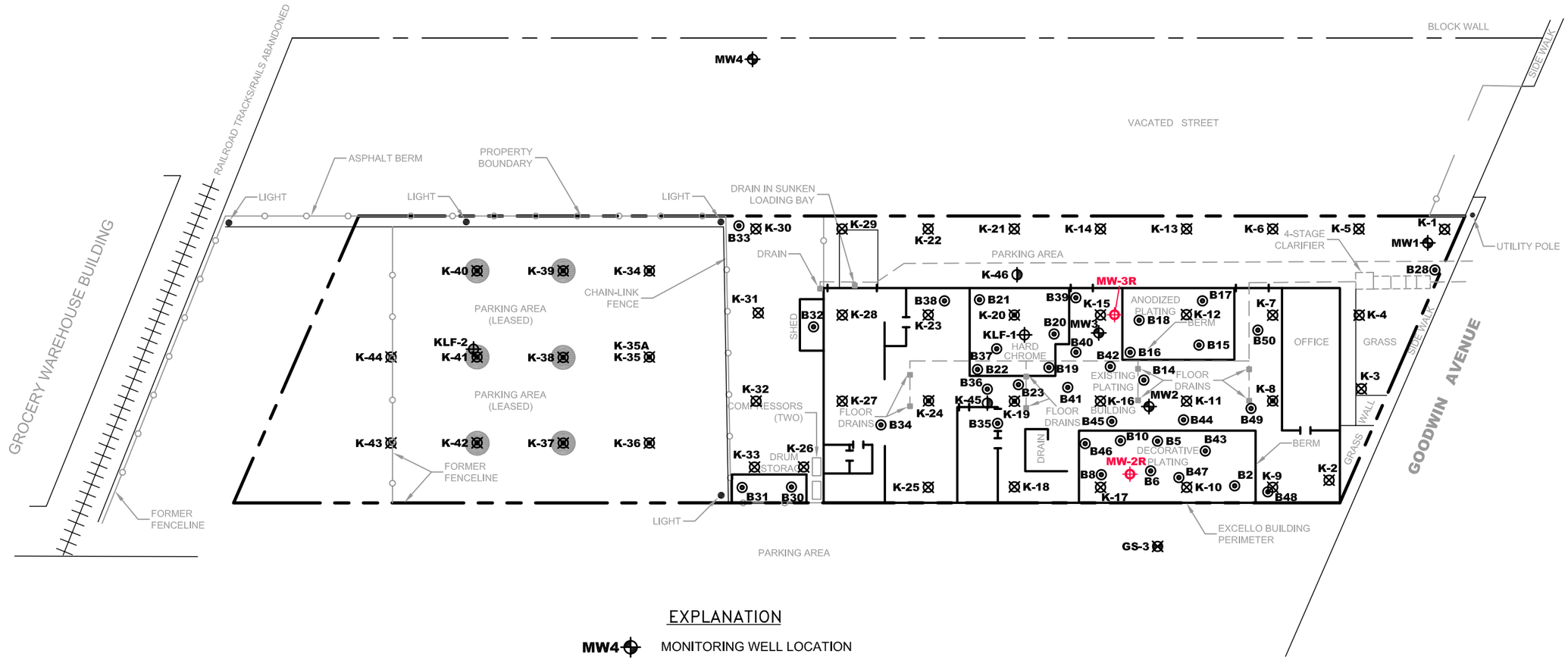
PLATE **1**

ATTACHED IMAGES: Images: 92124p1.JPG
ATTACHED XREFS:
Diamond Bar, CA

CAD FILE: L:\2010\CADD\101942\ LAYOUT: 1

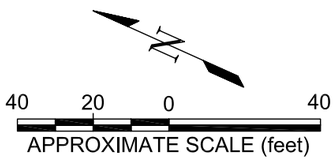
PLOTTED: 24 Sep 2010, 11:18am, mgriffin

PLOTTED: 24 Sep 2010, 11:19am, mgriffin
CAD FILE: L:\2010\CADD\101942\ LAYOUT: 2
ATTACHED IMAGES:
ATTACHED XREFS:
DIAMOND BAR, CA



EXPLANATION

MW4	MONITORING WELL LOCATION
K-33	KLEINFELDER VAPOR PROBE LOCATION
B50	CERES SOIL BORING LOCATION
K-44	KLEINFELDER SOIL BORING AND VAPOR PROBE LOCATION
K-46	KLEINFELDER SOIL BORING LOCATION
GS-3	EXTRACTION WELL LOCATION
KLF-2	PHYSICAL PARAMETER SOIL BORING LOCATION
MW-3R	PROPOSED REPLACEMENT WELL
	BURIED CONCRETE LAYER ENCOUNTERED



The information included on this graphic representation has been compiled from a variety of sources and is subject to change without notice. Kleinfelder makes no representations or warranties, express or implied, as to accuracy, completeness, timeliness, or rights to the use of such information. This document is not intended for use as a land survey product nor is it designed or intended as a construction design document. The use or misuse of the information contained on this graphic representation is at the sole risk of the party using or misusing the information.

KLEINFELDER
Bright People. Right Solutions.
www.kleinfelder.com

PROJECT NO.	101942
DRAWN:	9/2010
DRAWN BY:	MRG
CHECKED BY:	PD
FILE NAME:	101942p2_SP.dwg

SITE PLAN

EXCELLO PLATING CO., INC.
4057 AND 4059 GOODWIN AVENUE
LOS ANGELES, CALIFORNIA

PLATE
2

ATTACHMENT A
POST-REMEDIATION CONDITIONS
JOHNSON AND ETTINGER MODEL SPREADSHEETS

SG-ADV
Version 3.1; 02/04

Reset to Defaults

Soil Gas Concentration Data

ENTER Chemical CAS No. (numbers only, no dashes)	ENTER Soil gas conc., C_g ($\mu g/m^3$)	OR	ENTER Soil gas conc., C_g (ppmv)	ENTER Soil gas sampling depth below grade, L_s (cm)	ENTER Thickness of soil stratum A, h_A (cm)	ENTER Thickness of soil stratum B, (Enter value or 0) h_B (cm)	ENTER Thickness of soil stratum C, (Enter value or 0) h_C (cm)	Chemical
					Totals must add up to value of Ls (cell F24)			
79016	1770			152	152	0	0	Trichloroethylene
127184	603			152	152	0	0	Tetrachloroethylene
75354	400			152	152	0	0	1,1-Dichloroethylene
67663	200			152	152	0	0	Chloroform
71556	4800			152	152	0	0	1,1,1-Trichloroethane

MORE ↓

ENTER Depth below grade to bottom of enclosed space floor, L_F (cm)	ENTER Average soil temperature, T_S (°C)	ENTER Soil stratum A SCS soil type (used to estimate soil vapor permeability)	OR	ENTER User-defined stratum A soil vapor permeability, k_v (cm^2)
15	19.4	LS		

MORE ↓

DO NOT CHANGE STRATUM A VALUES AUTO UPDATED BASED ON CELL "E64"

DO NOT CHANGE STRATUM B VALUES AUTO UPDATED BASED ON CELL "I64"

DO NOT CHANGE STRATUM C VALUES AUTO UPDATED BASED ON CELL "M64"

ENTER Stratum A SCS soil type	Stratum A soil dry bulk density, ρ_b^A (g/cm^3)	Stratum A soil total porosity, n^A (unitless)	Stratum A soil water-filled porosity, θ_w^A (cm^3/cm^3)	ENTER Stratum B SCS soil type	Stratum B soil dry bulk density, ρ_b^B (g/cm^3)	Stratum B soil total porosity, n^B (unitless)	Stratum B soil water-filled porosity, θ_w^B (cm^3/cm^3)	ENTER Stratum C SCS soil type	Stratum C soil dry bulk density, ρ_b^C (g/cm^3)	Stratum C soil total porosity, n^C (unitless)	Stratum C soil water-filled porosity, θ_w^C (cm^3/cm^3)
LS	1.62	0.39	0.076	S	1.66	0.375	0.054	S	1.66	0.375	0.054

MORE ↓

ENTER Enclosed space floor thickness, L_{crack} (cm)	ENTER Soil-bldg. pressure differential, ΔP ($g/cm\text{-}s^2$)	ENTER Enclosed space floor length, L_B (cm)	ENTER Enclosed space floor width, W_B (cm)	ENTER Enclosed space height, H_B (cm)	ENTER Floor-wall seam crack width, w (cm)	ENTER Indoor air exchange rate, ER (1/h)	ENTER Average vapor flow rate into bldg. OR Leave blank to calculate Q_{soil} (L/m)
10	40	1000	1000	244	0.1	0.5	5

ENTER Averaging time for carcinogens, AT_C (yrs)	ENTER Averaging time for noncarcinogens, AT_{NC} (yrs)	ENTER Exposure duration, ED (yrs)	ENTER Exposure frequency, EF (days/yr)
70	30	30	350

END

CHEMICAL PROPERTIES

CAS No.	Chemical	Diffusivity in air, D_a (cm^2/s)	Diffusivity in water, D_w (cm^2/s)	Henry's law constant at reference temperature, H ($atm\text{-}m^3/mol$)	Henry's law constant reference temperature, T_R (^oC)	Enthalpy of vaporization at the normal boiling point, $\Delta H_{v,b}$ (cal/mol)	Normal boiling point, T_B (^oK)	Critical temperature, T_C (^oK)	Molecular weight, MW (g/mol)	Unit risk factor, URF $(\mu g/m^3)^{-1}$	Reference conc., RfC (mg/m^3)
79016	Trichloroethylene	7.90E-02	9.10E-06	1.03E-02	25	7,505	360.36	544.20	131.39	2.0E-06	6.0E-01
127184	Tetrachloroethylene	7.20E-02	8.20E-06	1.84E-02	25	8,288	394.40	620.20	165.83	5.9E-06	3.5E-02
75354	1,1-Dichloroethylene	9.00E-02	1.04E-05	2.60E-02	25	6,247	304.75	576.05	96.94	0.0E+00	7.0E-02
67663	Chloroform	1.04E-01	1.00E-05	3.66E-03	25	6,988	334.32	536.40	119.38	5.3E-06	3.0E-01
71556	1,1,1-Trichloroethane	7.80E-02	8.80E-06	1.72E-02	25	7,136	347.24	545.00	133.40	0.0E+00	5.0E+00

CAS No.	Chemical	Exposure duration, τ (sec)	Source-building separation, L_T (cm)	Stratum A soil air-filled porosity, θ_a^A (cm^3/cm^3)	Stratum B soil air-filled porosity, θ_a^B (cm^3/cm^3)	Stratum C soil air-filled porosity, θ_a^C (cm^3/cm^3)	Stratum A effective total fluid saturation, S_{te} (cm^3/cm^3)	Stratum A soil intrinsic permeability, k_i (cm^2)	Stratum A soil relative air permeability, k_{rg} (cm^2)	Stratum A soil effective vapor permeability, k_v (cm^2)	Floor-wall seam perimeter, X_{crack} (cm)	Soil gas conc. ($\mu g/m^3$)	Bldg. ventilation rate, $Q_{building}$ (cm^3/s)
79016	Trichloroethylene	9.46E+08	137	0.314	0.321	0.321	0.079	1.65E-08	0.957	1.58E-08	4,000	1.77E+03	3.39E+04
127184	Tetrachloroethylene	9.46E+08	137	0.314	0.321	0.321	0.079	1.65E-08	0.957	1.58E-08	4,000	6.03E+02	3.39E+04
75354	1,1-Dichloroethylene	9.46E+08	137	0.314	0.321	0.321	0.079	1.65E-08	0.957	1.58E-08	4,000	4.00E+02	3.39E+04
67663	Chloroform	9.46E+08	137	0.314	0.321	0.321	0.079	1.65E-08	0.957	1.58E-08	4,000	2.00E+02	3.39E+04
71556	1,1,1-Trichloroethane	9.46E+08	137	0.314	0.321	0.321	0.079	1.65E-08	0.957	1.58E-08	4,000	4.80E+03	3.39E+04

CAS No.	Chemical	Area of enclosed space below grade, A_B (cm^2)	Crack-to-total area ratio, η (unitless)	Crack depth below grade, Z_{crack} (cm)	Enthalpy of vaporization at ave. soil temperature, $\Delta H_{v,TS}$ (cal/mol)	Henry's law constant at ave. soil temperature, H_{TS} (atm-m^3/mol)	Henry's law constant at ave. soil temperature, H'_{TS} (unitless)	Vapor viscosity at ave. soil temperature, μ_{TS} (g/cm-s)	Stratum A effective diffusion coefficient, D^{eff}_A (cm^2/s)	Stratum B effective diffusion coefficient, D^{eff}_B (cm^2/s)	Stratum C effective diffusion coefficient, D^{eff}_C (cm^2/s)	Total overall effective diffusion coefficient, D^{eff}_T (cm^2/s)	Diffusion path length, L_d (cm)
79016	Trichloroethylene	1.06E+06	3.77E-04	15	8,440	7.82E-03	3.26E-01	1.78E-04	1.10E-02	0.00E+00	0.00E+00	1.10E-02	137
127184	Tetrachloroethylene	1.06E+06	3.77E-04	15	9,458	1.35E-02	5.63E-01	1.78E-04	1.00E-02	0.00E+00	0.00E+00	1.00E-02	137
75354	1,1-Dichloroethylene	1.06E+06	3.77E-04	15	6,330	2.12E-02	8.84E-01	1.78E-04	1.25E-02	0.00E+00	0.00E+00	1.25E-02	137
67663	Chloroform	1.06E+06	3.77E-04	15	7,456	2.88E-03	1.20E-01	1.78E-04	1.44E-02	0.00E+00	0.00E+00	1.44E-02	137
71556	1,1,1-Trichloroethane	1.06E+06	3.77E-04	15	7,783	1.33E-02	5.56E-01	1.78E-04	1.08E-02	0.00E+00	0.00E+00	1.08E-02	137

CAS No.	Chemical	Convection path length, L_p (cm)	Source vapor conc., C_{source} ($\mu g/m^3$)	Crack radius, r_{crack} (cm)	Average vapor flow rate into bldg., Q_{soil} (cm^3/s)	Crack effective diffusion coefficient, D^{crack} (cm^2/s)	Area of crack, A_{crack} (cm^2)	Exponent of equivalent foundation Peclet number, $\exp(Pe^f)$ (unitless)	Infinite source indoor attenuation coefficient, α (unitless)	Infinite source bldg. conc., $C_{building}$ ($\mu g/m^3$)	Unit risk factor, URF $(\mu g/m^3)^{-1}$	Reference conc., RfC (mg/m^3)
79016	Trichloroethylene	15	1.77E+03	0.10	8.33E+01	1.10E-02	4.00E+02	2.92E+82	1.24E-03	2.20E+00	2.0E-06	6.0E-01
127184	Tetrachloroethylene	15	6.03E+02	0.10	8.33E+01	1.00E-02	4.00E+02	3.04E+90	1.18E-03	7.14E-01	5.9E-06	3.5E-02
75354	1,1-Dichloroethylene	15	4.00E+02	0.10	8.33E+01	1.25E-02	4.00E+02	2.43E+72	1.32E-03	5.28E-01	NA	7.0E-02
67663	Chloroform	15	2.00E+02	0.10	8.33E+01	1.44E-02	4.00E+02	4.38E+62	1.41E-03	2.82E-01	5.3E-06	3.0E-01
71556	1,1,1-Trichloroethane	15	4.80E+03	0.10	8.33E+01	1.08E-02	4.00E+02	3.33E+83	1.23E-03	5.92E+00	NA	5.0E+00

END

INCREMENTAL RISK CALCULATIONS:

CAS No.	Chemical	Incremental risk from vapor intrusion to indoor air, carcinogen (unitless)	Hazard quotient from vapor intrusion to indoor air, noncarcinogen (unitless)
79016	Trichloroethylene	1.8E-06	3.5E-03
127184	Tetrachloroethylene	1.7E-06	2.0E-02
75354	1,1-Dichloroethylene	NA	7.2E-03
67663	Chloroform	6.1E-07	9.0E-04
71556	1,1,1-Trichloroethane	NA	1.1E-03
		Sum ILCR 4E-06	Sum HI 0.03

SCROLL DOWN TO "END"

END

APPENDIX K

LOGS OF BORINGS AND PHYSICAL PARAMETER ANALYTICAL TESTING RESULTS

Date Drilled:	Water Depth:
Drilled By:	Date Measured:
Drilling Method:	Reference Elevation:
Logged By:	Datum:

Elevation (feet) Depth	Sample	Sample No.	Blow Count (Blows/ft.)	Graphic Log	GEOTECHNICAL DESCRIPTION AND CLASSIFICATION	Dry Density (pcf)	Moisture Content (%)	Additional Tests
		1	6			108	10	DS, SE
		2	12					GS
5								
	(1)	(2)	(3)	(4)	(5)	(6)	(6)	(7)

NOTES ON FIELD INVESTIGATION

1. SAMPLE – Graphical representation of sample type as shown below.
   - Split Spoon – Standard Penetration Test Sample (SPT)
   - Drive Sample – California Sample (Cal)
   - Bulk Sample – Obtained by collecting cuttings in a plastic bag
   - Tube Sample – Shelby/Pitcher Tube Sample

2. SAMPLE NO. – Sample Number

3. BLOWS/FT – Number of blows required to advance sampler 1 foot (unless a lesser distance is specified). Samplers in general were driven into the soil at the bottom of the hole with a standard (140 lb) hammer dropping a standard 30 inches. Drive samples collected in bucket auger borings may be obtained by dropping non-standard weight from variable heights. When a SPT sampler is used the blow count conforms to ASTM D-1586.

   SCR/RQD – Sample Core Recovery (SCR) in percent (%) and Rock Quality Designation (RQD) in percent (%). RQD is defined as the percentage of core in each run which the spacing between natural fractures is greater than 4 inches. Mechanical breaks of the core are not considered.

4. GRAPHIC LOG – Standard symbols for soil and rock types, as shown on plate A-1b.

5. GEOTECHNICAL DESCRIPTION

   Soil – Soil classifications are based on the United Soil Classification System per ASTM D-2987, and designations include consistency, moisture, color and other modifiers. Field descriptions have been modified to reflect results of laboratory analyses where deemed appropriate.

   Rock – Rock classifications generally include a rock type, color, moisture, mineral constituents, degree of weathering, alteration, and the mechanical properties of the rock. Fabric, lineations, bedding spacing, foliations, and degree of cementation are also presented where appropriate.

   Description of soil origin or rock formation is placed in brackets at the beginning of the description where applicable, for example, Residual Soil.

6. DRY DENSITY, MOISTURE CONTENT: As estimated by laboratory or field testing.

7. ADDITIONAL TESTS – (Indicates sample tested for properties other than the above):

MAX – Maximum Dry Density	SG – Specific Gravity	PP – Pocket Penetrometer
GS – Grain Size Distribution	HA – Hydrometer Analysis	WA – Wash Analysis
SE – Sand Equivalent	AL – Atterberg Limits	DS – Direct Shear
EI – Expansion Index	RV – R-Value	CP – Collapse Potential
CHEM – Sulfate and Chloride Content, pH, Resistivity	CN – Consolidation	UC – Unconfined Compression
PM – Permeability	CU – Consolidation Undrained Triaxial	T – Torvane
UU – Unconsolidated Undrained Triaxial	CD – Consolidated Drained Triaxial	

8. ATTITUDES – Orientation of rock discontinuity observed in bucket auger boring or rock core, expressed in strike/dip and dip angle, respectively, preceeded by a one-letter symbol denoting nature of discontinuity as shown below.

   B: Bedding Plane J: Jointing C: Contact F: Fault S: Shear

KLEINFELDER
Bright People. Right Solutions.
www.kleinfelder.com

EXPLANATION OF LOGS

PLATE
A-1a

UNIFIED SOIL CLASSIFICATION SYSTEM (ASTM D-2487)

PRIMARY DIVISIONS			GROUP SYMBOLS	SECONDARY DIVISIONS
COURSE GRAINED SOILS: MORE THAN HALF OF MATERIALS IS LARGER THAN #200 SIEVE SIZE	GRAVELS: MORE THAN HALF OF COURSE FRACTION IS LARGER THAN #4 SIEVE	CLEAN GRAVELS (LESS THAN) 5% FINES	GW	WELL GRADED GRAVELS, GRAVEL-SAND MIXTURES, LITTLE OR NO FINES
			GP	POORLY GRADED GRAVELS OR GRAVEL-SAND MIXTURES, LITTLE OR NO FINES
		GRAVEL WITH FINES	GM	SILTY GRAVELS, GRAVEL-SAND-SILT MIXTURES
			GC	CLAYEY GRAVELS, GRAVEL-SAND-CLAY MIXTURES
	SANDS: MORE THAN HALF OF COURSE FRACTION IS SMALLER THAN #4 SIEVE	CLEAN SANDS (LESS THAN) 5% FINES	SW	WELL GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES
			SP	POORLY GRADED SANDS OR GRAVELLY SANDS, LITTLE OR NO FINES
		SANDS WITH FINES	SM	SILTY SANDS, SAND-SILT MIXTURES
			SC	CLAYEY SANDS, SAND-CLAY MIXTURES
FINE GRAINED SOILS: MORE THAN HALF OF MATERIALS IS SMALLER THAN #200 SIEVE SIZE	SILTS AND CLAYS: LIQUID LIMIT IS LESS THAN 50		ML	INORGANIC SILTS, VERY FINE SANDS, ROCK FLOUR, SILTY OR CLAYEY FINE SANDS
			CL	INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS, LEAN CLAYS
			OL	ORGANIC SILTS AND ORGANIC SILT-CLAYS OF LOW PLASTICITY
	SILTS AND CLAYS: LIQUID LIMIT IS GREATER THAN 50		MH	INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS FINE SANDS OR SILTS, ELASTIC SILTS
			CH	INORGANIC CLAYS OF HIGH PLASTICITY, FAT CLAYS
			OH	ORGANIC CLAYS OF MEDIUM TO HIGH PLASTICITY, ORGANIC SILTS
	HIGHLY ORGANIC SOILS		PT	PEAT, MUCK AND OTHER HIGHLY ORGANIC SOILS
TYPICAL FORMATIONAL MATERIALS	SANDSTONES		SS	
	SILTSTONES		SH	
	CLAYSTONES		CS	
	LIMESTONES		LS	
	SHALE		SL	

CONSISTENCY CRITERIA BASED ON FIELD TESTS

RELATIVE DENSITY – COARSE – GRAIN SOIL

RELATIVE DENSITY	SPT * (# blows/ft)	RELATIVE DENSITY (%)
Very Loose	<4	0 – 15
Loose	4 – 10	15 – 35
Medium Dense	10 – 30	35 – 65
Dense	30 – 50	65 – 85
Very Dense	>50	85 – 100

CONSISTENCY–FINE–GRAIN SOIL

CONSISTENCY	SPT (# blows/ft)	TORVANE: UNDRAINED SHEAR STRENGTH (tsf)	POCKET ** PENETROMETER: UNCONFINED COMPRESSIVE STRENGTH (tsf)
Very Soft	<2	<0.13	<0.25
Soft	2 – 4	0.13 – 0.25	0.25 – 0.5
Medium Stiff	4 – 8	0.25 – 0.5	0.5 – 1.0
Stiff	8 – 15	0.5 – 1.0	1.0 – 2.0
Very Stiff	15 – 30	1.0 – 2.0	2.0 – 4.0
Hard	>30	>2.0	>4.0

* NUMBER OF BLOWS OF 140 POUND HAMMER FALLING 30 INCHES TO DRIVE A 2 INCH O.D. (1 3/8 INCH I.D.) SPLIT BARREL SAMPLER (ASTM-1586 STANDARD PENETRATION TEST)

** UNCONFINED COMPRESSIVE STRENGTH IN TONS/SQ.FT. READ FROM POCKET PENETROMETER

MOISTURE CONTENT

DESCRIPTION	FIELD TEST
Dry	Absence of moisture, dusty, dry to the touch
Moist	Damp but no visible water
Wet	Visible free water, usually soil is below water table

CEMENTATION

DESCRIPTION	FIELD TEST
Weakly	Crumbles or breaks with handling or slight finger pressure
Moderately	Crumbles or breaks with considerable finger pressure
Strongly	Will not crumble or break with finger pressure

KLEINFELDER
Bright People. Right Solutions.
www.kleinfelder.com

EXPLANATION OF LOGS

PLATE
A-1b

Date Drilled:	11/6/09	Water Depth:	> 43.5
Drilled By:	ABC Liovin Drilling, Inc.	Date Measured:	11/6/2009
Drilling Method:	8 inch, HSA, Trip Hammer	Elevation:	
Logged By:	FJJ	Datum:	

Depth (feet)	Sample Type	Sample Number	Blows per Foot	Graphic Log	SOIL DESCRIPTION AND CLASSIFICATION	Dry Density (pcf)	Moisture Content (%)	Additional Tests
					Concrete: approximately 6 inches thick			
					Artificial Fill: **Silty Sand (SM):** olive brown to brown, moist, fine- to coarse-grained			
5			16		**Alluvium:** **Poorly Graded Sand (SP):** yellowish brown, moist, medium dense, fine- to coarse-grained, trace fine gravel			
			15		-- increase in fine-grained, with coarse granitic rock in middle of sample			
					Poorly Graded Sand with Silt (SP-SM): yellowish brown, moist, medium dense, fine- to medium-grained, trace coarse-grained, some fine gravel			
10			22		-- increase in fines content			
					Silty Sand (SM): olive, moist, fine- to medium-grained, trace coarse grained -- increase in moisture content -- decrease in fines content			
15			36		**Poorly Graded Sand (SP):** yellowish brown to brown, moist, dense, fine- to medium-grained, some coarse-grained, trace coarse gravel			
					Poorly Graded Sand with Silt (SP-SM): yellowish brown to brown, moist, fine- to medium-grained -- fine- to coarse-grained			
20			41		**Sandy Silt (ML):** yellowish brown to yellow, moist, firm to hard, fine- to coarse-grained, some fine and coarse gravel, trace salt-like material			KLF-1-21 KLF-1-21.5 KLF-1-22 KLF-1-BULK-1 KLF-1-22.5 KLF-1-23 KLF-1-23.5 KLF-1-24 KLF-1-26 KLF-1-26.5 KLF-1-27
					-- trace coarse gravel			
25			45		**Poorly Graded Sand with Silt (SP-SM):** yellow to light yellowish brown, moist, fine- to coarse-grained, trace fine and coarse gravel			
					-- increase in fines content			
					Silty Sand (SM): olive, moist, fine- to medium-grained, trace coarse gravel -- decrease in fines content			
30			48		**Poorly Graded Sand with Silt (SP-SM):** olive, moist, dense, fine- to medium-grained, some coarse-grained, trace fine- to coarse-grained at tip of sample -- increase in fines content -- with fine and coarse gravel			

KLEINFELDER
Bright People. Right Solutions.

PROJECT NO. 101942-005

The Spirito Family Trust Parcel
4057 and 4059 Goodwin Avenue
Los Angeles, California

LOG OF BORING KLF-1

PLATE
A-2a

GEOTECH DB 101942-005 REVISED.GPJ KA_RDLND.GDT 12/3/09

Drafted By: Reviewed By:

Legend To Logs On Plate A-1

Note: The boundaries between soil types shown on the logs are approximate as the transition between different soil layers may be gradual.

Depth (feet)	Sample Type	Sample Number	Blows per Foot	Graphic Log	SOIL DESCRIPTION AND CLASSIFICATION *(Continued From Previous Page)*	Dry Density (pcf)	Moisture Content (%)	Additional Tests
			36 50/6"		-- increase in fines content, some coarse gravel			
					Sandy Silt (ML): olive, moist, soft to firm, fine- to medium-grained, some clay, moderate iron oxide staining, slight yellowish staining -- decrease in fines content			KLF-1-37 KLF-1-38.5
40			51		**Clayey Sand (SC):** olive to dark brown, moist, very dense, fine- to medium-grained, trace vertical silt lenses approximately 1/8-inch thick, moderate iron oxide staining			KLF-1-39.5 KLF-1-40 KLF-1-BULK-2
			37 50/6"		-- gravel up to 3 inches in diameter observed in cuttings			KLF-1-40.5
			40 50/6"		-- decrease in fines content, heavy iron oxide staining			KLF-1-41 KLF-1-41.5
					Poorly Graded Sand (SP): yellowish brown, moist, very dense, fine- to coarse-grained, heavy iron oxide staining			KLF-1-42.5 KLF-1-43

Boring terminated at approximately 43.5 feet.
Groundwater not encountered.
Boring backfilled with bentonite-grout slurry and capped with approximately 4 inches of cement.`

GEOTECH DB 101942-005 REVISED.GPJ KA_RDLND.GDT 12/3/09

KLEINFELDER
Bright People. Right Solutions.

PROJECT NO. 101942-005

The Spirito Family Trust Parcel
4057 and 4059 Goodwin Avenue
Los Angeles, California

LOG OF BORING KLF-1

PLATE
A-2b

Legend To Logs On Plate A-1

Note: The boundaries between soil types shown on the logs are approximate as the transition between different soil layers may be gradual.

Date Drilled:	11/6/09	Water Depth:	> 45.5
Drilled By:	ABC Liovin Drilling, Inc.	Date Measured:	11/6/2009
Drilling Method:	8 inch, HSA, Trip Hammer	Elevation:	
Logged By:	FJJ	Datum:	

Depth (feet)	Sample Type	Sample Number	Blows per Foot	Graphic Log	SOIL DESCRIPTION AND CLASSIFICATION	Dry Density (pcf)	Moisture Content (%)	Additional Tests
					Asphalt/Concrete: approximately 3.75 inches of asphalt, 4.5 inches of base, 5 inches of sand with silt, 3.5 inches of concrete, and 3 feet of highly-compacted soil			
5					**Silty Sand (SM):** dark olive brown, moist, fine- to medium-grained, some coarse-grained and fine gravel -- grinding on possible cobbles			
10					-- decrease in fines content			
15					**Poorly Graded Sand with Silt (SP-SM):** dark olive brown, moist, fine- to coarse-grained			
20					-- olive, dense to very dense, trace fine gravel -- decrease in fines content			KLF-2-21.5 KLF-2-22 KLF-2-BULK-1 KLF-2-22.5 KLF-2-23 KLF-2-23.5 KLF-2-24 KLF-2-24.5 KLF-2-25 KLF-2-25.5
25			50 60		**Poorly Graded Sand (SP):** light gray, moist, dense to very dense, fine- to coarse-grained -- increase in fines content -- fine- to medium-grained -- increase in fines content toward tip of sample			
30								

KLEINFELDER
Bright People. Right Solutions.

PROJECT NO. 101942-005

The Spirito Family Trust Parcel
4057 and 4059 Goodwin Avenue
Los Angeles, California

LOG OF BORING KLF-2

PLATE

A-3a

GEOTECH DB 101942-005 REVISED.GPJ KA_RDLND.GDT 12/3/09

Drafted By: Reviewed By:

Legend To Logs On Plate A-1

Note: The boundaries between soil types shown on the logs are approximate as the transition between different soil layers may be gradual.

Depth (feet)	Sample Type	Sample Number	Blows per Foot	Graphic Log	SOIL DESCRIPTION AND CLASSIFICATION *(Continued From Previous Page)*	Dry Density (pcf)	Moisture Content (%)	Additional Tests
40					-- no recovery			
			41 50/6"		**Clayey Sand (SC):** olive gray, moist, very dense, fine to medium grained -- decrease in fines content toward tip of sample			KLF-2-41 KLF-2-41.5 KLF-2-BULK-2
45					**Poorly Graded Sand with Silt (SP-SM):** light gray to white, moist, fine- to coarse-grained, with fine to coarse gravel -- fine- to medium-grained -- increase in fines content, with fine to coarse pebble-like gravel			KLF-2-43 KFL-2-43.5 KLF-2-44 KLF-2-44.5 KLF-2-45
					Boring terminated at approximately 45.5 feet. Groundwater not encountered. Boring backfilled with bentonite-grout slurry and capped with approximately 4 inches of cement.`			

GEOTECH DB 101942-005 REVISED.GPJ KA_RDLND.GDT 12/3/09

KLEINFELDER
Bright People. Right Solutions.

PROJECT NO. 101942-005

The Spirito Family Trust Parcel
4057 and 4059 Goodwin Avenue
Los Angeles, California

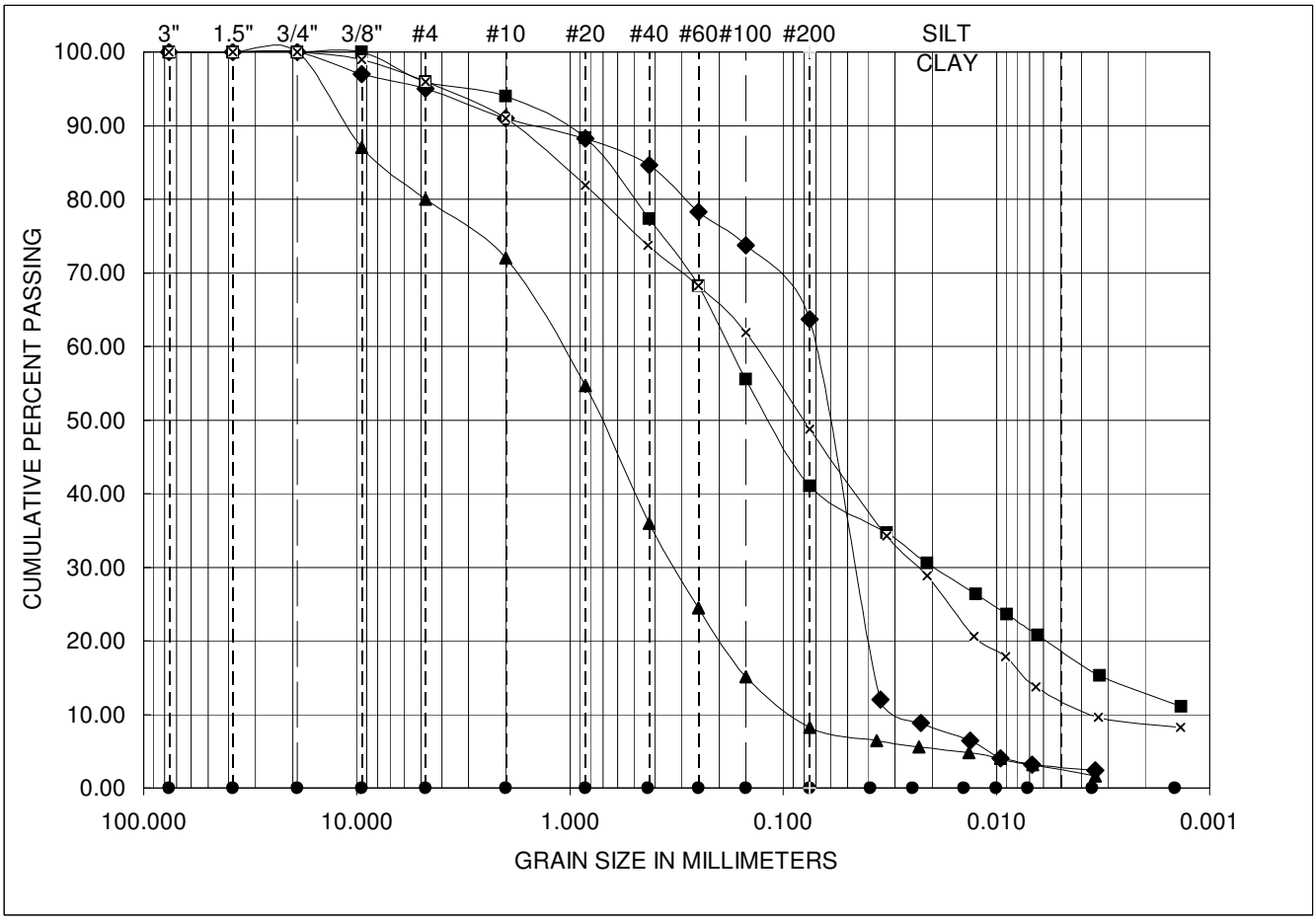
LOG OF BORING KLF-2

PLATE

A-3b

Legend To Logs On Plate A-1

Note: The boundaries between soil types shown on the logs are approximate as the transition between different soil layers may be gradual.



COBBLE	GRAVEL	SAND	SILT	CLAY

SYMBOL	SAMPLE IDENTIFICATION			PERCENTAGES			ATTERBERG LIMITS			SOIL CLASSIFICATION	USCS TOTAL SAMPLE
	BORING NO.	SAMPLE NO.	DEPTH (ft.)	GRAVEL	SAND	FINES	LL	PL	PI		
♦	KLF-1	1236	22-23	5	31	63.7	--	--	--	sandy SILT	ML
■	KLF-1	1335	40-41	4	55	41.0	--	--	--	clayey SAND	SC
▲	KLF-2	1545	22-23	20	72	8.3	--	--	--	SAND w/silt	SP-SM
X	KLF-2	1615	41-42	4	47	48.8	--	--	--	clayey SAND	SC

KLEINFELDER
Bright People. Right Solutions.

PROJECT # 101942/005

Spirito Family Trust

Physical Parameter Testing

Monrovia, California

GRAIN SIZE DISTRIBUTION

PLATE

SVHYD (new)

KLEINFELDER
Bright People. Right Solutions.

MOISTURE CONTENT - DRY DENSITY TEST RESULTS

PROJECT: Spirito Family Trust — Sampled By FJJ — DATE: 11/6/2009
Physical Parameter Testing — Tested By ELF — DATE 11/12/2009
NUMBER 101942/005 — Reviewed By SWH — DATE 11/16/2009

Boring	No.	Depth ft	USCS	Wet Density pcf	Moisture Content %	Dry Density pcf	Saturation %
KLF-1	1236	22.0	ML	106.1	2.9	103.2	12.6
KLF-1	1236	22.5	ML	111.4	3.7	107.5	18.2
KLF-1	1335	40.0	SC	91.1	22.9	74.1	49.2
KLF-1	1335	40.5	SC	99.9	18.2	84.5	50.5
KLF-2	1545	22.0	SP-SM	85.5	6.4	80.4	15.9
KLF-2	1545	22.5	SP-SM	89.2	2.9	86.7	8.4
KLF-2	1615	41.0	SC	90.9	14.6	79.3	35.7
KLF-2	1615	41.5	SC	112.4	10.9	101.3	45.8

KLEINFELDER
Bright People. Right Solutions.

SUITE OF CORROSION TESTS

PROJECT: Spirito Family Trust — Sampled By FJJ — DATE 11/6/2009
Physical Parameter Testing — Tested By ELF — DATE 11/12/2009
NUMBER 101942/005 — Reviewed By SWH — DATE 11/16/2009

Boring	No.	Depth	Minimum Resisitvity	Sulphate Content		Chloride Content		Ph
			ohm-cm	ppm	%	ppm	%	
KLF-1	1236	22-23						7.9
KLF-1	1335	40-41						7.9
KLF-2	1545	22-23						7.8
KLF-2	1615	41-42						8.2

PTS File No: 39975
Client: Kleinfelder

ORGANIC CARBON DATA - TOC (foc)

(METHODOLOGY: WALKLEY-BLACK)

PROJECT NAME: TSFT
PROJECT NO: 101942/005

SAMPLE ID.	DEPTH, ft.	ANALYSIS DATE	ANALYSIS TIME	SAMPLE MATRIX	FRACTION ORGANIC CARBON, g/g	TOTAL ORGANIC CARBON, mg/kg
KLF-1-22.0, 22.5	N/A	11/25/09	1230	SOIL	1.40E-04	140
KLF-2-22.0, 22.5	N/A	11/25/09	1230	SOIL	2.60E-04	260
KLF-1-40.0, 40.5	N/A	11/25/09	1230	SOIL	2.70E-04	270
KLF-2-41.0, 41.5	N/A	11/25/09	1230	SOIL	2.50E-04	250
Blank	N/A	11/25/09	1230	BLANK	ND	ND
SRM D064-542	N/A	11/25/09	1230	SOIL	2.78E-03	2780

QC DATA

SRM ID/Lot No.	REC (%)	Control Limits	Certified Value, mg/kg	QC Performance Acceptance Limits, mg/kg
D064-542	68	49-247	4110	1360-6860

ND = Not Detected

APPENDIX L

CEMENT STABILIZATION
BENCH-SCALE TREATABILITY TESTING

PRIMA ENVIRONMENTAL INC.

September 29, 2010

Mr. John Donatucci, PE
Kleinfelder
2 Ada, Suite 250
Irvine, CA 92618

RE: Final Report of Findings, "Evaluation of Cement for Stabilization/Solidification of Metals-Impacted Soil", Former Excello Plating Company, Inc.

Dear John:

Enclosed is the final report of findings "Evaluation of Cement for Stabilization/Solidification of Metals-Impacted Soil" that describes bench testing conducted on soil from the former Excello Plating Company site in Los Angeles, California. If you have any questions, please call me at 916-939-7300. Thank you for the opportunity to be of service.

Sincerely,
PRIMA Environmental, Inc.

Cindy G. Schreier, Ph.D.
President

5070 Robert J. Mathews Parkway, Suite 300, El Dorado Hills, CA 95762
Ph (916) 939-7300 • Fax (916) 939-7398
www.primaenvironmental.com

Report of Findings

EVALUATION OF CEMENT FOR THE STABILIZATION / SOLIDIFICATION OF METALS IN SOIL

Former Excello Plating Company
Los Angeles, California

September 29, 2010

Submitted to

Mr. John Donatucci, PE
Kleinfelder
2 Ada, Suite 250
Irvine, CA 9261

Submitted by
PRIMA Environmental, Inc.
5070 Robert J Mathews Parkway, Suite 300
El Dorado Hills, CA 95762

Cindy G. Schreier, Ph.D., President

Sept 29, 2010
Date

EXECUTIVE SUMMARY

Bench-scale treatability testing was conducted on soil (KLF1-Bulk-1) from the former Excello Plating Company, located in Los Angeles, California, which contained relatively low levels of metals. A portion of the soil was spiked with Cr(VI), cadmium, and nickel to better represent more highly impacted soils at the site. Testing evaluated the ability of cement to solidify soil and prevent leaching of metals from both spiked and unspiked soil. The specific metals of interest were hexavalent chromium [Cr(VI)], arsenic, cadmium, total chromium and nickel. This study is a follow-up study to bench testing conducted in December 2009, which evaluated the reducing agents; calcium polysulfide and ferrous iron [Fe(II)], in conjunction with cement (final report "Evaluation of Calcium Polysulfide and Ferrous Iron for the Reduction of Hexavalent Chromium in Soil" March 18, 2010).

Treatment of soil with up to 18% cement reduced the leachability of Cr(VI), nickel and cadmium, but did not prevent leaching in most cases. Cr(VI) concentrations in leachate from treated soils were of the same order of magnitude as untreated soil, though the exact concentrations decreased with increasing dose of cement. Treatment with cement dramatically reduced leachability of nickel for MTZ (high metals) soil, but slightly increased the leachability of nickel in BUF (low metals) soil. Cadmium leachability was completely eliminated by treatment of MTZ soil with cement. Arsenic was not detected in any leachate.

The DI WET results presented in this report must be viewed with caution and should be assumed to be a worst case scenario. Although cores were not crushed prior to performing the DI WET procedure, cores disintegrated to some extent during the mixing process. Thus, the surface area (and thus leaching potential) was much greater in the DI WET procedure than would be expected in the field if the soil is treated *in situ*.

Table of Contents

EXECUTIVE SUMMARY i
List of Tables iii
1.0 INTRODUCTION 1
1.1 Background 1
1.2 Study Objectives 1
2.0 MATERIALS and METHODS 2
2.1 Materials 2
2.2 Preparation and Characterization of Soil 2
2.3 Cement Stabilization 3
2.4 Analytical Methods 3
3.0 RESULTS and DISCUSSION 6
3.1 Untreated Soil 6
3.2 Cement Stabilization Results 6
3.2.1 Observations 6
3.2.2 DI WET 6
3.2.4 Geotechnical Parameters – UCS and Moisture content 9
3.3 Bulking Factor 10
4.0 CONCLUSIONS 11
APPENDIX A – Chains of Custody
APPENDIX B – Analytical Results

List of Tables

Table 1. Initial Conditions for Cement Stabilization Test 4
Table 2. Analytical Methods. 5
Table 3. Cr(VI) and Other Parameters in Untreated Soil. 7
Table 4. Cement Stabilization Test Results. 8
Table 5. Treated Bulk Density of Soil. 10

1.0 INTRODUCTION

Bench-scale treatability testing was conducted on soil (KLF1-Bulk-1) from the former Excello Plating Company, located in Los Angeles, California, which contained relatively low levels of metals. A portion of the soil was spiked with Cr(VI), cadmium, and nickel to better represent more highly impacted soils at the site. Testing evaluated the ability of cement to solidify soil and prevent leaching of metals from both spiked and unspiked soil. The specific metals of interest were hexavalent chromium [Cr(VI)], arsenic, cadmium, total chromium and nickel.

This study described herein is a follow-up study to bench testing conducted in December 2009, which evaluated the reducing agents calcium polysulfide and ferrous iron [Fe(II)], as well as cement. The December 2009 study is described in the final report "Evaluation of Calcium Polysulfide and Ferrous Iron for the Reduction of Hexavalent Chromium in Soil" dated March 18, 2010. All references herein to "the original bench test" or "the original study" refer to the December 2009 study.

1.1 Background

Cement is commonly used to solidify soils. Because cement is alkaline, it may reduce the solubility of metals by forming the metal hydroxide, which is often insoluble in water. Cement cannot convert significant amounts of Cr(VI) to trivalent chromium, but may reduce the leachability of Cr(VI) from soil by reducing the permeability of the soil.

1.2 Study Objectives

Batch tests will be conducted to evaluate the ability of cement to reduce leachability of Cr(VI) and solidify soil. Specific goals of the testing are to

- determine effect of various cement doses on leachability of metals of interest
- determine the strength of soil treated with various amounts of cement

The specific tests conducted to achieve these goals are described in Section 2.0 of this report. Results and observations are presented in Section 3.0. Conclusions and recommendations are presented in Sections 4.0. PRIMA Environmental, Inc. (PRIMA) has evaluated the effectiveness of cement stabilization based on the results of the bench tests. However, it is the responsibility of Kleinfelder to review this report and use its knowledge and expertise to determine whether cement stabilization should be applied at the site.

2.0 MATERIALS and METHODS

2.1 Materials

Cadmium nitrate tetrahydrate, $Cd(NO_3)_2 \cdot 4H_2O$. "Baker Analyzed" reagent grade $Cd(NO_3)_2 \cdot 4H_2O$ (JT Baker) was used in this study.

Cement. Type I/Type II Portland cement purchased from a local hardware store was used in this study.

Nickel chloride hexahydrate, $NiCl_2 \cdot 6H_2O$. "Reagent Plus" grade $NiCl_2 \cdot 6H_2O$ (Sigma Aldrich) was used in this study.

Potassium dichromate, $K_2Cr_2O_7$. 99%+ ACS reagent grade $K_2Cr_2O_7$. (Sigma Aldrich) was used in this study.

2.2 Preparation and Characterization of Soil

One 5-gallon bucket of soil labeled "KLF1-Bulk-1" and weighing approximately 14 kg (30 pounds) was received by PRIMA on July 26, 2010. This sample is in addition to KLF1-Bulk-1 received December 8, 2009 and used in the original bench test (see Section 1.0). The new soil was passed through a No. 4 sieve to remove rocks greater than 3/16 inches. Approximately 2 kg (4.4 lbs) of rocks were removed. The remaining soil was thoroughly homogenized then analyzed for:

- Cr(VI)
- Percent moisture
- Total metals (arsenic, cadmium, chromium, nickel)
- DI WET, with analysis of arsenic (As), cadmium (Cd), chromium (Cr), and nickel (Ni) in the leachate

Because Cr(VI) and total metal concentrations in KLF1-Bulk-1 were not representative of the most highly impacted soil at the site, 6.84 kg of soil was spiked to target concentrations of 10,000 mg/kg Cr(VI), 2600 mg/kg Ni and 230 mg/kg Cd using procedures described in the original bench test. This spiked soil was thoroughly composited with 3.66 kg of spiked soil remaining from the original bench test. The resulting composited spiked soil was used in this study and is hereafter referred to as MTZ soil or high metals soil.

The unspiked soil from the original bench test (5.54 kg) and the remaining (unspiked) soil received in July 2010 were thoroughly composited. The resulting unspiked KLF1-Bulk 1 soil was used in this study and is hereafter referred to as BUF soil or low metals soil.

The MTZ and BUF soils were analyzed for:

- Cr(VI)
- Metals (arsenic, cadmium, chromium, nickel)
- DI WET (extract analyzed for Cr(VI), As, Cd, Cr, Ni)

2.3 Cement Stabilization

Both low metals and high metals soils were evaluated. A clean sand (20 mesh silica sand) control using a single dose of cement was also run. Tests conditions are summarized in Table 1. Each soil was treated with 4 doses of cement ranging from 4 to 18% by weight. Soil and cement were blended dry, then water was added as needed to create thick slurry. Each slurry was poured into 2 plastic molds that were 2 inches in diameter and 4 inches high. The molds were rodded 10 times to remove air pockets. Any remaining slurry was poured into a plastic beaker and the volume recorded The slurries were cured on the bench top for 7 days. After curing, the penetration resistance was measured using a pocket penetrometer. One core from each pair of molds was then submitted for assessment of leachable metals (DI WET: As, Cr(VI), Cr, Cd, Ni). The cores were cut in half cross-wise by the analytical laboratory using a stainless saw in order to achieve the appropriate sample mass. One-half of the cores were extracted as is (rather than being crushed) in order to better represent the potential contact between solidified, in-place soil and leachate. However, because the DI WET extraction apparatus is an end-over-end tumbler, all of the cores disintegrated to some degree during the extraction process. (Note that for the MTZ soil, the top surface (<1/16 inch) of the core was scraped off because the surface appeared to have a "crust" of Cr(VI) that probably appeared when a very fine layer of water on the surface of the slurry evaporated.) The second core from each pair was submitted for measurement of unconfined compressive strength (UCS) and moisture content.

A set of slurries—similar to those in Table 1, but on a smaller scale and using twice as much water—were prepared and the pH measured. More water was used in order to enable measurement of pH. Readings were taken approximately 30 minutes after combining the soil, cement and water.

2.4 Analytical Methods

The method for each analysis and the lab to perform the analysis are given in Table 2.

Table 1. Initial Conditions for Cement Stabilization Tests.

Test	g soil	Cement added		H2O Added	Volume slurry, cm3		
		% (w/w)	g	mL	in molds	extra*	total*
Clean Sand (Control)							
Con - 1/1S - A	750	12	90	175	412	110	522
Con - 1/1S - B	750	12	90	175	412	120	532
Main treatment zone Soil [high Cr(VI)]							
MTZ - 1/1S - A	750	4	30	70	412	0	412
MTZ - 1/1S - B	750	4	30	71	412	0	412
MTZ - 2/2S - A	750	8	60	95	412	20	432
MTZ - 2/2S - B	750	8	60	95	412	20	432
MTZ - 3/3S - A	750	12	90	100	412	40	452
MTZ - 3/3S - B	750	12	90	100	412	40	452
MTZ - 4/4S - A	750	18	135	110	412	65	477
MTZ - 4/4S - B	750	18	135	115	412	65	477
Buffer zone soil [low Cr(VI)]							
Buf - 1/1S - A	750	4	30	146	412	35	447
Buf - 1/1S - B	750	4	30	146	412	30	442
Buf - 2/2S - A	750	8	60	156	412	50	462
Buf - 2/2S - B	750	8	60	156	412	50	462
Buf - 3/3S - A	750	12	90	159	412	70	482
Buf - 3/3S - B	750	12	90	160	412	65	477
Buf - 4/4S - A	750	18	135	172	412	90	502
Buf - 4/4S - B	750	18	135	172	412	90	502

* After curing for 7 days

Table 2. Analytical Methods.

Analyte	Method	Lab performing test*
Cr(VI)	7199	Cal Science
Total Metals	EPA 6020	Cal Science
DI WET	DI WET	Cal Science
Moisture content	ASTM D1633	Sierra Testing Labs
pH	Probe	PRIMA
UCS	ASTM D4832	Sierra Testing Labs

* Calscience (Garden Grove, CA), Sierra Testing Labs (El Dorado Hills, CA)

3.0 RESULTS and DISCUSSION

3.1 Untreated Soil

The analytical results for untreated soil are given in Table 3. Values for the soil used during the December 2009 tests are included for comparison. Complete analytical reports for the soils used in this study are provided in Appendix B. Concentrations of Cr(VI) and metals are similar in the original spiked soil and in MTZ soil and are near the target concentrations. Cr(VI) and metals concentrations are also similar in the original unspiked soil and the BUF soil.

3.2 Cement Stabilization Results

The results of the cement stabilization tests are shown in Table 4. Note that the samples subjected to the DI WET procedure consisted of ½ of an intact core—solidified material was not crushed. (One-half of each core was used in order maintain the 10:1 liquid to soil mass ratio required by the DI WET procedure. Cores were cut cross-wise using a stainless steel saw.)

3.2.1 Observations

Cement-treated BUF soils were generally tan colored with no obvious sign of Cr(VI) on the surface. BUF-1 soils appeared to be somewhat easy to break, while samples treated with higher doses of cement seemed stronger. However no effort was made to assess the friability of the treated materials because cores were needed intact for post-treatment testing.

Cement-treated MTZ soils were generally brown with a small crust of yellowish material on the surface. This yellowish material was presumed to be Cr(VI). It was scraped off of the samples before submitting the cores for DI WET. For MTZ-1, the crust was easily scraped off. For other cores, more effort was required.

3.2.2 DI WET

The samples used for DI WET procedure were ½ of an intact core. However, according to the analytical lab, all of the cores disintegrated to some degree during the mixing process (cores are tumbled in an end-over-end mixing apparatus). Thus, the DI WET results reported herein represent a worst case scenario since the large surface area of the crushed soil enhances leachability.

Control Sample. The control sample—clean sand treated with 12% cement—leached small amounts of Cr(VI) [0.24-0.25 mg/L], Cr (0.309-0.345 mg/L), and Ni (0.0284-0.0289 mg/L). The presence of these metals in the leachate may be due to

Table 3. Cr(VI) and Other Parameters in Untreated Soil.

Analyte	Units	Unspiked Soil* (12/09 tests)		Spiked Soil** (12/09 tests)		Unspiked Soil+ (7/10)	BUF Soil^#	MTZ Soil$, #
		Analyzed 12/09	Re-analyzed 6/10	Analyzed 12/09	Re-analyzed 6/10			
Metals (EPA								
Arsenic	mg/kg	1.8	n.m.	1.8	n.m.	1.1	1.07	1.02
Cadmium	mg/kg	< 1.0	< 1.0	210	242	< 1.0	< 1.0	214
Chromium	mg/kg	99	50.4	10,000	8,920	44	114	8,230
Nickel	mg/kg	7.3	4.33	2,900	2,790	4.25	4.53	2,100
DI WET								
Cr(VI) - 7199	mg/L	1.5	n.m.	290	n.m.	n.m.	2.2	900
Arsenic	mg/L	< 0.10	n.m.	< 0.05	n.m.	n.m.	< 0.01	< 0.01
Cadmium	mg/L	< 0.10	n.m.	9	n.m.	n.m.	< 0.01	17.3
Chromium	mg/L	1.5	n.m.	480	n.m.	n.m.	2.68	870
Nickel	mg/L	< 0.20	n.m.	130	n.m.	n.m.	0.0123	234
Munsell Soil Color*								
Brown	Munsell Color Code	7.5YR 5/3	7.5YR 5/3	n.a.	n.a.	n.m.	n.a.	n.a.
Dark yellowish brown		n.a.	n.a.	10YR 4/4	10YR 4/4	n.m.	10YR 4/3	10YR4/4
Other								
Cr(VI) - 7199	mg/kg	10.2	47	8,900	8,600	25	41	8,800

* KLF1-Bulk 1, received December 2009, unspiked

** KLF1-Bulk 1, received December 2009, spiked

+ KLF-1-Bulk 1, received July 2010

^ Composite of unsplied KLF-1-Bulk1 received in December 2009 and July 2010.

$ Composite of KLF-1-Bulk 1 soil spiked in 12/09 and in 8/10.

This soil used for cement stabilizaiton tests.

Table 4. Cement Stabilization Test Results.

Test	Cement	DI WET*, mg/L					pH$	UCS**	Moisture Content**,^	Munsell Color
	%	Cr(VI)	Arsenic	Cadmium	Chromium	Nickel		psi	%	
Clean Sand (Control)										
Con - 1A	12	0.25	< 0.01	< 0.01	0.345	0.0284	11.7	103	8.2	approx. 5Y 7/1 - samples grayer
Con - 1B	12	0.24	< 0.01	< 0.01	0.309	0.0289	11.7	131	7.1	
Main treatment zone Soil [high Cr(VI)]										
MTZ - 1A	4	530	< 0.01	< 0.01	772	0.041	10.2	74	16	5Y 4/4
MTZ - 1B	4	550	< 0.01	< 0.01	647	0.0519	10.2	69	16.9	5Y 4/4
MTZ - 2A	8	420	< 0.01	< 0.01	589	0.104	11.0	183	16.5	5Y 4/4
MTZ - 2B	8	470	< 0.01	< 0.01	508	0.0425	11.0	129	16.9	5Y 4/4
MTZ - 3A	12	490	< 0.01	< 0.01	469	0.0889	11.2	249	15.7	5Y 4/4
MTZ - 3B	12	380	< 0.01	< 0.01	510	0.0568	11.2	304	14.7	5Y 4/4
MTZ - 4A	18	290	< 0.01	< 0.01	378	0.0529	11.4	457	13.8	5Y 4/4
MTZ - 4B	18	280	< 0.01	< 0.01	321	0.0463	11.4	478	13.6	5Y 4/4
Buffer zone soil [low Cr(VI)]										
Buf - 1A	4	1.4	< 0.01	< 0.01	1.71	0.01	11.3	44	10	2.5Y 4/3
Buf - 1B	4	1.3	< 0.01	< 0.01	1.49	< 0.01	11.3	37	9.7	2.5Y 4/3
Buf - 2A	8	0.61	< 0.01	< 0.01	0.675	0.0207	11.4	118	10.3	2.5Y 4/3
Buf - 2B	8	0.58	< 0.01	< 0.01	0.688	0.0239	11.5	131	10.1	2.5Y 5/3
Buf - 3A	12	0.55	< 0.01	< 0.01	0.716	0.0291	11.6	300	10.1	2.5Y 6/3
Buf - 3B	12	0.46	< 0.01	< 0.01	0.562	0.0278	11.6	337	9.7	2.5Y 6/2
Buf - 4A	18	0.28	< 0.01	< 0.01	0.363	0.0328	11.7	826	11	2.5Y 6/2
Buf - 4B	18	0.36	< 0.01	< 0.01	0.496	0.0346	11.7	745	10.8	2.5Y 6/2

* DI WET extraction performed on intact soil cores.

$ Measured on separately prepared samples and measured approximately 30 minutes after soil, water and cement combined. See text for discussion.

** UCS and Moisture content performed on split sample - see text for discussion.

^ Moisture content = 100 *(mass water / mass dry soil)

impurities in the sand or cement, or to abrasion of the stainless steel saw used to cut the cores.

Cr(VI) and Cr. Cr(VI) and Cr were detected in leachate from all samples. For the BUF soil, Cr(VI) concentrations ranged from 0.28 to 1.4 mg/L; for MTZ soil, concentrations ranged from 280 to 550 mg/L. For both soils, the amount of Cr(VI) in the leachate was lower than in untreated soil (Table 3) and decreased with increasing cement dose (compare Buf-1 with Buf-4 and MTZ-1 with MTZ-4). This implies that treatment with cement can reduce the leachability of Cr(VI), though the mechanism is probably due to reduced permeability of the cement-treated soil. The amount of total Cr was usually somewhat higher than the amount of Cr(VI). This may be due to the slight solubility of trivalent chromium at high pH, or more likely, due to normal analytical variation between methods.

Nickel. Nickel was detected in most samples (0.01 to 0.104 mg/L). For BUF samples, the concentrations were typically less than or equal to the control. For MTZ soil, the concentrations were up to 3 times higher than in the control, but in all cases were much less than the 234 mg/L leached by untreated soil (Table 3.)

Arsenic and Cadmium. No arsenic or cadmium was detected in leachate from any sample. The lack of cadmium in the MTZ soil indicates that cement-treatment can stabilize cadmium, which was present at 17.1 mg/L in leachate from untreated MTZ soil (Table 3).

3.2.3 pH

The pH of the cement-treated samples was alkaline—ranging from pH 10.2 to 11.7, depending upon the amount of cement added and the soil. It should be noted that these values were taken about 30 minutes after mixing of soil, cement and water and may decline somewhat over time as the natural buffering ability of the soil neutralizes some of the alkalinity.

3.2.4 Geotechnical Parameters – UCS and Moisture content

Penetration resistance as measured using a pocket penetrometer was greater than 4.5 tons/ft^2 for all cores at 7 days. Unconfined compressive strength ranged from 37 psi to 826 psi. As expected, values increased with increasing amount of cement. In general UCS for the two soils was similar for a given dose of cement.

Moisture content (mass of water/mass of dry soil, expressed as a percent) was higher for the MTZ soil than for the BUF soil. This is probably because MTZ soil had higher moisture content to begin with due to the spiking procedure.

3.3 Bulking Factor

The total volume of slurry in Table 1 and the treated bulk density of the soil can be used in conjunction with the wet bulk density to estimate the bulking factor. The treated bulk density in Table 5 is defined as

Treated Bulk Density (g/cm^3) = mass soil (g) / volume of treated soil (cm^3) Eqn. 1

The bulking factor can be calculated according to Eqn. 2:

Bulking Factor =
Wet Bulk Density in Field (g/cm^3) / Treated Bulk Density (g/cm^3) Eqn. 2

Thus, if the wet bulk density of soil in the field is 2.00 g/cm^3, then the bulking factor for treatment of BUF soil with 18% cement (BUF 4) is 2.00/1.49 = 1.34.

Table 5. Treated Bulk Density of Soil.

Test	Mass Soil	Volume slurry*	Treated Bulk density of soil**
	g	cm^3	g soil/cm^3
Main treatment zone Soil [high Cr(VI)]			
MTZ - 1/1S - A	750	412	1.82
MTZ - 1/1S - B	750	412	1.82
MTZ - 2/2S - A	750	432	1.74
MTZ - 2/2S - B	750	432	1.74
MTZ - 3/3S - A	750	452	1.66
MTZ - 3/3S - B	750	452	1.66
MTZ - 4/4S - A	750	477	1.57
MTZ - 4/4S - B	750	477	1.57
Buffer zone soil [low Cr(VI)]			
Buf - 1/1S - A	750	447	1.68
Buf - 1/1S - B	750	442	1.70
Buf - 2/2S - A	750	462	1.62
Buf - 2/2S - B	750	462	1.62
Buf - 3/3S - A	750	482	1.56
Buf - 3/3S - B	750	477	1.57
Buf - 4/4S - A	750	502	1.49
Buf - 4/4S - B	750	502	1.49

* volume after curing for 7 days.

** Treated bulk density of soil was caluclated by dividing the mass of soil used by the volume after treatment

4.0 CONCLUSIONS

Treatment of soil with up to 18% cement reduced the leachability of Cr(VI), nickel and cadmium, but did not prevent leaching in most cases. Cr(VI) concentrations in leachate from treated soils were of the same order of magnitude as untreated soil, though the exact concentrations decreased with increasing dose of cement. Treatment with cement dramatically reduced leachability of nickel for MTZ (high metals) soil, but slightly increased the leachability of nickel in BUF (low metals) soil. Cadmium leachability was completely eliminated by treatment of MTZ soil with cement. Arsenic was not detected in any leachate.

The DI WET results presented in this report must be viewed with caution and should be assumed to be a worst case scenario. Although cores were not crushed prior to performing the DI WET procedure, cores disintegrated to some extent during the mixing process. Thus, the surface area (and thus leaching potential) was much greater in the DI WET procedure than would be expected in the field if the soil is treated *in situ*.

APPENDIX A
(Chain of Custody)

KLEINFELDER
Bright People. Bright Solutions.

PROJECT NO.	PROJECT NAME
101942 - 024	EXCELLO PLATING

L.P. NO. (PO. NO.)

~~SAMPLERS~~ (Signature/Number)
PACKAGED

RECEIVING LAB:
PRIMA ENVIRONMENTAL

	DATE MM/DD/YY	SAMPLE I.D. TIME HH-MM-SS	SAMPLE I.D.	MATRIX	NO. OF CON-TAINERS	TYPE OF CON-TAINERS	ANALYSIS: CEMENT STABILIZATION BENCH TEST	INSTRUCTIONS/REMARKS
1	11/6/2009		KLF-1-21.5		1	SL	X	
2			KLF-1-BULK1			BKT		DEPTH = 22'-25' bgs
3			KLF-1-23.5			SL		DEPTH
4			KLF-1-26					
5			KLF-1-26.5					
6			KLF-1-27					
7			KLF-1-41.5					
8			KLF-1-42.5					
9			KLF-1-43					
10			KLF-2-21.5					
11			KLF-2-BULK1			BKT		DEPTH = 22'-25' bgs
12			KLF-2-23.5			SL		
13			KLF-2-24.5					
14			KLF-2-25					
15			KLF-2-25.5					
16			KLF-2-BULK2			BKT		
17			KLF-2-44			SL		
18			KLF-2-44.5					
19			KLF-2-45					
20								

Relinquished by: (Signature)	Date/Time	Received by: (Signature)
	7/23/10 11:00	GIVEN TO FEDEX FOR SHIPPING
Relinquished by: (Signature)	Date/Time	Received by: (Signature)
		Cathleen Ryan 7/26/10 0900
Relinquished by: (Signature)	Date/Time	Received for Laboratory by: (Signature)

Instructions/Remarks:
SL - 6" x 2.5" STAINLESS STEEL MODIFIED CAL SAMPLER SLEEVE

BKT - PLASTIC 5 gallon PAIL

Send Results To:
KLEINFELDER IRVINE

Attn: JOHN DONNATUCCI

ENV-02 REV 05/08)

White – Sampler Canary – Return Copy To Shipper Pink – Lab Copy

CHAIN OF CUSTODY

COC № 07605

APPENDIX B
(Analytical Reports)

Calscience
Environmental
Laboratories, Inc.

June 04, 2010

Cindy Schreier
Prima Environmental
5070 Robert J. Mathews Pkwy, Ste. 300
El Dorado Hills, CA 95762-5702

Subject: **Calscience Work Order No.: 10-06-0089**
Client Reference: Not Listed

Dear Client:

Enclosed is an analytical report for the above-referenced project. The samples included in this report were received 6/2/2010 and analyzed in accordance with the attached chain-of-custody.

Unless otherwise noted, all analytical testing was accomplished in accordance with the guidelines established in our Quality Systems Manual, applicable standard operating procedures, and other related documentation. The original report of subcontracted analysis, if any, is provided herein, and follows the standard Calscience data package. The results in this analytical report are limited to the samples tested and any reproduction thereof must be made in its entirety.

If you have any questions regarding this report, please do not hesitate to contact the undersigned.

Sincerely,

Calscience Environmental
Laboratories, Inc.
Robert Stearns
Project Manager

Calscience Environmental Laboratories, Inc.

Analytical Report

ACCREDITED IN ACCORDANCE WITH nelac

Prima Environmental	Date Received: 06/02/10
5070 Robert J. Mathews Pkwy, Ste. 300	Work Order No: 10-06-0089
El Dorado Hills, CA 95762-5702	Preparation: EPA 3060A
	Method: EPA 7199

Project: Not Listed

Client Sample Number	Lab Sample Number	Date/Time Collected	Matrix	Instrument	Date Prepared	Date/Time Analyzed	QC Batch ID
KF.EXC2.UNSP.SO	**10-06-0089-1-A**	**06/01/10 15:30**	**Solid**	**IC 12**	**06/02/10**	**06/02/10 19:06**	**100602L02**

Parameter	Result	RL	DF	Qual	Units
Chromium, Hexavalent	47	0.80	20		mg/kg

Client Sample Number	Lab Sample Number	Date/Time Collected	Matrix	Instrument	Date Prepared	Date/Time Analyzed	QC Batch ID
KF.EXC2.SPK.SO	**10-06-0089-2-A**	**06/01/10 15:30**	**Solid**	**IC 12**	**06/02/10**	**06/02/10 18:19**	**100602L02**

Parameter	Result	RL	DF	Qual	Units
Chromium, Hexavalent	8600	160	4000		mg/kg

Client Sample Number	Lab Sample Number	Date/Time Collected	Matrix	Instrument	Date Prepared	Date/Time Analyzed	QC Batch ID
Method Blank	**099-05-125-2,139**	**N/A**	**Solid**	**IC 12**	**06/02/10**	**06/02/10 14:01**	**100602L02**

Parameter	Result	RL	DF	Qual	Units
Chromium, Hexavalent	ND	0.040	1		mg/kg

RL - Reporting Limit , DF - Dilution Factor , Qual - Qualifiers

Calscience Environmental Laboratories, Inc.

Analytical Report

ACCREDITED IN ACCORDANCE WITH nelac

Prima Environmental	Date Received: 06/02/10
5070 Robert J. Mathews Pkwy, Ste. 300	Work Order No: 10-06-0089
El Dorado Hills, CA 95762-5702	Preparation: T22.11.5.AII DI
	Method: EPA 7199

Project: Not Listed

Client Sample Number	Lab Sample Number	Date/Time Collected	Matrix	Instrument	Date Prepared	Date/Time Analyzed	QC Batch ID
KF.EXC2.UNSP.SO	**10-06-0089-1-A**	**06/01/10 15:30**	**Solid**	**IC 12**	**06/04/10**	**06/04/10 12:25**	**100604L01**

Comment(s): -This sample was prepared with deionized water as the extractant.
-Sample extracted outside recommended holding time.
-The analysis was performed on an STLC extract of the sample.

Parameter	Result	RL	DF	Qual	Units
Chromium, Hexavalent	2.8	0.10	10		mg/L

Client Sample Number	Lab Sample Number	Date/Time Collected	Matrix	Instrument	Date Prepared	Date/Time Analyzed	QC Batch ID
KF.EXC2.SPK.SO	**10-06-0089-2-A**	**06/01/10 15:30**	**Solid**	**IC 12**	**06/04/10**	**06/04/10 12:17**	**100604L01**

Comment(s): -This sample was prepared with deionized water as the extractant.
-Sample extracted outside recommended holding time.
-The analysis was performed on an STLC extract of the sample.

Parameter	Result	RL	DF	Qual	Units
Chromium, Hexavalent	890	10	1000		mg/L

Client Sample Number	Lab Sample Number	Date/Time Collected	Matrix	Instrument	Date Prepared	Date/Time Analyzed	QC Batch ID
Method Blank	**099-14-017-5**	**N/A**	**Solid**	**IC 12**	**06/04/10**	**06/04/10 09:29**	**100604L01**

Parameter	Result	RL	DF	Qual	Units
Chromium, Hexavalent	ND	0.010	1		mg/L

RL - Reporting Limit , DF - Dilution Factor , Qual - Qualifiers

Calscience Environmental Laboratories, Inc.

Analytical Report

Prima Environmental		Date Received:	06/02/10
5070 Robert J. Mathews Pkwy, Ste. 300		Work Order No:	10-06-0089
El Dorado Hills, CA 95762-5702		Preparation:	T22.11.5.AII DI
		Method:	EPA 6020
		Units:	mg/L

Project: Not Listed

Client Sample Number	Lab Sample Number	Date/Time Collected	Matrix	Instrument	Date Prepared	Date/Time Analyzed	QC Batch ID
KF.EXC2.UNSP.SO	**10-06-0089-1-A**	**06/01/10 15:30**	**Solid**	**ICP/MS 03**	**06/02/10**	**06/04/10 12:32**	**100604LA1**

Comment(s): -This sample was prepared with deionized water as the extractant.
-The analysis was performed on an STLC extract of the sample.

Parameter	Result	RL	DF	Qual	Parameter	Result	RL	DF	Qual
Cadmium	ND	0.0100	1		Nickel	ND	0.0100	1	
Chromium	3.70	0.0100	1						

Client Sample Number	Lab Sample Number	Date/Time Collected	Matrix	Instrument	Date Prepared	Date/Time Analyzed	QC Batch ID
KF.EXC2.SPK.SO	**10-06-0089-2-A**	**06/01/10 15:30**	**Solid**	**ICP/MS 03**	**06/02/10**	**06/04/10 12:46**	**100604LA1**

Comment(s): -This sample was prepared with deionized water as the extractant.
-The analysis was performed on an STLC extract of the sample.

Parameter	Result	RL	DF	Qual	Parameter	Result	RL	DF	Qual
Cadmium	25.5	0.100	10		Nickel	298	0.100	10	
Chromium	1090	0.100	10						

Client Sample Number	Lab Sample Number	Date/Time Collected	Matrix	Instrument	Date Prepared	Date/Time Analyzed	QC Batch ID
Method Blank	**096-06-003-2,829**	**N/A**	**Aqueous**	**ICP/MS 03**	**06/02/10**	**06/04/10 12:04**	**100604LA1**

Parameter	Result	RL	DF	Qual	Parameter	Result	RL	DF	Qual
Cadmium	ND	0.0100	1		Nickel	ND	0.0100	1	
Chromium	ND	0.0100	1						

RL - Reporting Limit , DF - Dilution Factor , Qual - Qualifiers

Calscience Environmental Laboratories, Inc.

Analytical Report

Prima Environmental		Date Received:	06/02/10
5070 Robert J. Mathews Pkwy, Ste. 300		Work Order No:	10-06-0089
El Dorado Hills, CA 95762-5702		Preparation:	EPA 3050B
		Method:	EPA 6020
		Units:	mg/kg
Project: Not Listed			Page 1 of 1

Client Sample Number	Lab Sample Number	Date/Time Collected	Matrix	Instrument	Date Prepared	Date/Time Analyzed	QC Batch ID
KF.EXC2.UNSP.SO	**10-06-0089-1-A**	**06/01/10 15:30**	**Solid**	**ICP/MS 03**	**06/02/10**	**06/02/10 15:12**	**100602L01**

Parameter	Result	RL	DF	Qual	Parameter	Result	RL	DF	Qual
Cadmium	ND	1.00	1		Nickel	4.33	1.00	1	
Chromium	50.4	2.00	1						

KF.EXC2.SPK.SO	**10-06-0089-2-A**	**06/01/10 15:30**	**Solid**	**ICP/MS 03**	**06/02/10**	**06/03/10 13:21**	**100602L01**

Parameter	Result	RL	DF	Qual	Parameter	Result	RL	DF	Qual
Cadmium	242	20.0	20		Nickel	2790	20.0	20	
Chromium	8920	40.0	20						

Method Blank	**096-10-002-1,750**	**N/A**	**Solid**	**ICP/MS 03**	**06/02/10**	**06/02/10 14:27**	**100602L01**

Parameter	Result	RL	DF	Qual	Parameter	Result	RL	DF	Qual
Cadmium	ND	1.00	1		Nickel	ND	1.00	1	
Chromium	ND	2.00	1						

RL - Reporting Limit , DF - Dilution Factor , Qual - Qualifiers

Calscience Environmental Laboratories, Inc.

Quality Control - Spike/Spike Duplicate

Prima Environmental
5070 Robert J. Mathews Pkwy, Ste. 300
El Dorado Hills, CA 95762-5702

Date Received: 06/02/10
Work Order No: 10-06-0089
Preparation: T22.11.5.AII DI
Method: EPA 6020

Project Not Listed

Quality Control Sample ID	Matrix	Instrument	Date Prepared	Date Analyzed	MS/MSD Batch Number
KF.EXC2.UNSP.SO	**Solid**	**ICP/MS 03**	**06/02/10**	**06/04/10**	**100604SA1**

Parameter	MS %REC	MSD %REC	%REC CL	RPD	RPD CL	Qualifiers
Cadmium	85	89	84-114	4	0-8	
Chromium	89	95	73-133	4	0-11	
Nickel	98	102	68-122	4	0-10	

RPD - Relative Percent Difference , CL - Control Limit

Calscience Environmental Laboratories, Inc.

Quality Control - PDS / PDSD

Prima Environmental		Date Received	06/02/10
5070 Robert J. Mathews Pkwy, Ste. 300		Work Order No:	10-06-0089
El Dorado Hills, CA 95762-5702		Preparation:	T22.11.5.AII DI
		Method:	EPA 6020

Project: Not Listed

Quality Control Sample ID	Matrix	Instrument	Date Prepared	Date Analyzed	PDS / PDSD Batch Number
KF.EXC2.UNSP.SO	**Solid**	**ICP/MS 03**	**06/02/10**	**06/04/10**	**100604SA1**

Parameter	PDS %REC	PDSD %REC	%REC CL	RPD	RPD CL	Qualifiers
Cadmium	94	92	75-125	1	0-8	
Chromium	116	118	75-125	0	0-11	Q
Nickel	101	101	75-125	0	0-10	

RPD - Relative Percent Difference , CL - Control Limit

Calscience Environmental Laboratories, Inc.

Quality Control - Spike/Spike Duplicate

Prima Environmental
5070 Robert J. Mathews Pkwy, Ste. 300
El Dorado Hills, CA 95762-5702

Date Received: 06/02/10
Work Order No: 10-06-0089
Preparation: EPA 3050B
Method: EPA 6020

Project Not Listed

Quality Control Sample ID	Matrix	Instrument	Date Prepared	Date Analyzed	MS/MSD Batch Number
10-06-0039-1	**Solid**	**ICP/MS 03**	**06/02/10**	**06/02/10**	**100602S01**

Parameter	MS %REC	MSD %REC	%REC CL	RPD	RPD CL	Qualifiers
Cadmium	294	289	85-121	2	0-12	3
Chromium	4X	4X	20-182	4X	0-15	Q
Nickel	206	193	46-154	4	0-15	3

RPD - Relative Percent Difference , CL - Control Limit

Calscience Environmental Laboratories, Inc.

Quality Control - PDS / PDSD

ACCREDITED IN ACCORDANCE WITH nelac

Prima Environmental		Date Received	06/02/10
5070 Robert J. Mathews Pkwy, Ste. 300		Work Order No:	10-06-0089
El Dorado Hills, CA 95762-5702		Preparation:	EPA 3050B
		Method:	EPA 6020

Project: Not Listed

Quality Control Sample ID	Matrix	Instrument	Date Prepared	Date Analyzed	PDS / PDSD Batch Number
10-06-0039-1	**Solid**	**ICP/MS 03**	**06/02/10**	**06/02/10**	**100602S01**

Parameter	PDS %REC	PDSD %REC	%REC CL	RPD	RPD CL	Qualifiers
Cadmium	302	310	75-125	2	0-12	5
Chromium	4X	4X	75-125	1	0-15	Q
Nickel	257	245	75-125	3	0-15	5

RPD - Relative Percent Difference , CL - Control Limit

Calscience Environmental Laboratories, Inc.

Quality Control - Spike/Spike Duplicate

Prima Environmental
5070 Robert J. Mathews Pkwy, Ste. 300
El Dorado Hills, CA 95762-5702

Date Received: 06/02/10
Work Order No: 10-06-0089
Preparation: EPA 3060A
Method: EPA 7199

Project Not Listed

Quality Control Sample ID	Matrix	Instrument	Date Prepared	Date Analyzed	MS/MSD Batch Number
KF.EXC2.UNSP.SO	**Solid**	**IC 12**	**06/02/10**	**06/02/10**	**100602S02**

Parameter	MS %REC	MSD %REC	%REC CL	RPD	RPD CL	Qualifiers
Chromium, Hexavalent	60	56	75-125	2	0-25	3

RPD - Relative Percent Difference , CL - Control Limit

Calscience Environmental Laboratories, Inc.

Quality Control - Spike/Spike Duplicate

Prima Environmental
5070 Robert J. Mathews Pkwy, Ste. 300
El Dorado Hills, CA 95762-5702

Date Received: 06/02/10
Work Order No: 10-06-0089
Preparation: T22.11.5.AII DI
Method: EPA 7199

Project Not Listed

Quality Control Sample ID	Matrix	Instrument	Date Prepared	Date Analyzed	MS/MSD Batch Number
KF.EXC2.UNSP.SO	**Solid**	**IC 12**	**06/04/10**	**06/04/10**	**100604S01**

Parameter	MS %REC	MSD %REC	%REC CL	RPD	RPD CL	Qualifiers
Chromium, Hexavalent	101	102	70-130	1	0-25	

RPD - Relative Percent Difference , CL - Control Limit

Calscience Environmental Laboratories, Inc.

Quality Control - LCS/LCS Duplicate

ACCREDITED IN ACCORDANCE WITH nelac

Prima Environmental		Date Received:	N/A
5070 Robert J. Mathews Pkwy, Ste. 300		Work Order No:	10-06-0089
El Dorado Hills, CA 95762-5702		Preparation:	T22.11.5.AII DI
		Method:	EPA 6020

Project: Not Listed

Quality Control Sample ID	Matrix	Instrument	Date Prepared	Date Analyzed	LCS/LCSD Batch Number
096-06-003-2,829	**Aqueous**	**ICP/MS 03**	**06/02/10**	**06/04/10**	**100604LA1**

Parameter	LCS %REC	LCSD %REC	%REC CL	RPD	RPD CL	Qualifiers
Cadmium	105	105	80-120	1	0-20	
Chromium	99	99	80-120	0	0-20	
Nickel	105	103	80-120	3	0-20	

RPD - Relative Percent Difference , CL - Control Limit

Calscience Environmental Laboratories, Inc.

Quality Control - LCS/LCS Duplicate

Prima Environmental
5070 Robert J. Mathews Pkwy, Ste. 300
El Dorado Hills, CA 95762-5702

Date Received: N/A
Work Order No: 10-06-0089
Preparation: EPA 3050B
Method: EPA 6020

Project: Not Listed

Quality Control Sample ID	Matrix	Instrument	Date Prepared	Date Analyzed	LCS/LCSD Batch Number
096-10-002-1,750	**Solid**	**ICP/MS 03**	**06/02/10**	**06/02/10**	**100602L01**

Parameter	LCS %REC	LCSD %REC	%REC CL	RPD	RPD CL	Qualifiers
Cadmium	104	104	80-120	0	0-20	
Chromium	96	96	80-120	1	0-20	
Nickel	101	103	80-120	2	0-20	

RPD - Relative Percent Difference , CL - Control Limit

Calscience Environmental Laboratories, Inc.

Quality Control - LCS/LCS Duplicate

Prima Environmental
5070 Robert J. Mathews Pkwy, Ste. 300
El Dorado Hills, CA 95762-5702

Date Received:	N/A
Work Order No:	10-06-0089
Preparation:	EPA 3060A
Method:	EPA 7199

Project: Not Listed

Quality Control Sample ID	Matrix	Instrument	Date Prepared	Date Analyzed	LCS/LCSD Batch Number
099-05-125-2,139	**Solid**	**IC 12**	**06/02/10**	**06/02/10**	**100602L02**

Parameter	LCS %REC	LCSD %REC	%REC CL	RPD	RPD CL	Qualifiers
Chromium, Hexavalent	103	103	80-120	1	0-20	

RPD - Relative Percent Difference , CL - Control Limit

Calscience Environmental Laboratories, Inc.

Quality Control - LCS/LCS Duplicate

Prima Environmental
5070 Robert J. Mathews Pkwy, Ste. 300
El Dorado Hills, CA 95762-5702

Date Received:	N/A
Work Order No:	10-06-0089
Preparation:	T22.11.5.AII DI
Method:	EPA 7199

Project: Not Listed

Quality Control Sample ID	Matrix	Instrument	Date Prepared	Date Analyzed	LCS/LCSD Batch Number
099-14-017-5	**Solid**	**IC 12**	**06/04/10**	**06/04/10**	**100604L01**

Parameter	LCS %REC	LCSD %REC	%REC CL	RPD	RPD CL	Qualifiers
Chromium, Hexavalent	101	99	80-120	2	0-20	

RPD - Relative Percent Difference , CL - Control Limit

Calscience Environmental Laboratories, Inc.

Glossary of Terms and Qualifiers

Work Order Number: 10-06-0089

Qualifier	Definition
*	See applicable analysis comment.
<	Less than the indicated value.
>	Greater than the indicated value.
1	Surrogate compound recovery was out of control due to a required sample dilution, therefore, the sample data was reported without further clarification.
2	Surrogate compound recovery was out of control due to matrix interference. The associated method blank surrogate spike compound was in control and, therefore, the sample data was reported without further clarification.
3	Recovery of the Matrix Spike (MS) or Matrix Spike Duplicate (MSD) compound was out of control due to matrix interference. The associated LCS and/or LCSD was in control and, therefore, the sample data was reported without further clarification.
4	The MS/MSD RPD was out of control due to matrix interference. The LCS/LCSD RPD was in control and, therefore, the sample data was reported without further clarification.
5	The PDS/PDSD or PES/PESD associated with this batch of samples was out of control due to a matrix interference effect. The associated batch LCS/LCSD was in control and, hence, the associated sample data was reported without further clarification.
B	Analyte was present in the associated method blank.
E	Concentration exceeds the calibration range.
J	Analyte was detected at a concentration below the reporting limit and above the laboratory method detection limit. Reported value is estimated.
ME	LCS Recovery Percentage is within LCS ME Control Limit range.
ND	Parameter not detected at the indicated reporting limit.
Q	Spike recovery and RPD control limits do not apply resulting from the parameter concentration in the sample exceeding the spike concentration by a factor of four or greater.
X	% Recovery and/or RPD out-of-range.
Z	Analyte presence was not confirmed by second column or GC/MS analysis.
	Solid - Unless otherwise indicated, solid sample data is reported on a wet weight basis, not corrected for % moisture.

Calscience Environmental Laboratories, Inc.

CHAIN OF CUSTODY RECORD

Date 6/1/10

Page 1 of 1

☒ SoCal Laboratory
7440 Lincoln Way
Garden Grove, CA 92841-1427
(714) 895-5494

☐ NorCal Service Center
5063 Commercial Circle, Suite H
Concord, CA 94520-8577
(925) 689-9022

PRIMA ENVIRONMENTAL, Inc.
5070 Robert J. Mathews Parkway, Suite 300
El Dorado Hills, CA 95762
PH: 916-939-7300
FAX: 916-939-7398

STATE ZIP

TEL: E-MAIL: data@primaenvironmental.com

CLIENT PROJECT NAME / NUMBER:

P.O. NO.:

PROJECT CONTACT:

LAB USE ONLY 06-0089

SAMPLER(S): (PRINT)

COELT LOG CODE

COOLER RECEIPT TEMP= °C

TURNAROUND TIME:
☐ SAME DAY ☒ 24 HR ☐ 48 HR ☐ 72 HR ☐ STANDARD

SPECIAL REQUIREMENTS (ADDITIONAL COSTS MAY APPLY)
☐ RWQCB REPORTING FORMS ☐ COELT EDF ☐

SPECIAL INSTRUCTIONS:
See notes below

REQUESTED ANALYSES

LAB USE ONLY	SAMPLE ID	FIELD POINT NAME (FOR COELT EDF)	SAMPLING DATE	SAMPLING TIME	MATRIX	NO. OF CONT.	TPH (g)	TPH (d) or (C6-C36) or (C6-C44)	TPH ( )	BTEX / MTBE (8260B) or ( )	VOCs (8260B)	Oxygenates (8260B)	Encore Prep (5035)	SVOCs (8270C)	Pesticides (8081A)	PCBs (8082)	PNAs (8310) or (8270C)	T22 Metals (6010B/747X)	Cr(VI) [7196A or (7199) or 218.6]	VOCs (TO-14A) or (TO-15)	TPH (g) [TO-3]+	Cd, Cr, Ni (6020)	DI WET - Cd, Cr, Ni (6020)
1	KF·EXC2·UNSP·SO		6/1	1530	SO	1													X			X	X
2	KF·EXC2·SPK·SO		6/1	1530	SO	1													X			X	X
	Note - "SPK·SO" sample contains ~ 10,000 ppm CrVI & other metals are ~ 100 - 2500 ppm.																						
	DI WET → 48h TAT																						

Relinquished by: (Signature)	Received by: (Signature/Affiliation)	Date:	Time:
Catherine Lynn 6/1/10 ~1530			
Relinquished by: (Signature)	Received by: (Signature/Affiliation)	Date:	Time:
Relinquished by: (Signature)	Received by: (Signature/Affiliation)	Date:	Time:
FEDEX	[signature]	6/2/10	10:15

DISTRIBUTION: White with final report, Green and Yellow to Client.
Please note that pages 1 and 2 of 2 of our T/Cs are printed on the reverse side of the Green and Yellow copies respectively.

05/01/07 Revision

Q&D Graphic 714-898-9702

0084

FedEx Express **US Airbill**

FedEx Tracking Number 8704 0156 2372

0215

Recipient's Copy

1 From This portion can be removed for Recipient's records.

Date 6/11/10 FedEx Tracking Number 870401562372

Sender's Name CINDY SCHRETER Phone 916 939-7300

Company PRIMA ENVIRONMENTAL, INC.

Address 5070 ROBERT J MATHEWS PKY Dept./Floor/Suite/Room

City EL DORADO HILLS State CA ZIP 95762-5767

2 Your Internal Billing Reference KF-Exc2

3 To

Recipient's Name SAMPLE RECEIVING Phone 714 895-5494

Company CALSCIENCE ENVIRON ☐ HOLD Weekday Print FedEx location address below. NOT available for FedEx First Overnight. ☐ HOLD Saturday Print FedEx location address below. Available ONLY for FedEx Priority Overnight and FedEx 2Day to select locations.

Address 7440 LINCOLN WAY Dept./Floor/Suite/Room

We cannot deliver to P.O. boxes or P.O. ZIP codes.

Address

Print FedEx location address here if HOLD option is selected.

City GARDEN GROVE State CA ZIP 92841

0409010611

8704 0156 2372

4a Express Package Service * To most locations. *Packages up to 150 lbs.*

- [X] FedEx Priority Overnight — Next business morning.* Friday shipments will be delivered on Monday unless SATURDAY Delivery is selected.
- [ ] FedEx Standard Overnight — Next business afternoon.* Saturday Delivery NOT available.
- [ ] FedEx First Overnight — Earliest next business morning delivery to select locations.* Saturday Delivery NOT available.
- [ ] FedEx 2Day — Second business day.* Thursday shipments will be delivered on Monday unless SATURDAY Delivery is selected.
- [ ] FedEx Express Saver — Third business day.* Saturday Delivery NOT available.

4b Express Freight Service ** To most locations. *Packages over 150 lbs.*

- [ ] FedEx 1Day Freight — Next business day.** Friday shipments will be delivered on Monday unless SATURDAY Delivery is selected. FedEx 1Day Freight Booking No.
- [ ] FedEx 2Day Freight — Second business day.** Thursday shipments will be delivered on Monday unless SATURDAY Delivery is selected.
- [ ] FedEx 3Day Freight — Third business day.** Saturday Delivery NOT available.

5 Packaging * Declared value limit $500.

- [ ] FedEx Envelope*
- [ ] FedEx Pak* — Includes FedEx Small Pak, FedEx Large Pak, and FedEx Sturdy Pak.
- [ ] FedEx Box
- [ ] FedEx Tube
- [X] Other

6 Special Handling and Delivery Signature Options

- [ ] SATURDAY Delivery — NOT available for FedEx Standard Overnight, FedEx First Overnight, FedEx Express Saver, or FedEx 3Day Freight.
- [ ] No Signature Required — Package may be left without obtaining a signature for delivery.
- [ ] Direct Signature — Someone at recipient's address may sign for delivery. *Fee applies.*
- [ ] Indirect Signature — If no one is available at recipient's address, someone at a neighboring address may sign for delivery. For residential deliveries only. *Fee applies.*

Does this shipment contain dangerous goods? One box must be checked.

- [X] No
- [ ] Yes — As per attached Shipper's Declaration.
- [ ] Yes — Shipper's Declaration not required.
- [ ] Dry Ice — Dry Ice, 9, UN 1845 ____ x ____ kg

Dangerous goods (including dry ice) cannot be shipped in FedEx packaging or placed in a FedEx Express Drop Box.

- [ ] Cargo Aircraft Only

7 Payment *Bill to:* Enter FedEx Acct. No. or Credit Card No. below. Obtain Recip. Acct. No. ☐

- [X] Sender — Acct. No. in Section 1 will be billed
- [ ] Recipient
- [ ] Third Party
- [ ] Credit Card
- [ ] Cash/Check

Total Packages 1 Total Weight 5 lbs. Credit Card Auth.

†Our liability is limited to $100 unless you declare a higher value. See the current FedEx Service Guide for details.

553

Rev. Date 2/08•Part #158279•©1994–2008 FedEx•PRINTED IN U.S.A.•SRS

FedEx 8704 0156 2372

Calscience Environmental Laboratories, Inc.

WORK ORDER #: 10-06-0 0 8 9

SAMPLE RECEIPT FORM

Cooler 1 of 1

CLIENT: PRIMA ENV'L.

DATE: 06/02/10

TEMPERATURE: Thermometer ID: SC1 (Criteria: 0.0 °C – 6.0 °C, not frozen)

Temperature 4.9 °C + 0.5 °C (CF) = 5.4 °C ☐ Blank ☑ Sample

☐ Sample(s) outside temperature criteria (PM/APM contacted by: _____).

☐ Sample(s) outside temperature criteria but received on ice/chilled on same day of sampling.

☐ **Received at ambient temperature, placed on ice for transport by Courier.**

Ambient Temperature: ☐ Air ☐ Filter ☐ Metals Only ☐ PCBs Only **Initial:** PS

CUSTODY SEALS INTACT:

☐ Cooler ☐_____ ☐ No (Not Intact) ☑ Not Present ☐ N/A **Initial:** PS

☐ Sample ☐_____ ☐ No (Not Intact) ☑ Not Present **Initial:** [illegible]

SAMPLE CONDITION:	Yes	No	N/A
Chain-Of-Custody (COC) document(s) received with samples	☑	☐	☐
COC document(s) received complete	☑	☐	☐
☐ Collection date/time, matrix, and/or # of containers logged in based on sample labels.			
☐ No analysis requested. ☐ Not relinquished. ☐ No date/time relinquished.			
Sampler's name indicated on COC	☐	☐	☑
Sample container label(s) consistent with COC	☑	☐	☐
Sample container(s) intact and good condition	☑	☐	☐
Proper containers and sufficient volume for analyses requested	☑	☐	☐
Analyses received within holding time	☐	☐	☐
pH / Residual Chlorine / Dissolved Sulfide received within 24 hours	☐	☐	☑
Proper preservation noted on COC or sample container	☐	☐	☑
☐ Unpreserved vials received for Volatiles analysis			
Volatile analysis container(s) free of headspace	☐	☐	☑
Tedlar bag(s) free of condensation	☐	☐	☑

CONTAINER TYPE:

Solid: ☑4ozCGJ ☐8ozCGJ ☐16ozCGJ ☐Sleeve (_____) ☐EnCores® ☐TerraCores® ☐_____

Water: ☐VOA ☐VOA**h** ☐VOA**na$_2$** ☐125AGB ☐125AGB**h** ☐125AGB**p** ☐1AGB ☐1AGB**na$_2$** ☐1AGB**s** ☐500AGB ☐500AGJ ☐500AGJ**s** ☐250AGB ☐250CGB ☐250CGB**s** ☐1PB ☐500PB ☐500PB**na** ☐250PB ☐250PB**n** ☐125PB ☐125PB**znna** ☐100PJ ☐100PJ**na$_2$** ☐_____ ☐_____ ☐_____

Air: ☐Tedlar® ☐Summa® **Other:** ☐_____ **Trip Blank Lot#:**_____ **Labeled/Checked by:** [illegible]

Container: **C:** Clear **A:** Amber **P:** Plastic **G:** Glass **J:** Jar **B:** Bottle **Z:** Ziploc/Resealable Bag **E:** Envelope **Reviewed by:** PS

Preservative: **h:** HCL **n:** HNO_3 **na$_2$:**$Na_2S_2O_3$ **na:** NaOH **p:** H_3PO_4 **s:** H_2SO_4 **znna:** $ZnAc_2$+NaOH **f:** Field-filtered **Scanned by:** PS

Calscience
Environmental
Laboratories, Inc.

Supplemental Report 1

August 09, 2010

Additional requested analyses have been added to the original report.

Cindy Schreier
Prima Environmental
5070 Robert J. Mathews Pkwy, Ste. 300
El Dorado Hills, CA 95762-5702

Subject: **Calscience Work Order No.: 10-07-1946**
Client Reference: KF-EXC2

Dear Client:

Enclosed is an analytical report for the above-referenced project. The samples included in this report were received 7/27/2010 and analyzed in accordance with the attached chain-of-custody.

Calscience Environmental Laboratories certifies that the test results provided in this report meet all NELAC requirements for parameters for which accreditation is required or available. Any exceptions to NELAC requirements are noted in the case narrative. The original report of subcontracted analysis, if any, is provided herein, and follows the standard Calscience data package. The results in this analytical report are limited to the samples tested and any reproduction thereof must be made in its entirety.

If you have any questions regarding this report, please do not hesitate to contact the undersigned.

Sincerely,

Calscience Environmental
Laboratories, Inc.
Robert Stearns
Project Manager

Calscience Environmental Laboratories, Inc.

Analytical Report

ACCREDITED IN ACCORDANCE WITH nelac

Prima Environmental
5070 Robert J. Mathews Pkwy, Ste. 300
El Dorado Hills, CA 95762-5702

Project: KF-EXC2

Date Received:	07/27/10
Work Order No:	10-07-1946
Preparation:	EPA 3050B
Method:	EPA 6020
Units:	mg/kg
	Page 1 of 1

Client Sample Number	Lab Sample Number	Date /Time Collected	Matrix	Instrument	Date Prepared	Date/Time Analyzed	QC Batch ID
KF.EXC2.UNSPK.SO	**10-07-1946-1-A**	**07/26/10 16:00**	**Solid**	**ICP/MS 04**	**07/30/10**	**07/30/10 20:57**	**100730L03**

Parameter	Result	RL	DF	Qual	Parameter	Result	RL	DF	Qual
Arsenic	1.10	1.00	1		Chromium	44.0	2.00	1	
Cadmium	ND	1.00	1		Nickel	4.25	1.00	1	

Client Sample Number	Lab Sample Number	Date /Time Collected	Matrix	Instrument	Date Prepared	Date/Time Analyzed	QC Batch ID
Method Blank	**096-10-002-1,793**	**N/A**	**Solid**	**ICP/MS 04**	**07/30/10**	**07/30/10 21:04**	**100730L03**

Parameter	Result	RL	DF	Qual	Parameter	Result	RL	DF	Qual
Arsenic	ND	1.00	1		Chromium	ND	2.00	1	
Cadmium	ND	1.00	1		Nickel	ND	1.00	1	

RL - Reporting Limit , DF - Dilution Factor , Qual - Qualifiers

Calscience Environmental Laboratories, Inc.

Analytical Report

Prima Environmental	Date Received: 07/27/10
5070 Robert J. Mathews Pkwy, Ste. 300	Work Order No: 10-07-1946
El Dorado Hills, CA 95762-5702	Preparation: T22.11.5.AII DI
	Method: EPA 6020
	Units: mg/L
Project: KF-EXC2	Page 1 of 1

Client Sample Number	Lab Sample Number	Date /Time Collected	Matrix	Instrument	Date Prepared	Date/Time Analyzed	QC Batch ID
KF.EXC2.UNSPK.SO	**10-07-1946-1-A**	**07/26/10 16:00**	**Solid**	**ICP/MS 04**	**07/30/10**	**08/04/10 00:46**	**100802L02**

Comment(s): -The analysis was performed on an STLC extract of the sample.

Parameter	Result	RL	DF	Qual	Parameter	Result	RL	DF	Qual
Arsenic	ND	0.0100	1		Chromium	2.90	0.0100	1	
Cadmium	ND	0.0100	1		Nickel	ND	0.0100	1	

Method Blank	099-14-037-2	N/A	Aqueous	ICP/MS 04	07/29/10	08/03/10 23:29	100802L02

Parameter	Result	RL	DF	Qual	Parameter	Result	RL	DF	Qual
Arsenic	ND	0.0100	1		Chromium	ND	0.0100	1	
Cadmium	ND	0.0100	1		Nickel	ND	0.0100	1	

RL - Reporting Limit , DF - Dilution Factor , Qual - Qualifiers

Calscience Environmental Laboratories, Inc.

Analytical Report

Prima Environmental
5070 Robert J. Mathews Pkwy, Ste. 300
El Dorado Hills, CA 95762-5702

Date Received: 07/27/10
Work Order No: 10-07-1946

Project: KF-EXC2

Client Sample Number	Lab Sample Number	Date Collected	Matrix
KF.EXC2.UNSPK.SO	**10-07-1946-1**	**07/26/10**	**Solid**

Comment(s): (39) Sample extracted outside recommended holding time.
(94) The analysis was performed on an STLC extract of the sample.

Parameter	Result	RL	DF	Qual	Units	Date Prepared	Date Analyzed	Method
Chromium, Hexavalent	25	0.40	10		mg/kg	07/27/10	07/27/10	EPA 7199
Chromium, Hexavalent (39) (94)	2.2	0.10	10		mg/L	08/01/10	08/02/10	EPA 7199

Method Blank			**N/A**	**Solid**

Parameter	Result	RL	DF	Qual	Units	Date Prepared	Date Analyzed	Method
Chromium, Hexavalent	ND	0.040	1		mg/kg	07/27/10	07/27/10	EPA 7199
Chromium, Hexavalent	ND	0.0010	0.1		mg/L	07/31/10	08/02/10	EPA 7199

RL - Reporting Limit , DF - Dilution Factor , Qual - Qualifiers

Calscience Environmental Laboratories, Inc.

Quality Control - Spike/Spike Duplicate

ACCREDITED IN ACCORDANCE WITH nelac

Prima Environmental
5070 Robert J. Mathews Pkwy, Ste. 300
El Dorado Hills, CA 95762-5702

Date Received: 07/27/10
Work Order No: 10-07-1946
Preparation: EPA 3050B
Method: EPA 6020

Project KF-EXC2

Quality Control Sample ID	Matrix	Instrument	Date Prepared	Date Analyzed	MS/MSD Batch Number
10-07-2222-1	**Solid**	**ICP/MS 04**	**07/30/10**	**07/30/10**	**100730S03**

Parameter	MS %REC	MSD %REC	%REC CL	RPD	RPD CL	Qualifiers
Arsenic	97	97	72-132	0	0-13	
Cadmium	101	100	85-121	1	0-12	
Chromium	95	97	20-182	1	0-15	
Nickel	96	97	46-154	0	0-15	

RPD - Relative Percent Difference , CL - Control Limit

Calscience Environmental Laboratories, Inc.

Quality Control - PDS / PDSD

ACCREDITED IN ACCORDANCE WITH nelac

Prima Environmental		Date Received	07/27/10
5070 Robert J. Mathews Pkwy, Ste. 300		Work Order No:	10-07-1946
El Dorado Hills, CA 95762-5702		Preparation:	EPA 3050B
		Method:	EPA 6020

Project: KF-EXC2

Quality Control Sample ID	Matrix	Instrument	Date Prepared	Date Analyzed	PDS / PDSD Batch Number
10-07-2222-1	**Solid**	**ICP/MS 04**	**07/30/10**	**07/30/10**	**100730S03**

Parameter	PDS %REC	PDSD %REC	%REC CL	RPD	RPD CL	Qualifiers
Arsenic	102	103	75-125	1	0-13	
Cadmium	92	93	75-125	2	0-12	
Chromium	89	91	75-125	2	0-15	
Nickel	90	94	75-125	4	0-15	

RPD - Relative Percent Difference , CL - Control Limit

Calscience Environmental Laboratories, Inc.

Quality Control - Spike/Spike Duplicate

Prima Environmental
5070 Robert J. Mathews Pkwy, Ste. 300
El Dorado Hills, CA 95762-5702

Date Received: 07/27/10
Work Order No: 10-07-1946
Preparation: T22.11.5.AII DI
Method: EPA 6020

Project KF-EXC2

Quality Control Sample ID	Matrix	Instrument	Date Prepared	Date Analyzed	MS/MSD Batch Number
KF.EXC2.UNSPK.SO	**Solid**	**ICP/MS 04**	**07/30/10**	**08/04/10**	**100802S02**

Parameter	MS %REC	MSD %REC	%REC CL	RPD	RPD CL	Qualifiers
Arsenic	90	89	73-127	1	0-11	
Cadmium	90	87	84-114	2	0-8	
Chromium	89	92	73-133	2	0-11	
Nickel	98	99	68-122	1	0-10	

RPD - Relative Percent Difference , CL - Control Limit

Calscience Environmental Laboratories, Inc.

Quality Control - PDS / PDSD

ACCREDITED IN ACCORDANCE WITH nelac

Prima Environmental		Date Received	07/27/10
5070 Robert J. Mathews Pkwy, Ste. 300		Work Order No:	10-07-1946
El Dorado Hills, CA 95762-5702		Preparation:	T22.11.5.AII DI
		Method:	EPA 6020

Project: KF-EXC2

Quality Control Sample ID	Matrix	Instrument	Date Prepared	Date Analyzed	PDS / PDSD Batch Number
KF.EXC2.UNSPK.SO	**Solid**	**ICP/MS 04**	**07/30/10**	**08/04/10**	**100802S02**

Parameter	PDS %REC	PDSD %REC	%REC CL	RPD	RPD CL	Qualifiers
Arsenic	90	89	75-125	1	0-11	
Cadmium	88	91	75-125	3	0-8	
Chromium	94	94	75-125	0	0-11	
Nickel	100	100	75-125	0	0-10	

RPD - Relative Percent Difference , CL - Control Limit

Calscience Environmental Laboratories, Inc.

Quality Control - Spike/Spike Duplicate

Prima Environmental
5070 Robert J. Mathews Pkwy, Ste. 300
El Dorado Hills, CA 95762-5702

Date Received: N/A
Work Order No: 10-07-1946

Project: KF-EXC2

Matrix: Aqueous or Solid

Parameter	Method	Quality Control Sample ID	Date Analyzed	Date Extracted	MS% REC	MSD % REC	%REC CL	RPD	RPD CL	Qualifiers
Chromium, Hexavalent	EPA 7199	KF.EXC2.UNSPK.SO	07/27/10	7/27/10	91	91	75-125	0	0-25	
Chromium, Hexavalent	EPA 7199	KF.EXC2.UNSPK.SO	08/02/10	8/1/10	102	102	70-130	0	0-25	

RPD - Relative Percent Difference , CL - Control Limit

Calscience Environmental Laboratories, Inc.

Quality Control - LCS/LCS Duplicate

Prima Environmental
5070 Robert J. Mathews Pkwy, Ste. 300
El Dorado Hills, CA 95762-5702

Date Received: N/A
Work Order No: 10-07-1946
Preparation: EPA 3050B
Method: EPA 6020

Project: KF-EXC2

Quality Control Sample ID	Matrix	Instrument	Date Prepared	Date Analyzed	LCS/LCSD Batch Number
096-10-002-1,793	**Solid**	**ICP/MS 04**	**07/30/10**	**07/30/10**	**100730L03**

Parameter	LCS %REC	LCSD %REC	%REC CL	RPD	RPD CL	Qualifiers
Arsenic	96	98	80-120	2	0-20	
Cadmium	96	95	80-120	1	0-20	
Chromium	95	96	80-120	1	0-20	
Nickel	100	99	80-120	0	0-20	

RPD - Relative Percent Difference , CL - Control Limit

Calscience Environmental Laboratories, Inc.

Quality Control - LCS/LCS Duplicate

ACCREDITED IN ACCORDANCE WITH nelac

Prima Environmental	Date Received:	N/A
5070 Robert J. Mathews Pkwy, Ste. 300	Work Order No:	10-07-1946
El Dorado Hills, CA 95762-5702	Preparation:	T22.11.5.AII DI
	Method:	EPA 6020

Project: KF-EXC2

Quality Control Sample ID	Matrix	Instrument	Date Prepared	Date Analyzed	LCS/LCSD Batch Number
099-14-037-2	**Aqueous**	**ICP/MS 04**	**07/29/10**	**08/04/10**	**100802L02**

Parameter	LCS %REC	LCSD %REC	%REC CL	RPD	RPD CL	Qualifiers
Arsenic	116	116	80-120	0	0-20	
Cadmium	99	100	80-120	1	0-20	
Chromium	110	111	80-120	1	0-20	
Nickel	109	109	80-120	0	0-20	

RPD - Relative Percent Difference , CL - Control Limit

Calscience Environmental Laboratories, Inc.

Quality Control - LCS/LCS Duplicate

ACCREDITED IN ACCORDANCE WITH nelac

Prima Environmental
5070 Robert J. Mathews Pkwy, Ste. 300
El Dorado Hills, CA 95762-5702

Date Received: N/A
Work Order No: 10-07-1946

Project: KF-EXC2

Matrix: Aqueous or Solid

Parameter	Method	Quality Control Sample ID	Date Extracted	Date Analyzed	LCS % REC	LCSD % REC	%REC CL	RPD	RPD CL	Qual
Chromium, Hexavalent	EPA 7199	099-05-125-2,152	07/27/10	07/27/10	98	99	80-120	1	0-20	
Chromium, Hexavalent	EPA 7199	099-14-017-6	07/31/10	08/02/10	99	100	80-120	1	0-20	

RPD - Relative Percent Difference , CL - Control Limit

Calscience Environmental Laboratories, Inc.

Glossary of Terms and Qualifiers

Work Order Number: 10-07-1946

Qualifier	Definition
*	See applicable analysis comment.
<	Less than the indicated value.
>	Greater than the indicated value.
1	Surrogate compound recovery was out of control due to a required sample dilution, therefore, the sample data was reported without further clarification.
2	Surrogate compound recovery was out of control due to matrix interference. The associated method blank surrogate spike compound was in control and, therefore, the sample data was reported without further clarification.
3	Recovery of the Matrix Spike (MS) or Matrix Spike Duplicate (MSD) compound was out of control due to matrix interference. The associated LCS and/or LCSD was in control and, therefore, the sample data was reported without further clarification.
4	The MS/MSD RPD was out of control due to matrix interference. The LCS/LCSD RPD was in control and, therefore, the sample data was reported without further clarification.
5	The PDS/PDSD or PES/PESD associated with this batch of samples was out of control due to a matrix interference effect. The associated batch LCS/LCSD was in control and, hence, the associated sample data was reported without further clarification.
B	Analyte was present in the associated method blank.
E	Concentration exceeds the calibration range.
J	Analyte was detected at a concentration below the reporting limit and above the laboratory method detection limit. Reported value is estimated.
ME	LCS Recovery Percentage is within LCS ME Control Limit range.
ND	Parameter not detected at the indicated reporting limit.
Q	Spike recovery and RPD control limits do not apply resulting from the parameter concentration in the sample exceeding the spike concentration by a factor of four or greater.
X	% Recovery and/or RPD out-of-range.
Z	Analyte presence was not confirmed by second column or GC/MS analysis.
	Solid - Unless otherwise indicated, solid sample data is reported on a wet weight basis, not corrected for % moisture.

Calscience Environmental Laboratories, Inc.
7440 LINCOLN WAY
GARDEN GROVE, CA 92841-1432
TEL: (714) 895-5494 . FAX: (714) 894-7501

CHAIN OF CUSTODY RECORD

DATE:

PAGE: 1 OF 1

LABORATORY CLIENT: Cindy Schreier

ADDRESS: PRIMA ENVIRONMENTAL, INC.

CITY: 10265 Old Placerville Rd., #15

TEL: Sacramento, CA 95827

PH: 916-363-8798

FAX: 916-363-8829

data@primaenvironmental.com

CLIENT PROJECT NAME / NUMBER: KF-EXC2

PROJECT CONTACT:

SAMPLER(S): (SIGNATURE) CR

P.O. NO.:

QUOTE NO.:

LAB USE ONLY: 07-1946

TURNAROUND TIME

☐ SAME DAY ☐ 24 HR ☐ 48HR ☐ 72 HR ☐ 5 DAYS ☐ 10 DAYS

SPECIAL REQUIREMENTS (ADDITIONAL COSTS MAY APPLY)

☐ RWQCB REPORTING ☐ ARCHIVE SAMPLES UNTIL ___/___/___

SPECIAL INSTRUCTIONS

Hold SX ~~until~~ Until further Inst. on TAT

REQUESTED ANALYSIS

LAB USE ONLY	SAMPLE ID	LOCATION/ DESCRIPTION	SAMPLING DATE	SAMPLING TIME	Matrix	#Cont	Please list tests required: Cd,Cr,Ni,As Metals (6020)	Cr(VI) (7199)	Cd,Cr,Ni,Cr(VI) DI Wet (Title 22)
1	KF-EXC2-UNSPK-SO	KF-EXC2	7/26/10	1600	SO	1	X	X	X

Relinquished by: (Signature) Catherine A. Rynori 7/26/10 Fed Ex	Received by: (Signature)	Date:	Time:
Relinquished by: (Signature)	Received by: (Signature)	Date:	Time:
Relinquished by: (Signature) FEDEX	Received by: (Signature)	Date: 7/27/10	Time: 10:30

28

FedEx Express **US Airbill**

FedEx Tracking Number 8704 0156 2199

Form ID No. 0215

1 From This portion can be removed for Recipient's records.

Date 7/24/08 FedEx Tracking Number 870401562199

RECIPIENT: PEEL HERE

Sender's Name CINDY SCHREIER Phone 916 939-7300

Company PRIMA ENVIRONMENTAL, INC

Address 5070 ROBERT J MATHEWS PKY Dept./Floor/Suite/Room

City EL DORADO HILLS State CA ZIP 95762-9767

2 Your Internal Billing Reference KT.LxC2

3 To

Recipient's Name SAMPLE RELEIVING Phone 714 895-5494

Company CALSCIENCE ENVIRON

HOLD Weekday — Print FedEx location address below. **NOT available for** FedEx First Overnight.

HOLD Saturday — Print FedEx location address below. **Available ONLY for** FedEx Priority Overnight and FedEx 2Day to select locations.

Address 7440 LINCOLN WAY

We cannot deliver to P.O. boxes or P.O. ZIP codes. Dept./Floor/Suite/Room

Address

Print FedEx location address here if HOLD option is selected.

City GARDEN GROVE State CA ZIP 92841

0409010611

8704 0156 2199

4a Express Package Service * To most locations. **Packages up to 1**

- [A] FedEx Priority Overnight — Next business morning.* Friday shipments will be delivered on Monday unless SATURDAY Delivery is selected.
- [ ] FedEx Standard Overnight — Next business afternoon.* Saturday Delivery NOT available.
- [ ] FedEx First Overni — Earliest next business mo delivery to select location Saturday Delivery NOT av
- [ ] FedEx 2Day — Second business day.* Thursday shipments will be delivered on Monday unless SATURDAY Delivery is selected.
- [ ] FedEx Express Saver — Third business day.* Saturday Delivery NOT available.

1946

4b Express Freight Service ** To most locations. **Packages over 1**

- [ ] FedEx 1Day Freight — Next business day.** Friday shipments will be delivered on Monday unless SATURDAY Delivery is selected. FedEx 1Day Freight Booking No.
- [ ] FedEx 2Day Freight — Second business day.** Thursday shipments will be delivered on Monday unless SATURDAY Delivery is selected.
- [ ] FedEx 3Day Freight — Third business day.** Saturday Delivery NOT availe

5 Packaging * Declared value limit $500.

- [ ] FedEx Envelope*
- [ ] FedEx Pak* — Includes FedEx Small Pak, FedEx Large Pak, and FedEx Sturdy Pak.
- [ ] FedEx Box
- [ ] FedEx Tube
- [Y]

6 Special Handling and Delivery Signature Options

- [ ] SATURDAY Delivery — **NOT available** for FedEx Standard Overnight, FedEx First Overnight, FedEx Express Saver, or FedEx 3Day Freight.
- [ ] No Signature Required — Package may be left without obtaining a signature for delivery.
- [ ] Direct Signature — Someone at recipient's address may sign for delivery. *Fee applies.*
- [ ] Indirect Signature — If no one is available at recipient's address, someone at a neighboring address may sign for delivery. For residential deliveries only. *Fee applies.*

Does this shipment contain dangerous goods? One box must be checked.

- [ ] No
- [ ] Yes — As per attached Shipper's Declaration.
- [ ] Yes — Shipper's Declaration not required.
- [ ] Dry Ice — Dry Ice, 9, UN 1845 x
- [ ] Cargo Aircraft Only

Dangerous goods (including dry ice) cannot be shipped in FedEx packaging or placed in a FedEx Express Drop Box.

7 Payment *Bill to:* Obtain Recipient Acct. Nu

Enter FedEx Acct. No. or Credit Card No. below.

- [X] Sender — Acct. No. in Section 1 will be billed.
- [ ] Recipient
- [ ] Third Party
- [ ] Credit Card
- [ ] Cash

Total Packages: 1 Total Weight: lbs. Credit Card Auth.

Our liability is limited to $100 unless you declare a higher value. See the current FedEx Service Guide for details.

553

Rev. Date 2/08•Part #158279•©1994–2008 FedEx•PRINTED IN U.S.A.•SRS

fedex.com 1.800.GoFedEx 1.800.463.3339

Calscience Environmental Laboratories, Inc.

WORK ORDER #: 10-07-1946

SAMPLE RECEIPT FORM

Cooler 1 of 1

CLIENT: PRIMA ENV'L. DATE: 07/27/10

TEMPERATURE: Thermometer ID: SC1 (Criteria: 0.0 °C – 6.0 °C, not frozen)

Temperature 18.2 °C + 0.5 °C (CF) = 18.7 °C ☐ Blank ☑ Sample

☑ Sample(s) outside temperature criteria (PM/APM contacted by: PS).

☐ Sample(s) outside temperature criteria but received on ice/chilled on same day of sampling.

☐ Received at ambient temperature, placed on ice for transport by Courier.

Ambient Temperature: ☐ Air ☐ Filter ☐ Metals Only ☐ PCBs Only Initial: PS

CUSTODY SEALS INTACT:

☐ Cooler ☐_____ ☐ No (Not Intact) ☑ Not Present ☐ N/A Initial: PS

☐ Sample ☐_____ ☐ No (Not Intact) ☑ Not Present Initial: PS

SAMPLE CONDITION:	Yes	No	N/A
Chain-Of-Custody (COC) document(s) received with samples	☑	☐	☐
COC document(s) received complete	☐	☑	☐
☐ Collection date/time, matrix, and/or # of containers logged in based on sample labels.			
☐ No analysis requested. ☐ Not relinquished. ☑ No date/time relinquished.			
Sampler's name indicated on COC	☑	☐	☐
Sample container label(s) consistent with COC	☑	☐	☐
Sample container(s) intact and good condition	☑	☐	☐
Proper containers and sufficient volume for analyses requested	☑	☐	☐
Analyses received within holding time	☑	☐	☐
pH / Residual Chlorine / Dissolved Sulfide received within 24 hours	☐	☐	☑
Proper preservation noted on COC or sample container	☐	☐	☑
☐ Unpreserved vials received for Volatiles analysis			
Volatile analysis container(s) free of headspace	☐	☐	☑
Tedlar bag(s) free of condensation	☐	☐	☑

CONTAINER TYPE:

Solid: ☐4ozCGJ ☑8ozCGJ ☐16ozCGJ ☐Sleeve (_____) ☐EnCores® ☐TerraCores® ☐_____

Water: ☐VOA ☐VOA**h** ☐VOA**na$_2$** ☐125AGB ☐125AGB**h** ☐125AGB**p** ☐1AGB ☐1AGB**na$_2$** ☐1AGB**s**

☐500AGB ☐500AGJ ☐500AGJ**s** ☐250AGB ☐250CGB ☐250CGB**s** ☐1PB ☐500PB ☐500PB**na**

☐250PB ☐250PB**n** ☐125PB ☐125PB**znna** ☐100PJ ☐100PJ**na$_2$** ☐_____ ☐_____ ☐_____

Air: ☐Tedlar® ☐Summa® **Other:** ☐_____ **Trip Blank Lot#:**_____ **Labeled/Checked by:** PS

Container: **C:** Clear **A:** Amber **P:** Plastic **G:** Glass **J:** Jar **B:** Bottle **Z:** Ziploc/Resealable Bag **E:** Envelope **Reviewed by:** JP

Preservative: **h:** HCL **n:** HNO_3 **na$_2$:**$Na_2S_2O_3$ **na:** NaOH **p:** H_3PO_4 **s:** H_2SO_4 **znna:** $ZnAc_2$+NaOH **f:** Field-filtered **Scanned by:** PS

Calscience
Environmental
Laboratories, Inc.

August 16, 2010

Cindy Schreier
Prima Environmental
5070 Robert J. Mathews Pkwy, Ste. 300
El Dorado Hills, CA 95762-5702

Subject: **Calscience Work Order No.: 10-08-0323**
Client Reference: KF-EXC #2

Dear Client:

Enclosed is an analytical report for the above-referenced project. The samples included in this report were received 8/5/2010 and analyzed in accordance with the attached chain-of-custody.

Calscience Environmental Laboratories certifies that the test results provided in this report meet all NELAC requirements for parameters for which accreditation is required or available. Any exceptions to NELAC requirements are noted in the case narrative. The original report of subcontracted analysis, if any, is provided herein, and follows the standard Calscience data package. The results in this analytical report are limited to the samples tested and any reproduction thereof must be made in its entirety.

If you have any questions regarding this report, please do not hesitate to contact the undersigned.

Sincerely,

Calscience Environmental
Laboratories, Inc.
Robert Stearns
Project Manager

Calscience Environmental Laboratories, Inc.

Analytical Report

ACCREDITED IN ACCORDANCE WITH nelac

Prima Environmental	Date Received: 08/05/10
5070 Robert J. Mathews Pkwy, Ste. 300	Work Order No: 10-08-0323
El Dorado Hills, CA 95762-5702	Preparation: EPA 3060A
	Method: EPA 7199

Project: KF-EXC #2

Client Sample Number	Lab Sample Number	Date/Time Collected	Matrix	Instrument	Date Prepared	Date/Time Analyzed	QC Batch ID
KP-EX2-unsp 1+2	**10-08-0323-1-A**	**08/04/10 16:15**	**Solid**	**IC 12**	**08/05/10**	**08/05/10 19:03**	**100805L02**

Parameter	Result	RL	DF	Qual	Units
Chromium, Hexavalent	41	0.80	20		mg/kg

Client Sample Number	Lab Sample Number	Date/Time Collected	Matrix	Instrument	Date Prepared	Date/Time Analyzed	QC Batch ID
KP-EX2-spike 1+2	**10-08-0323-2-A**	**08/04/10 16:15**	**Solid**	**IC 12**	**08/05/10**	**08/05/10 19:10**	**100805L02**

Parameter	Result	RL	DF	Qual	Units
Chromium, Hexavalent	8800	200	5000		mg/kg

Client Sample Number	Lab Sample Number	Date/Time Collected	Matrix	Instrument	Date Prepared	Date/Time Analyzed	QC Batch ID
Method Blank	**099-05-125-2,156**	**N/A**	**Solid**	**IC 12**	**08/05/10**	**08/05/10 15:02**	**100805L02**

Parameter	Result	RL	DF	Qual	Units
Chromium, Hexavalent	ND	0.040	1		mg/kg

RL - Reporting Limit , DF - Dilution Factor , Qual - Qualifiers

Calscience Environmental Laboratories, Inc.

Analytical Report

Prima Environmental
5070 Robert J. Mathews Pkwy, Ste. 300
El Dorado Hills, CA 95762-5702

Date Received: 08/05/10
Work Order No: 10-08-0323
Preparation: T22.11.5.AII DI
Method: EPA 7199

Project: KF-EXC #2

Client Sample Number	Lab Sample Number	Date/Time Collected	Matrix	Instrument	Date Prepared	Date/Time Analyzed	QC Batch ID
KP-EX2-unsp 1+2	**10-08-0323-1-A**	**08/04/10 16:15**	**Solid**	**IC 12**	**08/05/10**	**08/07/10 14:13**	**100807L01**

Comment(s): -This sample was prepared with deionized water as the extractant.

Parameter	Result	RL	DF	Qual	Units
Chromium, Hexavalent	2.2	0.050	5		mg/L

KP-EX2-spike 1+2	**10-08-0323-2-A**	**08/04/10 16:15**	**Solid**	**IC 12**	**08/05/10**	**08/07/10 14:06**	**100807L01**

Comment(s): -This sample was prepared with deionized water as the extractant.

Parameter	Result	RL	DF	Qual	Units
Chromium, Hexavalent	900	10	1000		mg/L

Method Blank	**099-14-017-7**	**N/A**	**Solid**	**IC 12**	**08/05/10**	**08/07/10 10:36**	**100807L01**

Parameter	Result	RL	DF	Qual	Units
Chromium, Hexavalent	ND	0.010	1		mg/L

RL - Reporting Limit , DF - Dilution Factor , Qual - Qualifiers

Calscience Environmental Laboratories, Inc.

Analytical Report

ACCREDITED IN ACCORDANCE WITH nelac

Prima Environmental
5070 Robert J. Mathews Pkwy, Ste. 300
El Dorado Hills, CA 95762-5702

Date Received: 08/05/10
Work Order No: 10-08-0323
Preparation: EPA 3050B
Method: EPA 6020
Units: mg/kg

Project: KF-EXC #2

Client Sample Number	Lab Sample Number	Date /Time Collected	Matrix	Instrument	Date Prepared	Date/Time Analyzed	QC Batch ID
KP-EX2-unsp 1+2	**10-08-0323-1-A**	**08/04/10 16:15**	**Solid**	**ICP/MS 04**	**08/05/10**	**08/05/10 19:28**	**100805L01**

Parameter	Result	RL	DF	Qual	Parameter	Result	RL	DF	Qual
Arsenic	1.07	1.00	1		Chromium	114	2.00	1	
Cadmium	ND	1.00	1		Nickel	4.53	1.00	1	

Client Sample Number	Lab Sample Number	Date /Time Collected	Matrix	Instrument	Date Prepared	Date/Time Analyzed	QC Batch ID
KP-EX2-spike 1+2	**10-08-0323-2-A**	**08/04/10 16:15**	**Solid**	**ICP/MS 04**	**08/05/10**	**08/05/10 19:31**	**100805L01**

Parameter	Result	RL	DF	Qual	Parameter	Result	RL	DF	Qual
Arsenic	1.02	1.00	1		Chromium	8230	2.00	1	
Cadmium	214	1.00	1		Nickel	2100	1.00	1	

Client Sample Number	Lab Sample Number	Date /Time Collected	Matrix	Instrument	Date Prepared	Date/Time Analyzed	QC Batch ID
Method Blank	**096-10-002-1,797**	**N/A**	**Solid**	**ICP/MS 04**	**08/05/10**	**08/05/10 18:51**	**100805L01**

Parameter	Result	RL	DF	Qual	Parameter	Result	RL	DF	Qual
Arsenic	ND	1.00	1		Chromium	ND	2.00	1	
Cadmium	ND	1.00	1		Nickel	ND	1.00	1	

RL - Reporting Limit , DF - Dilution Factor , Qual - Qualifiers

Calscience Environmental Laboratories, Inc.

Analytical Report

Prima Environmental		Date Received:	08/05/10
5070 Robert J. Mathews Pkwy, Ste. 300		Work Order No:	10-08-0323
El Dorado Hills, CA 95762-5702		Preparation:	T22.11.5.AII DI
		Method:	EPA 6020
		Units:	mg/L
Project: KF-EXC #2			Page 1 of 1

Client Sample Number	Lab Sample Number	Date /Time Collected	Matrix	Instrument	Date Prepared	Date/Time Analyzed	QC Batch ID
KP-EX2-unsp 1+2	**10-08-0323-1-A**	**08/04/10 16:15**	**Solid**	**ICP/MS 04**	**08/05/10**	**08/10/10 17:22**	**100809LA4**

Comment(s): -This sample was prepared with deionized water as the extractant.

Parameter	Result	RL	DF	Qual	Parameter	Result	RL	DF	Qual
Arsenic	ND	0.0100	1		Chromium	2.68	0.0100	1	
Cadmium	ND	0.0100	1		Nickel	0.0123	0.0100	1	

Client Sample Number	Lab Sample Number	Date /Time Collected	Matrix	Instrument	Date Prepared	Date/Time Analyzed	QC Batch ID
KP-EX2-spike 1+2	**10-08-0323-2-A**	**08/04/10 16:15**	**Solid**	**ICP/MS 04**	**08/05/10**	**08/10/10 17:28**	**100809LA4**

Comment(s): -This sample was prepared with deionized water as the extractant.

Parameter	Result	RL	DF	Qual	Parameter	Result	RL	DF	Qual
Arsenic	ND	0.0100	1		Chromium	870	1.00	100	
Cadmium	17.3	0.0100	1		Nickel	234	1.00	100	

Client Sample Number	Lab Sample Number	Date /Time Collected	Matrix	Instrument	Date Prepared	Date/Time Analyzed	QC Batch ID
Method Blank	**099-14-037-3**	**N/A**	**Aqueous**	**ICP/MS 04**	**08/05/10**	**08/10/10 16:23**	**100809LA4**

Parameter	Result	RL	DF	Qual	Parameter	Result	RL	DF	Qual
Arsenic	ND	0.0100	1		Chromium	ND	0.0100	1	
Cadmium	ND	0.0100	1		Nickel	ND	0.0100	1	

RL - Reporting Limit , DF - Dilution Factor , Qual - Qualifiers

Calscience Environmental Laboratories, Inc.

Quality Control - Spike/Spike Duplicate

Prima Environmental
5070 Robert J. Mathews Pkwy, Ste. 300
El Dorado Hills, CA 95762-5702

Date Received: 08/05/10
Work Order No: 10-08-0323
Preparation: EPA 3050B
Method: EPA 6020

Project KF-EXC #2

Quality Control Sample ID	Matrix	Instrument	Date Prepared	Date Analyzed	MS/MSD Batch Number
KP-EX2-unsp 1+2	**Solid**	**ICP/MS 04**	**08/05/10**	**08/05/10**	**100805S01**

Parameter	MS %REC	MSD %REC	%REC CL	RPD	RPD CL	Qualifiers
Arsenic	82	87	72-132	6	0-13	
Cadmium	99	100	85-121	1	0-12	
Chromium	4X	4X	20-182	4X	0-15	Q
Nickel	81	88	46-154	6	0-15	

RPD - Relative Percent Difference , CL - Control Limit

Calscience Environmental Laboratories, Inc.

Quality Control - PDS / PDSD

Prima Environmental
5070 Robert J. Mathews Pkwy, Ste. 300
El Dorado Hills, CA 95762-5702

Date Received 08/05/10
Work Order No: 10-08-0323
Preparation: EPA 3050B
Method: EPA 6020

Project: KF-EXC #2

Quality Control Sample ID	Matrix	Instrument	Date Prepared	Date Analyzed	PDS / PDSD Batch Number
KP-EX2-unsp 1+2	**Solid**	**ICP/MS 04**	**08/05/10**	**08/05/10**	**100805S01**

Parameter	PDS %REC	PDSD %REC	%REC CL	RPD	RPD CL	Qualifiers
Arsenic	82	80	75-125	2	0-13	
Cadmium	95	97	75-125	2	0-12	
Chromium	4X	4X	75-125	4X	0-15	Q
Nickel	86	80	75-125	6	0-15	

RPD - Relative Percent Difference , CL - Control Limit

Calscience Environmental Laboratories, Inc.

Quality Control - Spike/Spike Duplicate

Prima Environmental
5070 Robert J. Mathews Pkwy, Ste. 300
El Dorado Hills, CA 95762-5702

Date Received: 08/05/10
Work Order No: 10-08-0323
Preparation: T22.11.5.AII DI
Method: EPA 6020

Project KF-EXC #2

Quality Control Sample ID	Matrix	Instrument	Date Prepared	Date Analyzed	MS/MSD Batch Number
KP-EX2-unsp 1+2	**Solid**	**ICP/MS 04**	**08/05/10**	**08/10/10**	**100809SA4**

Parameter	MS %REC	MSD %REC	%REC CL	RPD	RPD CL	Qualifiers
Arsenic	88	90	73-127	2	0-11	
Cadmium	86	85	84-114	2	0-8	
Chromium	92	88	73-133	3	0-11	
Nickel	95	94	68-122	1	0-10	

RPD - Relative Percent Difference , CL - Control Limit

Calscience Environmental Laboratories, Inc.

Quality Control - PDS / PDSD

Prima Environmental
5070 Robert J. Mathews Pkwy, Ste. 300
El Dorado Hills, CA 95762-5702

Date Received: 08/05/10
Work Order No: 10-08-0323
Preparation: T22.11.5.AII DI
Method: EPA 6020

Project: KF-EXC #2

Quality Control Sample ID	Matrix	Instrument	Date Prepared	Date Analyzed	PDS / PDSD Batch Number
KP-EX2-unsp 1+2	**Solid**	**ICP/MS 04**	**08/05/10**	**08/10/10**	**100809SA4**

Parameter	PDS %REC	PDSD %REC	%REC CL	RPD	RPD CL	Qualifiers
Arsenic	97	99	75-125	2	0-11	
Cadmium	89	92	75-125	3	0-8	
Chromium	93	95	75-125	1	0-11	
Nickel	98	100	75-125	3	0-10	

RPD - Relative Percent Difference , CL - Control Limit

Calscience Environmental Laboratories, Inc.

Quality Control - Spike/Spike Duplicate

Prima Environmental
5070 Robert J. Mathews Pkwy, Ste. 300
El Dorado Hills, CA 95762-5702

Date Received: 08/05/10
Work Order No: 10-08-0323
Preparation: EPA 3060A
Method: EPA 7199

Project KF-EXC #2

Quality Control Sample ID	Matrix	Instrument	Date Prepared	Date Analyzed	MS/MSD Batch Number
KP-EX2-unsp 1+2	**Solid**	**IC 12**	**08/05/10**	**08/05/10**	**10080323S0**

Parameter	MS %REC	MSD %REC	%REC CL	RPD	RPD CL	Qualifiers
Chromium, Hexavalent	78	78	75-125	0	0-25	

RPD - Relative Percent Difference , CL - Control Limit

Calscience Environmental Laboratories, Inc.

Quality Control - Spike/Spike Duplicate

Prima Environmental
5070 Robert J. Mathews Pkwy, Ste. 300
El Dorado Hills, CA 95762-5702

Date Received: 08/05/10
Work Order No: 10-08-0323
Preparation: T22.11.5.AII DI
Method: EPA 7199

Project KF-EXC #2

Quality Control Sample ID	Matrix	Instrument	Date Prepared	Date Analyzed	MS/MSD Batch Number
KP-EX2-unsp 1+2	**Solid**	**IC 12**	**01/01/95**	**08/07/10**	**100807S01**

Parameter	MS %REC	MSD %REC	%REC CL	RPD	RPD CL	Qualifiers
Chromium, Hexavalent	107	107	70-130	0	0-25	

RPD - Relative Percent Difference , CL - Control Limit

Calscience Environmental Laboratories, Inc.

Quality Control - LCS/LCS Duplicate

Prima Environmental
5070 Robert J. Mathews Pkwy, Ste. 300
El Dorado Hills, CA 95762-5702

Date Received: N/A
Work Order No: 10-08-0323
Preparation: EPA 3050B
Method: EPA 6020

Project: KF-EXC #2

Quality Control Sample ID	Matrix	Instrument	Date Prepared	Date Analyzed	LCS/LCSD Batch Number
096-10-002-1,797	**Solid**	**ICP/MS 04**	**08/05/10**	**08/05/10**	**100805L01**

Parameter	LCS %REC	LCSD %REC	%REC CL	RPD	RPD CL	Qualifiers
Arsenic	97	95	80-120	2	0-20	
Cadmium	97	97	80-120	1	0-20	
Chromium	96	93	80-120	3	0-20	
Nickel	98	100	80-120	1	0-20	

RPD - Relative Percent Difference , CL - Control Limit

Calscience Environmental Laboratories, Inc.

Quality Control - LCS/LCS Duplicate

Prima Environmental
5070 Robert J. Mathews Pkwy, Ste. 300
El Dorado Hills, CA 95762-5702

Date Received: N/A
Work Order No: 10-08-0323
Preparation: T22.11.5.AII DI
Method: EPA 6020

Project: KF-EXC #2

Quality Control Sample ID	Matrix	Instrument	Date Prepared	Date Analyzed	LCS/LCSD Batch Number
099-14-037-3	**Aqueous**	**ICP/MS 04**	**08/05/10**	**08/10/10**	**100809LA4**

Parameter	LCS %REC	LCSD %REC	%REC CL	RPD	RPD CL	Qualifiers
Arsenic	89	89	80-120	0	0-20	
Cadmium	84	85	80-120	0	0-20	
Chromium	95	94	80-120	1	0-20	
Nickel	97	96	80-120	1	0-20	

RPD - Relative Percent Difference , CL - Control Limit

Calscience Environmental Laboratories, Inc.

Quality Control - LCS/LCS Duplicate

ACCREDITED IN ACCORDANCE WITH nelac

Prima Environmental		Date Received:	N/A
5070 Robert J. Mathews Pkwy, Ste. 300		Work Order No:	10-08-0323
El Dorado Hills, CA 95762-5702		Preparation:	EPA 3060A
		Method:	EPA 7199

Project: KF-EXC #2

Quality Control Sample ID	Matrix	Instrument	Date Prepared	Date Analyzed	LCS/LCSD Batch Number
099-05-125-2,156	**Solid**	**IC 12**	**08/05/10**	**08/05/10**	**100805L02**

Parameter	LCS %REC	LCSD %REC	%REC CL	RPD	RPD CL	Qualifiers
Chromium, Hexavalent	99	98	80-120	1	0-20	

RPD - Relative Percent Difference , CL - Control Limit

Calscience Environmental Laboratories, Inc.

Quality Control - LCS/LCS Duplicate

Prima Environmental
5070 Robert J. Mathews Pkwy, Ste. 300
El Dorado Hills, CA 95762-5702

Date Received: N/A
Work Order No: 10-08-0323
Preparation: T22.11.5.AII DI
Method: EPA 7199

Project: KF-EXC #2

Quality Control Sample ID	Matrix	Instrument	Date Prepared	Date Analyzed	LCS/LCSD Batch Number
099-14-017-7	**Solid**	**IC 12**	**08/05/10**	**08/07/10**	**100807L01**

Parameter	LCS %REC	LCSD %REC	%REC CL	RPD	RPD CL	Qualifiers
Chromium, Hexavalent	104	104	80-120	0	0-20	

RPD - Relative Percent Difference , CL - Control Limit

Calscience Environmental Laboratories, Inc.

Glossary of Terms and Qualifiers

Work Order Number: 10-08-0323

Qualifier	Definition
*	See applicable analysis comment.
<	Less than the indicated value.
>	Greater than the indicated value.
1	Surrogate compound recovery was out of control due to a required sample dilution, therefore, the sample data was reported without further clarification.
2	Surrogate compound recovery was out of control due to matrix interference. The associated method blank surrogate spike compound was in control and, therefore, the sample data was reported without further clarification.
3	Recovery of the Matrix Spike (MS) or Matrix Spike Duplicate (MSD) compound was out of control due to matrix interference. The associated LCS and/or LCSD was in control and, therefore, the sample data was reported without further clarification.
4	The MS/MSD RPD was out of control due to matrix interference. The LCS/LCSD RPD was in control and, therefore, the sample data was reported without further clarification.
5	The PDS/PDSD or PES/PESD associated with this batch of samples was out of control due to a matrix interference effect. The associated batch LCS/LCSD was in control and, hence, the associated sample data was reported without further clarification.
B	Analyte was present in the associated method blank.
E	Concentration exceeds the calibration range.
J	Analyte was detected at a concentration below the reporting limit and above the laboratory method detection limit. Reported value is estimated.
ME	LCS Recovery Percentage is within LCS ME Control Limit range.
ND	Parameter not detected at the indicated reporting limit.
Q	Spike recovery and RPD control limits do not apply resulting from the parameter concentration in the sample exceeding the spike concentration by a factor of four or greater.
X	% Recovery and/or RPD out-of-range.
Z	Analyte presence was not confirmed by second column or GC/MS analysis.
	Solid - Unless otherwise indicated, solid sample data is reported on a wet weight basis, not corrected for % moisture.

Calscience Environmental Laboratories, Inc.
7440 LINCOLN WAY
GARDEN GROVE, CA 92841-1432
TEL: (714) 895-5494 . FAX: (714) 894-7501

CHAIN OF CUSTODY RECORD

DATE:

PAGE: 1 OF 1

LABORATORY CLIENT: CINDY SCHREIER

PRIMA ENVIRONMENTAL, Inc.
5070 Robert J. Mathews Pkwy, Ste 300
El Dorado Hills, CA 95762
PH: 916-939-7300
FAX: 916-939-7398
data@primaenvironmental.com

CLIENT PROJECT NAME / NUMBER: KF-EXC #2

PROJECT CONTACT: Cindy Schreier

SAMPLER(S): (SIGNATURE) CSch

P.O. NO.:

QUOTE NO.:

LAB USE ONLY: 10-0323

☐ SAME DAY ☒ 24 HR ☐ 48HR ☐ 72 HR ☒ 5 DAYS ☐ 10 DAYS

SPECIAL REQUIREMENTS (ADDITIONAL COSTS MAY APPLY)

☐ RWQCB REPORTING ☐ ARCHIVE SAMPLES UNTIL ___/___/___

SPECIAL INSTRUCTIONS

Metals = As, Cd, Cr, Ni; "Spike 1+2" contains ~10,000ppm Cr(VI) and 1,000-5,000ppm Ni
Need 24hr TAT for Cr(VI) and metals
Need STD TAT for DI Wet

REQUESTED ANALYSIS

LAB USE ONLY	SAMPLE ID	LOCATION/ DESCRIPTION	SAMPLING DATE	SAMPLING TIME	Matrix	#Cont	Please list tests required: Cr(VI) 7199	As, Cd, Cr, Ni Metals	DI Wet/Metals*
1	KP-EX2 1 - UnSp 1+2		8/4/10	1615	SO	1	X	X	X
2	↓ - Spike 1+2		↓	↓	SO	1	X	X	X

Relinquished by: (Signature) Catherine Lynn → Fed EX	Received by: (Signature)	Date: CGS 8/4/10	Time: ~1700
Relinquished by: (Signature)	Received by: (Signature)	Date:	Time:
Relinquished by: (Signature) FEDEX	Received by: (Signature)	Date: 8/6/10	Time: 10:30

28

FedEx® US Airbill
Express

FedEx Tracking Number 8704 0156 2236

0323

0215

Recipient's

RECIPIENT: PEEL HERE

fedex.com 1.800.GoFedEx 1.800.463.3339

1 From This portion can be removed for Recipient's records.

Date 8/4/10 FedEx Tracking Number 870401562236

Sender's Name CINDY SCHREIER Phone 916 927-7300

Company PRIMA ENVIRONMENTAL, INC.

Address 5070 ROBERT J MATHEWS PKY Dept./Floor/Suite/Room

City EL DORADO HILLS State CA ZIP 95762-5767

2 Your Internal Billing Reference NST-CP / KF-Exc #2

3 To

Recipient's Name SAMPLE RECEIVING Phone 714 895-5494

Company CALSCIENCE ENVIRON

HOLD Weekday — Print FedEx location address below. NOT available for FedEx First Overnight.

HOLD Saturday — Print FedEx location address below. Available ONLY for FedEx Priority Overnight and FedEx 2Day to select locations.

Address 7440 LINCOLN WAY Dept./Floor/Suite/Room

We cannot deliver to P.O. boxes or P.O. ZIP codes.

Address

Print FedEx location address here if HOLD option is selected.

City GARDEN GROVE State CA ZIP 92841

0409010611

8704 0156 2236

4a Express Package Service * To most locations. Packages up

- [X] FedEx Priority Overnight — Next business morning.* Friday shipments will be delivered on Monday unless SATURDAY Delivery is selected.
- [ ] FedEx Standard Overnight — Next business afternoon.* Saturday Delivery NOT available.
- [ ] FedEx First O — Earliest next busin delivery to select l Saturday Delivery
- [ ] FedEx 2Day — Second business day.* Thursday shipments will be delivered on Monday unless SATURDAY Delivery is selected.
- [ ] FedEx Express Saver — Third business day.* Saturday Delivery NOT available.

4b Express Freight Service ** To most locations. Packages o

- [ ] FedEx 1Day Freight — Next business day.** Friday shipments will be delivered on Monday unless SATURDAY Delivery is selected. FedEx 1Day Freight Booking No.
- [ ] FedEx 2Day Freight — Second business day.** Thursday shipments will be delivered on Monday unless SATURDAY Delivery is selected.
- [ ] FedEx 3Day Freight — Third business day.** Saturday Delivery NO

5 Packaging * Declared value limit $500.

- [ ] FedEx Envelope*
- [ ] FedEx Pak* — Includes FedEx Small Pak, FedEx Large Pak, and FedEx Sturdy Pak.
- [ ] FedEx Box
- [ ] FedEx Tube

6 Special Handling and Delivery Signature Options

- [ ] SATURDAY Delivery — NOT available for FedEx Standard Overnight, FedEx First Overnight, FedEx Express Saver, or FedEx 3Day Freight.
- [ ] No Signature Required — Package may be left without obtaining a signature for delivery.
- [ ] Direct Signature — Someone at recipient's address may sign for delivery. Fee applies.
- [ ] Indirect Signature — If no one is available at recipient' address, someone at a neighbor address may sign for delivery. Fo residential deliveries only. Fee a

Does this shipment contain dangerous goods? One box must be checked.

- [ ] No
- [ ] Yes — As per attached Shipper's Declaration.
- [ ] Yes — Shipper's Declaration not required.
- [ ] Dry Ice — Dry Ice, 9, UN 1845 ____ x ____

Dangerous goods (including dry ice) cannot be shipped in FedEx packaging or placed in a FedEx Express Drop Box.

- [ ] Cargo Aircraft Only

7 Payment *Bill to:* Obtain Ac

Enter FedEx Acct. No. or Credit Card No. below.

- [X] Sender — Acct. No. in Section 1 will be billed
- [ ] Recipient
- [ ] Third Party
- [ ] Credit Card
- [ ]

Total Packages 1 Total Weight 8 lbs. Credit Card Auth.

†Our liability is limited to $100 unless you declare a higher value. See the current FedEx Service Guide for details.

55

Rev. Date 2/08•Part #158279•©1994–2008 FedEx•PRINTED IN U.S.A.•SRS

Calscience Environmental Laboratories, Inc.

WORK ORDER #: 10-08-0323

SAMPLE RECEIPT FORM

Cooler 1 of 1

CLIENT: PRIMA ENV'L

DATE: 08/06/10

TEMPERATURE: Thermometer ID: SC1 (Criteria: 0.0 °C – 6.0 °C, not frozen) PS 8/5/10

Temperature 4.1 °C + 0.5 °C (CF) = 4.6 °C ☐ Blank ☑ Sample

☐ Sample(s) outside temperature criteria (PM/APM contacted by: _____).

☐ Sample(s) outside temperature criteria but received on ice/chilled on same day of sampling.

☐ **Received at ambient temperature, placed on ice for transport by Courier.**

Ambient Temperature: ☐ Air ☐ Filter ☐ Metals Only ☐ PCBs Only Initial: RT

CUSTODY SEALS INTACT:

☐ Cooler ☐_____ ☐ No (Not Intact) ☑ Not Present ☐ N/A Initial: PS

☐ Sample ☐_____ ☐ No (Not Intact) ☑ Not Present Initial: PS

SAMPLE CONDITION:	Yes	No	N/A
Chain-Of-Custody (COC) document(s) received with samples	☑	☐	☐
COC document(s) received complete	☑	☐	☐
☐ Collection date/time, matrix, and/or # of containers logged in based on sample labels.			
☐ No analysis requested. ☐ Not relinquished. ☐ No date/time relinquished.			
Sampler's name indicated on COC	☑	☐	☐
Sample container label(s) consistent with COC	☑	☐	☐
Sample container(s) intact and good condition	☑	☐	☐
Proper containers and sufficient volume for analyses requested	☑	☐	☐
Analyses received within holding time	☑	☐	☐
pH / Residual Chlorine / Dissolved Sulfide received within 24 hours	☐	☐	☑
Proper preservation noted on COC or sample container	☐	☐	☑
☐ Unpreserved vials received for Volatiles analysis			
Volatile analysis container(s) free of headspace	☐	☐	☑
Tedlar bag(s) free of condensation	☐	☐	☑

CONTAINER TYPE:

Solid: ☑4ozCGJ ☐8ozCGJ ☐16ozCGJ ☐Sleeve (_____) ☐EnCores® ☐TerraCores® ☐_____

Water: ☐VOA ☐VOA**h** ☐VOA**na$_2$** ☐125AGB ☐125AGB**h** ☐125AGB**p** ☐1AGB ☐1AGB**na$_2$** ☐1AGB**s** ☐500AGB ☐500AGJ ☐500AGJ**s** ☐250AGB ☐250CGB ☐250CGB**s** ☐1PB ☐500PB ☐500PB**na** ☐250PB ☐250PB**n** ☐125PB ☐125PB**znna** ☐100PJ ☐100PJ**na$_2$** ☐_____ ☐_____ ☐_____

Air: ☐Tedlar® ☐Summa® **Other:** ☐_____ **Trip Blank Lot#:**_____ **Labeled/Checked by:** PS

Container: **C:** Clear **A:** Amber **P:** Plastic **G:** Glass **J:** Jar **B:** Bottle **Z:** Ziploc/Resealable Bag **E:** Envelope **Reviewed by:** RT

Preservative: **h:** HCL **n:** HNO_3 **na$_2$:**$Na_2S_2O_3$ **na:** NaOH **p:** H_3PO_4 **s:** H_2SO_4 **znna:** $ZnAc_2$+NaOH **f:** Field-filtered **Scanned by:** PS

Calscience
Environmental
Laboratories, Inc.

August 27, 2010

Cindy Schreier
Prima Environmental
5070 Robert J. Mathews Pkwy, Ste. 300
El Dorado Hills, CA 95762-5702

Subject: **Calscience Work Order No.: 10-08-1512**
Client Reference: KF-EX Pt2

Dear Client:

Enclosed is an analytical report for the above-referenced project. The samples included in this report were received 8/19/2010 and analyzed in accordance with the attached chain-of-custody.

Calscience Environmental Laboratories certifies that the test results provided in this report meet all NELAC requirements for parameters for which accreditation is required or available. Any exceptions to NELAC requirements are noted in the case narrative. The original report of subcontracted analysis, if any, is provided herein, and follows the standard Calscience data package. The results in this analytical report are limited to the samples tested and any reproduction thereof must be made in its entirety.

If you have any questions regarding this report, please do not hesitate to contact the undersigned.

Sincerely,

Calscience Environmental
Laboratories, Inc.
Robert Stearns
Project Manager

Calscience Environmental Laboratories, Inc.

Case Narrative

Calscience Work Order No. 10-08-1512

Each of the samples was a solid cylindrical core of approximate dimensions 2 inches wide by 4 inches long. Each core was received inside a plastic sleeve, which was removed for sample preparation/analysis. Each core weighed approximately 400 grams. In order to accommodate the maximum STLC extraction volume of 2-liters, each core was cut in half using a saw with a 4-inch steel (concrete-cutting) blade. The blade was rinsed between samples. For the STLC extraction and subsequent analysis, the smooth end of the core was used, per verbal instructions from the client. The samples were extracted using de-ionized water in accordance with the chain-of-custody instructions.

Calscience Environmental Laboratories, Inc.

Analytical Report

Prima Environmental
5070 Robert J. Mathews Pkwy, Ste. 300
El Dorado Hills, CA 95762-5702

Date Received: 08/19/10
Work Order No: 10-08-1512
Preparation: T22.11.5.AII DI
Method: EPA 7199

Project: KF-EX Pt2

Client Sample Number	Lab Sample Number	Date/Time Collected	Matrix	Instrument	Date Prepared	Date/Time Analyzed	QC Batch ID
MTZ-1-A	**10-08-1512-1-A**	**08/17/10 00:00**	**Solid**	**IC 11**	**08/23/10**	**08/25/10 19:43**	**100825L01**

Comment(s): -This sample was prepared with deionized water as the extractant.
-The analysis was performed on an STLC extract of the sample.

Parameter	Result	RL	DF	Qual	Units
Chromium, Hexavalent	530	10	1000		mg/L

Client Sample Number	Lab Sample Number	Date/Time Collected	Matrix	Instrument	Date Prepared	Date/Time Analyzed	QC Batch ID
MTZ-1-B	**10-08-1512-2-A**	**08/17/10 00:00**	**Solid**	**IC 11**	**08/23/10**	**08/25/10 19:50**	**100825L01**

Comment(s): -This sample was prepared with deionized water as the extractant.
-The analysis was performed on an STLC extract of the sample.

Parameter	Result	RL	DF	Qual	Units
Chromium, Hexavalent	550	10	1000		mg/L

Client Sample Number	Lab Sample Number	Date/Time Collected	Matrix	Instrument	Date Prepared	Date/Time Analyzed	QC Batch ID
MTZ-2-A	**10-08-1512-3-A**	**08/17/10 00:00**	**Solid**	**IC 11**	**08/23/10**	**08/25/10 19:58**	**100825L01**

Comment(s): -This sample was prepared with deionized water as the extractant.
-The analysis was performed on an STLC extract of the sample.

Parameter	Result	RL	DF	Qual	Units
Chromium, Hexavalent	420	10	1000		mg/L

Client Sample Number	Lab Sample Number	Date/Time Collected	Matrix	Instrument	Date Prepared	Date/Time Analyzed	QC Batch ID
MTZ-2-B	**10-08-1512-4-A**	**08/17/10 00:00**	**Solid**	**IC 11**	**08/23/10**	**08/25/10 20:05**	**100825L01**

Comment(s): -This sample was prepared with deionized water as the extractant.
-The analysis was performed on an STLC extract of the sample.

Parameter	Result	RL	DF	Qual	Units
Chromium, Hexavalent	470	10	1000		mg/L

Client Sample Number	Lab Sample Number	Date/Time Collected	Matrix	Instrument	Date Prepared	Date/Time Analyzed	QC Batch ID
MTZ-3-A	**10-08-1512-5-A**	**08/17/10 00:00**	**Solid**	**IC 11**	**08/23/10**	**08/25/10 20:13**	**100825L01**

Comment(s): -This sample was prepared with deionized water as the extractant.
-The analysis was performed on an STLC extract of the sample.

Parameter	Result	RL	DF	Qual	Units
Chromium, Hexavalent	490	10	1000		mg/L

RL - Reporting Limit , DF - Dilution Factor , Qual - Qualifiers

Calscience Environmental Laboratories, Inc.

Analytical Report

ACCREDITED IN ACCORDANCE WITH nelac

Prima Environmental		Date Received:	08/19/10
5070 Robert J. Mathews Pkwy, Ste. 300		Work Order No:	10-08-1512
El Dorado Hills, CA 95762-5702		Preparation:	T22.11.5.AII DI
		Method:	EPA 7199

Project: KF-EX Pt2

Client Sample Number	Lab Sample Number	Date/Time Collected	Matrix	Instrument	Date Prepared	Date/Time Analyzed	QC Batch ID
MTZ-3-B	**10-08-1512-6-A**	**08/17/10 00:00**	**Solid**	**IC 11**	**08/23/10**	**08/25/10 20:20**	**100825L01**

Comment(s): -This sample was prepared with deionized water as the extractant.
-The analysis was performed on an STLC extract of the sample.

Parameter	Result	RL	DF	Qual	Units
Chromium, Hexavalent	380	10	1000		mg/L

Client Sample Number	Lab Sample Number	Date/Time Collected	Matrix	Instrument	Date Prepared	Date/Time Analyzed	QC Batch ID
MTZ-4-A	**10-08-1512-7-A**	**08/17/10 00:00**	**Solid**	**IC 11**	**08/23/10**	**08/25/10 20:28**	**100825L01**

Comment(s): -This sample was prepared with deionized water as the extractant.
-The analysis was performed on an STLC extract of the sample.

Parameter	Result	RL	DF	Qual	Units
Chromium, Hexavalent	290	10	1000		mg/L

Client Sample Number	Lab Sample Number	Date/Time Collected	Matrix	Instrument	Date Prepared	Date/Time Analyzed	QC Batch ID
MTZ-4-B	**10-08-1512-8-A**	**08/17/10 00:00**	**Solid**	**IC 11**	**08/23/10**	**08/25/10 20:35**	**100825L01**

Comment(s): -This sample was prepared with deionized water as the extractant.
-The analysis was performed on an STLC extract of the sample.

Parameter	Result	RL	DF	Qual	Units
Chromium, Hexavalent	280	10	1000		mg/L

Client Sample Number	Lab Sample Number	Date/Time Collected	Matrix	Instrument	Date Prepared	Date/Time Analyzed	QC Batch ID
Con 20m-1-A	**10-08-1512-9-A**	**08/17/10 00:00**	**Solid**	**IC 11**	**08/23/10**	**08/25/10 17:58**	**100825L01**

Comment(s): -This sample was prepared with deionized water as the extractant.
-The analysis was performed on an STLC extract of the sample.

Parameter	Result	RL	DF	Qual	Units
Chromium, Hexavalent	0.25	0.010	1		mg/L

Client Sample Number	Lab Sample Number	Date/Time Collected	Matrix	Instrument	Date Prepared	Date/Time Analyzed	QC Batch ID
Con 20m-1-B	**10-08-1512-10-A**	**08/17/10 00:00**	**Solid**	**IC 11**	**08/23/10**	**08/25/10 18:05**	**100825L01**

Comment(s): -This sample was prepared with deionized water as the extractant.
-The analysis was performed on an STLC extract of the sample.

Parameter	Result	RL	DF	Qual	Units
Chromium, Hexavalent	0.24	0.010	1		mg/L

RL - Reporting Limit , DF - Dilution Factor , Qual - Qualifiers

Calscience Environmental Laboratories, Inc.

Analytical Report

ACCREDITED IN ACCORDANCE WITH nelac

Prima Environmental		Date Received:	08/19/10
5070 Robert J. Mathews Pkwy, Ste. 300		Work Order No:	10-08-1512
El Dorado Hills, CA 95762-5702		Preparation:	T22.11.5.AII DI
		Method:	EPA 7199

Project: KF-EX Pt2

Client Sample Number	Lab Sample Number	Date/Time Collected	Matrix	Instrument	Date Prepared	Date/Time Analyzed	QC Batch ID
Buf-1-A	**10-08-1512-11-A**	**08/17/10 00:00**	**Solid**	**IC 11**	**08/23/10**	**08/25/10 18:13**	**100825L01**

Comment(s): -This sample was prepared with deionized water as the extractant.
-The analysis was performed on an STLC extract of the sample.

Parameter	Result	RL	DF	Qual	Units
Chromium, Hexavalent	1.4	0.050	5		mg/L

Client Sample Number	Lab Sample Number	Date/Time Collected	Matrix	Instrument	Date Prepared	Date/Time Analyzed	QC Batch ID
Buf-1-B	**10-08-1512-12-A**	**08/17/10 00:00**	**Solid**	**IC 11**	**08/23/10**	**08/25/10 18:20**	**100825L01**

Comment(s): -This sample was prepared with deionized water as the extractant.
-The analysis was performed on an STLC extract of the sample.

Parameter	Result	RL	DF	Qual	Units
Chromium, Hexavalent	1.3	0.050	5		mg/L

Client Sample Number	Lab Sample Number	Date/Time Collected	Matrix	Instrument	Date Prepared	Date/Time Analyzed	QC Batch ID
Buf-2-A	**10-08-1512-13-A**	**08/17/10 00:00**	**Solid**	**IC 11**	**08/23/10**	**08/25/10 18:28**	**100825L01**

Comment(s): -This sample was prepared with deionized water as the extractant.
-The analysis was performed on an STLC extract of the sample.

Parameter	Result	RL	DF	Qual	Units
Chromium, Hexavalent	0.61	0.020	2		mg/L

Client Sample Number	Lab Sample Number	Date/Time Collected	Matrix	Instrument	Date Prepared	Date/Time Analyzed	QC Batch ID
Buf-2-B	**10-08-1512-14-A**	**08/17/10 00:00**	**Solid**	**IC 11**	**08/23/10**	**08/25/10 18:35**	**100825L01**

Comment(s): -This sample was prepared with deionized water as the extractant.
-The analysis was performed on an STLC extract of the sample.

Parameter	Result	RL	DF	Qual	Units
Chromium, Hexavalent	0.58	0.020	2		mg/L

Client Sample Number	Lab Sample Number	Date/Time Collected	Matrix	Instrument	Date Prepared	Date/Time Analyzed	QC Batch ID
Buf-3-A	**10-08-1512-15-A**	**08/17/10 00:00**	**Solid**	**IC 11**	**08/23/10**	**08/25/10 18:43**	**100825L01**

Comment(s): -This sample was prepared with deionized water as the extractant.
-The analysis was performed on an STLC extract of the sample.

Parameter	Result	RL	DF	Qual	Units
Chromium, Hexavalent	0.55	0.020	2		mg/L

RL - Reporting Limit , DF - Dilution Factor , Qual - Qualifiers

Calscience Environmental Laboratories, Inc.

Analytical Report

ACCREDITED IN ACCORDANCE WITH nelac

Prima Environmental		Date Received:	08/19/10
5070 Robert J. Mathews Pkwy, Ste. 300		Work Order No:	10-08-1512
El Dorado Hills, CA 95762-5702		Preparation:	T22.11.5.AII DI
		Method:	EPA 7199

Project: KF-EX Pt2

Client Sample Number	Lab Sample Number	Date/Time Collected	Matrix	Instrument	Date Prepared	Date/Time Analyzed	QC Batch ID
Buf-3-B	**10-08-1512-16-A**	**08/17/10 00:00**	**Solid**	**IC 11**	**08/23/10**	**08/25/10 18:50**	**100825L01**

Comment(s): -This sample was prepared with deionized water as the extractant.
-The analysis was performed on an STLC extract of the sample.

Parameter	Result	RL	DF	Qual	Units
Chromium, Hexavalent	0.46	0.010	1		mg/L

Client Sample Number	Lab Sample Number	Date/Time Collected	Matrix	Instrument	Date Prepared	Date/Time Analyzed	QC Batch ID
Buf-4-A	**10-08-1512-17-A**	**08/17/10 00:00**	**Solid**	**IC 11**	**08/23/10**	**08/25/10 18:58**	**100825L01**

Comment(s): -This sample was prepared with deionized water as the extractant.
-The analysis was performed on an STLC extract of the sample.

Parameter	Result	RL	DF	Qual	Units
Chromium, Hexavalent	0.28	0.010	1		mg/L

Client Sample Number	Lab Sample Number	Date/Time Collected	Matrix	Instrument	Date Prepared	Date/Time Analyzed	QC Batch ID
Buf-4-B	**10-08-1512-18-A**	**08/17/10 00:00**	**Solid**	**IC 11**	**08/23/10**	**08/25/10 19:05**	**100825L01**

Comment(s): -This sample was prepared with deionized water as the extractant.
-The analysis was performed on an STLC extract of the sample.

Parameter	Result	RL	DF	Qual	Units
Chromium, Hexavalent	0.36	0.010	1		mg/L

Client Sample Number	Lab Sample Number	Date/Time Collected	Matrix	Instrument	Date Prepared	Date/Time Analyzed	QC Batch ID
Method Blank	**099-14-017-8**	**N/A**	**Solid**	**IC 11**	**08/23/10**	**08/25/10 15:38**	**100825L01**

Parameter	Result	RL	DF	Qual	Units
Chromium, Hexavalent	ND	0.010	1		mg/L

RL - Reporting Limit , DF - Dilution Factor , Qual - Qualifiers

Calscience Environmental Laboratories, Inc.

Analytical Report

ACCREDITED IN ACCORDANCE WITH nelac

Prima Environmental
5070 Robert J. Mathews Pkwy, Ste. 300
El Dorado Hills, CA 95762-5702

Date Received: 08/19/10
Work Order No: 10-08-1512
Preparation: T22.11.5.AII DI
Method: EPA 6020
Units: mg/L

Project: KF-EX Pt2

Client Sample Number	Lab Sample Number	Date /Time Collected	Matrix	Instrument	Date Prepared	Date/Time Analyzed	QC Batch ID
MTZ-1-A	**10-08-1512-1-A**	**08/17/10 00:00**	**Solid**	**ICP/MS 04**	**08/23/10**	**08/25/10 23:54**	**100825L04**

Comment(s): -This sample was prepared with deionized water as the extractant.
-The analysis was performed on an STLC extract of the sample.

Parameter	Result	RL	DF	Qual	Parameter	Result	RL	DF	Qual
Arsenic	ND	0.0100	1		Chromium	772	1.00	100	
Cadmium	ND	0.0100	1		Nickel	0.0410	0.0100	1	

Client Sample Number	Lab Sample Number	Date /Time Collected	Matrix	Instrument	Date Prepared	Date/Time Analyzed	QC Batch ID
MTZ-1-B	**10-08-1512-2-A**	**08/17/10 00:00**	**Solid**	**ICP/MS 04**	**08/23/10**	**08/25/10 23:57**	**100825L04**

Comment(s): -This sample was prepared with deionized water as the extractant.
-The analysis was performed on an STLC extract of the sample.

Parameter	Result	RL	DF	Qual	Parameter	Result	RL	DF	Qual
Arsenic	ND	0.0100	1		Chromium	647	1.00	100	
Cadmium	ND	0.0100	1		Nickel	0.0519	0.0100	1	

Client Sample Number	Lab Sample Number	Date /Time Collected	Matrix	Instrument	Date Prepared	Date/Time Analyzed	QC Batch ID
MTZ-2-A	**10-08-1512-3-A**	**08/17/10 00:00**	**Solid**	**ICP/MS 04**	**08/23/10**	**08/26/10 00:00**	**100825L04**

Comment(s): -This sample was prepared with deionized water as the extractant.
-The analysis was performed on an STLC extract of the sample.

Parameter	Result	RL	DF	Qual	Parameter	Result	RL	DF	Qual
Arsenic	ND	0.0100	1		Chromium	589	1.00	100	
Cadmium	ND	0.0100	1		Nickel	0.104	0.0100	1	

Client Sample Number	Lab Sample Number	Date /Time Collected	Matrix	Instrument	Date Prepared	Date/Time Analyzed	QC Batch ID
MTZ-2-B	**10-08-1512-4-A**	**08/17/10 00:00**	**Solid**	**ICP/MS 04**	**08/23/10**	**08/26/10 00:03**	**100825L04**

Comment(s): -This sample was prepared with deionized water as the extractant.
-The analysis was performed on an STLC extract of the sample.

Parameter	Result	RL	DF	Qual	Parameter	Result	RL	DF	Qual
Arsenic	ND	0.0100	1		Chromium	508	1.00	100	
Cadmium	ND	0.0100	1		Nickel	0.0425	0.0100	1	

Client Sample Number	Lab Sample Number	Date /Time Collected	Matrix	Instrument	Date Prepared	Date/Time Analyzed	QC Batch ID
MTZ-3-A	**10-08-1512-5-A**	**08/17/10 00:00**	**Solid**	**ICP/MS 04**	**08/23/10**	**08/26/10 00:06**	**100825L04**

Comment(s): -This sample was prepared with deionized water as the extractant.
-The analysis was performed on an STLC extract of the sample.

Parameter	Result	RL	DF	Qual	Parameter	Result	RL	DF	Qual
Arsenic	ND	0.0100	1		Chromium	469	1.00	100	
Cadmium	ND	0.0100	1		Nickel	0.0889	0.0100	1	

RL - Reporting Limit , DF - Dilution Factor , Qual - Qualifiers

Calscience Environmental Laboratories, Inc.

Analytical Report

ACCREDITED IN ACCORDANCE WITH nelac

Prima Environmental
5070 Robert J. Mathews Pkwy, Ste. 300
El Dorado Hills, CA 95762-5702

Date Received: 08/19/10
Work Order No: 10-08-1512
Preparation: T22.11.5.AII DI
Method: EPA 6020
Units: mg/L

Project: KF-EX Pt2

Client Sample Number	Lab Sample Number	Date /Time Collected	Matrix	Instrument	Date Prepared	Date/Time Analyzed	QC Batch ID
MTZ-3-B	**10-08-1512-6-A**	**08/17/10 00:00**	**Solid**	**ICP/MS 04**	**08/23/10**	**08/26/10 00:09**	**100825L04**

Comment(s): -This sample was prepared with deionized water as the extractant.
-The analysis was performed on an STLC extract of the sample.

Parameter	Result	RL	DF	Qual	Parameter	Result	RL	DF	Qual
Arsenic	ND	0.0100	1		Chromium	510	1.00	100	
Cadmium	ND	0.0100	1		Nickel	0.0568	0.0100	1	

Client Sample Number	Lab Sample Number	Date /Time Collected	Matrix	Instrument	Date Prepared	Date/Time Analyzed	QC Batch ID
MTZ-4-A	**10-08-1512-7-A**	**08/17/10 00:00**	**Solid**	**ICP/MS 04**	**08/23/10**	**08/26/10 00:12**	**100825L04**

Comment(s): -This sample was prepared with deionized water as the extractant.
-The analysis was performed on an STLC extract of the sample.

Parameter	Result	RL	DF	Qual	Parameter	Result	RL	DF	Qual
Arsenic	ND	0.0100	1		Chromium	378	1.00	100	
Cadmium	ND	0.0100	1		Nickel	0.0529	0.0100	1	

Client Sample Number	Lab Sample Number	Date /Time Collected	Matrix	Instrument	Date Prepared	Date/Time Analyzed	QC Batch ID
MTZ-4-B	**10-08-1512-8-A**	**08/17/10 00:00**	**Solid**	**ICP/MS 04**	**08/23/10**	**08/26/10 00:24**	**100825L04**

Comment(s): -This sample was prepared with deionized water as the extractant.
-The analysis was performed on an STLC extract of the sample.

Parameter	Result	RL	DF	Qual	Parameter	Result	RL	DF	Qual
Arsenic	ND	0.0100	1		Chromium	321	1.00	100	
Cadmium	ND	0.0100	1		Nickel	0.0463	0.0100	1	

Client Sample Number	Lab Sample Number	Date /Time Collected	Matrix	Instrument	Date Prepared	Date/Time Analyzed	QC Batch ID
Con 20m-1-A	**10-08-1512-9-A**	**08/17/10 00:00**	**Solid**	**ICP/MS 04**	**08/23/10**	**08/25/10 21:26**	**100825L04**

Comment(s): -This sample was prepared with deionized water as the extractant.
-The analysis was performed on an STLC extract of the sample.

Parameter	Result	RL	DF	Qual	Parameter	Result	RL	DF	Qual
Arsenic	ND	0.0100	1		Chromium	0.345	0.0100	1	
Cadmium	ND	0.0100	1		Nickel	0.0284	0.0100	1	

Client Sample Number	Lab Sample Number	Date /Time Collected	Matrix	Instrument	Date Prepared	Date/Time Analyzed	QC Batch ID
Con 20m-1-B	**10-08-1512-10-A**	**08/17/10 00:00**	**Solid**	**ICP/MS 04**	**08/23/10**	**08/25/10 21:29**	**100825L04**

Comment(s): -This sample was prepared with deionized water as the extractant.
-The analysis was performed on an STLC extract of the sample.

Parameter	Result	RL	DF	Qual	Parameter	Result	RL	DF	Qual
Arsenic	ND	0.0100	1		Chromium	0.309	0.0100	1	
Cadmium	ND	0.0100	1		Nickel	0.0289	0.0100	1	

RL - Reporting Limit , DF - Dilution Factor , Qual - Qualifiers

Calscience Environmental Laboratories, Inc.

Analytical Report

ACCREDITED IN ACCORDANCE WITH nelac

Prima Environmental
5070 Robert J. Mathews Pkwy, Ste. 300
El Dorado Hills, CA 95762-5702

Date Received: 08/19/10
Work Order No: 10-08-1512
Preparation: T22.11.5.AII DI
Method: EPA 6020
Units: mg/L

Project: KF-EX Pt2

Client Sample Number	Lab Sample Number	Date /Time Collected	Matrix	Instrument	Date Prepared	Date/Time Analyzed	QC Batch ID
Buf-1-A	**10-08-1512-11-A**	**08/17/10 00:00**	**Solid**	**ICP/MS 04**	**08/23/10**	**08/25/10 22:03**	**100825L04**

Comment(s): -This sample was prepared with deionized water as the extractant.
-The analysis was performed on an STLC extract of the sample.

Parameter	Result	RL	DF	Qual	Parameter	Result	RL	DF	Qual
Arsenic	ND	0.0100	1		Chromium	1.71	0.0100	1	
Cadmium	ND	0.0100	1		Nickel	0.0100	0.0100	1	

Client Sample Number	Lab Sample Number	Date /Time Collected	Matrix	Instrument	Date Prepared	Date/Time Analyzed	QC Batch ID
Buf-1-B	**10-08-1512-12-A**	**08/17/10 00:00**	**Solid**	**ICP/MS 04**	**08/23/10**	**08/25/10 22:06**	**100825L04**

Comment(s): -This sample was prepared with deionized water as the extractant.
-The analysis was performed on an STLC extract of the sample.

Parameter	Result	RL	DF	Qual	Parameter	Result	RL	DF	Qual
Arsenic	ND	0.0100	1		Chromium	1.49	0.0100	1	
Cadmium	ND	0.0100	1		Nickel	ND	0.0100	1	

Client Sample Number	Lab Sample Number	Date /Time Collected	Matrix	Instrument	Date Prepared	Date/Time Analyzed	QC Batch ID
Buf-2-A	**10-08-1512-13-A**	**08/17/10 00:00**	**Solid**	**ICP/MS 04**	**08/23/10**	**08/25/10 22:09**	**100825L04**

Comment(s): -This sample was prepared with deionized water as the extractant.
-The analysis was performed on an STLC extract of the sample.

Parameter	Result	RL	DF	Qual	Parameter	Result	RL	DF	Qual
Arsenic	ND	0.0100	1		Chromium	0.675	0.0100	1	
Cadmium	ND	0.0100	1		Nickel	0.0207	0.0100	1	

Client Sample Number	Lab Sample Number	Date /Time Collected	Matrix	Instrument	Date Prepared	Date/Time Analyzed	QC Batch ID
Buf-2-B	**10-08-1512-14-A**	**08/17/10 00:00**	**Solid**	**ICP/MS 04**	**08/23/10**	**08/25/10 22:12**	**100825L04**

Comment(s): -This sample was prepared with deionized water as the extractant.
-The analysis was performed on an STLC extract of the sample.

Parameter	Result	RL	DF	Qual	Parameter	Result	RL	DF	Qual
Arsenic	ND	0.0100	1		Chromium	0.688	0.0100	1	
Cadmium	ND	0.0100	1		Nickel	0.0239	0.0100	1	

Client Sample Number	Lab Sample Number	Date /Time Collected	Matrix	Instrument	Date Prepared	Date/Time Analyzed	QC Batch ID
Buf-3-A	**10-08-1512-15-A**	**08/17/10 00:00**	**Solid**	**ICP/MS 04**	**08/23/10**	**08/25/10 22:15**	**100825L04**

Comment(s): -This sample was prepared with deionized water as the extractant.
-The analysis was performed on an STLC extract of the sample.

Parameter	Result	RL	DF	Qual	Parameter	Result	RL	DF	Qual
Arsenic	ND	0.0100	1		Chromium	0.716	0.0100	1	
Cadmium	ND	0.0100	1		Nickel	0.0291	0.0100	1	

RL - Reporting Limit , DF - Dilution Factor , Qual - Qualifiers

Calscience Environmental Laboratories, Inc.

Analytical Report

Prima Environmental		Date Received:	08/19/10
5070 Robert J. Mathews Pkwy, Ste. 300		Work Order No:	10-08-1512
El Dorado Hills, CA 95762-5702		Preparation:	T22.11.5.AII DI
		Method:	EPA 6020
		Units:	mg/L
Project: KF-EX Pt2			Page 4 of 4

Client Sample Number	Lab Sample Number	Date /Time Collected	Matrix	Instrument	Date Prepared	Date/Time Analyzed	QC Batch ID
Buf-3-B	**10-08-1512-16-A**	**08/17/10 00:00**	**Solid**	**ICP/MS 04**	**08/23/10**	**08/25/10 22:18**	**100825L04**

Comment(s): -This sample was prepared with deionized water as the extractant.
-The analysis was performed on an STLC extract of the sample.

Parameter	Result	RL	DF	Qual	Parameter	Result	RL	DF	Qual
Arsenic	ND	0.0100	1		Chromium	0.562	0.0100	1	
Cadmium	ND	0.0100	1		Nickel	0.0278	0.0100	1	

Client Sample Number	Lab Sample Number	Date /Time Collected	Matrix	Instrument	Date Prepared	Date/Time Analyzed	QC Batch ID
Buf-4-A	**10-08-1512-17-A**	**08/17/10 00:00**	**Solid**	**ICP/MS 04**	**08/23/10**	**08/25/10 22:21**	**100825L04**

Comment(s): -This sample was prepared with deionized water as the extractant.
-The analysis was performed on an STLC extract of the sample.

Parameter	Result	RL	DF	Qual	Parameter	Result	RL	DF	Qual
Arsenic	ND	0.0100	1		Chromium	0.363	0.0100	1	
Cadmium	ND	0.0100	1		Nickel	0.0328	0.0100	1	

Client Sample Number	Lab Sample Number	Date /Time Collected	Matrix	Instrument	Date Prepared	Date/Time Analyzed	QC Batch ID
Buf-4-B	**10-08-1512-18-A**	**08/17/10 00:00**	**Solid**	**ICP/MS 04**	**08/23/10**	**08/25/10 22:25**	**100825L04**

Comment(s): -This sample was prepared with deionized water as the extractant.
-The analysis was performed on an STLC extract of the sample.

Parameter	Result	RL	DF	Qual	Parameter	Result	RL	DF	Qual
Arsenic	ND	0.0100	1		Chromium	0.496	0.0100	1	
Cadmium	ND	0.0100	1		Nickel	0.0346	0.0100	1	

Client Sample Number	Lab Sample Number	Date /Time Collected	Matrix	Instrument	Date Prepared	Date/Time Analyzed	QC Batch ID
Method Blank	**099-14-037-4**	**N/A**	**Aqueous**	**ICP/MS 04**	**08/23/10**	**08/25/10 21:14**	**100825L04**

Parameter	Result	RL	DF	Qual	Parameter	Result	RL	DF	Qual
Arsenic	ND	0.0100	1		Chromium	ND	0.0100	1	
Cadmium	ND	0.0100	1		Nickel	ND	0.0100	1	

RL - Reporting Limit , DF - Dilution Factor , Qual - Qualifiers

Calscience Environmental Laboratories, Inc.

Quality Control - Spike/Spike Duplicate

Prima Environmental
5070 Robert J. Mathews Pkwy, Ste. 300
El Dorado Hills, CA 95762-5702

Date Received: 08/19/10
Work Order No: 10-08-1512
Preparation: T22.11.5.AII DI
Method: EPA 6020

Project KF-EX Pt2

Quality Control Sample ID	Matrix	Instrument	Date Prepared	Date Analyzed	MS/MSD Batch Number
MTZ-1-A	**Solid**	**ICP/MS 04**	**08/23/10**	**08/25/10**	**100825S04**

Parameter	MS %REC	MSD %REC	%REC CL	RPD	RPD CL	Qualifiers
Arsenic	100	112	73-127	11	0-11	
Cadmium	100	107	84-114	7	0-8	
Chromium	4X	4X	73-133	4X	0-11	Q
Nickel	96	103	68-122	7	0-10	

RPD - Relative Percent Difference , CL - Control Limit

Calscience Environmental Laboratories, Inc.

Quality Control - PDS / PDSD

Prima Environmental		Date Received	08/19/10
5070 Robert J. Mathews Pkwy, Ste. 300		Work Order No:	10-08-1512
El Dorado Hills, CA 95762-5702		Preparation:	T22.11.5.AII DI
		Method:	EPA 6020

Project: KF-EX Pt2

Quality Control Sample ID	Matrix	Instrument	Date Prepared	Date Analyzed	PDS / PDSD Batch Number
MTZ-1-A	**Solid**	**ICP/MS 04**	**08/23/10**	**08/25/10**	**100825S04**

Parameter	PDS %REC	PDSD %REC	%REC CL	RPD	RPD CL	Qualifiers
Arsenic	107	103	75-125	4	0-11	
Cadmium	104	100	75-125	4	0-8	
Chromium	87	81	75-125	2	0-11	
Nickel	103	99	75-125	3	0-10	

RPD - Relative Percent Difference , CL - Control Limit

Calscience Environmental Laboratories, Inc.

Quality Control - Spike/Spike Duplicate

ACCREDITED IN ACCORDANCE WITH nelac

Prima Environmental
5070 Robert J. Mathews Pkwy, Ste. 300
El Dorado Hills, CA 95762-5702

Date Received: 08/19/10
Work Order No: 10-08-1512
Preparation: T22.11.5.AII DI
Method: EPA 7199

Project KF-EX Pt2

Quality Control Sample ID	Matrix	Instrument	Date Prepared	Date Analyzed	MS/MSD Batch Number
Con 20m-1-A	**Solid**	**IC 11**	**08/23/10**	**08/25/10**	**100825S01**

Parameter	MS %REC	MSD %REC	%REC CL	RPD	RPD CL	Qualifiers
Chromium, Hexavalent	95	93	70-130	2	0-25	

RPD - Relative Percent Difference , CL - Control Limit

Calscience Environmental Laboratories, Inc.

Quality Control - LCS/LCS Duplicate

Prima Environmental
5070 Robert J. Mathews Pkwy, Ste. 300
El Dorado Hills, CA 95762-5702

Date Received: N/A
Work Order No: 10-08-1512
Preparation: T22.11.5.AII DI
Method: EPA 6020

Project: KF-EX Pt2

Quality Control Sample ID	Matrix	Instrument	Date Prepared	Date Analyzed	LCS/LCSD Batch Number
099-14-037-4	**Aqueous**	**ICP/MS 04**	**08/23/10**	**08/25/10**	**100825L04**

Parameter	LCS %REC	LCSD %REC	%REC CL	RPD	RPD CL	Qualifiers
Arsenic	88	89	80-120	1	0-20	
Cadmium	88	89	80-120	2	0-20	
Chromium	97	95	80-120	2	0-20	
Nickel	105	100	80-120	4	0-20	

RPD - Relative Percent Difference , CL - Control Limit

Calscience Environmental Laboratories, Inc.

Quality Control - LCS/LCS Duplicate

ACCREDITED IN ACCORDANCE WITH nelac

Prima Environmental	Date Received: N/A
5070 Robert J. Mathews Pkwy, Ste. 300	Work Order No: 10-08-1512
El Dorado Hills, CA 95762-5702	Preparation: T22.11.5.AII DI
	Method: EPA 7199

Project: KF-EX Pt2

Quality Control Sample ID	Matrix	Instrument	Date Prepared	Date Analyzed	LCS/LCSD Batch Number
099-14-017-8	**Solid**	**IC 11**	**08/23/10**	**08/25/10**	**100825L01**

Parameter	LCS %REC	LCSD %REC	%REC CL	RPD	RPD CL	Qualifiers
Chromium, Hexavalent	99	99	80-120	1	0-20	

RPD - Relative Percent Difference , CL - Control Limit

Calscience Environmental Laboratories, Inc.
7440 LINCOLN WAY
GARDEN GROVE, CA 92841-1432
TEL: (714) 895-5494 . FAX: (714) 894-7501

CHAIN OF CUSTODY RECORD

DATE:

LABORATORY CLIENT: CINDY SCHREIER

PRIMA ENVIRONMENTAL, Inc.
5070 Robert J. Mathews Pkwy, Ste 300
El Dorado Hills, CA 95762
PH: 916-939-7300
FAX: 916-939-7398
data@primaenvironmental.com

CLIENT PROJECT NAME / NUMBER: KF- Ex Pt 2

PROJECT CONTACT: Cindy Schreier / Bob Stearns

SAMPLER(S): (SIGNATURE) CSch

P.O. NO.:

QUOTE NO.:

LAB USE ONLY: 10815112

☐ SAME DAY ☐ 24 HR ☐ 48HR ☐ 72 HR ☒ 5 DAYS (standard) ☐ 10 DAYS

SPECIAL REQUIREMENTS (ADDITIONAL COSTS MAY APPLY)

☐ RWQCB REPORTING ☐ ARCHIVE SAMPLES UNTIL ___/___/___

SPECIAL INSTRUCTIONS

Run DI Extraction on INTACT CORE!!
Metals by 6020; Sx may contain high Cr(VI);
Save cores for possible return to PRIMA. Thanks☺

REQUESTED ANALYSIS

LAB USE ONLY	SAMPLE ID	LOCATION/ DESCRIPTION	SAMPLING DATE	SAMPLING TIME	Matrix	#Cont	Please list tests required: DI Wet - [As]	Cd, Cr, Ni, Cr(VI)
1	MTZ - 1-A	cement/soil core	8.17.10			1		X
2	MTZ- 1-B					1		X
3	MTZ- 2-A					1		X
4	MTZ- 2-B					1		X
5	MTZ- 3-A					1		X
6	MTZ- 3-B					1		X
7	MTZ- 4-A					1		X
8	MTZ- 4-B	↓	↓			1		X
9	Con 20m-1-A	↓	↓			1		X
10	Con 20m-1-B	↓	↓			1		X

Relinquished by: (Signature) CSch / PRIMA	Received by: (Signature) FedEx	Date: 8.18.10	Time: ~1780
Relinquished by: (Signature)	Received by: (Signature)	Date:	Time:
Relinquished by: (Signature) FEDEX	Received by: (Signature)	Date: 8/19/10	Time: 10:00

Calscience Environmental Laboratories, Inc.
7440 LINCOLN WAY
GARDEN GROVE, CA 92841-1432
TEL: (714) 895-5494 . FAX: (714) 894-7501

CHAIN OF CUSTODY RECORD

DATE:

PAGE: 2 OF 2

LABORATORY CLIENT: CINDY SCHREIER

PRIMA ENVIRONMENTAL, Inc.
5070 Robert J. Mathews Pkwy, Ste 300
El Dorado Hills, CA 95762
PH: 916-939-7300
FAX: 916-939-7398

data@primaenvironmental.com

CLIENT PROJECT NAME / NUMBER: KF-Ex Pt 2

PROJECT CONTACT: Bob Stearns -

SAMPLER(S): (SIGNATURE)

P.O. NO.:

QUOTE NO.:

LAB USE ONLY: 08-1512

☐ SAME DAY ☐ 24 HR ☐ 48HR ☐ 72 HR ☐ 5 DAYS ☐ 10 DAYS

SPECIAL REQUIREMENTS (ADDITIONAL COSTS MAY APPLY)

☐ RWQCB REPORTING ☐ ARCHIVE SAMPLES UNTIL ___/___/___

SPECIAL INSTRUCTIONS

Run DI Extraction on INTACT CORE!!
Metals By 6020;
Please save cores for possible return to PRIMA

REQUESTED ANALYSIS

LAB USE ONLY	SAMPLE ID	LOCATION/ DESCRIPTION	SAMPLING DATE	SAMPLING TIME	Matrix	#Cont	Please list tests required: DI Wet →	As, Cd, Cr, Ni, Cr(VI)
11	Buf-1-A	cement/soil cores	8.17.10			1	X	
12	Buf-1-B					1	X	
13	Buf-2-A					1	X	
14	Buf-2-B					1	X	
15	Buf-3-A					1	X	
16	Buf-3-B					1	X	
17	Buf-4-A					1	X	
18	Buf-4-B					1	X	

Relinquished by: (Signature) / PRIMA	Received by: (Signature) Fed Ex	Date: 8.18.10	Time: ~1700
Relinquished by: (Signature)	Received by: (Signature)	Date:	Time:
Relinquished by: (Signature)	Received by: (Signature)	Date: 8/19/10	Time: 10:00

FedEx Express US Airbill

FedEx Tracking Number 8704 0156 2214

RECIPIENT: PEEL HERE

fedex.com 1.800.GoFedEx 1.800.463.3339

1 From This portion can be removed for Recipient's records.

Date 08/18/10 FedEx Tracking Number 870401562214

Sender's Name CINDY SCHREIER Phone 916 939-7300

Company PRIMA ENVIRONMENTAL, INC.

Address 5070 ROBERT J MATHEWS PKY

Dept./Floor/Suite/Room

City EL DORADO HILLS State CA ZIP 95762-5757

2 Your Internal Billing Reference KF-Ex pt 2

3 To

Recipient's Name SAMPLE RECEIVING Phone 714 995-5494

Company CALSCIENCE ENVIRON

HOLD Weekday Print FedEx location address below. NOT available for FedEx First Overnight.

HOLD Saturday Print FedEx location address below. Available ONLY for FedEx Priority Overnight and FedEx 2Day to select locations.

Address 7440 LINCOLN WAY

We cannot deliver to P.O. boxes or P.O. ZIP codes.

Dept./Floor/Suite/Room

Address

Print FedEx location address here if HOLD option is selected.

City GARDEN GROVE State CA ZIP 92841

0409010611

8704 0156 2214

Recipient's

4a Express Package Service * To most locations. Packages up

- [X] FedEx Priority Overnight — Next business morning.* Friday shipments will be delivered on Monday unless SATURDAY Delivery is selected.
- [ ] FedEx Standard Overnight — Next business afternoon.* Saturday Delivery NOT available.
- [ ] FedEx First Ov — Earliest next busines delivery to select loc Saturday Delivery NI
- [ ] FedEx 2Day — Second business day.* Thursday shipments will be delivered on Monday unless SATURDAY Delivery is selected.
- [ ] FedEx Express Saver — Third business day.* Saturday Delivery NOT available.

4b Express Freight Service ** To most locations. Packages ove

- [ ] FedEx 1Day Freight — Next business day.** Friday shipments will be delivered on Monday unless SATURDAY Delivery is selected. FedEx 1Day Freight Booking No.
- [ ] FedEx 2Day Freight — Second business day.** Thursday shipments will be delivered on Monday unless SATURDAY Delivery is selected.
- [ ] FedEx 3Day Freight — Third business day.** Saturday Delivery NOT av

5 Packaging * Declared value limit $500.

- [ ] FedEx Envelope*
- [ ] FedEx Pak* — Includes FedEx Small Pak, FedEx Large Pak, and FedEx Sturdy Pak.
- [ ] FedEx Box
- [ ] FedEx Tube [X]

6 Special Handling and Delivery Signature Options

- [ ] SATURDAY Delivery — NOT available for FedEx Standard Overnight, FedEx First Overnight, FedEx Express Saver, or FedEx 3Day Freight.
- [ ] No Signature Required — Package may be left without obtaining a signature for delivery.
- [ ] Direct Signature — Someone at recipient's address may sign for delivery. Fee applies.
- [ ] Indirect Signature — If no one is available at recipient's address, someone at a neighboring address may sign for delivery. For residential deliveries only. Fee applie

Does this shipment contain dangerous goods? One box must be checked.

- [ ] No
- [ ] Yes — As per attached Shipper's Declaration.
- [ ] Yes — Shipper's Declaration not required.
- [ ] Dry Ice — Dry Ice, 9, UN 1845 ____ x ____

Dangerous goods (including dry ice) cannot be shipped in FedEx packaging or placed in a FedEx Express Drop Box.

- [ ] Cargo Aircraft Only

7 Payment *Bill to:*

Enter FedEx Acct. No. or Credit Card No. below. Obtain Rec Acct. N

- [X] Sender — Acct. No. in Section 1 will be billed.
- [ ] Recipient
- [ ] Third Party
- [ ] Credit Card
- [ ] Cash

Total Packages Total Weight ____ lbs. Credit Card Auth.

†Our liability is limited to $100 unless you declare a higher value. See the current FedEx Service Guide for details.

553

Rev. Date 2/08•Part #158279•©1994–2008 FedEx•PRINTED IN U.S.A.•SRS

1512

Calscience Environmental Laboratories, Inc.

WORK ORDER #: 10-08-1512

SAMPLE RECEIPT FORM

Box ~~Cooler~~ 1 of 1

CLIENT: PRIMA ENV'L. INC. DATE: 08/19/10

TEMPERATURE: Thermometer ID: SC1 (Criteria: 0.0 °C – 6.0 °C, not frozen)

Temperature 27.2 °C + 0.5 °C (CF) = 27.7 °C ☐ Blank ☑ Sample

☑ Sample(s) outside temperature criteria (PM/APM contacted by: PJ).

☐ Sample(s) outside temperature criteria but received on ice/chilled on same day of sampling.

☐ Received at ambient temperature, placed on ice for transport by Courier.

Ambient Temperature: ☐ Air ☐ Filter ☐ Metals Only ☐ PCBs Only Initial: PJ

CUSTODY SEALS INTACT:

☐ Cooler ☐_____ ☐ No (Not Intact) ☑ Not Present ☐ N/A Initial: PJ

☐ Sample ☐_____ ☐ No (Not Intact) ☑ Not Present Initial: PJ

SAMPLE CONDITION:	Yes	No	N/A
Chain-Of-Custody (COC) document(s) received with samples	☑	☐	☐
COC document(s) received complete	☐	☑	☐
☑ Collection date/time, matrix, and/or # of containers logged in based on sample labels.			
☐ No analysis requested. ☐ Not relinquished. ☐ No date/time relinquished.			
Sampler's name indicated on COC	☑	☐	☐
Sample container label(s) consistent with COC	☑	☐	☐
Sample container(s) intact and good condition	☑	☐	☐
Proper containers and sufficient volume for analyses requested	☑	☐	☐
Analyses received within holding time	☑	☐	☐
pH / Residual Chlorine / Dissolved Sulfide received within 24 hours	☐	☐	☑
Proper preservation noted on COC or sample container	☐	☐	☑
☐ Unpreserved vials received for Volatiles analysis			
Volatile analysis container(s) free of headspace	☐	☐	☑
Tedlar bag(s) free of condensation	☐	☐	☑

CONTAINER TYPE:

Solid: ☐4ozCGJ ☐8ozCGJ ☐16ozCGJ ☐Sleeve (_____) ☐EnCores® ☐TerraCores® ☑250 PJ (CBLACK)

Water: ☐VOA ☐VOAh ☐VOA**na$_2$** ☐125AGB ☐125AGBh ☐125AGBp ☐1AGB ☐1AGB**na$_2$** ☐1AGBs ☐500AGB ☐500AGJ ☐500AGJs ☐250AGB ☐250CGB ☐250CGBs ☐1PB ☐500PB ☐500PB**na** ☐250PB ☐250PBn ☐125PB ☐125PB**znna** ☐100PJ ☐100PJ**na$_2$** ☐_____ ☐_____ ☐_____

Air: ☐Tedlar® ☐Summa® **Other:** ☐_____ **Trip Blank Lot#:**_____ **Labeled/Checked by:** PJ

Container: C: Clear A: Amber P: Plastic G: Glass J: Jar B: Bottle Z: Ziploc/Resealable Bag E: Envelope **Reviewed by:** WSC

Preservative: h: HCL n: HNO_3 **na$_2$**: $Na_2S_2O_3$ **na**: NaOH p: H_3PO_4 s: H_2SO_4 **znna**: $ZnAc_2$+NaOH f: Field-filtered **Scanned by:** PJ

SIERRA TESTING LABORATORIES, INC.
GEOTECHNICAL AND MATERIALS TESTING SERVICES

August 24, 2010

PRIMA Environmental
Attn: Cindy Schreier
5070 Robert J Mathews #300
El Dorado Hills, CA 95762

STL Project No: **10-243**
Subject: **KF-EX PT2**
Project No: -
Invoice No: **8010**

LABORATORY TEST RESULTS

Dear Ms. Schreier:

As requested, Sierra Testing Laboratories, Inc. performed laboratory testing on **eighteen samples** of material from the subject site. The samples were identified as:

1. **MTZ-1S-A**
2. **MTZ-1S-B**
3. **MTZ-2S-A**
4. **MTZ-2S-B**
5. **MTZ-3S-A**
6. **MTZ-3S-B**
7. **MTZ-4S-A**
8. **MTZ-4S-B**
9. **BUF-1S-A**
10. **BUF-1S-B**
11. **BUF-2S-A**
12. **BUF-2S-B**
13. **BUF-3S-A**
14. **BUF-3S-B**
15. **BUF-4S-A**
16. **BUF-4S-B**
17. **CON-20M-1S-A**
18. **CON-20M-1S-B**

Our laboratory received the samples on **August 18, 2010**. The tests performed on the submitted samples were as follows:

1. **Control Low Strength Material (CLSM) Unconfined Compression without Stress Strain Curve or Photo (D4832 or D1633)**

The results of the above referenced testing are presented on the attached figure(s).

We appreciate the opportunity to be of service to you on this project and look forward to providing additional service, as needed, in the future.

Should you have any questions or require additional information, please contact our office at your convenience.

Respectfully submitted,

Michael Nagel
Project Manager

Enclosures/jm

UNCONFINED COMPRESSIVE STRENGTH

SIERRA TESTING LABORATORIES, INC.
GEOTECHNICAL AND MATERIALS TESTING SERVICES

Project Name: KF-EX PT 2

Project No.: 10-243

Report Date: August 19, 2010

Client: PRIMA Environmental

Material Type: cement soil cores

Date Tested: 8/18/10

Test Method: ASTM D1633, D4832

Moisture Condition At Testing: Ambient

Test Results

Sample ID.		Diameter, in.	Height, in.	Wet Unit Weight, pcf	Dry Unit Weight, pcf	Moisture Content, %	Unconfined Compressive Strength, psi
MTZ-1S-A		2.00	3.7	127.7	110.1	16.0	74

UNCONFINED COMPRESSIVE STRENGTH

SIERRA TESTING LABORATORIES, INC.
GEOTECHNICAL AND MATERIALS TESTING SERVICES

Project Name: KF-EX PT 2

Project No.: 10-243

Report Date: August 19, 2010

Client: PRIMA Environmental

Material Type: cement soil core

Date Tested: 8/18/10

Test Method: ASTM D1633, D4832

Moisture Condition At Testing: Ambient

Test Results

Sample ID.		Diameter, in.	Height, in.	Wet Unit Weight, pcf	Dry Unit Weight, pcf	Moisture Content, %	Unconfined Compressive Strength, psi
MTZ-1S-B		2.00	3.6	128.0	109.5	16.9	69

UNCONFINED COMPRESSIVE STRENGTH

SIERRA TESTING LABORATORIES, INC.
GEOTECHNICAL AND MATERIALS TESTING SERVICES

Project Name: KF-EX PT 2

Project No.: 10-243

Report Date: August 19, 2010

Client: PRIMA Environmental

Material Type: cement soil core

Date Tested: 8/18/10

Test Method: ASTM D1633, D4832

Moisture Condition At Testing: Ambient

Test Results

Sample ID.		Diameter, in.	Height, in.	Wet Unit Weight, pcf	Dry Unit Weight, pcf	Moisture Content, %	Unconfined Compressive Strength, psi
MTZ-2S-A		2.00	3.8	125.9	108.1	16.5	183

UNCONFINED COMPRESSIVE STRENGTH

SIERRA TESTING LABORATORIES, INC.
GEOTECHNICAL AND MATERIALS TESTING SERVICES

Project Name: KF-EX PT 2

Project No.: 10-243

Report Date: August 19, 2010

Client: PRIMA Environmental

Material Type: cement soil core

Date Tested: 8/18/10

Test Method: ASTM D1633, D4832

Moisture Condition At Testing: Ambient

Test Results

Sample ID.		Diameter, in.	Height, in.	Wet Unit Weight, pcf	Dry Unit Weight, pcf	Moisture Content, %	Unconfined Compressive Strength, psi
MTZ-2S-B		2.00	3.8	125.1	107.0	16.9	129

UNCONFINED COMPRESSIVE STRENGTH

SIERRA TESTING LABORATORIES, INC.
GEOTECHNICAL AND MATERIALS TESTING SERVICES

Project Name: KF-EX PT 2
Project No.: 10-243
Report Date: August 19, 2010

Client: PRIMA Environmental

Material Type: cement soil core

Date Tested: 8/18/10

Test Method: ASTM D1633, D4832
Moisture Condition At Testing: Ambient

Test Results

Sample ID.		Diameter, in.	Height, in.	Wet Unit Weight, pcf	Dry Unit Weight, pcf	Moisture Content, %	Unconfined Compressive Strength, psi
MTZ-3S-A		2.00	3.7	123.9	107.1	15.7	249

UNCONFINED COMPRESSIVE STRENGTH

SIERRA TESTING LABORATORIES, INC.
GEOTECHNICAL AND MATERIALS TESTING SERVICES

Project Name: KF-EX PT 2

Project No.: 10-243

Report Date: August 19, 2010

Client: PRIMA Environmental

Material Type: cement soil core

Date Tested: 8/18/10

Test Method: ASTM D1633, D4832

Moisture Condition At Testing: Ambient

Test Results

Sample ID.		Diameter, in.	Height, in.	Wet Unit Weight, pcf	Dry Unit Weight, pcf	Moisture Content, %	Unconfined Compressive Strength, psi
MTZ-3S-B		2.00	3.7	125.3	109.2	14.7	304

UNCONFINED COMPRESSIVE STRENGTH

SIERRA TESTING LABORATORIES, INC.
GEOTECHNICAL AND MATERIALS TESTING SERVICES

Project Name: KF-EX PT 2

Project No.: 10-243

Report Date: August 19, 2010

Client: PRIMA Environmental

Material Type: cement soil core

Date Tested: 8/18/10

Test Method: ASTM D1633, D4832

Moisture Condition At Testing: Ambient

Test Results

Sample ID.		Diameter, in.	Height, in.	Wet Unit Weight, pcf	Dry Unit Weight, pcf	Moisture Content, %	Unconfined Compressive Strength, psi
MTZ-4S-A		2.00	3.7	123.3	108.4	13.8	457

UNCONFINED COMPRESSIVE STRENGTH

SIERRA TESTING LABORATORIES, INC.
GEOTECHNICAL AND MATERIALS TESTING SERVICES

Project Name: KF-EX PT 2

Project No.: 10-243

Report Date: August 19, 2010

Client: PRIMA Environmental

Material Type: cement soil core

Date Tested: 8/18/10

Test Method: ASTM D1633, D4832

Moisture Condition At Testing: Ambient

Test Results

Sample ID.		Diameter, in.	Height, in.	Wet Unit Weight, pcf	Dry Unit Weight, pcf	Moisture Content, %	Unconfined Compressive Strength, psi
MTZ-4S-B		2.00	3.8	123.3	108.6	13.6	478

UNCONFINED COMPRESSIVE STRENGTH

SIERRA TESTING LABORATORIES, INC.
GEOTECHNICAL AND MATERIALS TESTING SERVICES

Project Name: KF-EX PT 2

Project No.: 10-243

Report Date: August 19, 2010

Client: PRIMA Environmental

Material Type: cement soil core

Date Tested: 8/18/10

Test Method: ASTM D1633, D4832

Moisture Condition At Testing: Ambient

Test Results

Sample ID.		Diameter, in.	Height, in.	Wet Unit Weight, pcf	Dry Unit Weight, pcf	Moisture Content, %	Unconfined Compressive Strength, psi
BUF-1S-A		2.00	3.7	115.1	104.7	10.0	44

UNCONFINED COMPRESSIVE STRENGTH

SIERRA TESTING LABORATORIES, INC.
GEOTECHNICAL AND MATERIALS TESTING SERVICES

Project Name: KF-EX PT 2

Project No.: 10-243

Report Date: August 19, 2010

Client: PRIMA Environmental

Material Type: cement soil core

Date Tested: 8/18/10

Test Method: ASTM D1633, D4832

Moisture Condition At Testing: Ambient

Test Results

Sample ID.		Diameter, in.	Height, in.	Wet Unit Weight, pcf	Dry Unit Weight, pcf	Moisture Content, %	Unconfined Compressive Strength, psi
BUF-1S-B		2.00	3.7	114.3	104.2	9.7	37

UNCONFINED COMPRESSIVE STRENGTH

SIERRA TESTING LABORATORIES, INC.
GEOTECHNICAL AND MATERIALS TESTING SERVICES

Project Name: KF-EX PT 2
Project No.: 10-243
Report Date: August 19, 2010

Client: PRIMA Environmental

Material Type: cement soil core

Date Tested: 8/18/10

Test Method: ASTM D1633, D4832
Moisture Condition At Testing: Ambient

Test Results

Sample ID.		Diameter, in.	Height, in.	Wet Unit Weight, pcf	Dry Unit Weight, pcf	Moisture Content, %	Unconfined Compressive Strength, psi
BUF-2S-A		2.00	3.8	117.3	106.3	10.3	118

UNCONFINED COMPRESSIVE STRENGTH

SIERRA TESTING LABORATORIES, INC.
GEOTECHNICAL AND MATERIALS TESTING SERVICES

Project Name: KF-EX PT 2

Project No.: 10-243

Report Date: August 19, 2010

Client: PRIMA Environmental

Material Type: cement soil core

Date Tested: 8/18/10

Test Method: ASTM D1633, D4832

Moisture Condition At Testing: Ambient

Test Results

Sample ID.		Diameter, in.	Height, in.	Wet Unit Weight, pcf	Dry Unit Weight, pcf	Moisture Content, %	Unconfined Compressive Strength, psi
BUF-2S-B		2.00	3.8	116.7	105.9	10.1	131

UNCONFINED COMPRESSIVE STRENGTH

SIERRA TESTING LABORATORIES, INC.
GEOTECHNICAL AND MATERIALS TESTING SERVICES

Project Name: KF-EX PT 2
Project No.: 10-243
Report Date: August 19, 2010

Client: PRIMA Environmental

Material Type: cement soil core

Date Tested: 8/18/10

Test Method: ASTM D1633, D4832

Moisture Condition At Testing: Ambient

Test Results

Sample ID.		Diameter, in.	Height, in.	Wet Unit Weight, pcf	Dry Unit Weight, pcf	Moisture Content, %	Unconfined Compressive Strength, psi
BUF-3S-A		2.00	3.8	119.0	108.1	10.1	300

UNCONFINED COMPRESSIVE STRENGTH

SIERRA TESTING LABORATORIES, INC.
GEOTECHNICAL AND MATERIALS TESTING SERVICES

Project Name: KF-EX PT 2

Project No.: 10-243

Report Date: August 19, 2010

Client: PRIMA Environmental

Material Type: cement soil core

Date Tested: 8/18/10

Test Method: ASTM D1633, D4832

Moisture Condition At Testing: Ambient

Test Results

Sample ID.		Diameter, in.	Height, in.	Wet Unit Weight, pcf	Dry Unit Weight, pcf	Moisture Content, %	Unconfined Compressive Strength, psi
BUF-3S-B		2.00	3.8	119.2	108.6	9.7	337

UNCONFINED COMPRESSIVE STRENGTH

SIERRA TESTING LABORATORIES, INC.
GEOTECHNICAL AND MATERIALS TESTING SERVICES

Project Name: KF-EX PT 2
Project No.: 10-243
Report Date: August 19, 2010

Client: PRIMA Environmental

Material Type: cement soil core

Date Tested: 8/18/10

Test Method: ASTM D1633, D4832

Moisture Condition At Testing: Ambient

Test Results

Sample ID.		Diameter, in.	Height, in.	Wet Unit Weight, pcf	Dry Unit Weight, pcf	Moisture Content, %	Unconfined Compressive Strength, psi
BUF-4S-A		2.00	3.8	122.1	110.0	11.0	826

UNCONFINED COMPRESSIVE STRENGTH

SIERRA TESTING LABORATORIES, INC.
GEOTECHNICAL AND MATERIALS TESTING SERVICES

Project Name: KF-EX PT 2

Project No.: 10-243

Report Date: August 19, 2010

Client: Prima Environmental

Material Type: cement soil core

Date Tested: 8/18/10

Test Method: ASTM D1633, D4832

Moisture Condition At Testing: Ambient

Test Results

Sample ID.		Diameter, in.	Height, in.	Wet Unit Weight, pcf	Dry Unit Weight, pcf	Moisture Content, %	Unconfined Compressive Strength, psi
BUF-4S-B		2.00	3.8	121.8	110.0	10.8	745

UNCONFINED COMPRESSIVE STRENGTH

SIERRA TESTING LABORATORIES, INC.
GEOTECHNICAL AND MATERIALS TESTING SERVICES

Project Name: KF-EX PT 2
Project No.: 10-243
Report Date: August 19, 2010

Client: PRIMA Environmental

Material Type: cement soil core
Date Cast: 1/0/00
Date Tested: 8/18/10
Age, Days: 0

Test Method: ASTM D1633, D4832
Moisture Condition At Testing: Ambient

Test Results

Sample ID.		Diameter, in.	Height, in.	Wet Unit Weight, pcf	Dry Unit Weight, pcf	Moisture Content, %	Unconfined Compressive Strength, psi
CON-20M-1S-A		2.00	3.7	108.7	100.5	8.2	103

UNCONFINED COMPRESSIVE STRENGTH

SIERRA TESTING LABORATORIES, INC.
GEOTECHNICAL AND MATERIALS TESTING SERVICES

Project Name: KF-EX PT 2

Project No.: 10-243

Report Date: August 19, 2010

Client: PRIMA Environmental

Material Type: cement soil core

Date Tested: 8/18/10

Test Method: ASTM D1633, D4832

Moisture Condition At Testing: Ambient

Test Results

Sample ID.		Diameter, in.	Height, in.	Wet Unit Weight, pcf	Dry Unit Weight, pcf	Moisture Content, %	Unconfined Compressive Strength, psi
CON-20M-1S-B		2.00	3.3	107.0	99.9	7.1	131

APPENDIX M

BENCH-SCALE TESTING REPORT

March 18, 2010

Mr. John Donatucci, PE
Kleinfelder
2 Ada, Suite 250
Irvine, CA 92618

RE: Final Report of Findings, Bench testing to Evaluate Metals Stabilization in Soil, Former Excello Plating Company, Inc.

Dear John:

Enclosed is the final report of findings "Evaluation of Calcium Polysulfide and Ferrous Iron for the Reduction of Hexavalent Chromium in Soil" that describes bench testing conducted on soil from the former Excello Plating Company site in Los Angeles, California. If you have any questions, please call me at 916-939-7300. Thank you for the opportunity to be of service.

Sincerely,
PRIMA Environmental, Inc.

Cindy G. Schreier, Ph.D.
President

5070 Robert J. Mathews Parkway, Suite 300, El Dorado Hills, CA 95762
Ph (916) 939-7300 • Fax (916) 939-7398
www.primaenvironmental.com

Report of Findings

EVALUATION OF CALCIUM POLYSULFIDE AND FERROUS IRON FOR THE REDUCTION OF HEXAVALENT CHROMIUM IN SOIL

Former Excello Plating Company
Los Angeles, California

March 18, 2010

Submitted to

Mr. John Donatucci, PE
Kleinfelder
2 Ada, Suite 250
Irvine, CA 9261

Submitted by
PRIMA Environmental, Inc.
5070 Robert J Mathews Parkway, Suite 300
El Dorado Hills, CA 95762

Cindy G. Schreier, Ph.D., President

Mar 18, 2010
Date

EXECUTIVE SUMMARY

Bench-scale treatability testing was conducted on soil (KLF1-Bulk-1) from the former Excello Plating Company, located in Los Angeles, California. Soil was spiked with Cr(VI), cadmium, and nickel to better represent more highly impacted soils. Testing evaluated the ability of two reducing agents—with and without a stabilizing agent—to convert hexavalent chromium [Cr(VI)] in soil to trivalent chromium and assessed the potential effect of treatment on groundwater. The reducing agents evaluated were calcium polysulfide (CaSx) and ferrous iron [Fe(II)]. Cement was used as a stabilizing agent to partially solidify treated soil.

Both CaSx and Fe(II) effectively reduced Cr(VI) concentrations in soil in laboratory tests. All of the CaSx treatments and the Fe(II) low dose with cement treatment also dramatically reduced the leachability of metals, indicating that these can potentially be used to treat Cr(VI) *in situ* without adversely affecting groundwater, if properly applied. Several factors may influence the implementability and/or practicality of these treatments, including the reactivity and odor of CaSx, the need to add Fe(II) in an acidic solution and follow treatment with cement.

Based on the results of this study, PRIMA recommends that both CaSx and Fe(II) be considered for *in situ* remediation of Cr(VI) at this site. The engineering considerations discussed in Section 4.0 should be carefully evaluated by Kleinfelder during this process. Additional testing may be needed to assess the reactivity of CaSx versus Cr(VI) concentration, determine how far excess water may percolate (if the distance above the water table is sufficiently great, water from the treatment zone may not reach groundwater), and assess the ability of untreated soil below the treatment zone to sorb any leached metals.

Table of Contents

EXECUTIVE SUMMARY ..... **i**
List of Figures ..... **iii**
List of Tables ..... **iv**
1.0 INTRODUCTION **1**
1.1 Background 1
1.2 Study Objectives 2
2.0 MATERIALS and METHODS **3**
2.1 Materials 3
2.2 Preparation and Characterization of Soil 3
2.2 Pre-test to Determine Cement Dose 5
2.3 Cr(VI) Reduction 5
2.4 Post-treatment Leachability 6
2.5 CaSx Soil Reductant Demand (SRD) 7
2.6 Soil Buffering Curves 7
2.7 Analytical Methods 7
3.0 RESULTS and DISCUSSION **8**
3.1 Untreated Soil and Groundwater 8
3.2 Cr(VI) Reduction/Stabilization 9
3.2.1 Cr(VI) Removal 9
3.2.2 Secondary Parameters 9
3.2.3 Observations 11
3.3 Leach Test Results 13
3.4 Soil Reductant Demand 15
3.5 Buffering Curve 15
4.0 ENGINEERING CONSIDERATIONS **18**
5.0 CONCLUSIONS **20**

APPENDIX A – Chains of Custody
APPENDIX B – Analytical Results

List of Figures

Figure 1. Soil Spiking Procedure. 4
Figure 2. Comparison of Spiked and Unspiked Soil. 5
Figure 3. Spiked soil after addition of reductants (no cement). Day 14. 11
Figure 4. Spiked soil after addition of reductants (no cement). Day 7. 12
Figure 5. Spiked soil after addition of reductants and cement. Day 7. 12
Figure 6. Soil Reductant Demand. 16
Figure 7. Soil Buffering Curves. (Unspiked Soil.) 17

List of Tables

Table 1. Cement Pre-Test Results. 5
Table 2. Summary of Cr(VI) Reduction/Stabilization Tests. 6
Table 3. Analytical Methods. 7
Table 4. Cr(VI) and Other Parameters in Untreated Soil. 8
Table 5. Cr(VI) Reduction. Day 7 Results. 10
Table 6. Leach Test Results. 14

1.0 INTRODUCTION

Bench-scale treatability testing was conducted on soil (KLF1-Bulk-1) from the former Excello Plating Company, located in Los Angeles, California. Soil was spiked with Cr(VI), cadmium, and nickel to better represent more highly impacted soils. Testing evaluated the ability of two reducing agents—with and without a stabilizing agent—to convert hexavalent chromium [Cr(VI)] in soil to trivalent chromium and assess the potential effect of treatment on groundwater. The reducing agents evaluated were calcium polysulfide (CaSx) and ferrous iron [Fe(II)]. Cement was used as a stabilizing agent to partially solidify treated soil.

1.1 Background

Both CaSx and Fe(II) are known to convert Cr(VI) to trivalent chromium [Cr(III)], but Fe(II) may have fewer impacts to groundwater or the treatment system associated with the extraction well. Specifically, CaSx reacts more slowly than Fe(II), it has a strong sulfide odor, and may potentially release arsenic if strong reducing conditions are established. In addition, CaSx oxidizes in air to form sulfur, which in PRIMA's experience sticks to glassware and can be difficult to remove, potentially causing a problem if unreacted CaSx reached the extraction well. In contrast, Fe(II) reacts rapidly with Cr(VI) and iron, should it reach the extraction well, is well-understood and any affects on the groundwater treatment system could be predicted. Fe(II) is usually added as ferrous sulfate, so sulfate concentrations might temporarily increase with the use of Fe(II). Finally, because the Fe(II) must be added as an acidic solution, other metals could potentially be released from soil. However, most soils have some ability to buffer against changes in pH, so it is likely that any such metals would precipitate once the pH of the soil returned to pre-treatment levels.

Calcium polysulfide. Calcium polysulfide is an orange liquid with a strong sulfide smell and a pH of about 10. The concentrated liquid is ~29% CaSx with an average density of 1.24 g/cm^3 that contains approximately 360 g CaSx/L solution. According to the manufacturer, Tessenderlo Kerley (Tucson, Arizona), the average number of sulfur atoms per molecule *(x)* is about 4, so that CaSx is approximately CaS_4. Upon exposure to air or at lower pH, CaSx oxidizes to generate colloidal sulfur and sulfate.

The ability of CaSx to convert Cr(VI) to trivalent chromium is well-established. Equation 1 shows the theoretical chemical reaction for this transformation. Based on this equation, 4.8 g CaS_4 (13 mL of 29% CaSx soln.) is needed to transform 1 g of Cr(VI). However, CaSx may react with non-target compounds in soil and groundwater as well as the target Cr(VI).

Equation 1:

$$\underset{\textit{calcium polysulfide}}{3CaS_4} + 2Cr^{6+} \rightarrow 3Ca^{2+} + 12S^0 + 2Cr^{3+}$$

Ferrous iron. Ferrous iron is well known to rapidly reduce Cr(VI) to Cr(III). The resulting iron-chromium hydroxides are generally less soluble than chromium hydroxide. Ferrous iron must be added as an acidified solution (usually of ferrous sulfate heptahydrate). The acid is needed to prevent air oxidation of ferrous iron to ferric iron.

The chemical equation for reduction of Cr(VI) to Cr(III) by Fe(II) is shown in Equation 2. Based on this equation, 3.2 g Fe(II) or16 g ferrous sulfate heptahydrate (a common form of ferrous iron) is needed to react with 1 g Cr(VI).

Equation 2:

$$\underset{\textit{ferrous iron}}{3Fe^{2+}} + Cr^{6+} \rightarrow 3Fe^{3+} + Cr^{3+}$$

Cement. Cement may be added to stabilize metals by increasing pH, including nickel and cadmium, are less soluble at higher pH. The addition of higher amounts of cement may prevent leaching of metals by reducing permeability of the soil.

1.2 Study Objectives

Batch tests will be conducted to evaluate the ability of CaSx and Fe(II)—with or without added cement—to reduce Cr(VI) without adversely affecting groundwater. Specific goals of the testing are to

- estimate the dose of CaSx and Fe(II) needed to decrease Cr(VI) in soil
- compare the effectiveness of reducing agent alone to reducing agent+stabilizing agent (cement)
- assess the leachability of Cr(VI) and other metals after treatment
- estimate the soil reductant demand of CaSx in order to assess the ability of unimpacted soil to consume excess reagent
- generate soil buffering curves to determine how much acid can be added without long-term changes in pH

The specific tests conducted to achieve these goals are described in Section 2.0 of this report. Results and observations are presented in Section 3.0. Conclusions and recommendations are presented in Sections 4.0. PRIMA Environmental, Inc. (PRIMA) has evaluated the effectiveness of each technology based on the results of the bench tests. However, it is the responsibility of Kleinfelder to review this report and use its knowledge and expertise to determine whether any of these technologies should be applied at the site.

2.0 MATERIALS and METHODS

2.1 Materials

Cadmium nitrate tetrahydrate, $Cd(NO_3)_2 \cdot 4H_2O$. "Baker Analyzed" reagent grade $Cd(NO_3)_2 \cdot 4H_2O$ (JT Baker) was used in this study.

Calcium polysulfide, CaSx. Calmet® brand 29% CaSx was obtained from Best Sulfur Products (Fresno, CA www.bestsulfurproducts.com). Dilutions were made as needed using deionized (DI) water.

Cement. Type II Portland cement purchased from a local hardware store was used in this study.

Ferrous sulfate heptahydrate, $FeSO_4 \cdot 7H_2O$. Granular $FeSO_4 \cdot 7H_2O$ was obtained from Fisher Scientific and used as received.

Nickel chloride hexahydrate, $NiCl_2 \cdot 6H_2O$. "Baker Analyzed" reagent grade $NiCl_2 \cdot 6H_2O$ (JT Baker) was used in this study.

Potassium dichromate, $K_2Cr_2O_7$. "Baker Analyzed" reagent grade $K_2Cr_2O_7$. (JT Baker) was used in this study.

Sulfuric Acid, H_2SO_4. ACS reagent grade 98% H_2SO_4 (EM Science) was used in this study. Dilute solutions were prepared as needed using DI water.

2.2 Preparation and Characterization of Soil

One 5-gallon bucket of soil labeled "KLF1-Bulk-1" and weighing approximately 48 pounds was received by PRIMA on December 8, 2009. The soil was passed through a No. 4 sieve to remove rocks greater than about 3/16 inches. Approximately 8 lbs of rocks were removed. The remaining soil was a fine brown sand. It was thoroughly homogenized by passing it several times through a riffle splitter. Homogenized soil was analyzed for

- Cr(VI)
- Percent moisture
- Total metals (arsenic, cadmium, chromium, nickel)
- Synthetic Precipitation Leaching Procedure (SPLP), with analysis of arsenic (As), cadmium (Cd), chromium (Cr), and nickel (Ni) in the leachate

Because Cr(VI) and total metal concentrations were not representative of highly impacted soil at the site, Kleinfelder directed that soil be spiked to target concentrations of 10,000 mg/kg Cr(VI), 2600 mg/kg Ni and 230 mg/kg Cd. This was done by dissolving the

appropriate amount of potassium dichromate ($K_2Cr_2O_7$), cadmium nitrate tetrahydrate ($Cd(NO_3)_2 \cdot 4H_2O$), and nickel chloride hexahydrate ($NiCl_2 \cdot 6H_2O$) in 1.5 liters of warm (42°C) DI water, mixing the water well with 8.8 kg soil, then allowing the soil to dry until the moisture content was similar to that of the unspiked soil. Dried soil had a crust of orange crystals, which was K2Cr2)7 that had precipitated as the water evaporated. The spiked soil was thoroughly homogenized to evenly distribute the crystals, then analyzed for the same parameters as the original soil. Figures 1a-d illustrate the spiking process. Figure 2 shows the original homogenized soil and the dried, homogenized spiked soil. Analytical results are presented and discussed in Section 3.0.

Figure 1. Soil Spiking Procedure. *a)* Adding metal solution to soil. *b)* Mixing solution and soil. *c)* Spiked soil slurry. *d)* Spiked soil after drying, but before homogenization. Orange crystals are $K_2Cr_2O_7$ that precipitated as water evaporated.

Figure 2. Comparison of Spiked and Unspiked Soil. *Left:* homogenized spiked soil after drying. *Right*: homogenized unspiked soil.

2.2 Pre-test to Determine Cement Dose

A pre-test was conducted to determine the dose of cement that should be added to stabilize treated soil. Four beakers, each containing 250 g of unspiked soil were prepared. Cement (2-20% by weight) and water (40-45 mL) were added and mixed well. (The amount of water used was the minimum amount needed to make a thick slurry.) After 48 hours, the penetration resistance was measured using a pocket penetrometer. The friability was also assessed. Based on the results (Table 1), Kleinfelder requested that approximately 5% cement be used for the stabilization tests.

Table 1. Cement Pre-Test Results.

Test	Cement Added	Penetration Resistance	Friability
	% (w/w)	tons/ft2	
2%Cem	2	~ 4.5	easy to break up
4%Cem	4	> 4.5	easy to break up
10%Cem	10	> 4.5	not easily broken up
20%Cem	20	> 4.5	not easily broken up

2.3 Cr(VI) Reduction

The ability of CaSx and Fe(II) to reduce Cr(VI), with and without an added stabilizer (cement) was evaluated. Five reactors, each containing 500 g spiked soil, were prepared for each reducing agent. One of the reactors received only water and served as the control. Two of the reactors received a low dose of reducing agent and the remaining two received a high dose. For CaSx, the low dose (134 mL 29%CaSx/kg soil) was the stoichiometric dose required to convert all of the added Cr(VI) to Cr(III), while the high

dose (268 mL 29%CaSx/kg soil) was approximately twice the stoichiometric dose. For iron, a 1 times stoichiometric dose (160 g $FeSO_4 \cdot 7H_2O$ /kg soil) and 3 times stoichiometric dose (480 g $FeSO_4 \cdot 7H_2O$/kg soil) were used. CaSx was added directly to the soil and mixed well. An additional 20 mL of DI water was added to the low dose test because the CaSx caused the soil to dry out (see Section 3.0 for further discussion). For Fe(II), solid $FeSO_4 \cdot 7H_2O$ and 75 mL of 0.12 N H_2SO_4 were added to the soil then blended well. (The amount of acid required from a preliminary test in which H_2SO_4 was added to soil as needed until the pH remained between 2.5 and 3 for 2 hours. In this case, 0.018 moles H^+/kg soil were needed.) The $FeSO_4 \cdot 7H_2O$ was added dry because it would not dissolve in the small amount of acid used. (A larger amount of liquid was not used in order to avoid creating a layer of water on the surface of the soil.) After 24 hours, cement and additional water was added to one reactor from each of the above pairs. (Cement was added after 24 hours in order to allow time for the reductant to react with Cr(VI).) Seven days after setting up the tests (6 days after addition of cement), the contents of each reactor were homogenized and subsamples were collected and analyzed for Cr(VI), ORP and pH. The tests are summarized in Table 2.

Table 2. Summary of Cr(VI) Reduction/Stabilization Tests.

Test	Reductant	Cement*	Est. Sample Time, days
CaSx Tests			
Control	None**	None	7
CPS-Low	134 mL 29%CaSx/kg soil (1 x stoich.)	None	7
CPS-Low-Cem		5%+ 50 mL DI	7
CPS-High	268 mL 29%CaSx/kg soil (2 x stoich.)	None	7
CPS-High-Cem		5%+ 16 mL DI	7
Fe(II) Tests			
Control	None**	None	7
Fe-Low	160 g $FeSO_4 \cdot 7H_2O$ /kg soil + 75 mL 0.12N H_2SO_4/kg (1 x stoich dose)	None	7
Fe—Low-Cem		5% + 50 mL DI	7
Fe-High	480 g $FeSO_4 \cdot 7H_2O$ /kg soil + 75 mL 0.12N H_2SO_4/kg (3 x stoich dose)	None	7
Fe-High-Cem		5% (no DI needed)	7

* Cement was 5% of soil mass and was added approximately 24 hours after reductant.
** 75 mL DI water/kg soil was added in place of the reductant.

2.4 Post-treatment Leachability

In order to assess the potential effect of each treatment on groundwater, each test in Section 2.3 was subjected to the Simulated Precipitation Leaching Procedure (SPLP) and the extract analyzed for Cr(VI), arsenic, cadmium, chromium, and nickel.

2.5 CaSx Soil Reductant Demand (SRD)

The amount of CaSx that can be consumed by soil (the soil reductant demand, SRD) was measured in order to evaluate how much excess CaSx could potentially be added without affecting groundwater. SRD was measured by determining the change in CaSx concentration over time in the presence and absence of soil. Four vials, each containing 25 g unspiked soil and approximately 30 mL CaSx were prepared. The CaSx concentration was 10 mL CaSx/L soln. (0.29% CaSx) in two of the vials and 20 mL CaSx/L soln. (0.58% CaSx) in the remaining two vials. Two controls containing CaSx but no soil were also prepared. All vials were prepared under a nitrogen blanket in order to minimize exposure to oxygen. Periodically, an aliquot was removed from each vial and analyzed for CaSx via visible spectroscopy (absorbance at 370 nm). All dilutions were made using 0.01 M sodium hydroxide solution to minimize oxidation/precipitation of CaSx. The sampling times were 6 hrs, 24 hours, 48 hrs, and 7 days. SRD is defined as the difference between the amount of CaSx consumed in the sample and in the amount consumed in the control (Eqn. 3).

$$SRD = (CaSx\ consumed)_{sample} - (CaSx\ consumed)_{control} \qquad \text{Eqn. 3}$$

2.6 Soil Buffering Curves

Buffering curves were generated to estimate the amount of acid that can be added to soil (when using Fe(II) as the reducing agent) without causing long-term changes in pH. Soil and dilute sulfuric acid will be combined in a 1:1 soil to liquid ratio. The pH was measured periodically over time. Three initial concentrations of acid were used: 100 mmol H^+/kg soil, 10 mmol H^+/kg soil, and 1 mmol H^+/kg soil.

2.7 Analytical Methods

The method for each analysis and the lab to perform the analysis are given in Table 3.

Table 3. Analytical Methods.

Analyte	Method	Lab performing test*
Cr(VI)	7199	Excelchem/Alpha
Total Metals	EPA 6020	Alpha Analytical
SPLP	EPA 1312	Alpha Analytical
ORP	Probe	PRIMA
pH	Probe	PRIMA

* Alpha Analytical (Sparks, NV), Excelchem (Rocklin, CA),

3.0 RESULTS and DISCUSSION

3.1 Untreated Soil and Groundwater

The analytical results for untreated soil—as received and spiked—are given in Table 4. Complete analytical reports are provided in Appendix B. Unspiked soil contained very little Cr(VI)—10.2-22 mg/kg, depending upon the analytical method. This amount is consistent with the SPLP results of was 1.5 mg/L Cr(VI). (Because Cr(VI) is highly water soluble, most of it should leached by the SPLP test. Since the SPLP uses a 20 to 1 extraction fluid to soil ratio, the amount of Cr(VI) that leached was approximately 1.5 mg/L x 20 = 30 mg/kg.) The concentrations of total chromium, cadmium and nickel were was 99 mg/kg, < 1.0 mg/kg and 7.3 mg/kg, respectively. The concentration of arsenic was 1.8 mg/kg, but none was detected in the SPLP test.

Table 4. Cr(VI) and Other Parameters in Untreated Soil.

Analyte	Units	Unspiked Soil (soil as received)	Spiked Soil
Metals (EPA SW6020)			
Arsenic	mg/kg	1.8	1.8
Cadmium	mg/kg	< 1.0	210
Chromium	mg/kg	99	10,000
Nickel	mg/kg	7.3	2,900
Metals (SPLP)			
Cr(VI)	mg/L	1.5*	290
Arsenic	mg/L	< 0.10	< 0.05
Cadmium	mg/L	< 0.10	9.0
Chromium	mg/L	1.5	480
Nickel	mg/L	< 0.20	130
Munsell Soil Color*			
Brown	Munsell Color Code	7.5YR 5/3	n.a.
Dark yellowish brown	Munsell Color Code	n.a.	10YR 4/4
Other Measurements			
Cr(VI) - 7199	mg/kg	10.2	8,900
Cr(VI) - DI/Hach	mg/kg	22**	10,000^
ORP	mV	175	n.m.
Percent Moisture	%	4.27	6.6
pH	--	6.81	n.m.

* Note - Vanadium, iron, molybdenum and mercury may enhance the absorption measured at the same wavelength as Cr(VI).

** Estimated value: PRIMA mixed soil and DI water in 1:1 ratio for ~1hr, then analyzed colorimetrically for Cr(VI).

^ Estimated value: PRIMA mixed soil and DI water in 1:10 ratio for ~1hr, then analyzed colorimetrically for Cr(VI).

3.2 Cr(VI) Reduction/Stabilization

3.2.1 Cr(VI) Removal

The results of the Cr(VI) reduction/stabilization tests are shown in Table 5. Both CaSx and Fe(II), with and without added cement, dramatically decreased the concentration of Cr(VI). Up to 6.2 mg/kg Cr(VI) was present in the CaSx low dose test without added cement and 3.0 mg/kg remained after addition of cement. The remaining Cr(VI) was probably due to imperfect mixing of the reagent and the soil. (As discussed in Section 3.2.2.1, CaSx reacted very quickly with soil, drying it out and rendering mixing difficult.) Doubling the dose of CaSx resulted in complete removal of Cr(VI) in the high dose test without cement, but 1.5 mg/kg were detected when cement was added. In contrast, < 1.0 mg/kg Cr(VI) were detected in any of the iron-treated tests, with or without added cement.

3.2.2 Secondary Parameters

ORP and pH was measured for each treatment. The results are shown in Table 5. The pH increased from 4.28 in the CaSx control to 8.16 in the low dose test and 9.87 in the high dose test. Addition of cement further increased the pH (to over 11) in both cases. ORP was negative in all of the CaSx tests. These changes were expected because CaSx is alkaline and strongly reducing. In contrast, the pH after 7 days in the iron tests (without cement) ranged from 2.16 to 2.32. The low pH was required initially to prevent unwanted oxidation of ferrous iron, but prolonged acidic conditions are likely to leach metals. Adding cement increased the pH to 7.22 in the low dose test, but only to 4.54 in the high dose test. The moderate increases are presumably due to the acidic nature of ferrous sulfate. (Ferrous sulfate has long been used by gardeners to decrease the pH of soil.) The ORP in the iron tests was oxidizing in most cases because the Fe(II), while reducing, was not completely dissolved in the poor water.

Table 5. Cr(VI) Reduction. Day 7 Results.

Analyte	Units	CaSx Tests					Fe(II) Tests				
		Control	Low Dose	Low Dose + Cement	High Dose	High Dose + Cement	Control	Low Dose	Low Dose + Cement	High Dose	High Dose + Cement
Cr(VI) - 7199	mg/kg	7,700	6.2	3	< 0.01	1.5	7,700	< 0.01	0.41	< 0.01	< 0.01
Cr(VI) - DI/Hach*	mg/kg	8,400	< 0.1	0.11	< 0.1	< 0.1	7,600	0.12	0.5	< 0.1	0.11
moisture content	%	10.5	10.2	12.6	14.8	14.7	12.2	13.7	17.4	21.1	19.3
ORP	mV	418	-80	-130	-170	-485	388	295	35	198	-40
pH	--	4.28	8.16	11.33	9.87	12.02	4.35	2.16	7.22	2.32	4.54

* Estimated value: PRIMA mixed soil and DI water in 1:10 ratio for ~1hr, then analyzed colorimetrically for Cr(VI).

All results on a wet weight basis.

3.2.3 Observations

Observations made throughout the Cr(VI) reduction study are summarized in Table 6. Some observations are discussed in more detail below. Figure 3 show the spiked soil 14 hours after treatment. Figures 4 and 5 show the spiked soils (with and without added cement) on Day 7.

3.2.3.1 Treatment with CaSx – no cement

CaSx reacted atypically with site soil. In PRIMA's experience, addition of CaSx is uneventful, resulting in an orange/yellow slurry that often turns greenish/gray over time; samples have a strong sulfide odor, but no heat is generated. In this study, however, addition of the low dose of CaSx to spiked soil immediately turned the soil black, dried it out, and generated heat (the temperature rose from about 20°C to about 38°C). The soil dried out as the reagent was added, necessitating the addition of 20 mL of water in order to improve mixing. No sulfide odor was evident within minutes after addition of CaSx. Similarly, when the high dose of CaSx was added, the soil turned black immediately, though the mixture remained soupy enough to enable good mixing without adding water. Heat was also generated and the soil became much drier within 30 minutes. The CaSx-treated soils at 14 hours are shown in Figure 3.

Figure 3. Spiked soil after addition of reductants (no cement). Day 14.

Figure 4. Spiked soil after addition of reductants (no cement). Day 7.

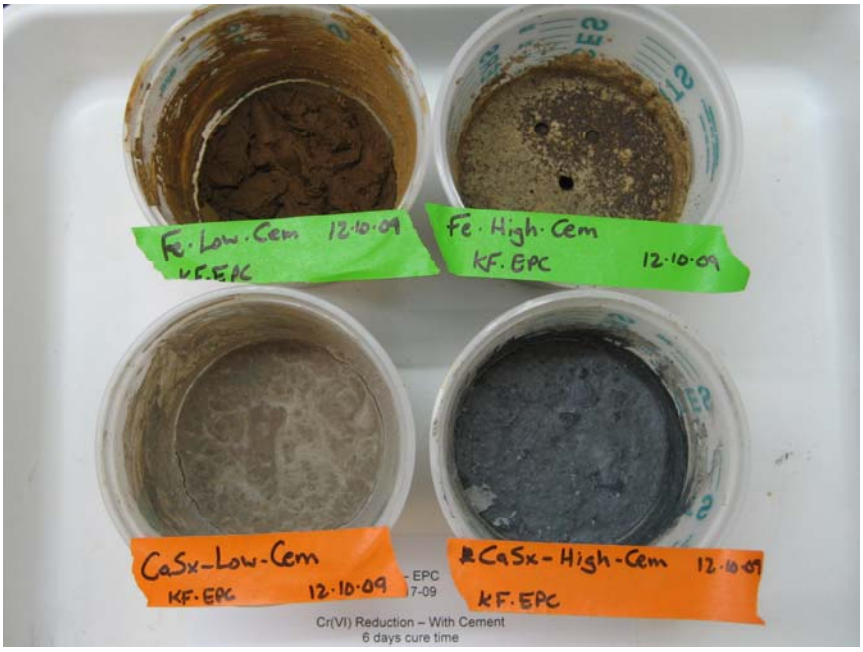


Figure 5. Spiked soil after addition of reductants and cement. Day 7.

The extensive reactivity of the CaSx with spiked soil was probably due to very rapid chemical reactions between Cr(VI), which is a strong oxidant at the high concentrations present in the soil, and the CaSx, which is a strong reductant. This hypothesis is supported by the more typical reaction observed when CaSx was added to unspiked soil—specifically, no heat was generated, the soil turned gray slowly, and a strong sulfide odor was present. The effect of Cr(VI) concentration on CaSx reactivity is important to consider when evaluating CaSx for *in situ* treatment of vadose zone soil because the dose of CaSx may need to be varied with Cr(VI) soil concentration in order to avoid potential adverse effects of CaSx on groundwater. If CaSx does not completely react with soil, then it could potentially enter the groundwater and be extracted.

3.2.3.2 Addition of Cement

Addition of cement to the various treatments solidified the soil, but resulting solid was relatively weak. Although a force of 4.5 tons/ft^2 (measured with a pocket penetrometer) did not make an indentation in most samples after 6 days of curing, all of the materials could be broken up with moderate to little effort. The CaSx-cement tests required the use of a steel spatula to initially break the material, but smaller pieces could be crushed by hand. The Fe(II)-cement tests were easily crushed by hand. These results are consistent with the request by Kleinfelder to add enough cement to stabilize the Cr(VI) and prevent leaching, but not enough to create a hard, solid cement core.

Addition of cement did not generate a significant amount of heat. Temperature did not increase in the CaSx-Low-Cem test, but increased by approximately 3°C in the CaSx-High-Cem test, by 6°C in the Fe-Low-Cem test, and by 2°C in the Fe-High-Cem test.

3.2.3.3 DI Extraction Supernatant

The supernatants from the DI extraction tests (on which PRIMA measured Cr(VI) colorimetrically) were highly colored in the iron-only tests. In the low dose test the liquid was blue, indicating Fe(II) was still present. In the high dose test, the liquid was green/yellow, indicating that iron was still present, but some was ferric iron rather than ferrous iron. The presence of iron is consistent with the low pH of these samples. The supernatants of the iron+cement tests were not significantly colored, which is consistent with the higher pH since neither ferrous nor ferric iron is soluble above pH ~ 4.5.

3.3 Leach Test Results

The results of the leach tests are shown in Table 6. The maximum amount of leachable metal is included in the Table; it was calculated by multiplying the concentration in the SPLP extract by 20 because the SPLP test uses a 1 to 20 soil to liquid ratio.

Treatment with CaSx dramatically reduced leachability of all of the metals compared to the control. Neither cadmium nor nickel were detected in SPLP extracts from any of the CaSx tests, indicating that after treatment, less than 2 mg/kg Cd and less than 4 mg/kg Ni

Table 6. Leach Test Results.

Analyte	Units	CaSx Tests					Fe(II) Tests				
		Control	Low Dose	Low Dose + Cement	High Dose	High Dose + Cement	Control	Low Dose	Low Dose + Cement	High Dose	High Dose + Cement
Metals (SPLP)											
Cr(VI)	mg/L	340*	0.23*	0.25*	0.19*	0.065*	450*	< 0.020*	< 0.020*	< 0.020*	< 0.020*
Arsenic	mg/L	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Cadmium	mg/L	8.2	< 0.10	< 0.10	< 0.10	< 0.10	7.8	8	< 0.10	6.4	5.2
Chromium	mg/L	470	3.5	0.32	0.18	< 0.10	460	140	< 0.10	140	< 0.10
Nickel	mg/L	120	< 0.2	< 0.2	< 0.2	< 0.2	110	100	< 0.2	85	50
Maximum Amount of Leachable Metal (based on SPLP Results)*											
Cr(VI)	mg/kg	6,800	4.6	5	3.8	1.3	9,000	< 0.4	< 0.4	< 0.4	< 0.4
Arsenic	mg/kg	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1
Cadmium	mg/kg	164	< 2	< 2	< 2	< 2	156	160	< 2	128	104
Chromium	mg/kg	9,400	70	6.4	3.6	< 2	9,200	2,800	< 2	2,800	< 2
Nickel	mg/kg	2,400	< 4	< 4	< 4	< 4	2,200	2,000	< 4	1,700	1,000

* Note - Vanadium, iron, molybdenum and mercury may enhance the absorption measured at the same wavelength as Cr(VI).

** Calculated by multiplying the SPLP value by 20.

are leachable. This is in contrast to the control test in which 164 mg/kg Cd and 2,400 mg/kg nickel were leachable. A small amount of Cr(VI) was present in the SPLP tests, but these values may be high to matrix interference. Matrix interference is likely because they indicated that 1.3 to 5 mg/kg Cr(VI) is leachable, but Cr(VI) was not detected in most post-treatment samples (see Section 3.2.1). Arsenic was not detected in any SPLP sample indicating that less than 1 mg/kg is leachable.

Treatment with iron (with or without added cement), reduced leaching of Cr(VI), but not necessarily other metals. Cr(VI) was not detected in the SPLP extract from any iron treatment, indicating that less than 0.4 mg/kg Cr(VI) is leachable after treatment. Total chromium was present in the iron-only samples due to low pH, but it was trivalent chromium, not Cr(VI). Cd and Ni were highly soluble in both of the iron only-treatments, because of the low pH (see Section 3.2.2). However, addition of cement to the low dose test increased the pH to near neutral, which prevented leaching (neither Cd nor Ni was detected in the SPLP extract). Addition of cement to the high dose test did not reduce leaching significantly because it did not raise the pH significantly. It is likely that a higher dose of cement in this test would raise the pH to neutral and also prevent leaching. Arsenic was not detected in any SPLP sample indicating that less than 1 mg/kg is leachable.

It must be emphasized that although the SPLP results indicate most treatments will significantly reduce the leachability of metals, a small fraction of each metal may still be leachable since metals may be present in SPLP extracts below the reporting limit. The impact to groundwater will depend upon many factors including the rate of infiltration of water through the treated soil, the rate of desorption of the metal from impacted soil, the ability of the metal to sorbed to um-impacted/untreated soil (between the treatment zone and the water table), and the degree of mixing between leachate and groundwater. For example, if all of the remaining leachable metals leached at once and groundwater is stagnant, then groundwater may be significantly impacted even though very little leachable metal is present. If, however, the remaining leachable metals leached slowly over time and groundwater is fast moving, impacts to groundwater may be too small to detect.

3.4 Soil Reductant Demand

The results of the soil reductant demand tests are shown in Figure 6. The soil consumed the equivalent of 6.9-7.2 mL of full strength (29%) CaSx per kg soil, about 0.1 mL/kg of which is due to the Cr(VI) in the untreated soil. Thus, if excess CaSx is applied, some may be consumed by soil before reaching groundwater. Note that additional CaSx will be consumed if it comes in contact with air.

3.5 Buffering Curve

The buffering curves are shown in Figure 7. Soil exhibits very little buffering ability. Addition of 1 mmol H+/kg soil initially decreased the pH to 6.13, which rebounded to 6.7

within7 days. However, addition of 10 mmol H+/kg soil decreased the pH to 3.3, which only rebounded to 4.4 within 7 days. Care must therefore be taken if using ferrous sulfate, since the acid added as part of the reagent will not be readily neutralized by the soil (though some may be neutralized by groundwater).

	(mL CaSx/L solution) Remaining				(mL CaSx/kg soil) Consumed	
Time (day)	Control (Low)	Control (High)	CaSx (Low)	CaSx (High)	CaSx (Low)	CaSx (High)
0	10	20	10	20		
0.25	9.8	20	7.1	17	3.5	2.8
1	10	20	6.3	16	4.8	4.8
2	10	20	5.9	16	5.3	4.8
7	10.0	20	4.6	14	6.9	7.2

CaSx results are the average of two replicates.

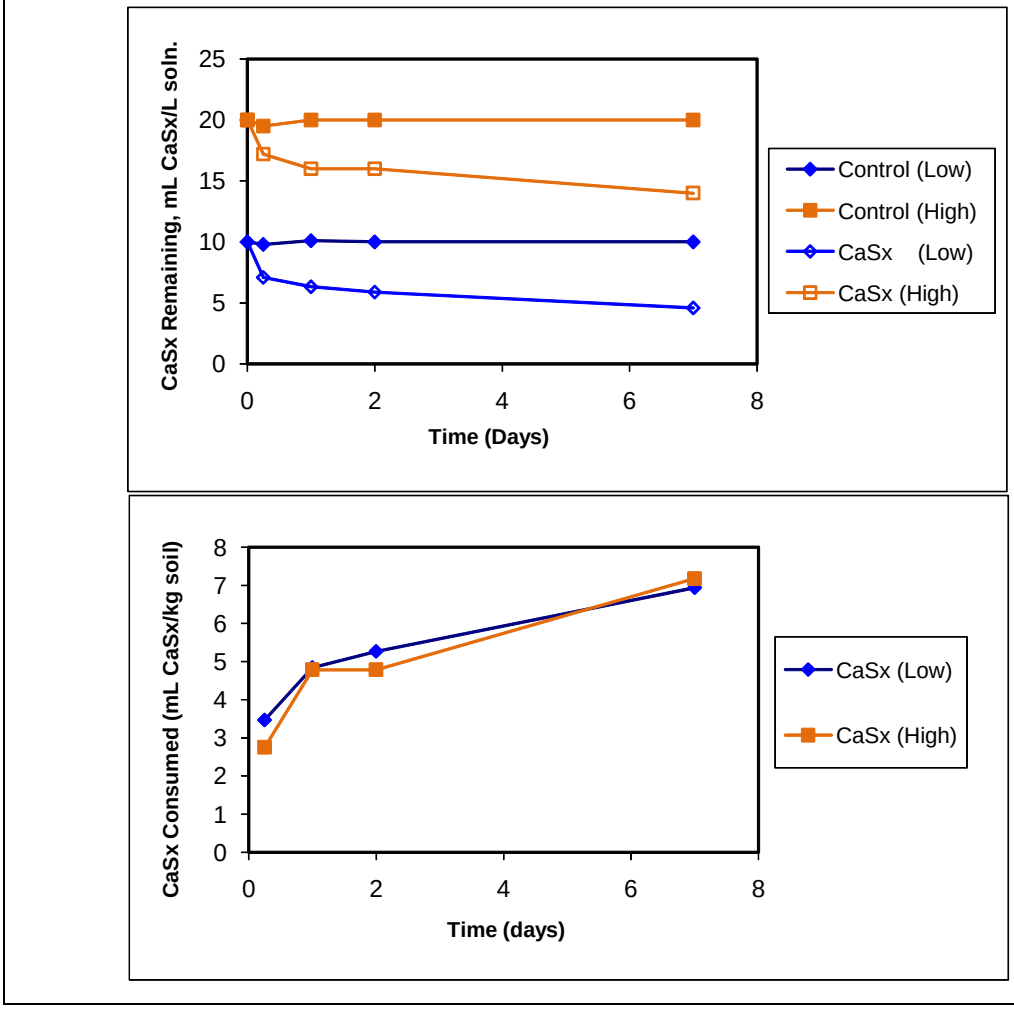


Figure 6. Soil Reductant Demand.

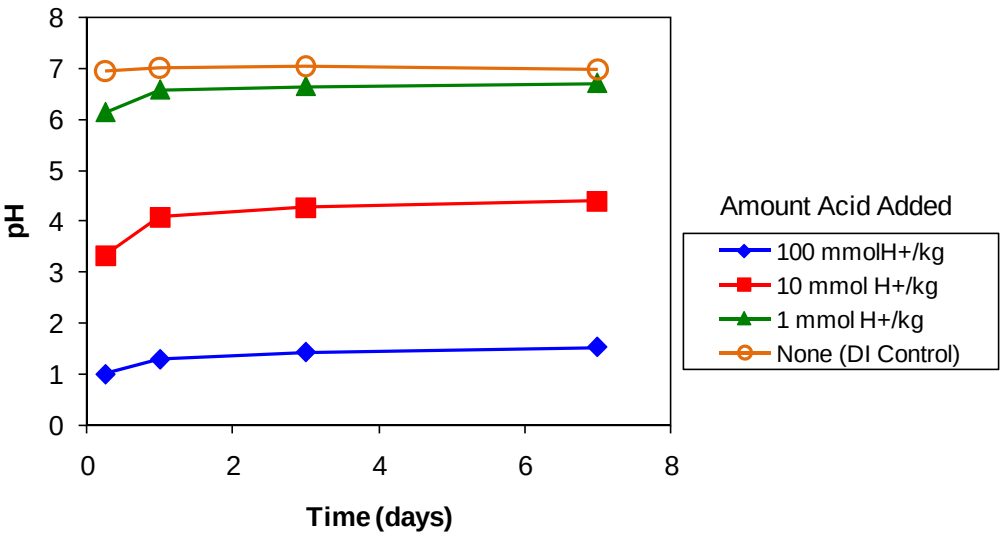


Figure 7. Soil Buffering Curves. (Unspiked Soil.)

4.0 ENGINEERING CONSIDERATIONS

Based on the results of this study, it is highly likely that CaSx with or without added cement and Fe(II) with added cement could meet the goals of treating Cr(VI) without adversely impacting groundwater, if the technology is properly implemented. This section describes some of the engineering considerations that should be taken into account when evaluating the implementability of each technology. It must be noted that these considerations are provided by PRIMA based on the results of the bench-scale study and do not necessarily reflect all engineering considerations associated with these technologies.

General

- The lowest reasonable dose of each reagent should be added to minimize the potential for excess reagent to leach into groundwater. In this study, a stoichiometric dose was generally effective. However, the Cr(VI) concentrations were very high and the effective of amount of excess reagent needed for much lower concentrations of Cr(VI) was not evaluated.

- Reagents should be emplaced as far above the water table as possible to allow the maximum amount of soil to sorb/react with an excess reagent or leached metals.

CaSx Reduction

- CaSx has a strong sulfide odor.

- Temperature increased and soil dried out when CaSx was applied to spiked soil. However, this behavior may depend upon the concentration of Cr(VI), since it was not observed when unspiked soil was treated with CaSx.

- CaSx decomposed rapidly when a low dose was applied to spiked soil, drying the soil out and rendering mixing difficult. This may necessitate the addition of additional water in some cases to enable good mixing before CaSx completely decomposes.

- Air-injection (or other method) may be needed to fully oxidize excess CaSx. CaSx was completely consumed very quickly when added to spiked soil, but much more slowly when added to unspiked soil (probably due to slow oxidation by air). Although some CaSx should react with soil (the SRD was approximately 7 mL CaSx soln/kg soil), injection of air may be needed to completely decompose any excess.

Fe(II) Treatment

- Fe(II) should be used only in conjunction with cement in order to ensure at least near-neutral pH after treatment. Fe(II) alone effectively decreased concentrations of Cr(VI), but because of low pH, most other metals were highly leachable.

- If possible, Fe(II) should be dissolved in acid before being mixed with soil in order to maximize contact between iron and Cr(VI). However, if the amount of iron needed is very high (as in this study), then the Fe(II) may need to be added dry, since the solubility of $FeSO_4 \cdot 7H_2O$ is on the order of 250 g/L. Water will also need to be added to enable dissolution of the Fe(II) salt.

- Fe(II) must be added as a acidic solution (or with acidified make-up water, if added dry) to prevent pre-mature oxidation of ferrous iron to ferric iron.

- The cement dose must be optimized to ensure the final pH is adequate. Addition of 5% cement increased the pH to near-neutral in the low dose iron test, but only to 4.5 in the high dose test, due to the ability of $FeSO_4 \cdot 7H_2O$ to acidify soil.

5.0 CONCLUSIONS

Both CaSx and Fe(II) effectively reduced Cr(VI) concentrations in soil. All of the CaSx treatments and the Fe(II) low dose with cement treatment also dramatically reduced the leachability of metals, indicating that these can potentially be used to treat Cr(VI) *in situ* without adversely affecting groundwater, if properly applied. Several factors may influence the implementability and/or practicality of these treatments, including the reactivity and odor of CaSx, the need to add Fe(II) in an acidic solution and follow treatment with cement.

Based on the results of this study, PRIMA recommends that both CaSx and Fe(II) be considered for *in situ* remediation of Cr(VI) at this site. The engineering considerations discussed in Section 4.0 should be carefully evaluated by Kleinfelder during this process. Additional testing may be needed to assess the reactivity of CaSx versus Cr(VI) concentration, determine how far excess water may percolate (if the distance above the water table is sufficiently great, water from the treatment zone may not reach groundwater), and assess the ability of untreated soil below the treatment zone to sorb any leached metals.

APPENDIX A
(Chain of Custody)

CHAIN OF CUSTODY

PRIMA Environmental, Inc.
5070 Robert J Mathews Parkway, Suite 300, El Dorado Hills, CA 95762
(916) 939-7300 * (916) 939-7398 FAX

Project Manager: Michael Cerante, KLEINfelder
Project Name: Former Excello Plating Co, Inc.
Job Number:
Date:
Phone:
Email:

Lab Name: PRIMA Environmental Inc.
Address: 5070 Robert J. Mathews Pkwy Ste 300
El Dorado Hills, CA 95762
Phone: (916) 939-7300
Turnaround Time:

SAMPLE ID	Date	Time	Matrix	# containers	Analysis	Comments
KLF1-Bulk-1	12/8/09			1	5gal. Bucket (approx. wt = 48 lbs)	

Special Instructions	Relinquished by:		Received by:
NO Chain of Custody Provide by Kleinfelder.	Company	Date 12/8/09	Company PRIMA ENVIRONMENTAL
	Printed Name	Time 1400	Printed Name Kelly Tripp
	Signature		Signature Kelly Tripp
	Relinquished by:		Received by:
	Company	Date	Company
	Printed Name	Time	Printed Name
	Signature		Signature

APPENDIX B
(Analytical Reports)

Alpha Analytical, Inc.

255 Glendale Ave. • Suite 21 • Sparks, Nevada 89431-5778
(775) 355-1044 • (775) 355-0406 FAX • 1-800-283-1183

ANALYTICAL REPORT

Prima Environmental
5070 Robert J. Mathews Parkway
El Dorado Hills, CA 95762

Attn: Cindy Schreier
Phone: (916) 939-7300
Fax: (916) 393-7398
Date Received : 12/09/09

Job: Kleinfelder-EPC

Metals by ICPMS
EPA Method SW6020 / SW6020A

Parameter		Concentration	Reporting Limit	Date Extracted	Date Analyzed
Client ID: **KF-EPC-SOIL**					
Lab ID : PES09120940-01A	Chromium (Cr)	1.5	0.10 mg/L	12/10/09 10:36	12/10/09
Date Sampled 12/08/09 00:00	Nickel (Ni)	ND	0.20 mg/L	12/10/09 10:36	12/10/09
	Arsenic (As)	ND	0.10 mg/L	12/10/09 10:36	12/10/09
	Cadmium (Cd)	ND	0.10 mg/L	12/10/09 10:36	12/10/09

This analysis was performed on an SPLP extract.
This replaces the report signed 12/10/09 due to a change in the analyte list, per client request.

ND = Not Detected

Roger Scholl Randy Gardner Walter Hinchman

Roger L. Scholl, Ph.D., Laboratory Director • • Randy Gardner, Laboratory Manager • • Walter Hinchman, Quality Assurance Officer
Sacramento, CA • (916) 366-9089 / Las Vegas, NV • (702) 736-7522 / info@alpha-analytical.com
Alpha certifies that the test results meet all requirements of NELAC unless footnoted otherwise.
Alpha Analytical, Inc. currently holds appropriate and available California (#2019) and NELAC (01154CA) certifications for the data reported. Test results relate only to reported samples.

12/17/09
Report Date

Alpha Analytical, Inc.

255 Glendale Ave. • Suite 21 • Sparks, Nevada 89431-5778
(775) 355-1044 • (775) 355-0406 FAX • 1-800-283-1183

ANALYTICAL REPORT

Prima Environmental
5070 Robert J. Mathews Parkway
El Dorado Hills, CA 95762

Attn: Cindy Schreier
Phone: (916) 939-7300
Fax: (916) 393-7398
Date Received : 12/09/09

Job: Kleinfelder-EPC

Chromium VI
EPA Method 7196A/SM3500Cr-D

Parameter		Concentration	Reporting Limit	Date Extracted	Date Analyzed
Client ID: **KF-EPC-SOIL**					
Lab ID : PES09120940-01A	Chromium (Cr), Hexavalent (+6)	1.5	0.20 mg/L	12/10/09	12/10/09
Date Sampled 12/08/09 00:00					

Note: Vanadium, Iron, Molybdenum, and Mercury may enhance the absorption measured at the same wavelength as Cr+6.

This analysis was performed on an SPLP extract.

Roger Scholl Randy Gardner Walter Hinchman

Roger L. Scholl, Ph.D., Laboratory Director • • Randy Gardner, Laboratory Manager • • Walter Hinchman, Quality Assurance Officer
Sacramento, CA • (916) 366-9089 / Las Vegas, NV • (702) 736-7522 / info@alpha-analytical.com
Alpha certifies that the test results meet all requirements of NELAC unless footnoted otherwise.
Alpha Analytical, Inc. currently holds appropriate and available California (#2019) and NELAC (01154CA) certifications for the data reported. Test results relate only to reported samples.

12/10/09
Report Date

Alpha Analytical, Inc.

255 Glendale Ave. • Suite 21 • Sparks, Nevada 89431-5778
(775) 355-1044 • (775) 355-0406 FAX • 1-800-283-1183

ANALYTICAL REPORT

Prima Environmental
5070 Robert J. Mathews Parkway
El Dorado Hills, CA 95762

Attn: Cindy Schreier
Phone: (916) 939-7300
Fax: (916) 393-7398
Date Received : 12/09/09

Job: Kleinfelder-EPC

Metals by ICPMS
EPA Method SW6020 / SW6020A

Parameter		Concentration	Reporting Limit	Date Extracted	Date Analyzed
Client ID: **KF-EPC-SOIL**					
Lab ID : PES09120940-01A	Chromium (Cr)	99	1.0 mg/Kg	12/09/09 10:43	12/09/09
Date Sampled 12/08/09 00:00	Nickel (Ni)	7.3	2.0 mg/Kg	12/09/09 10:43	12/09/09
	Arsenic (As)	1.8	1.0 mg/Kg	12/09/09 10:43	12/09/09
	Cadmium (Cd)	ND	1.0 mg/Kg	12/09/09 10:43	12/09/09

Sample results were calculated on a wet weight basis.
ND = Not Detected

Roger Scholl Randy Gardner Walter Hinchman

Roger L. Scholl, Ph.D., Laboratory Director • • Randy Gardner, Laboratory Manager • • Walter Hinchman, Quality Assurance Officer
Sacramento, CA • (916) 366-9089 / Las Vegas, NV • (702) 736-7522 / info@alpha-analytical.com
Alpha certifies that the test results meet all requirements of NELAC unless footnoted otherwise.
Alpha Analytical, Inc. currently holds appropriate and available California (#2019) and NELAC (01154CA) certifications for the data reported. Test results relate only to reported samples.

12/10/09
Report Date

Alpha Analytical, Inc.

255 Glendale Ave. • Suite 21 • Sparks, Nevada 89431-5778

(775) 355-1044 • (775) 355-0406 FAX • 1-800-283-1183

Date: *18-Dec-09*

QC Summary Report

Work Order: 09120940

Method Blank

Type: **MBLK** Test Code: **EPA Method SW6020 / SW6020A**

File ID: **120909.B\076SMPL.D** Batch ID: **23213** Analysis Date: **12/09/2009 18:54**

Sample ID: **MB-23213** Units : **mg/L** Run ID: **ICP/MS_091209B** Prep Date: **12/09/2009 11:13**

Analyte	Result	PQL	SpkVal	SpkRefVal	%REC	LCL(ME)	UCL(ME)	RPDRefVal	%RPD(Limit)	Qual
Chromium (Cr)	ND	0.005								
Nickel (Ni)	ND	0.01								
Arsenic (As)	ND	0.005								
Cadmium (Cd)	ND	0.005								

Laboratory Control Spike

Type: **LCS** Test Code: **EPA Method SW6020 / SW6020A**

File ID: **120909.B\077_LCS.D** Batch ID: **23213** Analysis Date: **12/09/2009 19:00**

Sample ID: **LCS-23213** Units : **mg/L** Run ID: **ICP/MS_091209B** Prep Date: **12/09/2009 11:13**

Analyte	Result	PQL	SpkVal	SpkRefVal	%REC	LCL(ME)	UCL(ME)	RPDRefVal	%RPD(Limit)	Qual
Chromium (Cr)	0.255	0.005	0.25		91	80	124			
Nickel (Ni)	0.247	0.01	0.25		99	83	123			
Arsenic (As)	0.229	0.005	0.25		91	85	118			
Cadmium (Cd)	0.24	0.005	0.25		96	85	121			

Sample Matrix Spike

Type: **MS** Test Code: **EPA Method SW6020 / SW6020A**

File ID: **120909.B\082SMPL.D** Batch ID: **23213** Analysis Date: **12/09/2009 19:28**

Sample ID: **09120952-01AMS** Units : **mg/L** Run ID: **ICP/MS_091209B** Prep Date: **12/09/2009 11:13**

Analyte	Result	PQL	SpkVal	SpkRefVal	%REC	LCL(ME)	UCL(ME)	RPDRefVal	%RPD(Limit)	Qual
Chromium (Cr)	0.308	0.005	0.25	0.007308	120	70	133			
Nickel (Ni)	0.307	0.01	0.25	0.01836	115	70	132			
Arsenic (As)	0.243	0.005	0.25	0	97	70	130			
Cadmium (Cd)	0.245	0.005	0.25	0	98	70	130			

Sample Matrix Spike Duplicate

Type: **MSD** Test Code: **EPA Method SW6020 / SW6020A**

File ID: **120909.B\083SMPL.D** Batch ID: **23213** Analysis Date: **12/09/2009 19:33**

Sample ID: **09120952-01AMSD** Units : **mg/L** Run ID: **ICP/MS_091209B** Prep Date: **12/09/2009 11:13**

Analyte	Result	PQL	SpkVal	SpkRefVal	%REC	LCL(ME)	UCL(ME)	RPDRefVal	%RPD(Limit)	Qual
Chromium (Cr)	0.277	0.005	0.25	0.007308	108	70	133	0.308	10.5(20)	
Nickel (Ni)	0.275	0.01	0.25	0.01836	103	70	132	0.3071	10.9(20)	
Arsenic (As)	0.245	0.005	0.25	0	98	70	130	0.2426	1.0(20)	
Cadmium (Cd)	0.254	0.005	0.25	0	101	70	130	0.2451	3.4(20)	

Comments:

Calculations are based off of raw (non-rounded) data. However, for reporting purposes, all QC data is rounded to three significant figures. Therefore, hand calculated values may differ slightly.

Alpha Analytical, Inc.

255 Glendale Ave. • Suite 21 • Sparks, Nevada 89431-5778

(775) 355-1044 • (775) 355-0406 FAX • 1-800-283-1183

Date: *14-Dec-09*

QC Summary Report

Work Order: 09120940

Method Blank

Type **MBLK** Test Code: **EPA Method 7196A/SM3500Cr-D**

File ID: Batch ID: **W1210CR** Analysis Date: **12/10/2009 12:01**

Sample ID: **MBLK-W1210CR** Units : **mg/L** Run ID: **WETLAB_091210F** Prep Date: **12/10/2009 12:01**

Analyte	Result	PQL	SpkVal	SpkRefVal	%REC	LCL(ME)	UCL(ME)	RPDRefVal	%RPD(Limit)	Qual
Chromium (Cr), Hexavalent (+6)	ND	0.02								

Laboratory Control Spike

Type **LCS** Test Code: **EPA Method 7196A/SM3500Cr-D**

File ID: Batch ID: **W1210CR** Analysis Date: **12/10/2009 12:00**

Sample ID: **LCS-W1210CR** Units : **mg/L** Run ID: **WETLAB_091210F** Prep Date: **12/10/2009 12:00**

Analyte	Result	PQL	SpkVal	SpkRefVal	%REC	LCL(ME)	UCL(ME)	RPDRefVal	%RPD(Limit)	Qual
Chromium (Cr), Hexavalent (+6)	0.326	0.02	0.3		109	85	115			

Sample Matrix Spike

Type **MS** Test Code: **EPA Method 7196A/SM3500Cr-D**

File ID: Batch ID: **W1210CR** Analysis Date: **12/10/2009 12:03**

Sample ID: **09120940-01AMS** Units : **mg/L** Run ID: **WETLAB_091210F** Prep Date: **12/10/2009 12:03**

Analyte	Result	PQL	SpkVal	SpkRefVal	%REC	LCL(ME)	UCL(ME)	RPDRefVal	%RPD(Limit)	Qual
Chromium (Cr), Hexavalent (+6)	4.45	0.2	3	1.517	98	85	115			

Sample Matrix Spike Duplicate

Type **MSD** Test Code: **EPA Method 7196A/SM3500Cr-D**

File ID: Batch ID: **W1210CR** Analysis Date: **12/10/2009 12:04**

Sample ID: **09120940-01AMSD** Units : **mg/L** Run ID: **WETLAB_091210F** Prep Date: **12/10/2009 12:04**

Analyte	Result	PQL	SpkVal	SpkRefVal	%REC	LCL(ME)	UCL(ME)	RPDRefVal	%RPD(Limit)	Qual
Chromium (Cr), Hexavalent (+6)	4.45	0.2	3	1.517	98	85	115	4.445	0.1(20)	

Comments:

Calculations are based off of raw (non-rounded) data. However, for reporting purposes, all QC data is rounded to three significant figures. Therefore, hand calculated values may differ slightly.

Alpha Analytical, Inc.

255 Glendale Ave. • Suite 21 • Sparks, Nevada 89431-5778

(775) 355-1044 • (775) 355-0406 FAX • 1-800-283-1183

Date: *14-Dec-09*

QC Summary Report

Work Order: 09120940

Method Blank

Type **MBLK** Test Code: **EPA Method SW6020 / SW6020A**

File ID: **120909.B\031SMPL.D** Batch ID: **23205** Analysis Date: **12/09/2009 14:38**

Sample ID: **MB-23205** Units : **mg/Kg** Run ID: **ICP/MS_091209A** Prep Date: **12/08/2009 00:08**

Analyte	Result	PQL	SpkVal	SpkRefVal	%REC	LCL(ME)	UCL(ME)	RPDRefVal	%RPD(Limit)	Qual
Chromium (Cr)	ND	1								
Nickel (Ni)	ND	2								
Arsenic (As)	ND	1								
Cadmium (Cd)	ND	1								

Laboratory Control Spike

Type **LCS** Test Code: **EPA Method SW6020 / SW6020A**

File ID: **120909.B\032_LCS.D** Batch ID: **23205** Analysis Date: **12/09/2009 14:44**

Sample ID: **LCS-23205** Units : **mg/Kg** Run ID: **ICP/MS_091209A** Prep Date: **12/08/2009 00:08**

Analyte	Result	PQL	SpkVal	SpkRefVal	%REC	LCL(ME)	UCL(ME)	RPDRefVal	%RPD(Limit)	Qual
Chromium (Cr)	25.5	1	25		102	75	120			
Nickel (Ni)	25.7	2	25		103	80	124			
Arsenic (As)	25	1	25		100	80	120			
Cadmium (Cd)	25.7	1	25		103	80	120			

Sample Matrix Spike

Type **MS** Test Code: **EPA Method SW6020 / SW6020A**

File ID: **120909.B\036SMPL.D** Batch ID: **23205** Analysis Date: **12/09/2009 15:06**

Sample ID: **09110456-03AMS** Units : **mg/Kg** Run ID: **ICP/MS_091209A** Prep Date: **12/08/2009 00:08**

Analyte	Result	PQL	SpkVal	SpkRefVal	%REC	LCL(ME)	UCL(ME)	RPDRefVal	%RPD(Limit)	Qual
Chromium (Cr)	23	1	25	1.572	86	50	150			
Nickel (Ni)	29.5	2	25	7.104	90	50	149			
Arsenic (As)	27.2	1	25	1.894	101	60	130			
Cadmium (Cd)	26.3	1	25	0	105	70	130			

Sample Matrix Spike Duplicate

Type **MSD** Test Code: **EPA Method SW6020 / SW6020A**

File ID: **120909.B\037SMPL.D** Batch ID: **23205** Analysis Date: **12/09/2009 15:12**

Sample ID: **09110456-03AMSD** Units : **mg/Kg** Run ID: **ICP/MS_091209A** Prep Date: **12/08/2009 00:08**

Analyte	Result	PQL	SpkVal	SpkRefVal	%REC	LCL(ME)	UCL(ME)	RPDRefVal	%RPD(Limit)	Qual
Chromium (Cr)	24.7	1	25	1.572	92	50	150	22.96	7.1(20)	
Nickel (Ni)	29.9	2	25	7.104	91	50	149	29.52	1.3(20)	
Arsenic (As)	26.2	1	25	1.894	97	60	130	27.21	3.9(20)	
Cadmium (Cd)	24.7	1	25	0	99	70	130	26.25	6.1(20)	

Comments:

Calculations are based off of raw (non-rounded) data. However, for reporting purposes, all QC data is rounded to three significant figures. Therefore, hand calculated values may differ slightly.

Billing Information :

CHAIN-OF-CUSTODY RECORD

CARUSH! Page: 1 of 1

Alpha Analytical, Inc.
255 Glendale Avenue, Suite 21 Sparks, Nevada 89431-5778
TEL: (775) 355-1044 FAX: (775) 355-0406

WorkOrder : PES09120940

Report Due By : 5:00 PM On : 09-Dec-09

Client:
Prima Environmental
5070 Robert J. Mathews Parkway
Suite 300
El Dorado Hills, CA 95762

Report Attention	Phone Number	EMail Address
Cindy Schreier	(916) 939-7300 x	data@primaenvironmental.com

EDD Required : **No**

Sampled by : Kelly Tripp

PO :

Client's COC # : 27297 Job : Kleinfelder-EPC

Cooler Temp	Samples Received	Date Printed
4 °C	09-Dec-09	09-Dec-09

QC Level : S3 = Final Rpt, MBLK, LCS, MS/MSD With Surrogates

Alpha Sample ID	Client Sample ID	Matrix	Collection Date	No. of Bottles Alpha	Sub	TAT	Requested Tests METALS_AQ	METALS_CR6_W	METALS_SO						Sample Remarks
PES09120940-01A	KF-EPC-SOIL	SO	12/08/09 00:00	1	0	1	As,Cr,Ni	Cr6+	As,Cd,Cr,Ni						SPLP Extract

Comments: Security seals intact. Frozen Ice. No sample time provided. ASAP TAT. SPLP as soon as possible due to 18 hr processing time. :

	Signature	Print Name	Company	Date/Time
Logged in by:		Cheryl Gamble	Alpha Analytical, Inc.	12/9/09 10:07

NOTE: Samples are discarded 60 days after results are reported unless other arrangements are made. Hazardous samples will be returned to client or disposed of at client expense.
The report for the analysis of the above samples is applicable only to those samples received by the laboratory with this COC. The liability of the laboratory is limited to the amount paid for the report.
Matrix Type : AQ(Aqueous) AR(Air) SO(Soil) WS(Waste) DW(Drinking Water) OT(Other) Bottle Type: L-Liter V-Voa S-Soil Jar O-Orbo T-Tedlar B-Brass P-Plastic OT-Other

Billing Information:

Name

Address

C

Pl

PRIMA ENVIRONMENTAL, Inc.
5070 Robert J. Mathews Parkway, Suite 300
El Dorado Hills, CA 95762
PH: 916-939-7300
FAX: 916-939-7398

Alpha Analytical, Inc.
255 Glendale Avenue, Suite 21
Sparks, Nevada 89431-5778
Phone (775) 355-1044
Fax (775) 355-0406

Samples Collected From Which State? AZ ___ CA ___ NV ___ WA ___ ID ___ OR ___ OTHER ___

27297

Page # 1 of 1

P.O. # | Job# Kleinfelder-EPC

EMail Address: data@primaenvironmental.com

City, State, Zip | Phone # | Fax #

Report Attention: CINDY SCHREIER

Sampled by: KT

Analyses Required: Metals | SPLP

Required QC Level? I II III IV

EDD / EDF? YES ___ NO ___

Global ID # ___

Time Sampled	Date Sampled	Matrix* See Key Below	Lab ID Number (Office Use Only)	Sample Description	TAT	Field Filtered	Total and type of containers ** See below	Metals	SPLP	REMARKS
	12/8	SO	PES09120940-01A	KF-EPC-SOIL	24hr		1-SO	X	X	Metals = Arsenic, Cadmium, Chromium, Nickel SPLP = Cr(VI), Arsenic, Chromium, Nickel

ADDITIONAL INSTRUCTIONS: SPLP as soon as possible due to 18hr processing time.

	Signature	Print Name	Company	Date	Time
Relinquished by	Kelly Tripp	Kelly Tripp	PRIMA	12/8	1320
Received by	Lisa deSilva	Lisa deSilva	ALPHA	12/8/09	1320
Relinquished by	Lisa deSilva	Lisa deSilva	ALPHA	12-8-09	1320
Received by	Cheryl Gamble	Cheryl Gamble	Alpha	12/9/09	10:06
Relinquished by					
Received by					

*Key: AQ - Aqueous SO - Soil WA - Waste OT - Other AR - Air **: L-Liter V-Voa S-Soil Jar O-Orbo T-Tedlar B-Brass P-Plastic OT-Other

NOTE: Samples are discarded 60 days after results are reported unless other arrangements are made. Hazardous samples will be returned to client or disposed of at client expense. The report for the analysis of the above samples is applicable only to those samples received by the laboratory with this coc. The liability of the laboratory is limited to the amount paid for the report.

Alpha Analytical, Inc.

255 Glendale Ave. • Suite 21 • Sparks, Nevada 89431-5778
(775) 355-1044 • (775) 355-0406 FAX • 1-800-283-1183

ANALYTICAL REPORT

Prima Environmental
5070 Robert J. Mathews Parkway
El Dorado Hills, CA 95762

Attn: Cindy Schreier
Phone: (916) 939-7300
Fax: (916) 393-7398
Date Received : 12/18/09

Job: Kleinfelder-EPC

Metals by ICPMS
EPA Method SW6020 / SW6020A

	Parameter	Concentration	Reporting Limit	Date Extracted	Date Analyzed
Client ID: **KF-EPC-Spiked Soil**					
Lab ID : PES09121821-01A	Chromium (Cr)	480	5.0 mg/L	12/19/09 10:49	12/19/09
Date Sampled 12/17/09 11:00	Nickel (Ni)	130	0.20 mg/L	12/19/09 10:49	12/19/09
	Arsenic (As)	ND	0.050 mg/L	12/19/09 10:49	12/19/09
	Cadmium (Cd)	9.0	0.10 mg/L	12/19/09 10:49	12/19/09
Client ID: **CaSx-Con**					
Lab ID : PES09121821-02A	Chromium (Cr)	470	5.0 mg/L	12/19/09 10:49	12/21/09
Date Sampled 12/17/09 12:00	Nickel (Ni)	120	0.20 mg/L	12/19/09 10:49	12/19/09
	Arsenic (As)	ND	0.050 mg/L	12/19/09 10:49	12/19/09
	Cadmium (Cd)	8.2	0.10 mg/L	12/19/09 10:49	12/19/09
Client ID: **CaSx-Low**					
Lab ID : PES09121821-03A	Chromium (Cr)	3.5	0.10 mg/L	12/19/09 10:49	12/19/09
Date Sampled 12/17/09 12:00	Nickel (Ni)	ND	0.20 mg/L	12/19/09 10:49	12/19/09
	Arsenic (As)	ND	0.050 mg/L	12/19/09 10:49	12/19/09
	Cadmium (Cd)	ND	0.10 mg/L	12/19/09 10:49	12/19/09
Client ID: **CaSx-Low-cem**					
Lab ID : PES09121821-04A	Chromium (Cr)	0.32	0.10 mg/L	12/19/09 10:49	12/19/09
Date Sampled 12/17/09 12:00	Nickel (Ni)	ND	0.20 mg/L	12/19/09 10:49	12/19/09
	Arsenic (As)	ND	0.050 mg/L	12/19/09 10:49	12/19/09
	Cadmium (Cd)	ND	0.10 mg/L	12/19/09 10:49	12/19/09
Client ID: **CaSx-High**					
Lab ID : PES09121821-05A	Chromium (Cr)	0.18	0.10 mg/L	12/19/09 10:49	12/19/09
Date Sampled 12/17/09 12:00	Nickel (Ni)	ND	0.20 mg/L	12/19/09 10:49	12/19/09
	Arsenic (As)	ND	0.050 mg/L	12/19/09 10:49	12/19/09
	Cadmium (Cd)	ND	0.10 mg/L	12/19/09 10:49	12/19/09
Client ID: **CaSx-High-cem**					
Lab ID : PES09121821-06A	Chromium (Cr)	ND	0.10 mg/L	12/19/09 10:49	12/19/09
Date Sampled 12/17/09 12:00	Nickel (Ni)	ND	0.20 mg/L	12/19/09 10:49	12/19/09
	Arsenic (As)	ND	0.050 mg/L	12/19/09 10:49	12/19/09
	Cadmium (Cd)	ND	0.10 mg/L	12/19/09 10:49	12/19/09
Client ID: **Fe-Con**					
Lab ID : PES09121821-07A	Chromium (Cr)	460	5.0 mg/L	12/19/09 10:49	12/21/09
Date Sampled 12/17/09 12:00	Nickel (Ni)	110	0.20 mg/L	12/19/09 10:49	12/19/09
	Arsenic (As)	ND	0.050 mg/L	12/19/09 10:49	12/19/09
	Cadmium (Cd)	7.8	0.10 mg/L	12/19/09 10:49	12/19/09

Alpha Analytical, Inc.

255 Glendale Ave. • Suite 21 • Sparks, Nevada 89431-5778

(775) 355-1044 • (775) 355-0406 FAX • 1-800-283-1183

Client ID: **Fe-Low**					
Lab ID : PES09121821-08A	Chromium (Cr)	140	0.10 mg/L	12/19/09 10:49	12/19/09
Date Sampled 12/17/09 12:00	Nickel (Ni)	100	0.20 mg/L	12/19/09 10:49	12/19/09
	Arsenic (As)	ND	0.050 mg/L	12/19/09 10:49	12/19/09
	Cadmium (Cd)	8.0	0.10 mg/L	12/19/09 10:49	12/19/09
Client ID: **Fe-Low-cem**					
Lab ID : PES09121821-09A	Chromium (Cr)	ND	0.10 mg/L	12/19/09 10:49	12/19/09
Date Sampled 12/17/09 12:00	Nickel (Ni)	ND	0.20 mg/L	12/19/09 10:49	12/19/09
	Arsenic (As)	ND	0.050 mg/L	12/19/09 10:49	12/19/09
	Cadmium (Cd)	ND	0.10 mg/L	12/19/09 10:49	12/19/09
Client ID: **Fe-High**					
Lab ID : PES09121821-10A	Chromium (Cr)	140	0.10 mg/L	12/19/09 10:49	12/19/09
Date Sampled 12/17/09 12:00	Nickel (Ni)	85	0.20 mg/L	12/19/09 10:49	12/19/09
	Arsenic (As)	ND	0.050 mg/L	12/19/09 10:49	12/19/09
	Cadmium (Cd)	6.4	0.10 mg/L	12/19/09 10:49	12/19/09
Client ID: **Fe-High-cem**					
Lab ID : PES09121821-11A	Chromium (Cr)	ND	0.10 mg/L	12/19/09 10:49	12/19/09
Date Sampled 12/17/09 12:00	Nickel (Ni)	50	0.20 mg/L	12/19/09 10:49	12/19/09
	Arsenic (As)	ND	0.050 mg/L	12/19/09 10:49	12/19/09
	Cadmium (Cd)	5.2	0.10 mg/L	12/19/09 10:49	12/19/09

This analysis was performed on an SPLP extract.

This replaces the report signed 12/21/09 due to a change in the reporting limit for Arsenic, per client request.

ND = Not Detected

Roger Scholl Randy Gardner Walter Hinchman

Roger L. Scholl, Ph.D., Laboratory Director • • Randy Gardner, Laboratory Manager • • Walter Hinchman, Quality Assurance Officer

Sacramento, CA • (916) 366-9089 / Las Vegas, NV • (702) 736-7522 / info@alpha-analytical.com

Alpha certifies that the test results meet all requirements of NELAC unless footnoted otherwise.

Alpha Analytical, Inc. currently holds appropriate and available California (#2019) and NELAC (01154CA) certifications for the data reported. Test results relate only to reported samples.

2/22/09

Report Date

Alpha Analytical, Inc.

255 Glendale Ave. • Suite 21 • Sparks, Nevada 89431-5778
(775) 355-1044 • (775) 355-0406 FAX • 1-800-283-1183

ANALYTICAL REPORT

Prima Environmental
5070 Robert J. Mathews Parkway
El Dorado Hills, CA 95762

Attn: Cindy Schreier
Phone: (916) 939-7300
Fax: (916) 393-7398
Date Received : 12/18/09

Job: Kleinfelder-EPC

Chromium VI
EPA Method 7196A/SM3500Cr-D

Parameter	Concentration	Reporting Limit	Date Extracted	Date Analyzed
Client ID: **KF-EPC-Spiked Soil**				
Lab ID : PES09121821-01A Chromium (Cr), Hexavalent (+6)	290	10 mg/L	12/21/09 12:27	12/21/09 12:27
Date Sampled 12/17/09 11:00				
Client ID: **CaSx-Con**				
Lab ID : PES09121821-02A Chromium (Cr), Hexavalent (+6)	340	20 mg/L	12/21/09 12:27	12/21/09 12:27
Date Sampled 12/17/09 12:00				
Client ID: **CaSx-Low**				
Lab ID : PES09121821-03A Chromium (Cr), Hexavalent (+6)	0.23	0.020 mg/L	12/21/09 12:28	12/21/09 12:28
Date Sampled 12/17/09 12:00				
Client ID: **CaSx-Low-cem**				
Lab ID : PES09121821-04A Chromium (Cr), Hexavalent (+6)	0.25	0.020 mg/L	12/21/09 12:07	12/21/09 12:07
Date Sampled 12/17/09 12:00				
Client ID: **CaSx-High**				
Lab ID : PES09121821-05A Chromium (Cr), Hexavalent (+6)	0.19	0.020 mg/L	12/21/09 12:08	12/21/09 12:08
Date Sampled 12/17/09 12:00				
Client ID: **CaSx-High-cem**				
Lab ID : PES09121821-06A Chromium (Cr), Hexavalent (+6)	0.065	0.020 mg/L	12/21/09 12:13	12/21/09 12:13
Date Sampled 12/17/09 12:00				
Client ID: **Fe-Con**				
Lab ID : PES09121821-07A Chromium (Cr), Hexavalent (+6)	450	20 mg/L	12/21/09 12:28	12/21/09 12:28
Date Sampled 12/17/09 12:00				
Client ID: **Fe-Low**				
Lab ID : PES09121821-08A Chromium (Cr), Hexavalent (+6)	ND	0.020 mg/L	12/21/09 12:14	12/21/09 12:14
Date Sampled 12/17/09 12:00				
Client ID: **Fe-Low-cem**				
Lab ID : PES09121821-09A Chromium (Cr), Hexavalent (+6)	ND	0.020 mg/L	12/21/09 12:29	12/21/09 12:29
Date Sampled 12/17/09 12:00				
Client ID: **Fe-High**				
Lab ID : PES09121821-10A Chromium (Cr), Hexavalent (+6)	ND	0.020 mg/L	12/21/09 12:16	12/21/09 12:16
Date Sampled 12/17/09 12:00				
Client ID: **Fe-High-cem**				
Lab ID : PES09121821-11A Chromium (Cr), Hexavalent (+6)	ND	0.020 mg/L	12/21/09 12:30	12/21/09 12:30
Date Sampled 12/17/09 12:00				

Alpha Analytical, Inc.

255 Glendale Ave. • Suite 21 • Sparks, Nevada 89431-5778

(775) 355-1044 • (775) 355-0406 FAX • 1-800-283-1183

Note: Vanadium, Iron, Molybdenum, and Mercury may enhance the absorption measured at the same wavelength as Cr+6.
This analysis was performed on an SPLP extract.

ND = Not Detected

Roger Scholl Randy Gardner Walter Hinchman

Roger L. Scholl, Ph.D., Laboratory Director • • Randy Gardner, Laboratory Manager • • Walter Hinchman, Quality Assurance Officer

Sacramento, CA • (916) 366-9089 / Las Vegas, NV • (702) 736-7522 / info@alpha-analytical.com

Alpha certifies that the test results meet all requirements of NELAC unless footnoted otherwise.

Alpha Analytical, Inc. currently holds appropriate and available California (#2019) and NELAC (01154CA) certifications for the data reported. Test results relate only to reported samples.

12/21/09

Report Date

Alpha Analytical, Inc.

255 Glendale Ave. • Suite 21 • Sparks, Nevada 89431-5778
(775) 355-1044 • (775) 355-0406 FAX • 1-800-283-1183

ANALYTICAL REPORT

Prima Environmental
5070 Robert J. Mathews Parkway
El Dorado Hills, CA 95762

Attn: Cindy Schreier
Phone: (916) 939-7300
Fax: (916) 393-7398
Date Received : 12/18/09

Job: Kleinfelder-EPC

Metals by ICPMS
EPA Method SW6020 / SW6020A

Parameter		Concentration	Reporting Limit	Date Extracted	Date Analyzed
Client ID: **KF-EPC-Spiked Soil**					
Lab ID : PES09121821-01A	Chromium (Cr)	10,000	100 mg/Kg	12/18/09 12:40	12/19/09
Date Sampled 12/17/09 11:00	Nickel (Ni)	2,900	200 mg/Kg	12/18/09 12:40	12/19/09
	Arsenic (As)	1.8	1.0 mg/Kg	12/18/09 12:40	12/19/09
	Cadmium (Cd)	210	1.0 mg/Kg	12/18/09 12:40	12/19/09

Sample results were calculated on a wet weight basis.
ND = Not Detected

Roger Scholl Randy Gardner Walter Hinchman

Roger L. Scholl, Ph.D., Laboratory Director • • Randy Gardner, Laboratory Manager • • Walter Hinchman, Quality Assurance Officer
Sacramento, CA • (916) 366-9089 / Las Vegas, NV • (702) 736-7522 / info@alpha-analytical.com

Alpha certifies that the test results meet all requirements of NELAC unless footnoted otherwise.

Alpha Analytical, Inc. currently holds appropriate and available California (#2019) and NELAC (01154CA) certifications for the data reported. Test results relate only to reported samples.

✓
12/21/09
Report Date

CALIFORNIA LABORATORY SERVICES

3249 Fitzgerald Road Rancho Cordova, CA 95742

December 31, 2009

CLS Work Order #: CSL0979
COC #:

Reyna Vallejo
Alpha Analytical, Inc.-Sparks
255 Glendale Ave.; Suite 21
Sparks, NV 89431

Project Name: PES09121821

Enclosed are the results of analyses for samples received by the laboratory on 12/29/09 10:00. Samples were analyzed pursuant to client request utilizing EPA or other ELAP approved methodologies. I certify that the results are in compliance both technically and for completeness.

Analytical results are attached to this letter. Please call if we can provide additional assistance.

Sincerely,

James Liang, Ph.D.
Laboratory Director

CA DOHS ELAP Accreditation/Registration number 1233

CALIFORNIA LABORATORY SERVICES

Alpha Analytical, Inc.-Sparks
255 Glendale Ave.; Suite 21
Sparks, NV 89431

Project: PES09121821
Project Number: PES09121821
Project Manager: Reyna Vallejo

CLS Work Order #: CSL0979
COC #:

Conventional Chemistry Parameters by APHA/EPA Methods

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
PES09121821-01A (KF-EPC-Spiked Soil) (CSL0979-01) Soil Sampled: 12/17/09 11:00 Received: 12/29/09 10:00									
Hexavalent Chromium	**8900000**	250000	µg/kg	25000	CS09747	12/30/09	12/30/09	EPA 7199	
PES09121821-02A (CaSx-Con) (CSL0979-02) Soil Sampled: 12/17/09 12:00 Received: 12/29/09 10:00									
Hexavalent Chromium	**7700000**	200000	µg/kg	20000	CS09747	12/30/09	12/30/09	EPA 7199	
PES09121821-03A (CaSx-Low) (CSL0979-03) Soil Sampled: 12/17/09 12:00 Received: 12/29/09 10:00									
Hexavalent Chromium	**6200**	1000	µg/kg	100	CS09747	12/30/09	12/30/09	EPA 7199	
PES09121821-04A (CaSx-Low-cem) (CSL0979-04) Soil Sampled: 12/17/09 12:00 Received: 12/29/09 10:00									
Hexavalent Chromium	**3000**	1000	µg/kg	100	CS09747	12/30/09	12/30/09	EPA 7199	
PES09121821-05A (CaSx-High) (CSL0979-05) Soil Sampled: 12/17/09 12:00 Received: 12/29/09 10:00									
Hexavalent Chromium	ND	10	µg/kg	1	CS09747	12/30/09	12/30/09	EPA 7199	
PES09121821-06A (CaSx-High-cem) (CSL0979-06) Soil Sampled: 12/17/09 12:00 Received: 12/29/09 10:00									
Hexavalent Chromium	**1500**	500	µg/kg	50	CS09747	12/30/09	12/30/09	EPA 7199	
PES09121821-07A (Fe-Con) (CSL0979-07) Soil Sampled: 12/17/09 12:00 Received: 12/29/09 10:00									
Hexavalent Chromium	**7700000**	200000	µg/kg	20000	CS09747	12/30/09	12/30/09	EPA 7199	
PES09121821-08A (Fe-Low) (CSL0979-08) Soil Sampled: 12/17/09 12:00 Received: 12/29/09 10:00									
Hexavalent Chromium	ND	10	µg/kg	1	CS09747	12/30/09	12/30/09	EPA 7199	
PES09121821-09A (Fe-Low-cem) (CSL0979-09) Soil Sampled: 12/17/09 12:00 Received: 12/29/09 10:00									
Hexavalent Chromium	**410**	50	µg/kg	5	CS09747	12/30/09	12/30/09	EPA 7199	

CALIFORNIA LABORATORY SERVICES

12/31/09 11:26

Alpha Analytical, Inc.-Sparks	Project: PES09121821	
255 Glendale Ave.; Suite 21	Project Number: PES09121821	**CLS Work Order #: CSL0979**
Sparks, NV 89431	Project Manager: Reyna Vallejo	COC #:

Conventional Chemistry Parameters by APHA/EPA Methods

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
PES09121821-10A (Fe-High) (CSL0979-10) Soil	**Sampled: 12/17/09 12:00**			**Received: 12/29/09 10:00**					
Hexavalent Chromium	ND	10	µg/kg	1	CS09747	12/30/09	12/30/09	EPA 7199	
PES09121821-11A (Fe-High-cem) (CSL0979-11) Soil	**Sampled: 12/17/09 12:00**			**Received: 12/29/09 10:00**					
Hexavalent Chromium	ND	10	µg/kg	1	CS09747	12/30/09	12/30/09	EPA 7199	

Alpha Analytical, Inc.-Sparks	Project: PES09121821	
255 Glendale Ave.; Suite 21	Project Number: PES09121821	**CLS Work Order #: CSL0979**
Sparks, NV 89431	Project Manager: Reyna Vallejo	COC #:

Conventional Chemistry Parameters by APHA/EPA Methods - Quality Control

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch CS09747 - General Prep										
Blank (CS09747-BLK1)				Prepared & Analyzed: 12/30/09						
Hexavalent Chromium	ND	10	µg/kg							
LCS (CS09747-BS1)				Prepared & Analyzed: 12/30/09						
Hexavalent Chromium	46.2	10	µg/kg	50.0		92	80-120			
LCS Dup (CS09747-BSD1)				Prepared & Analyzed: 12/30/09						
Hexavalent Chromium	48.9	10	µg/kg	50.0		98	80-120	6	20	
Matrix Spike (CS09747-MS1)		**Source: CSL0979-05**		Prepared & Analyzed: 12/30/09						
Hexavalent Chromium	ND	10	µg/kg	50.0	ND		75-125			QM-5
Matrix Spike Dup (CS09747-MSD1)		**Source: CSL0979-05**		Prepared & Analyzed: 12/30/09						
Hexavalent Chromium	ND	10	µg/kg	50.0	ND		75-125		25	QM-5

Alpha Analytical, Inc.-Sparks	Project: PES09121821	
255 Glendale Ave.; Suite 21	Project Number: PES09121821	**CLS Work Order #: CSL0979**
Sparks, NV 89431	Project Manager: Reyna Vallejo	COC #:

Notes and Definitions

QM-5	The spike recovery was outside acceptance limits for the MS and/or MSD due to matrix interference. The LCS and/or LCSD were within acceptance limits showing that the laboratory is in control and the data is acceptable.
DET	Analyte DETECTED
ND	Analyte NOT DETECTED at or above the reporting limit
NR	Not Reported
dry	Sample results reported on a dry weight basis
RPD	Relative Percent Difference

AMENDED

Billing Information :

CHAIN-OF-CUSTODY RECORD

CA RUSH!

Alpha Analytical, Inc.
255 Glendale Avenue, Suite 21 Sparks, Nevada 89431-5778
TEL: (775) 355-1044 FAX: (775) 355-0406

WorkOrder : PES09121821

Report Due By : 5:00 PM On : 21-Dec-09

Amendment due 12-31-09

Report Attention	Phone Number	EMail Address
Cindy Schreier	(916) 939-7300 x	data@primaenvironmental.com

Client:
Prima Environmental
5070 Robert J. Mathews Parkway
Suite 300
El Dorado Hills, CA 95762

EDD Required : **No**

Sampled by : KT

PO :

Client's COC # : 27304 Job : Kleinfelder-EPC

Cooler Temp	Samples Received	Date Printed
4 °C	18-Dec-09	**28-Dec-09**

QC Level : S3 = Final Rpt, MBLK, LCS, MS/MSD With Surrogates

Alpha Sample ID	Client Sample ID	Matrix	Collection Date	No. of Bottles Alpha	Sub	TAT	Requested Tests METALS_AQ	METALS_CR6_S	METALS_CR6_W	METALS_SO				Sample Remarks
PES09121821-01A	KF-EPC-Spiked Soil	SO	12/17/09 11:00	0	1	1	As, Cd, Ni, Cr_SPLP	Cr6	Cr6+_SPLP	As, Cd, Cr, Ni				SPLP Extract
PES09121821-02A	CaSx-Con	SO	12/17/09 12:00	0	1	1	As, Cd, Ni, Cr_SPLP	Cr6	Cr6+_SPLP					SPLP Extract
PES09121821-03A	CaSx-Low	SO	12/17/09 12:00	0	1	1	As, Cd, Ni, Cr_SPLP	Cr6	Cr6+_SPLP					SPLP Extract
PES09121821-04A	CaSx-Low-cem	SO	12/17/09 12:00	0	1	1	As, Cd, Ni, Cr_SPLP	Cr6	Cr6+_SPLP					SPLP Extract
PES09121821-05A	CaSx-High	SO	12/17/09 12:00	0	1	1	As, Cd, Ni, Cr_SPLP	Cr6	Cr6+_SPLP					SPLP Extract
PES09121821-06A	CaSx-High-cem	SO	12/17/09 12:00	0	1	1	As, Cd, Ni, Cr_SPLP	Cr6	Cr6+_SPLP					SPLP Extract
PES09121821-07A	Fe-Con	SO	12/17/09 12:00	0	1	1	As, Cd, Ni, Cr_SPLP	Cr6	Cr6+_SPLP					SPLP Extract
PES09121821-08A	Fe-Low	SO	12/17/09 12:00	0	1	1	As, Cd, Ni, Cr_SPLP	Cr6	Cr6+_SPLP					SPLP Extract
PES09121821-09A	Fe-Low-cem	SO	12/17/09 12:00	0	1	1	As, Cd, Ni, Cr_SPLP	Cr6	Cr6+_SPLP					SPLP Extract
PES09121821-10A	Fe-High	SO	12/17/09 12:00	0	1	1	As, Cd, Ni, Cr_SPLP	Cr6	Cr6+_SPLP					SPLP Extract

Comments: 24 HR TAT. SPLP due as soon as possible after 18 hr extraction time. Security seals intact. Frozen ice. Amended 12/28/09 11:40 to add Cr6+ to all samples on 72 HR TAT, per Randy and email from Cindy. Cr6+ subbed to CLS. Total sample volume for all samples : sent to CLS. Due 12/31/09.KM

	Signature	Print Name	Company	Date/Time
Logged in by:	K Murray	K Murray	**Alpha Analytical, Inc.**	12/28/09 1140

NOTE: Samples are discarded 60 days after results are reported unless other arrangements are made. Hazardous samples will be returned to client or disposed of at client expense.
The report for the analysis of the above samples is applicable only to those samples received by the laboratory with this COC. The liability of the laboratory is limited to the amount paid for the report.
Matrix Type : AQ(Aqueous) AR(Air) SO(Soil) WS(Waste) DW(Drinking Water) OT(Other) Bottle Type: L-Liter V-Voa S-Soil Jar O-Orbo T-Tedlar B-Brass P-Plastic OT-Other

AMENDED

Billing Information :

CHAIN-OF-CUSTODY RECORD

CA RUSH!

Alpha Analytical, Inc.
255 Glendale Avenue, Suite 21 Sparks, Nevada 89431-5778
TEL: (775) 355-1044 FAX: (775) 355-0406

WorkOrder : PES09121821

Report Due By : 5:00 PM On : 21-Dec-09

,

Client:
Prima Environmental
5070 Robert J. Mathews Parkway
Suite 300
El Dorado Hills, CA 95762

Report Attention	Phone Number	EMail Address
Cindy Schreier	(916) 939-7300 x	data@primaenvironmental.com

EDD Required : **No**

Sampled by : KT

PO :

Client's COC # : 27304 Job : Kleinfelder-EPC

Cooler Temp	Samples Received	Date Printed
4 °C	18-Dec-09	**28-Dec-09**

QC Level : S3 = Final Rpt, MBLK, LCS, MS/MSD With Surrogates

Alpha Sample ID	Client Sample ID	Matrix	Collection Date	No. of Bottles Alpha	Sub	TAT	Requested Tests METALS_AQ	METALS_CR6_S	METALS_CR6_W	METALS_SO					Sample Remarks
PES09121821-11A	Fe-High-cem	SO	12/17/09 12:00	0	1	1	As, Cd, Ni, Cr_SPLP	Cr6	Cr6+_SPLP						SPLP Extract

Comments: 24 HR TAT. SPLP due as soon as possible after 18 hr extraction time. Security seals intact. Frozen ice. Amended 12/28/09 11:40 to add Cr6+ to all samples on 72 HR TAT, per Randy and email from Cindy. Cr6+ subbed to CLS. Total sample volume for all samples : sent to CLS. Due 12/31/09.KM

	Signature	Print Name	Company	Date/Time
Logged in by:	K Murray	K Murray	**Alpha Analytical, Inc.**	12/28/09 1140

NOTE: Samples are discarded 60 days after results are reported unless other arrangements are made. Hazardous samples will be returned to client or disposed of at client expense.
The report for the analysis of the above samples is applicable only to those samples received by the laboratory with this COC. The liability of the laboratory is limited to the amount paid for the report.
Matrix Type : AQ(Aqueous) AR(Air) SO(Soil) WS(Waste) DW(Drinking Water) OT(Other) Bottle Type: L-Liter V-Voa S-Soil Jar O-Orbo T-Tedlar B-Brass P-Plastic OT-Other

Billing Information :

CHAIN-OF-CUSTODY RECORD

CA RUSH! Page: 1 of 2

Alpha Analytical, Inc.
255 Glendale Avenue, Suite 21 Sparks, Nevada 89431-5778
TEL: (775) 355-1044 FAX: (775) 355-0406

WorkOrder : PES09121821

Report Due By : 5:00 PM On : 21-Dec-09

Client:
Prima Environmental
5070 Robert J. Mathews Parkway
Suite 300
El Dorado Hills, CA 95762

PO :

Client's COC # : 27304 Job : Kleinfelder-EPC

Report Attention	Phone Number	EMail Address
Cindy Schreier	(916) 939-7300 x	data@primaenvironmental.com

EDD Required : **No**

Sampled by : KT

Cooler Temp	Samples Received	Date Printed
4 °C	18-Dec-09	**18-Dec-09**

QC Level : S3 = Final Rpt, MBLK, LCS, MS/MSD With Surrogates

Alpha Sample ID	Client Sample ID	Matrix	Collection Date	No. of Bottles Alpha	Sub	TAT	Requested Tests METALS_AQ	METALS_CR6_W	METALS_SO	Sample Remarks
PES09121821-01A	KF-EPC-Spiked Soil	SO	12/17/09 11:00	1	0	1	As, Cd, Ni, Cr_SPLP	Cr6+_SPLP	As, Cd, Cr, Ni	SPLP Extract
PES09121821-02A	CaSx-Con	SO	12/17/09 12:00	1	0	1	As, Cd, Ni, Cr_SPLP	Cr6+_SPLP		SPLP Extract
PES09121821-03A	CaSx-Low	SO	12/17/09 12:00	1	0	1	As, Cd, Ni, Cr_SPLP	Cr6+_SPLP		SPLP Extract
PES09121821-04A	CaSx-Low-cem	SO	12/17/09 12:00	1	0	1	As, Cd, Ni, Cr_SPLP	Cr6+_SPLP		SPLP Extract
PES09121821-05A	CaSx-High	SO	12/17/09 12:00	1	0	1	As, Cd, Ni, Cr_SPLP	Cr6+_SPLP		SPLP Extract
PES09121821-06A	CaSx-High-cem	SO	12/17/09 12:00	1	0	1	As, Cd, Ni, Cr_SPLP	Cr6+_SPLP		SPLP Extract
PES09121821-07A	Fe-Con	SO	12/17/09 12:00	1	0	1	As, Cd, Ni, Cr_SPLP	Cr6+_SPLP		SPLP Extract
PES09121821-08A	Fe-Low	SO	12/17/09 12:00	1	0	1	As, Cd, Ni, Cr_SPLP	Cr6+_SPLP		SPLP Extract
PES09121821-09A	Fe-Low-cem	SO	12/17/09 12:00	1	0	1	As, Cd, Ni, Cr_SPLP	Cr6+_SPLP		SPLP Extract
PES09121821-10A	Fe-High	SO	12/17/09 12:00	1	0	1	As, Cd, Ni, Cr_SPLP	Cr6+_SPLP		SPLP Extract

Comments: 24 HR TAT. SPLP due as soon as possible after 18 hr extraction time. Security seals intact. Frozen ice. :

	Signature	Print Name	Company	Date/Time
Logged in by:	K Murray	K Murray	Alpha Analytical, Inc.	12/18/09 1035

NOTE: Samples are discarded 60 days after results are reported unless other arrangements are made. Hazardous samples will be returned to client or disposed of at client expense.
The report for the analysis of the above samples is applicable only to those samples received by the laboratory with this COC. The liability of the laboratory is limited to the amount paid for the report.
Matrix Type : AQ(Aqueous) AR(Air) SO(Soil) WS(Waste) DW(Drinking Water) OT(Other) Bottle Type: L-Liter V-Voa S-Soil Jar O-Orbo T-Tedlar B-Brass P-Plastic OT-Other

Billing Information :

CHAIN-OF-CUSTODY RECORD

Alpha Analytical, Inc.
255 Glendale Avenue, Suite 21 Sparks, Nevada 89431-5778
TEL: (775) 355-1044 FAX: (775) 355-0406

CA RUSH!

WorkOrder : PES09121821

Report Due By : 5:00 PM On : 21-Dec-09

Client:
Prima Environmental
5070 Robert J. Mathews Parkway
Suite 300
El Dorado Hills, CA 95762

PO :

Client's COC # : 27304 Job : Kleinfelder-EPC

Report Attention	Phone Number	EMail Address
Cindy Schreier	(916) 939-7300 x	data@primaenvironmental.com

EDD Required : **No**

Sampled by : KT

Cooler Temp	Samples Received	Date Printed
4 °C	18-Dec-09	**18-Dec-09**

QC Level : S3 = Final Rpt, MBLK, LCS, MS/MSD With Surrogates

Alpha Sample ID	Client Sample ID	Matrix	Collection Date	No. of Bottles Alpha	Sub	TAT	Requested Tests METALS_AQ	METALS_CR6_W	METALS_SO						Sample Remarks
PES09121821-11A	Fe-High-cem	SO	12/17/09 12:00	1	0	1	As, Cd, Ni, Cr_SPLP	Cr6+_SPLP							SPLP Extract

Comments: 24 HR TAT. SPLP due as soon as possible after 18 hr extraction time. Security seals intact. Frozen ice. :

	Signature	Print Name	Company	Date/Time
Logged in by:	K Murray	K Murray	**Alpha Analytical, Inc.**	12/18/09 1035

NOTE: Samples are discarded 60 days after results are reported unless other arrangements are made. Hazardous samples will be returned to client or disposed of at client expense.
The report for the analysis of the above samples is applicable only to those samples received by the laboratory with this COC. The liability of the laboratory is limited to the amount paid for the report.
Matrix Type : AQ(Aqueous) AR(Air) SO(Soil) WS(Waste) DW(Drinking Water) OT(Other) Bottle Type: L-Liter V-Voa S-Soil Jar O-Orbo T-Tedlar B-Brass P-Plastic OT-Other

Billing Information:

Name _____

PRIMA ENVIRONMENTAL, Inc.
5070 Robert J. Mathews Parkway, Suite 300
El Dorado Hills, CA 95762
PH: 916-939-7300
FAX: 916-939-7398

Alpha Analytical, Inc.
255 Glendale Avenue, Suite 21
Sparks, Nevada 89431-5778
Phone (775) 355-1044
Fax (775) 355-0406

Samples Collected From Which State? AZ ___ CA ___ NV ___ WA ___ ID ___ OR ___ OTHER ___

27304

Page # 1 of 2

P.O. # _____ Job # Kleinfelder-EPC

EMail Address data@primaenvironmental.com

City, State, Zip _____ Phone # _____

Analyses Required

Required QC Level? I II III IV

EDD / EDF? YES ___ NO ___

Global ID # _____

Time Sampled	Date Sampled	Matrix* See Key Below	Sampled by RT Lab ID Number (Office Use Only)	Report Attention Sample Description	TAT	Field Filtered	Total and type of containers ** See below	6020 Metals	SPLP Metals						REMARKS
1100	12/17	So	PES0912182 1-01	RF-EPC-Spiked Soil	24 Hr		1-Soil	X	X						6020 Metals = As, Cd, Cr, Ni SPLP Metals Cr(VI), As, Cd, Ni, Cr

ADDITIONAL INSTRUCTIONS:

	Signature	Print Name	Company	Date	Time
Relinquished by	Kelly Tripp	Kelly TRIPP	PRIMA	12/17/09	1300
Received by	Lisa deSilva	Lisa deSilva	ALPHA	12-17-09	1300
Relinquished by	Lisa deSilva	Lisa deSilva	ALPHA	12-17-09	1500
Received by	K Murray	K Murray	AAI	12/18/09	1000
Relinquished by					
Received by					

*Key: AQ - Aqueous SO - Soil WA - Waste OT - Other AR - Air **: L-Liter V-Voa S-Soil Jar O-Orbo T-Tedlar B-Brass P-Plastic OT-Other

NOTE: Samples are discarded 60 days after results are reported unless other arrangements are made. Hazardous samples will be returned to client or disposed of at client expense. The report for the analysis of the above samples is applicable only to those samples received by the laboratory with this coc. The liability of the laboratory is limited to the amount paid for the report.

Billing Information:

Name _____

A _____

C **PRIMA ENVIRONMENTAL, Inc.**
F **5070 Robert J. Mathews Parkway, Suite 300**
El Dorado Hills, CA 95762
PH: 916-939-7300
FAX: 916-939-7398

Alpha Analytical, Inc.
255 Glendale Avenue, Suite 21
Sparks, Nevada 89431-5778
Phone (775) 355-1044
Fax (775) 355-0406

Samples Collected From Which State? AZ ___ CA X NV ___ WA ___ ID ___ OR ___ OTHER ___

27306

Page # 2 of 2

P.O. # | Job # Kleinfelder - EPC

EMail Address: data@primaenvironmental.com

City, State, Zip | Phone # | Fax #

Sampled by CGS | Report Attention: E.

Time Sampled	Date Sampled	Matrix* See Key Below	Lab ID Number (Office Use Only)	Sample Description	TAT	Field Filtered	Total and type of containers ** See below	SPLP-metals*	Analyses Required	REMARKS
1200	12/7	SO	PES09121821-02	CaSx-Con	24hr		1J	X		*SPLP metals= As, Cd, Ni, Cr, Cr(VI)
			03	CaSx-Low				X		
			04	CaSx-Low-cem				X		
			05	CaSx-High				X		
			06	CaSx-High-cem				X		
			07	Fe-Con				X		
			08	Fe-Low				X		
			09	Fe-Low-cem				X		
			10	Fe-High				X		
			11	Fe-High-cem				X		

Required QC Level? I II III IV

EDD / EDF? YES ___ NO ___

Global ID # _____

ADDITIONAL INSTRUCTIONS: Need results 24hrs or as soon thereafter as possible

	Signature	Print Name	Company	Date	Time
Relinquished by		Cindy Schreier	PRIMA	12.17.09	1300
Received by		LISA dt SILVA	ALPHA	12/7/09	1300
Relinquished by		LISA dt SILVA	ALPHA	12-7-09	1500
Received by		K Murray	ASH	12/8/09	1000
Relinquished by					
Received by					

*Key: AQ - Aqueous SO - Soil WA - Waste OT - Other AR - Air **: L-Liter V-Voa S-Soil Jar O-Orbo T-Tedlar B-Brass P-Plastic OT-Other

NOTE: Samples are discarded 60 days after results are reported unless other arrangements are made. Hazardous samples will be returned to client or disposed of at client expense. The report for the analysis of the above samples is applicable only to those samples received by the laboratory with this coc. The liability of the laboratory is limited to the amount paid for the report.

EXCELCHEM
Environmental Labs

1135 W Sunset Boulevard
Suite A
Rocklin, CA 95765
Phone# 916-543-4445
Fax# 916-543-4449

ELAP Certificate No. : 2119

15 December 2009

Cindy Schreier

Prima Environmental

5070 Robert J. Mathews Parkway, Suite 300

El Dorado Hills, CA 95762

RE: Kleinfelder

Workorder number:0912049

Enclosed are the results of analyses for samples received by the laboratory on 12/08/09 15:07. All Quality Control results are within acceptable limits except where noted as a case narrative. If you have any questions concerning this report, please feel free to contact the laboratory.

Sincerely,

_____

John Somers, Lab Director

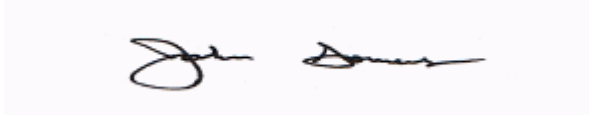
Excelchem Environmental Labs

Prima Environmental	Project:	Kleinfelder	
5070 Robert J. Mathews Parkway, Suite 300	Project Number:	[none]	Date Reported:
El Dorado Hills, CA 95762	Project Manager:	Cindy Schreier	12/15/09 17:08

ANALYTICAL REPORT FOR SAMPLES

Sample ID	Laboratory ID	Matrix	Date Sampled	Date Received
KF-EPC-SOIL	0912049-01	Soil	12/08/09 13:00	12/08/09 15:07

Excelchem Environmental Lab.



Laboratory Representative

The results in this report apply to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

Excelchem Environmental Labs

Prima Environmental	Project:	Kleinfelder	
5070 Robert J. Mathews Parkway, Suite 300	Project Number:	[none]	Date Reported:
El Dorado Hills, CA 95762	Project Manager:	Cindy Schreier	12/15/09 17:08

KF-EPC-SOIL
0912049-01 (Soil)

Analyte	Result	Reporting Limit	Units	Batch	Date Prepared	Date Analyzed	Method	Notes
Ion Chromatography								
Hexavalent Chromium	**10.2**	1.00	mg/kg	ASL0114	12/15/09	12/15/09	EPA 7199	

Excelchem Environmental Lab.

Laboratory Representative

The results in this report apply to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

Excelchem Environmental Labs

Prima Environmental	Project:	Kleinfelder	
5070 Robert J. Mathews Parkway, Suite 300	Project Number:	[none]	Date Reported:
El Dorado Hills, CA 95762	Project Manager:	Cindy Schreier	12/15/09 17:08

Ion Chromatography - Quality Control

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch ASL0114 - EPA 7199										
Blank (ASL0114-BLK1)				Prepared & Analyzed: 12/15/09						
Hexavalent Chromium	ND	0.001	mg/kg							
LCS (ASL0114-BS1)				Prepared & Analyzed: 12/15/09						
Hexavalent Chromium	0.010	0.001	mg/kg	0.0100		96.2	80-120			
LCS Dup (ASL0114-BSD1)				Prepared & Analyzed: 12/15/09						
Hexavalent Chromium	0.010	0.001	mg/kg	0.0100		104	80-120	7.69	20	
Duplicate (ASL0114-DUP1)		**Source: 0912049-01**		Prepared & Analyzed: 12/15/09						
Hexavalent Chromium	10.2	1.00	mg/kg		10.2			0.0197	20	

Excelchem Environmental Lab.

Laboratory Representative

The results in this report apply to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

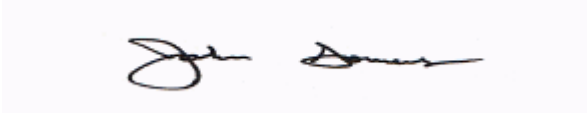
Excelchem Environmental Labs

Prima Environmental	Project:	Kleinfelder	
5070 Robert J. Mathews Parkway, Suite 300	Project Number:	[none]	Date Reported:
El Dorado Hills, CA 95762	Project Manager:	Cindy Schreier	12/15/09 17:08

Notes and Definitions

ND	Analyte not detected at reporting limit.
NR	Not reported

Excelchem Environmental Lab.

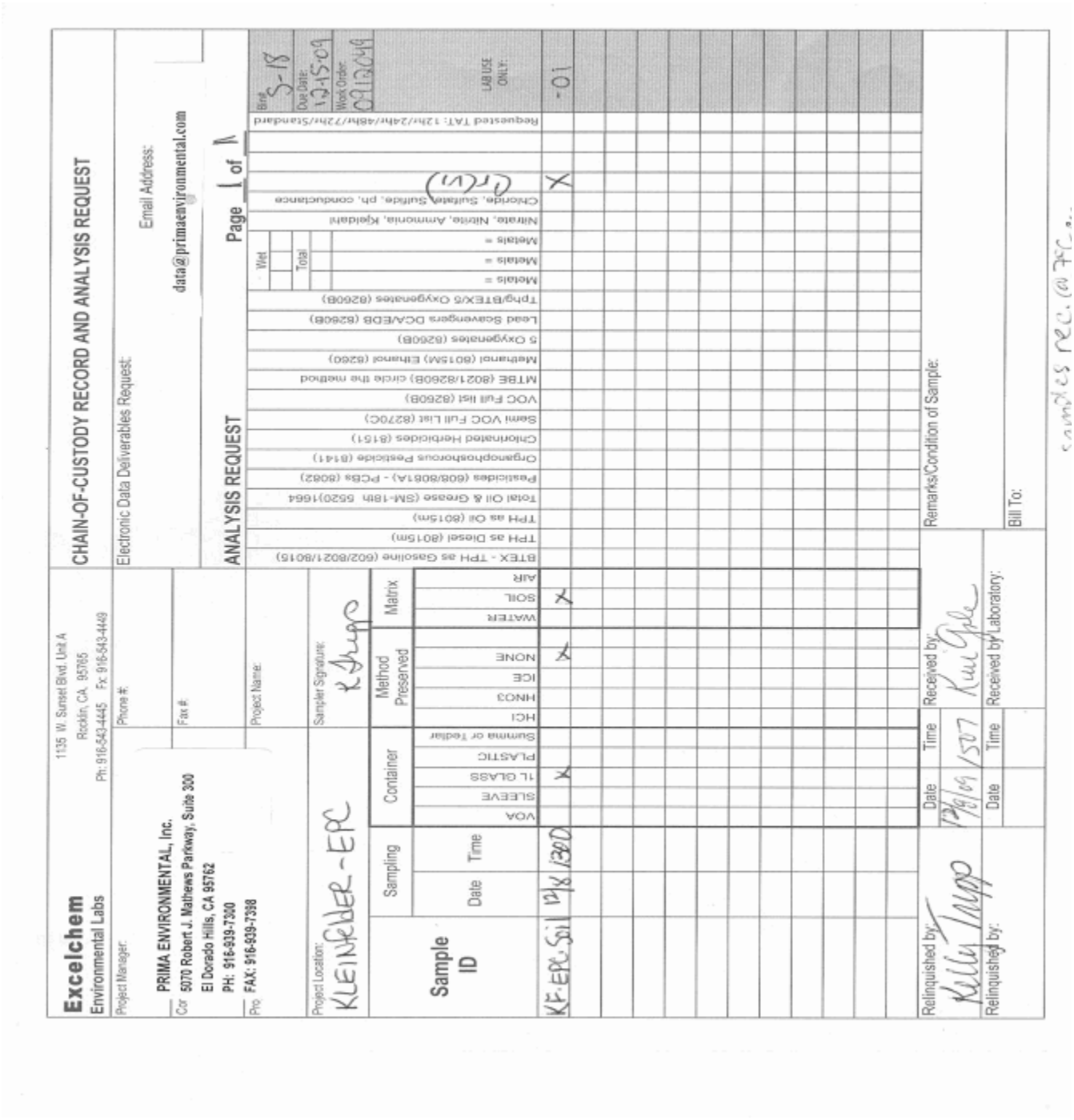


Laboratory Representative

The results in this report apply to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

Excelchem Environmental Labs

Prima Environmental	Project:	Kleinfelder	
5070 Robert J. Mathews Parkway, Suite 300	Project Number:	[none]	Date Reported:
El Dorado Hills, CA 95762	Project Manager:	Cindy Schreier	12/15/09 17:08



Excelchem Environmental Lab.

The results in this report apply to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

Laboratory Representative

EXCELCHEM
Environmental Labs

1135 W Sunset Boulevard
Suite A
Rocklin, CA 95765
Phone# 916-543-4445
Fax# 916-543-4449

ELAP Certificate No. : 2119

22 December 2009

Cindy Schreier

Prima Environmental

5070 Robert J. Mathews Parkway, Suite 300

El Dorado Hills, CA 95762

RE: KF - EPC

Workorder number:0912113

Enclosed are the results of analyses for samples received by the laboratory on 12/17/09 13:49. All Quality Control results are within acceptable limits except where noted as a case narrative. If you have any questions concerning this report, please feel free to contact the laboratory.

Sincerely,

_____

John Somers, Lab Director

Excelchem Environmental Labs

Prima Environmental	Project:	KF - EPC	
5070 Robert J. Mathews Parkway, Suite 300	Project Number:	[none]	Date Reported:
El Dorado Hills, CA 95762	Project Manager:	Cindy Schreier	12/22/09 18:22

ANALYTICAL REPORT FOR SAMPLES

Sample ID	Laboratory ID	Matrix	Date Sampled	Date Received
CaSx-Con	0912113-01	Soil	12/17/09 12:00	12/17/09 13:49
CaSx-Low	0912113-02	Soil	12/17/09 12:00	12/17/09 13:49
CaSx-Low-Cem	0912113-03	Soil	12/17/09 12:00	12/17/09 13:49
CaSx-High-Cem	0912113-04	Soil	12/17/09 12:00	12/17/09 13:49
CaSx-High	0912113-05	Soil	12/17/09 12:00	12/17/09 13:49
Fe.Con	0912113-06	Soil	12/17/09 12:00	12/17/09 13:49
Fe.Low	0912113-07	Soil	12/17/09 12:00	12/17/09 13:49
Fe.Low-Cem	0912113-08	Soil	12/17/09 12:00	12/17/09 13:49
Fe.High-Cem	0912113-09	Soil	12/17/09 12:00	12/17/09 13:49
Fe.High	0912113-10	Soil	12/17/09 12:00	12/17/09 13:49

Excelchem Environmental Lab.

Laboratory Representative

The results in this report apply to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

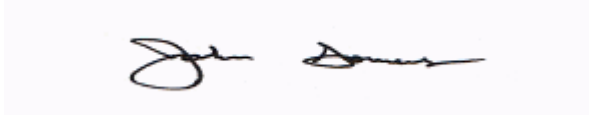
Excelchem Environmental Labs

Prima Environmental	Project:	KF - EPC	
5070 Robert J. Mathews Parkway, Suite 300	Project Number:	[none]	Date Reported:
El Dorado Hills, CA 95762	Project Manager:	Cindy Schreier	12/22/09 18:22

CaSx-Con
0912113-01RE1 (Soil)

Analyte	Result	Reporting Limit	Units	Batch	Date Prepared	Date Analyzed	Method	Notes
Ion Chromatography								
Hexavalent Chromium	**1410**	500	mg/kg	ASL0165	12/21/09	12/22/09	EPA 7199	

Excelchem Environmental Lab.



Laboratory Representative

The results in this report apply to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

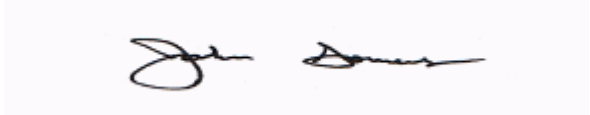
Excelchem Environmental Labs

Prima Environmental	Project:	KF - EPC	
5070 Robert J. Mathews Parkway, Suite 300	Project Number:	[none]	Date Reported:
El Dorado Hills, CA 95762	Project Manager:	Cindy Schreier	12/22/09 18:22

CaSx-Low
0912113-02 (Soil)

Analyte	Result	Reporting Limit	Units	Batch	Date Prepared	Date Analyzed	Method	Notes
Ion Chromatography								
Hexavalent Chromium	**32.4**	1.00	mg/kg	ASL0145	12/18/09	12/18/09	EPA 7199	

Excelchem Environmental Lab.



Laboratory Representative

The results in this report apply to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

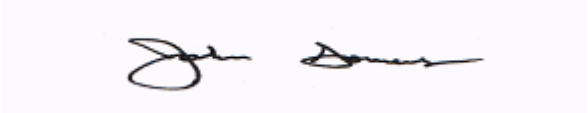
Excelchem Environmental Labs

Prima Environmental	Project:	KF - EPC	
5070 Robert J. Mathews Parkway, Suite 300	Project Number:	[none]	Date Reported:
El Dorado Hills, CA 95762	Project Manager:	Cindy Schreier	12/22/09 18:22

CaSx-Low-Cem
0912113-03RE1 (Soil)

Analyte	Result	Reporting Limit	Units	Batch	Date Prepared	Date Analyzed	Method	Notes
Ion Chromatography								
Hexavalent Chromium	ND	0.010	mg/kg	ASL0165	12/21/09	12/22/09	EPA 7199	

Excelchem Environmental Lab.



Laboratory Representative

The results in this report apply to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

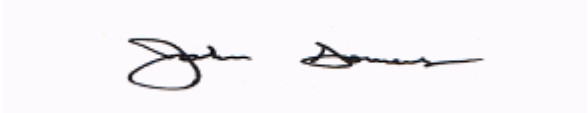
Excelchem Environmental Labs

Prima Environmental	Project:	KF - EPC	
5070 Robert J. Mathews Parkway, Suite 300	Project Number:	[none]	Date Reported:
El Dorado Hills, CA 95762	Project Manager:	Cindy Schreier	12/22/09 18:22

CaSx-High-Cem
0912113-04RE1 (Soil)

Analyte	Result	Reporting Limit	Units	Batch	Date Prepared	Date Analyzed	Method	Notes
Ion Chromatography								
Hexavalent Chromium	ND	0.010	mg/kg	ASL0165	12/21/09	12/22/09	EPA 7199	

Excelchem Environmental Lab.



Laboratory Representative

The results in this report apply to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

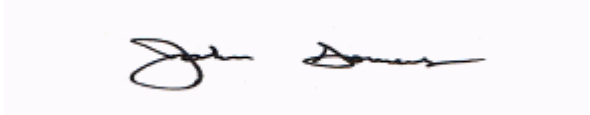
Excelchem Environmental Labs

Prima Environmental	Project:	KF - EPC	
5070 Robert J. Mathews Parkway, Suite 300	Project Number:	[none]	Date Reported:
El Dorado Hills, CA 95762	Project Manager:	Cindy Schreier	12/22/09 18:22

CaSx-High
0912113-05RE1 (Soil)

Analyte	Result	Reporting Limit	Units	Batch	Date Prepared	Date Analyzed	Method	Notes
Ion Chromatography								
Hexavalent Chromium	ND	0.010	mg/kg	ASL0165	12/21/09	12/22/09	EPA 7199	

Excelchem Environmental Lab.



Laboratory Representative

The results in this report apply to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

Excelchem Environmental Labs

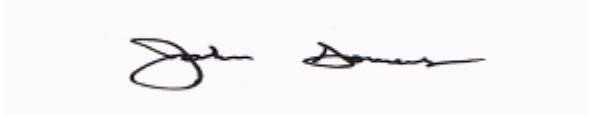
Prima Environmental	Project:	KF - EPC	
5070 Robert J. Mathews Parkway, Suite 300	Project Number:	[none]	Date Reported:
El Dorado Hills, CA 95762	Project Manager:	Cindy Schreier	12/22/09 18:22

Fe.Con

0912113-06RE1 (Soil)

Analyte	Result	Reporting Limit	Units	Batch	Date Prepared	Date Analyzed	Method	Notes
Ion Chromatography								
Hexavalent Chromium	**634**	500	mg/kg	ASL0165	12/21/09	12/22/09	EPA 7199	

Excelchem Environmental Lab.



Laboratory Representative

The results in this report apply to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

Excelchem Environmental Labs

Prima Environmental	Project:	KF - EPC	
5070 Robert J. Mathews Parkway, Suite 300	Project Number:	[none]	Date Reported:
El Dorado Hills, CA 95762	Project Manager:	Cindy Schreier	12/22/09 18:22

Fe.Low

0912113-07RE1 (Soil)

Analyte	Result	Reporting Limit	Units	Batch	Date Prepared	Date Analyzed	Method	Notes
Ion Chromatography								
Hexavalent Chromium	ND	1.00	mg/kg	ASL0165	12/21/09	12/22/09	EPA 7199	

Excelchem Environmental Lab.

Laboratory Representative

The results in this report apply to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

Excelchem Environmental Labs

Prima Environmental	Project:	KF - EPC	
5070 Robert J. Mathews Parkway, Suite 300	Project Number:	[none]	Date Reported:
El Dorado Hills, CA 95762	Project Manager:	Cindy Schreier	12/22/09 18:22

Fe.Low-Cem
0912113-08 (Soil)

Analyte	Result	Reporting Limit	Units	Batch	Date Prepared	Date Analyzed	Method	Notes
Ion Chromatography								
Hexavalent Chromium	**0.010**	0.001	mg/kg	ASL0145	12/18/09	12/18/09	EPA 7199	

Excelchem Environmental Lab.

Laboratory Representative

The results in this report apply to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

Excelchem Environmental Labs

Prima Environmental	Project:	KF - EPC	
5070 Robert J. Mathews Parkway, Suite 300	Project Number:	[none]	Date Reported:
El Dorado Hills, CA 95762	Project Manager:	Cindy Schreier	12/22/09 18:22

Fe.High-Cem
0912113-09RE1 (Soil)

Analyte	Result	Reporting Limit	Units	Batch	Date Prepared	Date Analyzed	Method	Notes
Ion Chromatography								
Hexavalent Chromium	ND	1.00	mg/kg	ASL0165	12/21/09	12/22/09	EPA 7199	

Excelchem Environmental Lab.

The results in this report apply to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

Laboratory Representative

Excelchem Environmental Labs

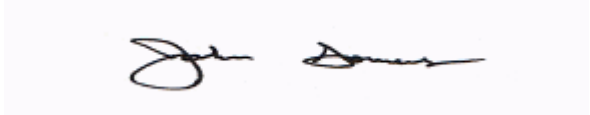
Prima Environmental	Project:	KF - EPC	
5070 Robert J. Mathews Parkway, Suite 300	Project Number:	[none]	Date Reported:
El Dorado Hills, CA 95762	Project Manager:	Cindy Schreier	12/22/09 18:22

Fe.High

0912113-10RE1 (Soil)

Analyte	Result	Reporting Limit	Units	Batch	Date Prepared	Date Analyzed	Method	Notes
Ion Chromatography								
Hexavalent Chromium	ND	1.00	mg/kg	ASL0165	12/21/09	12/22/09	EPA 7199	

Excelchem Environmental Lab.



Laboratory Representative

The results in this report apply to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

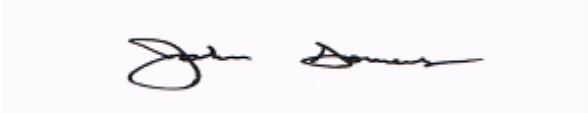
Excelchem Environmental Labs

Prima Environmental	Project:	KF - EPC	
5070 Robert J. Mathews Parkway, Suite 300	Project Number:	[none]	Date Reported:
El Dorado Hills, CA 95762	Project Manager:	Cindy Schreier	12/22/09 18:22

Ion Chromatography - Quality Control

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch ASL0145 - EPA 7199										
Blank (ASL0145-BLK1)				Prepared & Analyzed: 12/18/09						
Hexavalent Chromium	ND	0.001	mg/kg							
LCS (ASL0145-BS1)				Prepared & Analyzed: 12/18/09						
Hexavalent Chromium	0.010	0.001	mg/kg	0.0100		103	80-120			
LCS Dup (ASL0145-BSD1)				Prepared & Analyzed: 12/18/09						
Hexavalent Chromium	0.010	0.001	mg/kg	0.0100		101	80-120	2.61	20	
Batch ASL0165 - EPA 7199										
Blank (ASL0165-BLK1)				Prepared: 12/21/09 Analyzed: 12/22/09						
Hexavalent Chromium	ND	0.001	mg/kg							
LCS (ASL0165-BS1)				Prepared: 12/21/09 Analyzed: 12/22/09						
Hexavalent Chromium	0.010	0.001	mg/kg	0.0100		105	80-120			
LCS Dup (ASL0165-BSD1)				Prepared: 12/21/09 Analyzed: 12/22/09						
Hexavalent Chromium	0.009	0.001	mg/kg	0.0100		87.2	80-120	18.1	20	

Excelchem Environmental Lab.



Laboratory Representative

The results in this report apply to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

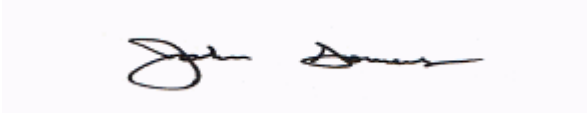
Excelchem Environmental Labs

Prima Environmental	Project:	KF - EPC	
5070 Robert J. Mathews Parkway, Suite 300	Project Number:	[none]	Date Reported:
El Dorado Hills, CA 95762	Project Manager:	Cindy Schreier	12/22/09 18:22

Notes and Definitions

ND	Analyte not detected at reporting limit.
NR	Not reported

Excelchem Environmental Lab.

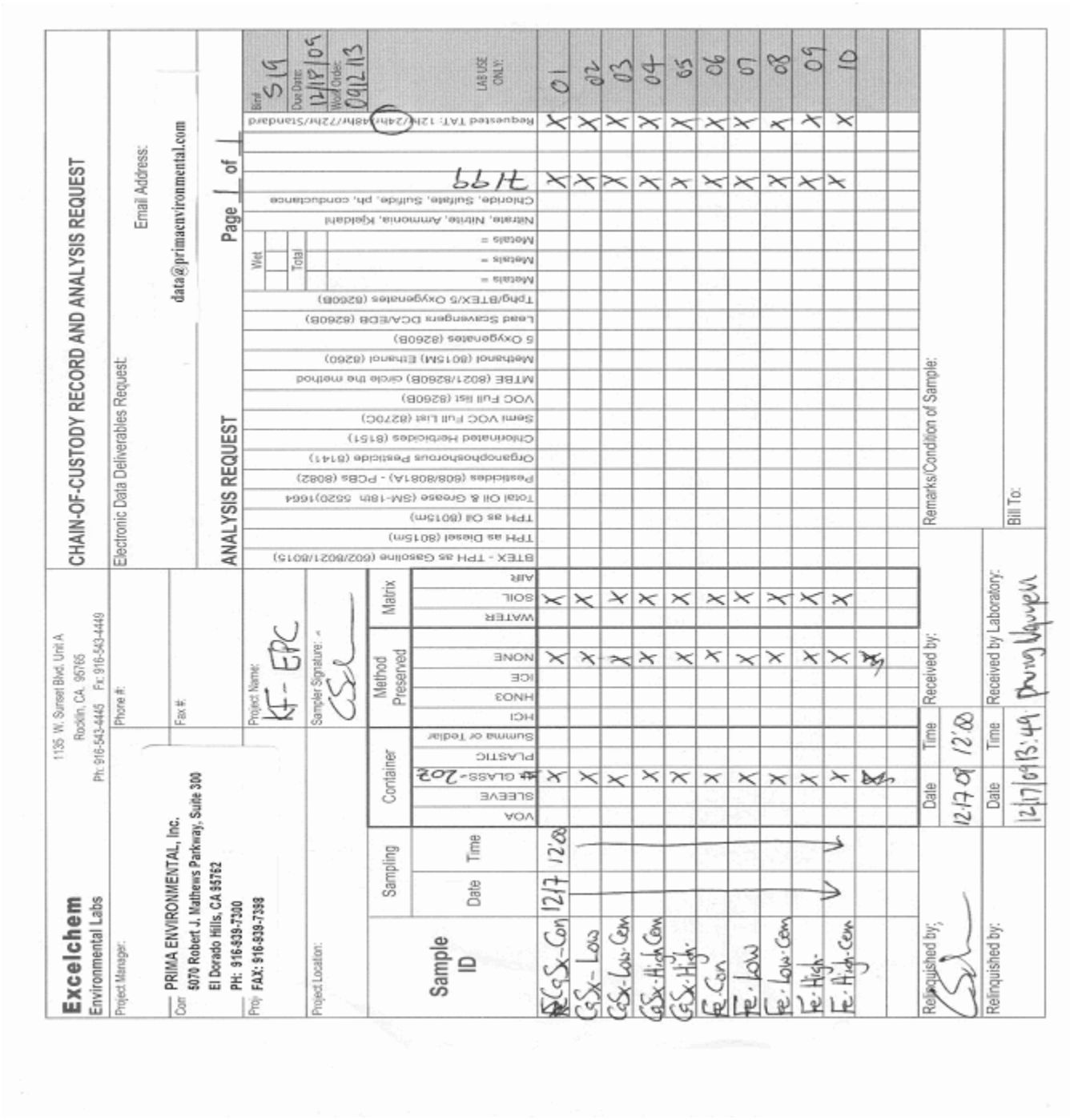


Laboratory Representative

The results in this report apply to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

Excelchem Environmental Labs

Prima Environmental	Project:	KF - EPC	
5070 Robert J. Mathews Parkway, Suite 300	Project Number:	[none]	Date Reported:
El Dorado Hills, CA 95762	Project Manager:	Cindy Schreier	12/22/09 18:22



Excelchem Environmental Lab.

The results in this report apply to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

Laboratory Representative

EXCELCHEM
Environmental Labs

1135 W Sunset Boulevard
Suite A
Rocklin, CA 95765
Phone# 916-543-4445
Fax# 916-543-4449

ELAP Certificate No. : 2119

22 December 2009

Cindy Schreier

Prima Environmental

5070 Robert J. Mathews Parkway, Suite 300

El Dorado Hills, CA 95762

RE: KF - EPC

Workorder number:0912114

Enclosed are the results of analyses for samples received by the laboratory on 12/17/09 13:49. All Quality Control results are within acceptable limits except where noted as a case narrative. If you have any questions concerning this report, please feel free to contact the laboratory.

Sincerely,

_____

John Somers, Lab Director

Excelchem Environmental Labs

Prima Environmental	Project:	KF - EPC	
5070 Robert J. Mathews Parkway, Suite 300	Project Number:	[none]	Date Reported:
El Dorado Hills, CA 95762	Project Manager:	Cindy Schreier	12/22/09 15:01

ANALYTICAL REPORT FOR SAMPLES

Sample ID	Laboratory ID	Matrix	Date Sampled	Date Received
KF.EPC.Spiked Soil	0912114-01	Soil	12/17/09 11:00	12/17/09 13:49

Excelchem Environmental Lab.

Laboratory Representative

The results in this report apply to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

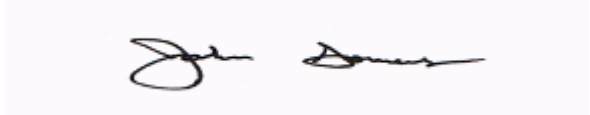
Excelchem Environmental Labs

Prima Environmental	Project:	KF - EPC	
5070 Robert J. Mathews Parkway, Suite 300	Project Number:	[none]	Date Reported:
El Dorado Hills, CA 95762	Project Manager:	Cindy Schreier	12/22/09 15:01

KF.EPC.Spiked Soil
0912114-01RE1 (Soil)

Analyte	Result	Reporting Limit	Units	Batch	Date Prepared	Date Analyzed	Method	Notes
Ion Chromatography								
Hexavalent Chromium	**3810**	500	mg/kg	ASL0165	12/21/09	12/22/09	EPA 7199	

Excelchem Environmental Lab.



Laboratory Representative

The results in this report apply to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

Excelchem Environmental Labs

Prima Environmental	Project:	KF - EPC	
5070 Robert J. Mathews Parkway, Suite 300	Project Number:	[none]	Date Reported:
El Dorado Hills, CA 95762	Project Manager:	Cindy Schreier	12/22/09 15:01

Ion Chromatography - Quality Control

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch ASL0145 - EPA 7199										
Blank (ASL0145-BLK1)				Prepared & Analyzed: 12/18/09						
Hexavalent Chromium	ND	0.001	mg/kg							
LCS (ASL0145-BS1)				Prepared & Analyzed: 12/18/09						
Hexavalent Chromium	0.010	0.001	mg/kg	0.0100		103	80-120			
LCS Dup (ASL0145-BSD1)				Prepared & Analyzed: 12/18/09						
Hexavalent Chromium	0.010	0.001	mg/kg	0.0100		101	80-120	2.61	20	
Batch ASL0165 - EPA 7199										
Blank (ASL0165-BLK1)				Prepared: 12/21/09 Analyzed: 12/22/09						
Hexavalent Chromium	ND	0.001	mg/kg							
LCS (ASL0165-BS1)				Prepared: 12/21/09 Analyzed: 12/22/09						
Hexavalent Chromium	0.010	0.001	mg/kg	0.0100		105	80-120			
LCS Dup (ASL0165-BSD1)				Prepared: 12/21/09 Analyzed: 12/22/09						
Hexavalent Chromium	0.009	0.001	mg/kg	0.0100		87.2	80-120	18.1	20	

Excelchem Environmental Lab.

Laboratory Representative

The results in this report apply to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

Excelchem Environmental Labs

Prima Environmental	Project:	KF - EPC	
5070 Robert J. Mathews Parkway, Suite 300	Project Number:	[none]	Date Reported:
El Dorado Hills, CA 95762	Project Manager:	Cindy Schreier	12/22/09 15:01

Notes and Definitions

ND	Analyte not detected at reporting limit.
NR	Not reported

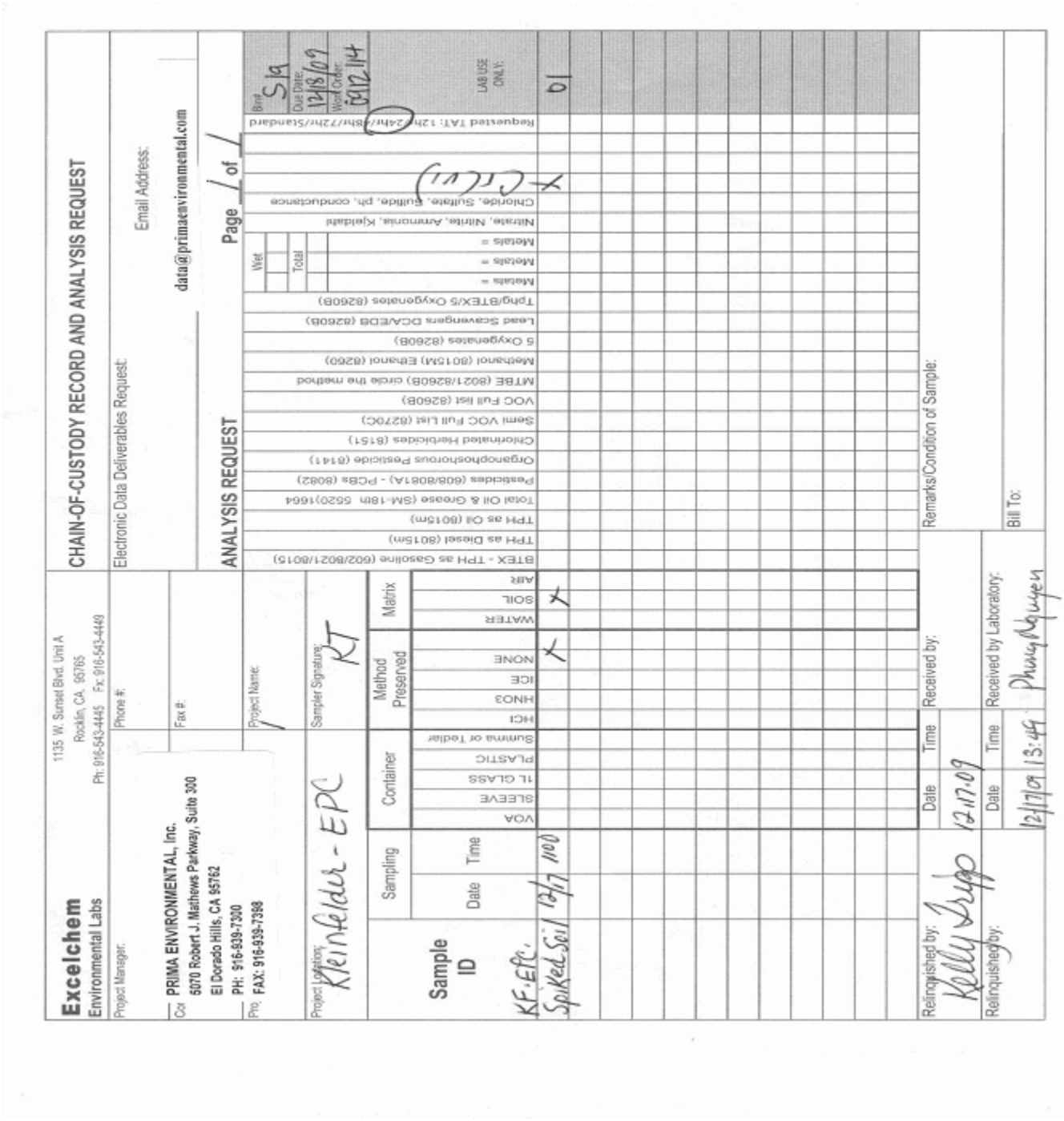
Excelchem Environmental Lab.

Laboratory Representative

The results in this report apply to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

Excelchem Environmental Labs

Prima Environmental	Project:	KF - EPC	
5070 Robert J. Mathews Parkway, Suite 300	Project Number:	[none]	Date Reported:
El Dorado Hills, CA 95762	Project Manager:	Cindy Schreier	12/22/09 15:01



Excelchem Environmental Lab.

The results in this report apply to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

Laboratory Representative

APPENDIX N

CALCULATION OF TREATED Cr^{6+}-IMPACTED SOIL MASS

TSFT - Excello Cr^{6+} Percent Calculation with Depth

	Chrome VI Impacted Soil Volumes at Various Depths					Mass of Cr^{6+}	Percent Cr^{6+} Mass
	(cy)	(cy)	(cy)	(cy)	(cy)	(lbs)	(%)
Depth Interval 0'-15' (Based on 5' Isoconcentrations - Plate 4A)	61	346	307	1097	906	1713.7	75.80%
Depth Interval 15'-25' (Based on 15' Isoconcentrations - Plate 4B)		83	238	659	726	236.8	10.47%
Depth Interval 25'-35' (Based on 25' Isoconcentrations - Plate 4C)		61	106	283	174	142.6	6.31%
Depth Interval 35'-45' (Based on 35' Isoconcentrations - Plate 4D)		78	119	206	170	167.8	7.42%
TOTALs	61	568	769	2245	1977	2261	
Low End Concentration	1000	100	37	5.6	2		
High End Concentration	10000	1000	100	37	5.6		
Average Concentration	5500	550	68.5	21.3	3.8		

Mass = (Cubic Yards of Soil) X (1.5 tons/Cubic Yard) X (2000 lbs/ton) X (Concentration mg/kg) X (1 g/ 1000 mg) X (1 kg/ 1000 g)
cy = cubic yards
lbs = pounds

APPENDIX O

CASE STUDIES

California Regional Water Quality Control Board

Los Angeles Region

Recipient of the 2001 *Environmental Leadership Award* from Keep California Beautiful

Linda S. Adams
Agency Secretary

320 W. 4th Street, Suite 200, Los Angeles, California 90013
Phone (213) 576-6600 FAX (213) 576-6640 - Internet Address: http://www.waterboards.ca.gov/losangeles

Arnold Schwarzenegger
Governor

December 12, 2007

Mr. Benny DeHghi
Remediation & Evaluation Services
Honeywell International Inc.
2525 West 190th Street
Torrance, California 90505-6099

Dear Mr. DeHghi:

GENERAL WASTE DISCHARGE REQUIREMENTS FOR CALCIUM POLYSULFIDE INJECTION FOR GROUNDWATER CLEANUP AT PETROLEUM HYDROCARBON FUEL, VOLATILE ORGANIC COMPOUND AND/OR HEXAVALENT CHROMIUM IMPACTED SITES – FORMER HONEYWELL FACILITY, 11600 SHERMAN WAY, NORTH HOLLYWOOD, CALIFORNIA (WIP FILE NO. 111.0180, SITE ID NO. 2041900, ORDER NO. R4-2007-0019, SERIES NO. 042; CI NO. 9355)

We have completed our review of your application for coverage under General Waste Discharge Requirements to inject calcium polysulfide (CPS) at the site referenced above in the City of Los Angeles, California for soil and groundwater cleanup and remediation.

The facility was used for the production of hydraulic and pneumatic valves between 1941 and 1992; first by Bendix Corporation which then purchased by AlliedSignal which is now known as Honeywell International Incorporated. The site has been the subject of assessment activities since the 1980's. Volatile organic compounds (VOCs), total chromium (Cr), and hexavalent chromium (CrVI) contamination in the soil extends from ground surface to groundwater. The historical concentrations of CrVI have included 3,100 mg/Kg of in soil, and 32,000 mg/L in groundwater. The groundwater contaminant plume extends offsite, to the southwest. The Regional Board has issued Cleanup and Abatement Order (CAO) No. R4-2003-0037 directing replacement of water supply and aeration wells affected in the downgradient direction. Remediation to date has consisted of "hot spot" excavation.

The site has been divided and sold; the western portion to Kaiser Permanente, the middle portion to Public Storage, and the eastern portion to Home Depot. The primary Cr and CrVI source area is beneath the former Plating Shop location contained within the Public Storage property.

MWH Americas Incorporated (MWH) submitted the "*Design Update for Soil and Interim Groundwater Remedial Action Plan, Hexavalent Chromium Cleanup Project, Honeywell North Holley wood Site, 11600 Sherman Way, North Hollywood, CA*" dated September 17, 2007 (Updated RAP). The Regional Board approved the Updated RAP on November 5, 2007.

Regional Board staff has determined that the proposed discharge meets the conditions specified in Order No. R4-2007-0019, *Revised General Waste Discharge Requirements for Groundwater Remediation at Petroleum Hydrocarbon Fuel, Volatile Organic Compound and/or Hexavalent Chromium Impacted Sites (General WDRs)*, adopted by the Regional Water Quality Control Board on March 1, 2007.

This WDR shall not be rescinded until Regional Board staff determines the WDR is no longer needed for the site cleanup.

Enclosed are your Waste Discharge Requirements consisting of General WDRs Board Order No. 2007-0019, and Monitoring and Reporting Program No. CI-9355 stipulations along with Standard Provisions.

The Monitoring and Reporting Program requires you to implement the monitoring program on the effective date of this enrollment under Regional Board Order No. R4-2007-0019. All monitoring reports shall be sent to the Regional Board, ATTN: Information Technology Unit.

When you submit monitoring or technical reports to the Regional Board per these requirements, please include a reference to Compliance File No. CI-9355, which will assure that the reports are directed to the appropriate staff and file. Do not combine other reports with your monitoring reports. Submit each type of report as a separate document.

We are sending a copy of the Order No. R4-2007-0019, only to the applicant. A copy of the Order will be furnished to anyone who requests it, or on line at:
http://www.waterboards.ca.gov/losangeles/html/permits/gen_orders/R4-2007-0019/R4-2007-0019.pdf

If you have any questions, please contact Mr. Dixon Oriola at (213) 576-6803 or Mr. Larry Moore at (213) 576-6730.

Sincerely,

Tracy J. Egoscue
Executive Officer

Enclosures: 1. Regional Board Order No. R4-2007-0019
2. Monitoring and Reporting Program No. CI-9355
3. Standard Provisions applicable to Waste Discharge Requirements
4. Site map

st 190th Street
ce, CA 90505
-512-2296

RECEIVED
2008 JAN 11 PM 2 46
CALIFORNIA REGIONAL WATER QUALITY CONTROL BOARD LOS ANGELES REGION

LOGGED IN BY TECHNICAL SUPPORT
Name: lk
2.Jan.08

January 11, 2008

Information Technology Unit
California Regional Water Quality Control Board
Los Angeles Region
320 W. 4th Street, Suite 200
Los Angeles, CA 90013

Subject: **Fourth Quarter 2007 Groundwater Remediation Progress and Discharge Monitoring Report (Order No. R4-2007-0019, Series No. 042; CI No. 9355)**
Former Honeywell North Hollywood Site
11600 Sherman Way
North Hollywood, California

In accordance with the above-referenced Board Order and the Monitoring and Reporting Program No. CI-9355 for the Former Honeywell North Hollywood Site (Site), this report represents a summary of permitted discharge for the period from October 1, 2007 to December 31, 2007 (Fourth Quarter 2007).

Background

Honeywell International Inc. (Honeywell) is preparing for construction of a soil and interim groundwater remediation system to remediate the hexavalent chromium soil source area and extract and treat impacted groundwater beneath the Site. The remediation system includes an infiltration basin for *in-situ* soil remediation, four groundwater extraction wells (EW-1 through EW-4), two treated water injection trenches (IT-1 and IT-2), and three injection locations for reductant solution delivery (IW-3/IT-3, IT-4, IT-5A/B/C). Extracted groundwater will be treated through ion exchange vessels (for hexavalent chromium removal), followed by granular activated carbon vessels (for volatile organic compound [VOC] removal). Treated groundwater will injected into the two treated water injection trenches (IT-1 and IT-2) for hydraulic containment or to the infiltration basin or injection locations (IW-3/IT-3, IT-4, and IT-5A/B/C) for delivery of calcium polysulfide (reductant for *in-situ* treatment) to the subsurface. The remediation system and monitoring well locations are shown on Figure 1.

Quarterly Monitoring

The remediation system has not been constructed and therefore no groundwater remediation progress and discharge monitoring took place during the Fourth Quarter of 2007. Remediation system construction is scheduled to be completed during Second Quarter 2008.

Future Activities

Honeywell will submit the next quarterly remediation progress and discharge monitoring report to summarize permitted discharge activities completed during First Quarter 2008 to the RWQCB by April 15, 2008.

SHERMAN WAY

SIDEWALK

LANKERSHIM BOULEVARD

PUBLIC STORAGE PROPERTY

KAISER PROPERTY

HOME DEPOT PROPERTY

EXISTING BUILDING (KAISER)

EXISTING BUILDING (KAISER)

WROUGHT IRON FENCE

EXISTING BUILDING

Infiltration Basin

GW-1 GW-2 GW-3 GW-4 GW-5 GW-6 GW-7 GW-8 GW-9 GW-10 GW-11 GW-12A GW-14A GW-14B GW-15 GW-16 GW-17 GW-17A GW-20 GW-21 GW-22 GW-23

EW-1 EW-2 EW-3 EW-4

IW-3

IT-1 IT-2 IT-3 IT-4 IT-5A IT-5B IT-5C IT-6 IT-7

CHAIN LINK FENCE

RAMP

SVE SYSTEM

Treatment System Equipment

METROLINK RIGHT OF WAY

EXISTING BUILDING (MODERN BATHROOM)

EXISTING BUILDING (20th CENTURY PROPS)

EXISTING BUILDING (BOBRICK)

EXISTING BUILDING

EXISTING BUILDING

NURSERY

HART STREET

0 FEET 150
SCALE

LEGEND:

- Existing Groundwater Monitoring Well
- Multi-port Groundwater Monitoring Well
- Existing Structures
- Former Structures
- Site Boundary
- Offsite Investigation Area
- Injection Trench (Treated Water)
- Injection Trench (Reductant Solution Delivery)
- Extraction Well Location
- Injection Well Location (Reductant Solution Delivery)
- IT Injection Trench
- EW Extraction Well
- IW Injection Well

NOTE:
Groundwater Monitoring Wells Shown in Red are also for Remediation Progress Monitoring.

MWH

HONEYWELL NORTH HOLLYWOOD SITE
NORTH HOLLYWOOD, CALIFORNIA

REMEDIATION SYSTEM AND MONITORING WELL LOCATIONS

FIGURE 1

JOB No. 18909.33 FILE No. INDSVR\INDUSTRIAL\CAD MLUEBKE\HONEYWELL\NORTH HOLLYWOOD\REMEDIATION SYSTEM 7 2 08

California Regional Water Quality Control Board

Los Angeles Region

Recipient of the 2001 *Environmental Leadership Award* from Keep California Beautiful

Linda S. Adams
Agency Secretary

320 W. 4th Street, Suite 200, Los Angeles, California 90013
Phone (213) 576-6600 FAX (213) 576-6640 - Internet Address: http://www.waterboards.ca.gov/losangeles

Arnold Schwarzenegger
Governor

August 12, 2010

Mr. Benny DeHghi, Manager
Remediation & Evaluation Services
2525 West 190th Street
Torrance, California 90505-6099

CONDITIONAL APPROVAL OF A CHANGE TO APPROVED SOIL AND INTERIM GROUNDWATER REMEDIAL ACTION PLAN FOR GENERAL WASTE DISCHARGE REQUIREMENTS FOR CALCIUM POLYSULFIDE INJECTION – FORMER HONEYWELL FACILITY, 11600 SHERMAN WAY, NORTH HOLLYWOOD, CALIFORNIA (WIP FILE NO. 111.0180, SITE ID NO. 2041900, ORDER NO. R4-2007-0019, SERIES NO. 042; CI NO. 9355)

Dear Mr. DeHghi:

The California Regional Water Quality Control Board, Los Angeles Region (Regional Board) is the public agency with primary responsibility for the protection of groundwater and surface water quality for all beneficial uses within major portions of Los Angeles and Ventura Counties, including the referenced site.

The Regional Board has reviewed the letter entitled "Addendum to Approved SIGRAP for General Waste Discharge Requirements (WDR) Order No. R4-2007-0019, Former Bendix Facility - North Hollywood, California, (MWH, February 24, 2010). The letter is an addendum to the approved design update to the Soil and Interim Groundwater Remedial Action Plan (Design Update to SIGRAP), submitted to the Regional on September 17, 2007 by (MWH) on behalf of Honeywell International Inc. (Honeywell). The addendum to the SIGRAP includes an alternate reductant source to enhance operations of the *in-situ* hexavalent chromium soil and interim groundwater treatment system performance at the former Bendix facility (site) in North Hollywood, California. Specifically, the proposed modification is to use an alternate reductant source, a calcium polysulfide/sodium polysulfide blend known as COPRex to be used in addition to calcium polysulfide, which is currently being used as the reductant solution at the site and has been approved under the General WDR permit reference above.

The Regional Board understands the following regarding the existing onsite Remediation system:

- Operations began in January 2009 with the testing of injection trenches for infiltration rates, system equipment, and calcium polysulfide solution equipment prove-out;
- Continuous treatment system groundwater extraction and injection operations began on January 26, 2009;

- Calcium polysulfide reductant solution injection began at IT-3 in mid-March 2009 to establish a reducing environment in groundwater in the vicinity and downgradient of the onsite infiltration basin;

- In May 2009, calcium polysulfide delivery to the subsurface was directed to IT-3 (via clean-out connection) at full strength (as a 29% solution, as delivered) from tanker trucks in batches of approximately 4,800 gallons;

- Following each tanker truck delivery of calcium polysulfide, treated water was injected into IT-3 to help flush the calcium polysulfide down through the vadose zone to groundwater;

- Soil borings filled with gravel were installed in July 2009 in injection trench IT-3 to help increase the infiltration capacity, which was limited by the precipitates/solids generated in the trench gravel material and native surrounding soil; and

- In August 2009, injection trench IT-3 was expanded on the south side to increase infiltration capacity.

As stated in the February 24, 2010 letter, your proposed modifications include the following:

- The application/use of an alternate reductant solution, a calcium polysulfide/sodium polysulfide blend (COPRex) with the use of calcium polysulfide, which is currently the approved reductant solution)

- The combined used of the alternate reductant solution with existing COPRex will further expedite the cleanup schedule and avoid potential for unanticipated precipitated solids.

- The two components of COPRex, calcium polysulfide and sodium polysulfide, are both listed as approved reductant types in the General WDR, as listed in Table 1 of WDR Order No. R4-2007-0019.

The injection locations and injection methods of COPRex will not be modified from previous operations with the use of calcium polysulfide.

Upon receipt of approval from the RWQCB for use of COPRex at the site, MWH will proceed with arrangements to procure this reductant solution.

A summary of the modifications made will be provided in the next quarterly WDR Monitoring Report submitted to the RWQCB.

Based on the information presented in the letter, your addendum is approved provided that the proposed modifications are completed as discussed in your February 24, 2010 letter.

These changes to the WDR Permit shall be implemented during the third quarter of 2010.

Should you have questions or wish to discuss details, please contact Mr. Jeffrey Hu at (213) 576-6736 or email at ghu@waterboards.ca.gov or Mr. Larry Moore at (213) 576-6730 or email at lmoore@waterboards.ca.gov.

Sincerely,

Samuel Unger
Interim Executive Officer

cc. Ms. Kelly Manheimer, USEPA Superfund Division, Region IX, San Francisco
Mr. Fred Schaufler, USEPA Superfund Division, Region IX, San Francisco
Mr. Leighton Fong, City of Glendale,
Mr. Richard Slade, Upper Los Angeles River Area Watermaster
Mr. Robert McKinney, Los Angeles Department of Water & Power
Mr. Thomas Erb, Los Angeles Department of Water & Power
Mr. Bill Mace, City of Burbank Water Supply Department
Ms. Linda Tuley, MWH Inc.
Mr. Albert Pena - Home Depot
Ms. Karen Lore - Public Storage
Mr. Ron Newquist - Kaiser Permanente

REDOX SOLUTIONS, LLC

"...providing sulfide reagents for treatment of COPR and other metal-bearing wastes..."

$COPR_{EX}$

(Proprietary Polysulfide Blend)
CAS NO.: (1344-81-6 & 1313-82-2)

Description

$COPR_{EX}$ is a deep reddish black solution; pH is in the 11.5-12.5 range.

Uses

Uses include precipitation of heavy metals from plating, circuit board and other liquid waste streams and cyanide conversion and destruction. Used for ground water remediation for heavy metals and for soil remediation at manufacturing sites, mine areas and similar locations. Used in ex-situ and in situ processes for on-site remediation projects.

Formula: NaS_x & CaS_x Formula Weight: 187.20

Specifications

Sodium/Calcium Polysulfide	51%
pH	11.5-12.5
Specific Gravity	1.2-1.45
Appearance	Deep reddish black solution
Physical Properties	11.8 lbs/gal 169 gal/ton
Solubility	Soluble in Water

Domestic Shipping Information

DOT Proper Shipping Name	Not Regulated
DOT Hazard Class	Not Regulated
DOT ID Number	Not Regulated
Shipping Description	Sodium/Calcium Polysulfide Solution
Shipment Options	DOT Approved Rail Tank Cars or Tanker Trucks

11550 N. Meridian ST., Suite 180
Carmel, IN 46032
317-660-6867

REDOX SOLUTIONS, LLC

"...providing sulfide reagents for treatment of COPR and other metal-bearing wastes..."

COPRex

Material Safety Data Sheet

Section 1: CHEMICAL PRODUCT and COMPANY IDENTIFICATION

1.1 Product Name	***COPRex***
Chemical Family	Inorganic salt solution
Synonyms	None
Formula	Sodium / Calcium Polysulfide
1.2 Manufacturer	Redox Solutions, LLC 11550 N. Meridian St., Suite 180 Carmel, IN 46032
1.3 Emergency Contact	(317) 660-6867

Section 2: COMPOSITION, INFORMATION ON INGREDIENTS

2.1 Chemical Ingredients	**CAS #**	**(% by wt.)**
Sodium Polysulfide Solution	012034-39-8	17 - 20%
Calcium Polysulfide Solution	1344-81-6	17 - 20%
Water	7732-18-5 71	60 – 66%

(See Section 8 for exposure guidelines)

Section 3: HAZARDS IDENTIFICATION

NFPA: **Health - 2** **Flammability - 0** **Reactivity - 1**

EMERGENCY OVERVIEW

Warning:
Avoid inhalation of product fumes (hydrogen sulfide) near openings on storage Container. Release of the product to the environment may cause the evolution of highly toxic hydrogen sulfide vapors. Product solution is alkaline and may cause irritation to the skin. Eye contact will cause eye irritation and possible corneal damage. Ingestion will result in irritation of tissues and the release of hydrogen sulfide in the gastrointestinal tract.

Section 3: HAZARDS IDENTIFICATION (Cont.)

3.1 POTENTIAL HEALTH EFFECTS

EYE: Contact with the eyes by product mist or solution will cause irritation and a burning sensation. Eye contact may result in severe corneal injury.

SKIN CONTACT: Contact with product mist or solution will cause skin irritation and may result in corrosion of the skin.

SKIN ABSORPTION: Absorption is unlikely to occur.

INGESTION: Ingestion of product solution will cause irritation and corrosion of the gastrointestinal tract to include nausea, vomiting and diarrhea. Contact with stomach acid will cause highly toxic hydrogen sulfide to evolve.

INHALATION: Inhalation of product vapors (hydrogen sulfide) may cause dizziness and unconsciousness possibly resulting in serious falls from elevated positions.

CHRONIC EFFECTS/CARCINOGENICITY: Related polysulfide formulations, including Sodium and Calcium Polysulfide are not listed as carcinogens by NTP, IARC or OSHA.

Section 4: FIRST AID MEASURES

4.1 EYES: Immediately flush with large quantities of water for 15 minutes. Hold eyelids apart during irrigation to insure thorough flushing of the entire area of the eye and lids. Obtain immediate medical attention.

4.2 SKIN: Immediately flush with large quantities of water. Remove contaminated clothing under a safety shower. Obtain immediate medical attention.

4.3 INGESTION: DO NOT INDUCE VOMITING. If victim is conscious, immediately give large quantities of water. If vomiting does occur, continue to give fluids. Obtain immediate medical attention.

4.4 INHALATION: Remove victim from contaminated atmosphere. If breathing is labored, administer oxygen. If breathing has ceased, clear airway and start mouth to mouth resuscitation. If heart has stopped beating, external heart massage should be applied. Obtain immediate medical attention.

Section 5: FIRE FIGHTING MEASURES

5.1 FLAMMABLE PROPERTIES

FLASH POINT: Not flammable (See Section 5.4) **METHOD USED:** NA

5.2 FLAMMABLE LIMITS: H_2S **LFL:** 4% **UFL:** 44%

5.3 EXTINGUISHING MEDIA: Water spray or foam or as appropriate for combustibles involved in fire.

California Regional Water Quality Control Board

Los Angeles Region

Recipient of the 2001 *Environmental Leadership Award* from Keep California Beautiful

Linda S. Adams
Agency Secretary

320 W. 4th Street, Suite 200, Los Angeles, California 90013
Phone (213) 576-6600 FAX (213) 576-6640 - Internet Address: http://www.waterboards.ca.gov/losangeles

Arnold Schwarzenegger
Governor

December 12, 2007

Mr. Benny DeHghi
Remediation & Evaluation Services
Honeywell International Inc.
2525 West 190th Street
Torrance, California 90505-6099

Dear Mr. DeHghi:

GENERAL WASTE DISCHARGE REQUIREMENTS FOR CALCIUM POLYSULFIDE INJECTION FOR GROUNDWATER CLEANUP AT PETROLEUM HYDROCARBON FUEL, VOLATILE ORGANIC COMPOUND AND/OR HEXAVALENT CHROMIUM IMPACTED SITES – FORMER HONEYWELL FACILITY, 11600 SHERMAN WAY, NORTH HOLLYWOOD, CALIFORNIA (WIP FILE NO. 111.0180, SITE ID NO. 2041900, ORDER NO. R4-2007-0019, SERIES NO. 042; CI NO. 9355)

We have completed our review of your application for coverage under General Waste Discharge Requirements to inject calcium polysulfide (CPS) at the site referenced above in the City of Los Angeles, California for soil and groundwater cleanup and remediation.

The facility was used for the production of hydraulic and pneumatic valves between 1941 and 1992; first by Bendix Corporation which then purchased by AlliedSignal which is now known as Honeywell International Incorporated. The site has been the subject of assessment activities since the 1980's. Volatile organic compounds (VOCs), total chromium (Cr), and hexavalent chromium (CrVI) contamination in the soil extends from ground surface to groundwater. The historical concentrations of CrVI have included 3,100 mg/Kg of in soil, and 32,000 mg/L in groundwater. The groundwater contaminant plume extends offsite, to the southwest. The Regional Board has issued Cleanup and Abatement Order (CAO) No. R4-2003-0037 directing replacement of water supply and aeration wells affected in the downgradient direction. Remediation to date has consisted of "hot spot" excavation.

The site has been divided and sold; the western portion to Kaiser Permanente, the middle portion to Public Storage, and the eastern portion to Home Depot. The primary Cr and CrVI source area is beneath the former Plating Shop location contained within the Public Storage property.

MWH Americas Incorporated (MWH) submitted the "*Design Update for Soil and Interim Groundwater Remedial Action Plan, Hexavalent Chromium Cleanup Project, Honeywell North Holley wood Site, 11600 Sherman Way, North Hollywood, CA*" dated September 17, 2007 (Updated RAP). The Regional Board approved the Updated RAP on November 5, 2007.

Regional Board staff has determined that the proposed discharge meets the conditions specified in Order No. R4-2007-0019, *Revised General Waste Discharge Requirements for Groundwater Remediation at Petroleum Hydrocarbon Fuel, Volatile Organic Compound and/or Hexavalent Chromium Impacted Sites (General WDRs)*, adopted by the Regional Water Quality Control Board on March 1, 2007.

This WDR shall not be rescinded until Regional Board staff determines the WDR is no longer needed for the site cleanup.

Enclosed are your Waste Discharge Requirements consisting of General WDRs Board Order No. 2007-0019, and Monitoring and Reporting Program No. CI-9355 stipulations along with Standard Provisions.

The Monitoring and Reporting Program requires you to implement the monitoring program on the effective date of this enrollment under Regional Board Order No. R4-2007-0019. All monitoring reports shall be sent to the Regional Board, ATTN: Information Technology Unit.

When you submit monitoring or technical reports to the Regional Board per these requirements, please include a reference to Compliance File No. CI-9355, which will assure that the reports are directed to the appropriate staff and file. Do not combine other reports with your monitoring reports. Submit each type of report as a separate document.

We are sending a copy of the Order No. R4-2007-0019, only to the applicant. A copy of the Order will be furnished to anyone who requests it, or on line at:
http://www.waterboards.ca.gov/losangeles/html/permits/gen_orders/R4-2007-0019/R4-2007-0019.pdf

If you have any questions, please contact Mr. Dixon Oriola at (213) 576-6803 or Mr. Larry Moore at (213) 576-6730.

Sincerely,

Tracy J. Egoscue
Executive Officer

Enclosures: 1. Regional Board Order No. R4-2007-0019
2. Monitoring and Reporting Program No. CI-9355
3. Standard Provisions applicable to Waste Discharge Requirements
4. Site map

SECTION 2.0

OVERVIEW OF REMEDIAL TECHNOLOGY

The approved remedial technology to be implemented at the Site is an integrated approach to cause the *in-situ* reduction of hexavalent chromium contamination in the vadose zone with remediation of on-Site groundwater contamination by a combination of groundwater extraction (pump and treat) and *in-situ* reduction. An overview of the remediation system is provided below. The remediation system design details are provided in Appendix A.

The vast majority of contaminant treatment will occur *in-situ*, because this treatment method addresses the source of the groundwater impacts more quickly and effectively than a pump and treat system alone. However, it is also understood that groundwater pumping and reinjection not only provides a means of accomplishing the *in-situ* remediation by providing make-up water for the reductant solution, it can also be used for hydraulic containment during treatment and to control or direct reductant solution movement in the Site groundwater. Therefore, in addition to the *in-situ* components, a groundwater extraction and *ex-situ* treatment component is also a critical component of the approved remedial approach. The remediation system layout is presented as Figure 2.

Extraction wells immediately upgradient of the soil source area and groundwater plume will be used primarily to intercept groundwater flux onto the site, reducing the hydraulic gradient within and flux through the treatment area. Although some draw-in of hexavalent chromium-impacted water is anticipated, the goal will be to adjust pumping rates to obtain relatively low average influent concentrations that can be readily treated by granular activated carbon (GAC) and ion-exchange (IE) resins prior to reinjection through injection trenches on the far east and west sides of the Site. This injection helps increase the inward gradient and degree of protection provided. In addition, downgradient extraction wells will capture impacted on-Site groundwater and help pull back some downgradient off-Site groundwater. This water will likely contain higher concentrations of hexavalent chromium. Depending upon the actual concentrations, which will vary during treatment, this water will either be treated aboveground with GAC/IE or partially treated aboveground with GAC/IE followed by polishing treatment at the infiltration basin mixing/separation tank with the selected reductant, calcium polysulfide.

This reductant solution from the mixing/separation tank will then be infiltrated through the subgrade infiltration basin (soil source area) for treatment of impacted vadose soils, or through injection trenches in clean soil areas at various locations across the groundwater plume. The injection trenches, which will be subdivided, will be used to more rapidly and accurately distribute the reductant solution to other parts of the groundwater plume, such as (1) immediately downgradient of the infiltration basin to facilitate source area treatment (IT-3), (2) the downgradient edge of the Site to create a reductive barrier (IT-5A/B/C), or (3) other areas of the plume that may not be addressed by flow of the reductant solution away from the primary basin infiltration area (IT-4).

The extraction, *ex-situ* treatment, reductant dosing, and reinjection cycle will continue until the vadose soils have been remediated and dissolved hexavalent chromium concentrations meeting the remedial goal are observed across the majority of the Site. Adjustment in flow from specific extraction wells and/or to injection trenches will be made throughout treatment to control the direction of groundwater and/or reductant flux across the Site, enhancing distribution and mixing.

While most of the reduction of hexavalent chromium will be accomplished by inorganic reactions, it has been shown that there are benefits to introducing carbon sources into the treated water. These benefits include the decrease in sulfate ion concentrations by means of the actions of sulfate reducing bacteria, the generation of conditions suitable for the reductive dechlorination of chlorinated solvents, providing a longer-term reducing source for final treatment or "polishing" of recalcitrant areas. Therefore, at the end of remediation with the reductant solution, injection of a carbon source, such as ethanol, edible oils, or other similar compound, will be considered if warranted by residual hexavalent chromium or elevated sulfate concentrations. This dosing would be completed at the end of remediation, rather than throughout to reduce the risk of biological fouling of the basin, trenches, or extraction wells.

SECTION 3.0

RE-EVALUATION OF REMEDIAL DESIGN

In response to recent increases in hexavalent chromium concentrations in Site wells, the remediation system design described in the *SIGRAP* was re-evaluated to ensure feasibility in meeting the remediation goals for the Site. This re-evaluation included conducting the following:

(1) Running a groundwater model of the proposed extraction and injection well layout to determine hydraulic capture and pumping/injection rates;

(2) Performing a bench-scale test to confirm feasibility of IE resin treatment using Site water; and

(3) Review of soil reductant demand (SRD) test results to determine feasibility of injection trenches for distribution of reductant solution to the groundwater.

A summary of these tasks performed is provided in the following sections. Remediation system operation is described in Section 4.0.

3.1 GROUNDWATER FLOW MODELING

MWH conducted groundwater flow modeling utilizing United States Environmental Protection Agency's (EPA's) Modflow groundwater flow model generated for the NHOU to assure the combination of extraction and injection would "flatten" or "stagnate" the hydraulic gradient within the treatment area on-Site, to assure hydraulic control during treatment, and to pull back the downgradient dissolved phase plume. The results of groundwater flow modeling are presented in Appendix B and demonstrate that moderate pumping rates can achieve hydraulic control of the Site, while providing a low flux treatment zone within the center of the Site, permitting more of the reduction reactions to occur *in-situ* rather than through operations and maintenance (O&M) intensive extraction, treatment, and disposal (see Figures 2 through 7 in Appendix B).

Groundwater modeling results were used as the design basis for the treatment system. The wellfield layout was modified to address the present on-Site extent of groundwater contamination by hexavalent chromium using the results of the modeling. The wellfield layout presented in the *SIGRAP* (MWH 2004) was modified from two extraction wells and two injection wells to four extraction wells and four primary injection locations, two for clean water injection (IT-1, IT-2) and two for reductant solution injection (IT-3, IT-4), as shown on Figure 2.

3.2 ION EXCHANGE RESIN BENCH-SCALE TEST

A bench-scale test was determined to be prudent to ensure that IE would still be the optimum treatment technology at the current hexavalent chromium concentrations and to determine the most effective type of IE resin.

The bench-scale test began in March 2007 and was completed in July 2007. Site groundwater from wells GW-3 and GW-4 were used for bench-scale testing. Several test runs were conducted to (1) generate a breakthrough curve for the resins tested (one for strong-base regenerable resin and one for a weak-base non-regenerable resin) and (2) measure the loading capacity of the resin with various factors. All test columns contained the same volume of resin and were tested at the same flowrate. The bench-scale test consisted of runs for up to five different IE resins to determine the loading factors of resins and the effects that conditions at the Site (various hexavalent chromium concentrations and sulfate concentrations) may have on the loading factors at hexavalent chromium concentrations of 10 and 100 milligrams per liter (mg/l). The runs included the following conditions:

- Natural pH levels (7.5);
- Adjusted pH levels of 5.5 and 4.5, and
- Elevated sulfate levels of approximately 2 and 10 times natural sulfate levels,

Bench-test results indicate that IE is an effective technology for removing hexavalent chromium from Site groundwater. From the mass measured on the spent resin, the loading factor (pounds of hexavalent chromium removed per cubic foot of resin) was determined.

IE resins retain more hexavalent chromium (increased "loading") at lower water pHs; therefore, tests were run to evaluate this effect with site-specific groundwater at natural pH (7.5), a pH of 5.5, and a pH of 4.5. It was determined the resulting IE regeneration cost savings did not justify pH adjustment. The sulfate conditions were tested because sulfate competes weakly for IE resin sorption sites with hexavalent chromium., This effect can be significant at high concentrations. The results of the bench testing indicate that the effects of sulfate at 2 times sulfate concentration (approximately 200 mg/l) the IE loading rate was reduced to approximately 85 percent of the sorption at current site sulfate concentrations, and the 10 times sulfate concentration (approximately 700 mg/l) test indicated that the loading rate was reduced to between 48 and 65 percent. This information will be used during operation to anticipate IE change-out requirements because increased sulfate concentrations are anticipated as a result of the calcium polysulfide injection. This effect was one of the primary reasons for the extraction well placement and planned operation and treatment options discussed in Section 4.0.

3.3 REVIEW OF PILOT STUDY RESULTS

An evaluation of injection methods, via well or trench, was conducted to determine if injection trenches would be a feasible method of providing reductant solution to other parts of the groundwater plume. Injection wells quickly and precisely deliver the water or reductant solution to groundwater, but they are susceptible to plugging from natural groundwater turbidity and precipitates generated from the reductant solution. Trenches have significantly more surface area for infiltration and are therefore much less susceptible to plugging than vertical wells. The depth of the vadose zone (approximately 300 feet) is not a significant factor for perimeter clean water injection; therefore trenches IT-1 and IT-2 will be used to inject clean treated water. However, the large vadose zone would influence how the reductant solution is distributed and how much of the reductant would be used from natural SRD.

Therefore, the SRD test results from previous pilot studies conducted for this project in November 2005 were reviewed. The pilot study activities and results were summarized in the *Submittal of Additional information for Waste Discharge Requirement Permit Application for Former Honeywell North Hollywood Site*, dated March 27, 2006 (MWH 2006) and described briefly below.

A SRD test was conducted to measure the SRD in hexavalent chromium impacted source-area soil. Soil slurries were prepared and dosed with 0.1%, 0.5%, 1.0%, 5.0%, and 10% concentrations of calcium polysulfide solution. Measurements of slurry pH and oxidation reduction potential (ORP) were made to provide data on the reagent dose required to achieve generation of reduced conditions (generally ORP of -250 millivolts or less) and were repeated on an hourly basis for 4 hours to determine long-term trends. All slurries dosed with 0.1% and greater calcium polysulfide concentrations resulted in sustained reducing conditions within the soil column over the 4 hour testing duration, indicating that the SRD is low to moderate, and hence acceptable for *in-situ* treatment.

The results of the SRD test suggest that the reductant demand is not high. Also, the subsurface lithology, lack of confining layers, and past chromium migration pathways indicate near-vertical movement through the soil. Therefore, it is likely reductant solution (and treated water) injected into trenches would contact groundwater within a reasonable period of time.

SECTION 4.0

SYSTEM OPERATION AND MONITORING

4.1 SYSTEM STARTUP

Initial system operation includes refinement of the hydraulic modeling results to determine what combination of extraction and injection flow rates will result in the optimal combination of plume capture and low flux through the treatment area. The location of extraction wells and injection well/trenches are shown on Figure 2. All equipment will undergo a 2-week testing and prove-out period following construction. Initially, above ground equipment will be charged and operated with clean water to leak check piping/fittings, assure proper equipment operation, and assure level and alarm float operation. Thereafter, extraction and treatment of Site groundwater will begin. Chemical dosing rates, pressures, and flow rates will be monitored and adjusted as necessary.

Operation will continue 24-hours per day, 7 days per week and will begin by pumping from all extraction wells, with higher pumping rates from upgradient wells (EW-1 and EW-2) in an attempt to reduce the on-site gradient, minimizing flux through the treatment area. All treated water will first be injected into cross-gradient perimeter trenches (IT-1 and IT-2), as flowrates from each extraction well are adjusted based upon gauging of site wells (GW-2, GW-14A, GW-3, IW-3) to create a reduced and hydraulically inward gradient. Pumping rates will then be proportionately increased to supply water for the calcium polysulfide solution for injection through the basin and downgradient injection trench. Piping laterals within the first sub-basin of the infiltration basin will be opened to achieve lateral distribution of reductant solution. Injection into other sub-basins will be rotated on a regular basis to obtain complete treatment of the soil source area.

Injections of reductant will begin in the infiltration basin and fluid movement through the vadose zone will be monitored with lysimeters prior to beginning any injections through perimeter trenches/wells. Simultaneous with basin injection, injection of reductant solution will be conducted just downgradient (perpendicular to groundwater flow) of the infiltration basin (IW-3 and IT-3). It is anticipated that the trench will be used to inject reductant solution, and the well will be initially used to monitor dissolved phase concentrations from the basin injection and record when reductant first arrives from IT-3 injection. If additional reductant solution is required more quickly, solution will also be injected down IW-3. This injection will be used to create a reducing zone to treat high hexavalent chromium concentration soil pore water that is expected during vadose zone soil pore water flushing/treatment prior to the water reaching down-gradient extraction wells (EW-3 and EW-4).

Nearby wells (IW-3, GW-1, and GW-3) will be monitored for ORP, hexavalent chromium, and sulfate throughout the infiltration process. If hexavalent chromium spikes are detected in surrounding wells (GW-1, GW-2, or GW-3), infiltration into the basin will cease until concentrations decrease as a result of non-source area calcium polysulfide injection and/or flushing from groundwater extraction and treatment. Injection of solution into other injection

trenches in other portions of the plume may be completed during or after basin treatment, depending upon required groundwater extraction flow rates and available reductant solution.

4.2 OPERATION, MAINTENANCE, AND MONITORING (OM&M)

Proper OM&M is necessary to assure remedial goals are achieved in a timely and cost-effective manner. This section provides a summary of the probable OM&M activities. An OM&M Plan will be prepared upon approval of the detailed design.

4.2.1 Routine Operation

Operation will continue 24-hours per day, 7 days per week with variations in pumping and injecting from different locations and to different locations (infiltration basin and injection trenches). The goal for interim groundwater remediation is to provide for hydraulic control of the on-Site chromium plume and to reduce concentrations of dissolved chromium in groundwater. Confirmation of achievement of remedial goals will be performed through the quarterly groundwater monitoring program. The results will continue to be provided in quarterly reports, which will include a specific section to discuss the remedial action activities and results.

Once the remedial goal has been achieved, the system will be shut down for a period of 1 month to allow subsurface conditions to stabilize. Confirmation groundwater and soil monitoring will be completed after this time. If results indicate the remedial goals have been achieved, the system will be shut down and decommissioned. If not, groundwater extraction and solution injection will continue where required. Extraction and/or injection well flow rates will be adjusted as necessary to promote capture and/or *in-situ* treatment of any recalcitrant areas.

4.2.2 Contingency Operation

Additional injection locations (IT-5A, IT-5B,and IT-5C) will be installed along the southern edge of the Site (during conveyance line placement) as a contingency measure in case continued IE treatment of downgradient extraction well water becomes uneconomical. If needed, these locations will be used to inject reductant solution to reduce *in-situ* hexavalent chromium concentrations in groundwater prior to extraction and further reductant dosing (primary water treatment) and reinjection through the infiltration basin or trenches. Calcium polysulfide reacts quickly and is not anticipated to be present in the extracted groundwater; however, elevated sulfate concentrations would likely preclude IE treatment. This alternative *ex-situ* calcium polysulfide treatment would be effective; however, flexibility would be reduced, as treated water would contain excess calcium polysulfide and hence should only be injected within the plume (not the perimeter of the Site).

Additional injection trenches will also be located in the western portion of the Home Depot parcel (currently identified as IT-4) and can be used to treat a potential secondary soil source area and known groundwater impacts. Delineation is not complete; therefore, a conveyance line for treated water containing calcium polysulfide will be routed to the western portion of Home Depot and capped within a below-ground vault for future routing to potential trench locations. The number, length, and location of trenches will be based upon results from the investigation

outlined in the *Additional Site Assessment Workplan* (MWH 2007a), expected to occur prior during construction of the remediation treatment system.

4.2.3 Maintenance

Metals precipitation increases required maintenance compared to a standard volatile organic compound (VOC) pump and treat system; however, high operational up-time can be maintained with proper preventative maintenance procedures. Some of the procedures include:

- Monitoring of system pressures to detect precipitation in piping. Piping will be designed to permit easy mechanical or chemical cleaning and removal of the precipitates.
- Pressure monitoring will indicate when injection wells require redevelopment.
- Mid-point IE and GAC sampling will be used to indicate when change-out is required.
- Precipitates will be regularly measured in the solids separator and required removal of accumulated solids will be scheduled to assure adequate retention times.
- Standard pump maintenance/cleaning and reductant solution conveyance piping cleaning will be completed.
- All piping, fittings, and tanks will be regularly inspected for leaks.
- Periodic testing and cleaning of level control and alarm floats will be conducted.

4.2.4 Monitoring

Monitoring activities will be of two types:

- Remediation monitoring to evaluate the effectiveness of the on-going remedial efforts, to allow for modifications to increase the effectiveness of the system.
- Regulatory monitoring to be specified as a part of the regulatory system.

Each aspect is discussed below. The regulatory monitoring requirements are to be imposed by the WDR requirements, which are expected to be received from the RWQCB. In the absence of specific requirements at this time, these are the anticipated monitoring requirements.

Remediation Monitoring. It is anticipated that the chemical nature of groundwater down-gradient of the infiltration basin will change soon after the start of operation.. Therefore, for the first 3 months of operation, daily readings will be made of the volume of water extracted from each well, daily groundwater level monitoring will be conducted on each extraction well, and daily field analysis of the pH, ORP, electrical conductivity, and hexavalent chromium (by means of a HACH field test kit) will be conducted on each extraction well discharge. Daily measurements will be made for the first 3 months and a minimum of three times per week after the first 3 months.

Once per month, samples from the extraction wells will be collected and submitted to an analytical laboratory for analysis of the following:

- Dissolved hexavalent chromium by EPA Method 7199;
- Iron, manganese, and arsenic by EPA Method 6010B;
- Calcium, magnesium, potassium, and sodium by EPA Method 6010B;
- Carbonate/bicarbonate alkalinity by SM2320; and
- Nitrate, nitrite, chloride, and sulfate by EPA Method 300.0.

Samples from the influent and effluent of the treatment system will also be collected daily and analyzed in the field for pH, ORP, and electrical conductivity for the first 3 months; and a minimum of three times per week after the first 3 months. A log will be kept of the amount of reductant added to the treatment system. Samples will be collected monthly from the influent and effluent of the treatment system and submitted to an analytical laboratory for analysis of hexavalent chromium by EPA Method 7199 and VOCs by EPA Method 8260B.

Monitoring of the infiltration basin will include monitoring the flow into each sub-basin and the standing solution depth daily for the first 3 months, and a minimum of three times per week after the first 3 months. Lysimeters will be sampled at least weekly and analyzed in the field for ORP, pH, electrical conductivity, and hexavalent chromium (by means of a HACH field test kit). Samples will be collected quarterly from the lysimeters and submitted to an analytical laboratory for analysis of hexavalent chromium by EPA Method 7199.

Monitoring of the injection well/trenches will include determination of the volume of solution discharged to each well/trench, the head pressure (if any) involved in the injection, and the water level in each injection well or trench. Monitoring will be conducted daily for the first 3 months and a minimum of three times per week after the first 3 months.

Frequency of the above-mentioned remediation monitoring may be modified as remediation progresses, depending on the results obtained in the field.

Regulatory Monitoring. As noted, the program of regulatory monitoring will be specified by the permitting authority; the RWQCB, and issuance of the WDR permit is expected within the month. However, it is anticipated that quarterly monitoring of the Site wells will be sufficient. The quarterly report that is submitted to the RWQCB will include remediation monitoring data, including the laboratory analyses of the recovery well(s) and treatment system influent and effluent.

MWH

BUILDING A BETTER WORLD

February 24, 2010

Ms. Tracy Egoscue, Executive Officer
Regional Water Quality Control Board, Los Angeles Region
320 West 4th Street, Suite 200
Los Angeles, California 90013

Subject: Addendum to Approved Soil and Interim Groundwater Remedial Action Plan for General Waste Discharge Requirements (WDR) Order No. R4-2007-0019, Former Bendix Facility - North Hollywood, California

Dear Ms. Egoscue:

This letter serves as an addendum to the approved *Design Update to the Soil and Interim Groundwater Remedial Action Plan* (*Design Update to SIGRAP*), submitted to the Regional Water Quality Control Board – Los Angeles Region (RWQCB) on September 17, 2007 by MWH Americas, Inc. (MWH) on behalf of Honeywell International Inc. (Honeywell), to include an alternate reductant source to enhance operations of the *in-situ* hexavalent chromium soil and interim groundwater treatment system performance at the former Bendix facility (site) in North Hollywood, California. The proposed modification is to have an alternate reductant source, a calcium polysulfide/sodium polysulfide blend known as COPRex, approved for use at this site in addition to calcium polysulfide, which is currently the approved reductant solution being used and approved under the General WDR referenced above.

Background

Remediation system operation began in January 2009. System operation began with testing injection trenches for infiltration rates, system equipment operation, and calcium polysulfide solution equipment prove-out. Continuous treatment system groundwater extraction and injection operations began on January 26, 2009. Calcium polysulfide reductant solution injection began at IT-3 in mid-March 2009. Injection of reductant solution began at IT-3 to establish a reducing environment in groundwater in the vicinity and downgradient of the infiltration basin.

In May 2009, calcium polysulfide delivery to the subsurface was directly to IT-3 (via clean-out connection) at full strength (as a 29% solution, as delivered) from tanker trucks in batches of approximately 4,800 gallons. Following each tanker truck delivery of calcium polysulfide, treated water was injected into IT-3 to help flush the calcium polysulfide down through the vadose zone to groundwater. Soil borings filled with gravel were installed in July 2009 in injection trench IT-3 to help increase the infiltration capacity, which was limited by the precipitates/solids generated in the trench gravel material and native surrounding soil. In August 2009, injection trench IT-3 was expanded on the south side to increase infiltration capacity.

3050 Saturn Street
Suite 205
Brea, California 92821

TEL 714-646-2020
FAX 714-986-9834
www.mwhglobal.com

Proposed Modifications

The application/use of an alternate reductant solution, a calcium polysulfide/sodium polysulfide blend (COPRex), in addition to calcium polysulfide (currently the approved reductant solution) is requested to further expedite the cleanup schedule and avoid potential for unanticipated precipitated solids. The two components of COPRex, calcium polysulfide and sodium polysulfide, are both listed as approved reductant types in the General WDR, as listed in Table 1 of WDR Order No. R4-2007-0019 (see Attachment A for reference). A copy of the material safety data sheet (MSDS) for COPRex is provided as Attachment B. The injection locations and injection methods of COPRex will not be modified from previous operations with the use of calcium polysulfide.

Closing

Upon receipt of approval from the RWQCB for use of COPRex at the site, MWH will proceed with arrangements to procure this reductant solution. A summary of the modifications made will be provided in the next quarterly WDR Monitoring Report submitted to the RWQCB on April 15, 2010. Should you have any questions, please feel free to contact Linda Tuley at (714) 646-2003.

Sincerely,
MWH

Linda Tuley

Linda Tuley, P.E.
Project Manager/Engineer

Attachments: A - Table 1 of WDR Order No. R4-2007-0019
B - COPRex MSDS

cc: Benny DeHghi – Honeywell International Inc.
Dixon Oriola and Larry Moore - RWQCB
Albert Pena - Home Depot
Karen Lore – Public Storage
Ron Newquist – Kaiser Permanente

ATTACHMENTS

TABLE 1

Remediation Technologies Used at U.S. Chromium Sites

Additive	Additive Type	Treatment Mechanism	Comments
Calcium Polysulfide	Inorganic	Sulfide oxidation causing hexavalent chromium reduction to trivalent chromium and precipitation as a sulfide	End products in aerobic conditions is sulfate and sulfide precipitate (retained by soil) and in anaerobic conditions may produce measurable concentrations of aqueous sulfide or other sulfide compounds.
Hydrogen Sulfide Gas	Inorganic		
Sodium Sulfide	Inorganic		
Ferrous Sulfate	Inorganic	Ferrous oxidation causing hexavalent chromium reduction to trivalent chromium and coprecipitation with ferric iron hydroxide	End products in aerobic conditions is ferric coprecipitate (retained by soil) and in anaerobic conditions may produce measurable concentrations of aqueous ferrous iron and trivalent chromium.
Sodium Dithionite	Inorganic	Sulfite oxidation causing hexavalent chromium reduction to trivalent chromium, excess trivalent chromium precipitates as hydroxide	End products in aerobic conditions is a hydroxide precipitate (retained by soil) and, potentially, measureable concentrations of aqueous trivalent chromium and in anaerobic conditions may produce higher measurable concentrations of aqueous trivalent chromium.
Sulfur Dioxide Gas	Inorganic		
Sodium Metabisulfite	Inorganic		
Molasses	Organic (Off-the-Shelf)	Anaerobic biological depression of ORP causing reduction of hexavalent chromium reduction to trivalent chromium, excess trivalent chromium precipitates as hydroxide	End products in aerobic conditions is a hydroxide precipitate (retained by soil) and, potentially, measureable concentrations of aqueous trivalent chromium and in anaerobic conditions may produce higher measurable concentrations of aqueous trivalent chromium and carboxylic acids (incomplete transformation of organic source).
Cheese Whey	Organic (Off-the-Shelf)		
Sodium Lactate	Organic (Off-the-Shelf)		
Emulsified Oil	Organic (Off-the-Shelf)		
Corn Syrup	Organic (Off-the-Shelf)		
Ethanol	Organic (Off-the-Shelf)		
Lactose	Organic (Off-the-Shelf)		
HRC	Organic (Proprietary)	Anaerobic biological depression of ORP causing reduction of hexavalent chromium reduction to trivalent chromium, excess trivalent chromium precipitates as hydroxide	HRC (Hydrogen Release Compound by Regenesis) is propanoic acid, also known as Glycerol Tripolylactate, a carbohydrate. It is a highly viscous material (like Honey) that dissolves slowly, typically about 18 months. End products in aerobic conditions is a hydroxide precipitate (retained by soil) and, potentially, measureable concentrations of aqueous trivalent chromium and in anaerobic conditions may produce higher measurable concentrations of aqueous trivalent chromium and carboxylic acids (incomplete transformation of organic source).
ORC	Organic (Proprietary) blended with inorganic	Anaerobic biological depression of ORP causing reduction of hexavalent chromium reduction to trivalent chromium, potentially also direct reduction by inorganic sulfide, trivalent chromium precipitates as sulfide	ORC (Oxygen Remediation Compound by Regenesis) is the same material as HRC with an additional organosulfur to precipitate trivalent chromium as a sulfide precipitate. Like HRC, it is a highly viscous material that dissolves slowly, typically about 18 months. End products in aerobic conditions is sulfate and sulfide precipitate (retained by soil) and in anaerobic conditions may produce measurable concentrations of aqueous sulfide or other sulfide compounds and carboxylic acids (incomplete transformation of organic source).

ATTACHMENT A

REDOX SOLUTIONS, LLC

"...providing sulfide reagents for treatment of COPR and other metal-bearing wastes..."

$COPR_{EX}$

(Proprietary Polysulfide Blend)
CAS NO.: (1344-81-6 & 1313-82-2)

Description

$COPR_{EX}$ is a deep reddish black solution; pH is in the 11.5-12.5 range.

Uses

Uses include precipitation of heavy metals from plating, circuit board and other liquid waste streams and cyanide conversion and destruction. Used for ground water remediation for heavy metals and for soil remediation at manufacturing sites, mine areas and similar locations. Used in ex-situ and in situ processes for on-site remediation projects.

Formula: NaS_x & CaS_x Formula Weight: 187.20

Specifications

Sodium/Calcium Polysulfide	51%
pH	11.5-12.5
Specific Gravity	1.2-1.45
Appearance	Deep reddish black solution
Physical Properties	11.8 lbs/gal 169 gal/ton
Solubility	Soluble in Water

Domestic Shipping Information

DOT Proper Shipping Name	Not Regulated
DOT Hazard Class	Not Regulated
DOT ID Number	Not Regulated
Shipping Description	Sodium/Calcium Polysulfide Solution
Shipment Options	DOT Approved Rail Tank Cars or Tanker Trucks

11550 N. Meridian ST., Suite 180
Carmel, IN 46032
317-660-6867

MWH

BUILDING A BETTER WORLD

RECEIVED
2010 FEB 4 AM 9 38

February 3, 2010

Ms. Tracy Egoscue, Executive Officer
Regional Water Quality Control Board, Los Angeles Region
320 West 4th Street, Suite 200
Los Angeles, California 90013

Subject: Addendum to Approved Soil and Interim Groundwater Remedial Action Plan for General Waste Discharge Requirements (WDR) Order No. R4-2007-0019, Former Bendix Facility - North Hollywood, California

Dear Ms. Egoscue:

This letter serves as an addendum to the approved *Design Update to the Soil and Interim Groundwater Remedial Action Plan* (*Design Update to SIGRAP*), submitted to the Regional Water Quality Control Board – Los Angeles Region (RWQCB) on September 17, 2007 by MWH Americas, Inc. (MWH) on behalf of Honeywell International Inc. (Honeywell), to include installation and operation on one additional extraction well to enhance and expedite the soil and groundwater cleanup at the former Bendix facility (site) in North Hollywood, California. It is our intent to install an additional upgradient extraction well (EW-5), northwest of existing upgradient extraction well EW-1, to provide additional pumping capacity to help with reductant solution movement that accelerates clean-up at the site (Figure 1). Extracted water from EW-5 will be conveyed with extracted water from EW-1 (through existing conveyance piping) to the treatment system equipment prior to reinjection, meeting all requirements identified in the General WDR issued for the site on December 12, 2007.

Background

Remediation system operation began in January 2009. System operation began with testing injection trenches for infiltration rates, system equipment operation, and calcium polysulfide solution equipment prove-out. Continuous treatment system groundwater extraction and injection operations began on January 26, 2009. Calcium polysulfide reductant solution injection began at IT-3 in mid-March 2009. Injection of reductant solution began at IT-3 to establish a reducing environment in groundwater in the vicinity and downgradient of the infiltration basin. Reduced conditions (negative oxidation reduction potential [ORP]) in groundwater were measured in well IW-3 (just upgradient of injection trench IT-3) in mid-June 2009. A large reduced (low ORP) area in groundwater beneath the infiltration basin (i.e. GW-14A) is desired to prepare for the pore-water flush of high-concentration hexavalent chromium that will occur during infiltration basin injections. Reduced conditions have not been observed in any other monitoring well, including GW-14A. To accelerate reductant migration beneath the infiltration basin, extraction of two existing groundwater monitoring wells (GW-14A and GW-14B) were recently installed to enhance northward migration of reductant solution in groundwater from the IT-3 injections. In conjunction, extraction from an additional upgradient well is proposed to further enhance reductant solution movement and allow for greater hydraulic control during source area (infiltration basin) injections.

3050 Saturn Street
Suite 205
Brea, California 92821

TEL 714-646-2020
FAX 714-986-9834
www.mwhglobal.com

Proposed Modifications

EW-5 will be constructed similar to other existing extraction wells operating at the site, as shown on Sheet M-5 (attached). It is anticipated that EW-5 will operate concurrently with other extraction wells EW-2, EW-3, and EW-4, along with EW-1 to further enhance reductant solution movement and allow for greater hydraulic control during source area (infiltration basin) injections. The operation of these wells will be adjusted as warranted by data and system operations.

The installation of EW-5 is contemplated to begin during the week of February 8, 2010, after securing RWQCBs approval. The appropriate well installation permit will be obtained from the County of Los Angeles Department of Public Health prior to well construction. Following well installation, well development and trenching for conveyance line and electrical tie-ins will be performed.

Closing

A summary of the above mentioned modifications will be provided in the next quarterly WDR Monitoring Report that will be submitted to the RWQCB on April 15, 2010. Should you have any questions, please feel free to contact Linda Tuley at (714) 646-2003.

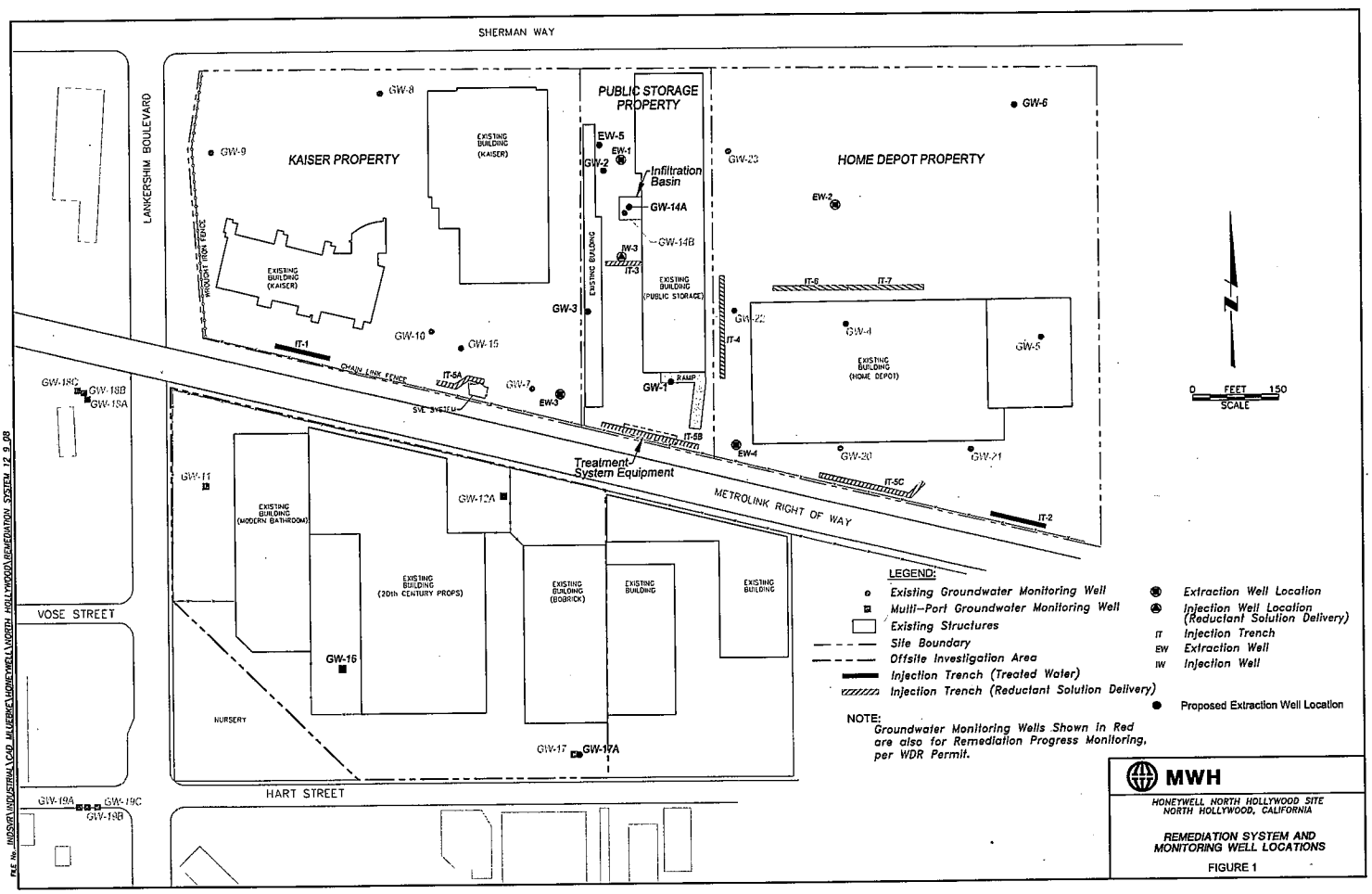
Sincerely,
MWH

Linda Tuley

Linda Tuley, P.E.
Project Manager/Engineer

Attachments: Figure 1 – Remediation System Layout and Monitoring Well Locations
Sheet M-5 – Extraction Well Construction Detail (Detail 2)

cc: Benny DeHghi – Honeywell International Inc.
Albert Pena, - Home Depot
Karen Lore – Public Storage
Ron Newquist – Kaiser Permanente



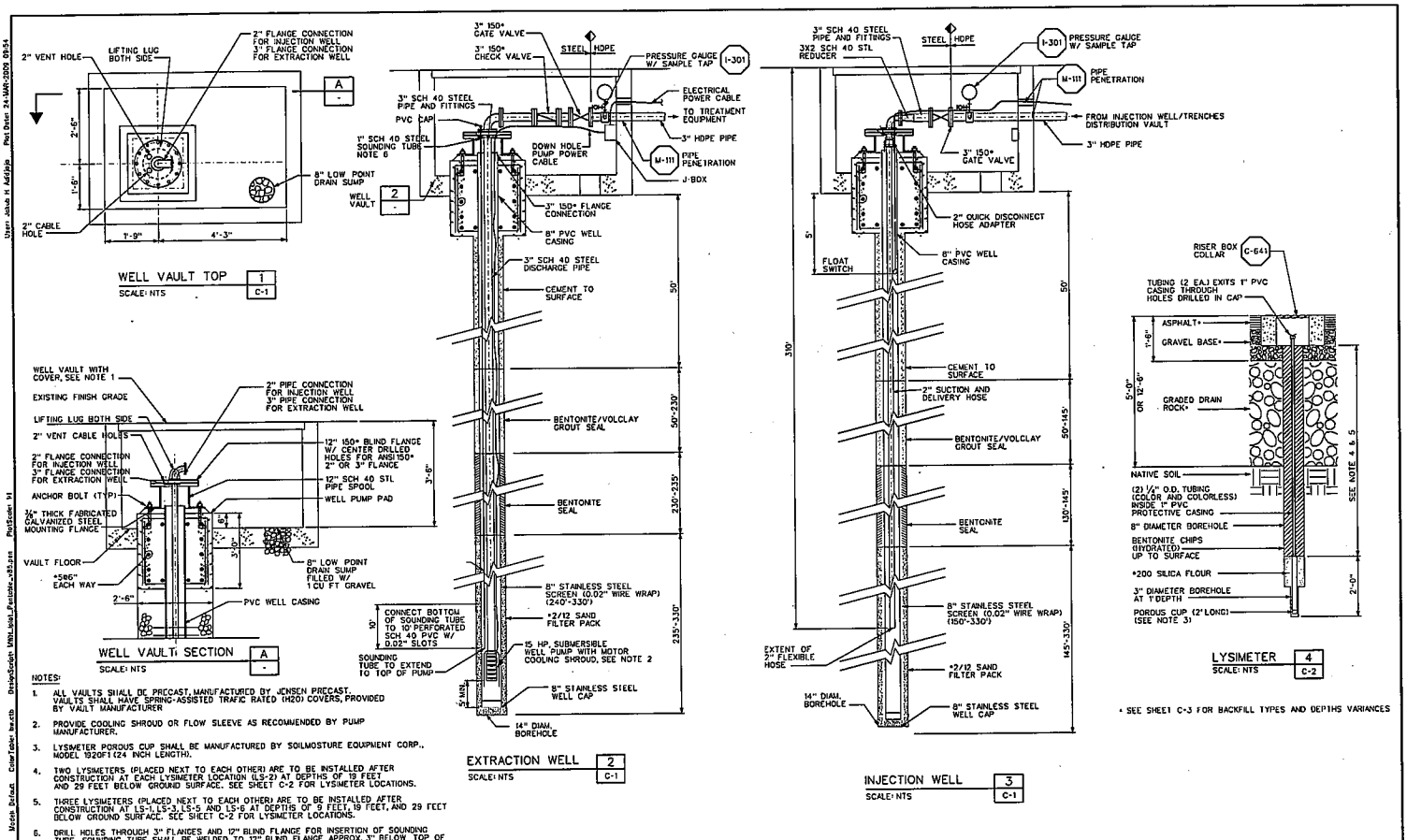
P:\E No. INDUSTRY\INDUSTRIAL\CAD_JAL\EBKC\HONEYWELL\NORTH HOLLYWOOD\REMEDIATION SYSTEM_12_9_08

MWH

HONEYWELL NORTH HOLLYWOOD SITE
NORTH HOLLYWOOD, CALIFORNIA

REMEDIATION SYSTEM AND MONITORING WELL LOCATIONS

FIGURE 1


2" VENT HOLE
LIFTING LUG BOTH SIDE
2" FLANGE CONNECTION FOR INJECTION WELL 3" FLANGE CONNECTION FOR EXTRACTION WELL
2'-6"
1'-6"
8" LOW POINT DRAIN SUMP
2" CABLE HOLE
1'-9"
4'-3"
WELL VAULT TOP
SCALE: NTS
3" 150# GATE VALVE
3" 150# CHECK VALVE
STEEL | HDPE
PRESSURE GAUGE W/ SAMPLE TAP
I-301
3" SCH 40 STEEL PIPE AND FITTINGS
PVC CAP
ELECTRICAL POWER CABLE
TO TREATMENT EQUIPMENT
1" SCH 40 STEEL SOUNDING TUBE NOTE 6
DOWN HOLE PUMP POWER CABLE
3" HDPE PIPE
M-111
PIPE PENETRATION
J-BOX
WELL VAULT
3" 150# FLANGE CONNECTION
8" PVC WELL CASING
3" SCH 40 STEEL DISCHARGE PIPE
CEMENT TO SURFACE
50'
BENTONITE/VOLCLAY GROUT SEAL
50'-230'
BENTONITE SEAL
230'-235'
8" STAINLESS STEEL SCREEN (0.02" WIRE WRAP) (240'-330')
#2/12 SAND FILTER PACK
15 HP, SUBMERSIBLE WELL PUMP WITH MOTOR COOLING SHROUD, SEE NOTE 2
CONNECT BOTTOM OF SOUNDING TUBE TO 10' PERFORATED SCH 40 PVC W/ 0.02" SLOTS
10'
SOUNDING TUBE TO EXTEND TO TOP OF PUMP
5' MIN.
8" STAINLESS STEEL WELL CAP
14" DIAM. BOREHOLE
EXTRACTION WELL
SCALE: NTS
WELL VAULT WITH COVER, SEE NOTE 1
EXISTING FINISH GRADE
LIFTING LUG BOTH SIDE
2" VENT CABLE HOLES
2" FLANGE CONNECTION FOR INJECTION WELL 3" FLANGE CONNECTION FOR EXTRACTION WELL
2" PIPE CONNECTION FOR INJECTION WELL 3" PIPE CONNECTION FOR EXTRACTION WELL
12" 150# BLIND FLANGE W/ CENTER DRILLED HOLES FOR ANSI 150# 2" OR 3" FLANGE
12" SCH 40 STL PIPE SPOOL
3'-6"
WELL PUMP PAD
ANCHOR BOLT (TYP)
3/4" THICK FABRICATED GALVANIZED STEEL MOUNTING FLANGE
VAULT FLOOR
+5%" EACH WAY
3'-0"
8" LOW POINT DRAIN SUMP FILLED W/ 1 CU FT GRAVEL
2'-6"
PVC WELL CASING
WELL VAULT SECTION
SCALE: NTS
NOTES:
1. ALL VAULTS SHALL BE PRECAST, MANUFACTURED BY JENSEN PRECAST. VAULTS SHALL HAVE SPRING-ASSISTED TRAFIC RATED (H20) COVERS, PROVIDED BY VAULT MANUFACTURER.
2. PROVIDE COOLING SHROUD OR FLOW SLEEVE AS RECOMMENDED BY PUMP MANUFACTURER.
3. LYSIMETER POROUS CUP SHALL BE MANUFACTURED BY SOILMOISTURE EQUIPMENT CORP., MODEL 1920F1 (24 INCH LENGTH).
4. TWO LYSIMETERS (PLACED NEXT TO EACH OTHER) ARE TO BE INSTALLED AFTER CONSTRUCTION AT EACH LYSIMETER LOCATION (LS-2) AT DEPTHS OF 19 FEET AND 29 FEET BELOW GROUND SURFACE. SEE SHEET C-2 FOR LYSIMETER LOCATIONS.
5. THREE LYSIMETERS (PLACED NEXT TO EACH OTHER) ARE TO BE INSTALLED AFTER CONSTRUCTION AT LS-1, LS-3, LS-5 AND LS-6 AT DEPTHS OF 9 FEET, 19 FEET, AND 29 FEET BELOW GROUND SURFACE. SEE SHEET C-2 FOR LYSIMETER LOCATIONS.
6. DRILL HOLES THROUGH 3" FLANGES AND 12" BLIND FLANGE FOR INSERTION OF SOUNDING TUBE. SOUNDING TUBE SHALL BE WELDED TO 12" BLIND FLANGE APPROX. 3" BELOW TOP OF TUBE. PROVIDE THREADED COVER TO TOP OF TUB. CONTRACTOR SHALL SUBMIT INSTALLATION DETAIL TO ENGINEER FOR APPROVAL.
3" SCH 40 STEEL PIPE AND FITTINGS
3X2 SCH 40 STL REDUCER
STEEL | HDPE
I-301
PRESSURE GAUGE W/ SAMPLE TAP
M-111
PIPE PENETRATION
FROM INJECTION WELL/TRENCHES DISTRIBUTION VAULT
3" HDPE PIPE
3" 150# GATE VALVE
2" QUICK DISCONNECT HOSE ADAPTER
8" PVC WELL CASING
5'
FLOAT SWITCH
310'
50'
CEMENT TO SURFACE
2" SUCTION AND DELIVERY HOSE
50'-145'
BENTONITE/VOLCLAY GROUT SEAL
BENTONITE SEAL
145'-330'
8" STAINLESS STEEL SCREEN (0.02" WIRE WRAP) (150'-330')
#2/12 SAND FILTER PACK
EXTENT OF 2" FLEXIBLE HOSE
14" DIAM. BOREHOLE
8" STAINLESS STEEL WELL CAP
INJECTION WELL
SCALE: NTS
RISER BOX COLLAR
C-641
TUBING (2 EA.) EXITS 1" PVC CASING THROUGH HOLES DRILLED IN CAP
ASPHALT*
1'-6"
GRAVEL BASE*
5'-0" OR 12'-0"
GRADED DRAIN ROCK*
NATIVE SOIL
(2) 1/4" O.D. TUBING (COLOR AND COLORLESS) INSIDE 1" PVC PROTECTIVE CASING
8" DIAMETER BOREHOLE
BENTONITE CHIPS (HYDRATED) UP TO SURFACE
#200 SILICA FLOUR
3" DIAMETER BOREHOLE AT 1' DEPTH
POROUS CUP (2" LONG) (SEE NOTE 3)
2'-0"
SEE NOTE 4 & 5
LYSIMETER
SCALE: NTS
* SEE SHEET C-3 FOR BACKFILL TYPES AND DEPTHS VARIANCES
R 03/02/08 RLL RECORD DRAWING
REV DATE BY DESCRIPTION
SCALE NO SCALE
WARNING 0 1/2 1 IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO SCALE
DESIGNED J. ADEJAJA
DRAWN J. ADEJAJA
CHECKED C. SEMON
RECORD DRAWING
This record drawing has been prepared, entirely or in part on the basis of unverified information compiled and furnished by others to the preparer who is not responsible for any inaccuracies, errors or omissions which may have been incorporated into the document as a result.
MWH
Arcadia CA
HONEYWELL INTERNATIONAL INC.
TORRANCE, CALIFORNIA
HONEYWELL NORTH HOLLYWOOD PROJECT
NORTH HOLLYWOOD, CALIFORNIA
100% REMEDIATION DESIGN SUBMITTAL
MECHANICAL
SECTIONS AND DETAILS II
SHEET
M-5
1091378
User: Mark H. Adelpia Plot Date: 24-MAR-2009 09:54
PlotScale= 1.1
DesignScript: MNA_Mod_Parameters.scr
ColorTable= bw.ctb
Mode: Default
File: M-5_Sht2.dgn

From: Larry Moore
To: Tuley, Linda
CC: Dehghi, Benny; Dixon Oriola; Larry Moore; Walsh, Donald
Date: 2/4/2010 10:28 AM
Subject: Re: Feb. 3, 2010 Addendum to Approved SIGRAP for General Waste Discharge Requirements (WDR) Order No. R4-2007¬0019, Former Bendix Facility

Good Morning Linda,

The Regional Board has reviewed the letter entitled "Addendum to Approved Soil and Interim Groundwater Remedial Action Plan for General Waste Discharge Requirements (WDR) Order No. R4-2007¬0019, Former Bendix Facility - North Hollywood, California, (MWH, February 3, 2010). The letter is an addendum to the approved *Design Update to the Soil and interim Groundwater Remedial Action Plan* (Design Update to SIGRAP), submitted to the Regional on September 17, 2007 by (MWH) on behalf of Honeywell International Inc. (Honeywell), and includes the installation and operation of one additional extraction well to enhance and expedite the soil and groundwater cleanup at the former Bendix facility (site) in North Hollywood, California. It is Honeywell's intent to install one additional upgradient extraction well (EW-5), northwest of existing upgradient extraction well EW-1, to provide additional pumping capacity and to help with reductant solution movement which will accelerate clean-up at the site. Extracted water from EW-5 will be conveyed with extracted water from EW-1 (through existing conveyance piping) to the onsite treatment system equipment prior to reinjection, meeting all of the Regional Board's requirements identified in the General WDR issued for the site on December 12, 2007.

The Regional Board understands Honeywell's proposed modifications are for EW-5 to be constructed similar to other existing extraction wells operating at the site. Honeywell anticipates that EW-5 will operate concurrently with other extraction wells EW-2, EW-3, and EW-4, along with EW-1 to further enhance reductant solution movement and allow for greater hydraulic control during source area (infiltration basin) injections. The operation of these wells will be adjusted as warranted by data and system operations. If Regional Board approval is granted, then Honeywell's plans are to begin the installation of EW-5 beginning the week of February 8, 2010. Honeywell is prepared to procure the appropriate well installation permit from the County of Los Angeles Department of Public Health prior to well construction. Once well installation is completed, well development and trenching for conveyance line and electrical tie-ins will be performed. A summary of the above mentioned modifications will be provided in the next quarterly WDR Monitoring Report that will be submitted to the RWQCB on April 15, 2010.

Based on the information presented in the letter, your proposed addendum is approved provided that the proposed modifications are completed as discussed in the letter.

We are providing this approval so that you can begin implementing the proposed addendum. A formal letter documenting the proposed modifications and subsequent approval by the Regional Board will be submitted to Mr. Benny Dehghi of Honeywell, with copies being provided to you and Mr. Walsh of MWH. This letter will be issued within the next 30 working days.

If you have questions please call either Dixon Oriola at 213-576-6803 or me at the number provided below.

Best regards,

Larry Moore, REA
Environmental Scientist III

==========
Site Cleanup Program - Unit II
CAL EPA
Regional Water Quality Control Board - LA Region

320 West 4th Street, Suite 200
Los Angeles, CA 90013-2342

Office: (213) 576-6730
Fax: (213) 576-6717
Email: lmoore@waterboards.ca.gov

To comply with the Governor's order mandating furloughs, the boards, departments and offices of Cal-EPA are closed the first, second, and third Fridays of the month.

The energy challenge facing California is real. Every Californian needs to take immediate action to reduce energy consumption
***For a list of simple ways to reduce demand and cut your energy costs, see the tips at: http://www.swrcb.ca.gov/news/echallenge.html ***

Arundo Donax Removal in the Santa Ana River Watershed

Jenny Glasser *– Orange County Water District*

On June 6, 2003, Orange County Water District (OCWD) was awarded the Ruth Anderson Wilson Award by the Santa Ana Watershed Project Authority for its collaborative efforts in a program to remove Arundo donax (arundo) from the Santa Ana River watershed. The arundo removal program is also one reason the U.S. Environmental Protection Agency selected OCWD as a Clean Water Partner for 2003.

Arundo donax, or the giant cane, is a non-native, abundant bamboo-like grass that invades the habitats of native flora and fauna, all the while consuming enormous amounts of water. In addition, it is extremely flammable, it clutters beaches, and it clogs up streams and waterways, causing flooding and even bridge damage. Eight thousand acres of arundo use 20,000 to 30,000 acre-feet (about 10 billion gallons) of water per year more than does native habitat, enough water for 100,000 people.

Arundo donax. Photo by Orange County Water District.

Arundo, nicknamed "the plant from hell," was introduced into Orange County from Europe in the late 1800s as a means of preventing erosion of irrigation ditches. It is a member of the grass family, although it looks more like bamboo. It is primarily found along the Santa Ana River and its tributaries, but can also be found in neighborhoods throughout Orange County and all the way down to the beach. Given sufficient sunlight and water, it can grow up to 10 inches per day in the summer and reach a height of more than 25 feet. Arundo grows so densely in pure stands that it is virtually impenetrable.

An estimated 8,000 to 10,000 acres of arundo inhabit the Santa Ana River watershed. To date, about 1,500 acres have been removed. Initial removal of one acre of arundo costs $5,000 to $9,500, but removing the plant by cutting it off above ground only stimulates additional growth from its massive root system. Full control requires decades of follow-up treatment of the regrowth by additional manual cutting and treatment with herbicides. Removal of the root systems is impractical. Furthermore, arundo removal must be initiated at the top of each watershed because the persistent plant has the ability to break off and transplant itself downstream. However, after the long battle against arundo is waged, native willows, sycamores, and cottonwoods can be replanted or regenerate

see Arundo, page 33

Arundo, continued from page 6

on their own. Restoration of the natural habitat supports local flora and fauna and saves water.

OCWD has not tackled arundo removal alone; the agency has partnered with several others, including the Santa Ana Watershed Association, which consists of the Riverside-Corona, East Valley, San Jacinto Basin, and Inland Empire West Resource Conservation Districts; the U.S. Fish and Wildlife Service; the Santa Ana Regional Water Quality Control Board; the U.S. Army Corps of Engineers; the California Department of Fish and Game; and area counties, cities, and private landowners abutting the Santa Ana River and its tributaries. To date, more than $17 million has been raised for arundo removal. The resource conservation districts either perform or oversee most of the work on the ground.

Compounding problems in removing arundo is the fact that some commercial nurseries sell it for use as a privacy screen because of its dense growth. It is hoped that soon the California Department of Food and Agriculture will ban the sale of arundo in the state.

The Ruth Anderson Wilson Award is named after a co-founder of the Tri-County Conservation League. The group aims to keep a "soft bottom" to the river for recreational use when it is not in flood conditions, let the natural effects of flooding be accommodated so that new soil and seeds can create young forage for wildlife, and retain water in the Santa Ana River to refill the local groundwater reservoirs. The Santa Ana Watershed Project Authority, which sponsors the award, is a group of water agencies that collaborate to protect and improve the environment and water in the land drained by the Santa Ana River. The Authority includes the Inland Empire Utilities Agency, Eastern Municipal Water District, Orange County Water District, San Bernardino Valley Municipal Water District, and Western Municipal Water District.

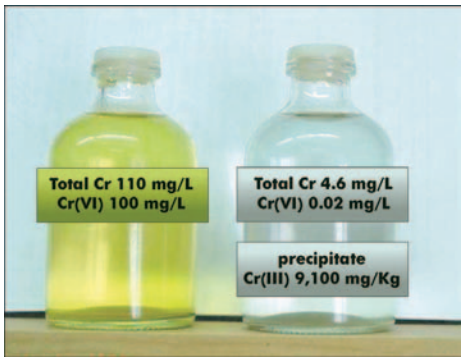
Visit www.ocwd.com for more information.

In-Situ Remediation of a Chromium-Contaminated Site Using Calcium Polysulfide

Andrew Messer, Peter Storch, *and* ***David Palmer*** *– URS Corporation*

URS Corporation is using calcium polysulfide (CPS) for in-situ geochemical fixation of hexavalent chromium, Cr(VI), in soil and groundwater in alluvial fan sediments at a former metal plating facility in western Arizona. Concentrations of Cr(VI) in groundwater at the site exceed 200 milligrams per liter (mg/L) compared to the maximum contaminant level of 0.1 mg/L for dissolved chromium in drinking water set by the U.S. Environmental Protection Agency. URS has completed vadose zone and groundwater pilot tests using CPS and has begun full-scale vadose zone application in the source area.

CPS is used extensively as an agricultural soil amendment and for removal of metals in water treatment systems, and has recently been approved for in-situ remediation at several sites in the United States. CPS is more stable and persistent in subsurface environments than other reductants such as

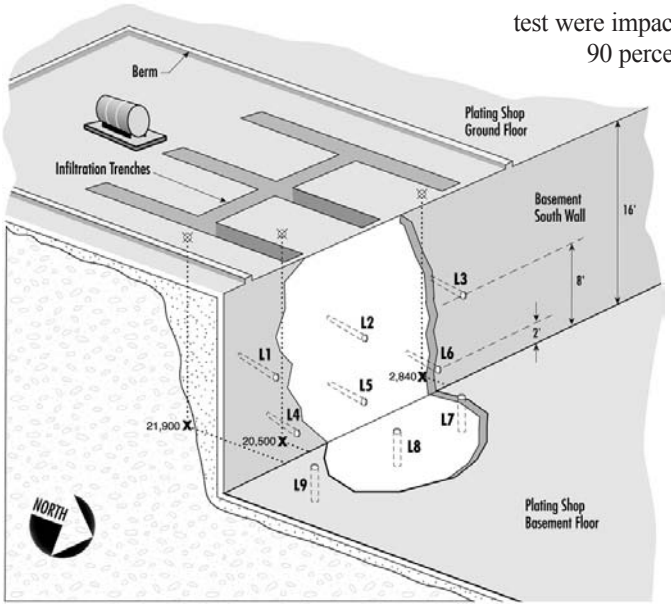


Groundwater samples from an observation well: pretreatment (left) and day 9 of treatment (right).

sodium dithionite, does not form insoluble precipitates such as ferrous sulfate, and is relatively safe to handle in the field. CPS reduces Cr(VI), commonly in the form of chromate, CrO_4^{2-}, to the relatively insoluble form of trivalent chromium, Cr(III), which is less toxic and tends to fall out of solution and adhere to soil. One example of the reaction is:

$$2CrO_4^{2-} + 3CaS_5 + 10H^+ \rightleftarrows 2Cr(OH)_{3\,(s)} + 15S_{(s)} + 3Ca^{2+} + 2H_2O$$

The fixation of Cr(VI) by CPS is considered to be a permanent remediation technique under most groundwater conditions. The reaction is theoretically reversible; however, under natural groundwater conditions the equilibrium condition is dominated by the right side of this reaction. Furthermore, the only mechanism identified in the literature for the re-oxidation of Cr(III) under natural groundwater conditions is by a grain surface reaction that occurs when dissolved Cr(III) is exposed to aquifer sediments coated with manganese dioxide (MnO_2). Since $Cr(OH)_3$ is a solid precipitate, reaction with MnO_2 is limited by the extremely low solubility of this compound.



Vadose zone pilot test infiltration trenches and lysimeters.

Prior to vadose zone treatment, Cr(VI) concentrations in the 20 square-foot test zone were as high as 2,190 mg/kg in soil and 3,600 mg/L in the vadose zone pore water. Over a period of about 24 hours, approximately 660 gallons of 29 percent CPS were applied to infiltration trenches, followed by 2,500 gallons of water to disperse the chemical through the test zone. The wetting front was monitored and sampled with soil lysimeters installed in a basement wall (see figure above). Results during the first 30 days indicated that eight of the nine lysimeters used to monitor the test were impacted and demonstrated a 90 percent reduction in Cr(VI) concentrations.

In the groundwater pilot test area, the aquifer at 165 feet below surface was impacted by Cr(VI) concentrations of 240 mg/L, nitrates exceeding 400 mg/L, and trichloroethene and other VOCs. Approximately 9,000 gallons of 29 percent CPS were injected through an existing monitor well, followed by 79,000 gallons of water, at an average rate of 31 gallons per minute, to flush the well and push the reductant to an observation well at a distance of 30 feet across the regional hydraulic gradient. Downhole monitoring was conducted in the observation well using a multiparameter probe and depth-specific sampler. After 35 hours, breakthrough of CPS was indicated by a decrease in oxidation/reduction potential (ORP) and an increase in pH and total dissolved solids. Concentrations of Cr(VI) in the observation well dropped from 240 mg/L to less than 1 mg/L shortly after ORP became negative. Mobilization of arsenic, iron, and manganese from aquifer solids due to the reducing conditions was not observed. In the observation well at the edge of the injected CPS footprint, rebound of Cr(VI) concentrations occurred after 115 days. In the injection well at the center of the injected reductant, ORP has remained negative and Cr(VI) concentrations were below detection after 419 days. URS is proceeding with full-scale vadose zone application in the source area and plans a full-scale groundwater remediation.

For more information, contact Peter Storch at 602-861-7422 or Andrew Messer 520-407-2844.

hydroGEOPHYSICS, Inc.
www.hydrogeophysics.com
Non-Intrusive Hydrogeologic Characterization
✓ Alluvial Basin Definition
✓ Recharge Site Monitoring
✓ Plume Mapping
✓ Fracture and Fissure Mapping
Arizona registered geophysical engineer • over 30 years experience
2302 N. FORBES BLVD. • TUCSON, ARIZONA 85745
TELEPHONE (520) 647-3315 • FAX (520) 647-3428

Siphon-Infiltration Trench Field-Tested in Albuquerque

***James A. Kelsey**, Senior Scientist and **John T. Kay**, Hydrogeologist – Daniel B. Stephens & Associates*

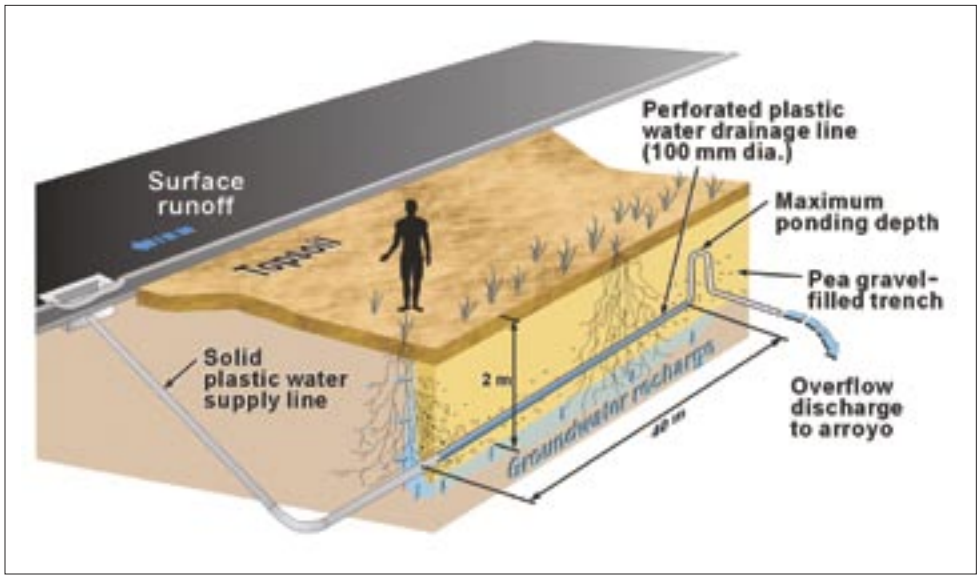
Daniel B. Stephens & Associates (DBS&A) recently designed and field-tested a self-cleaning infiltration trench. DBS&A's siphon-infiltration trench offers a low-cost, low-maintenance solution to the sedimentation and performance problems associated with traditional agricultural drains and other infiltration trenches. The trench intercepts surface runoff and diverts it to the subsurface, and, depending on the location, can result in increased groundwater recharge, decreased erosion, improved water quality, and improved riparian habitat. A siphon creates periodic, rapid-flow conditions that flush sediment out of the infiltration system, thus providing a self-cleaning function.

AMAFCA assists with construction of the trench

With the assistance of the Albuquerque Metropolitan Arroyo Flood Control Authority (AMAFCA), DBS&A installed a 50-meter-long siphon-infiltration trench adjacent to an unlined arroyo in Albuquerque, New Mexico. The trench was outfitted with multiple flow meters and pressure transducers to monitor flow rates and water levels at different locations along the trench. Self-cleaning ability and infiltration potential are currently being monitored and assessed.

How It Works

As far as DBS&A has been able to ascertain, siphons have not previously been used in a similar infiltration application. Almost no relevant literature exists on this subject. The design and installation of this system were determined from bench-scale results obtained in the DBS&A laboratory.



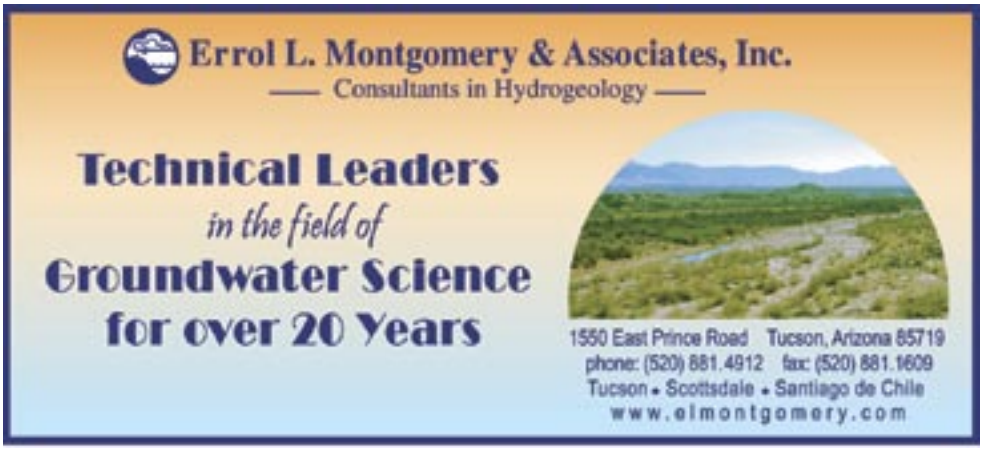
Schematic diagram of a typical siphon-infiltration trench. The infiltration trench can be applied to most locations where diversion of surface water to the subsurface is desirable.

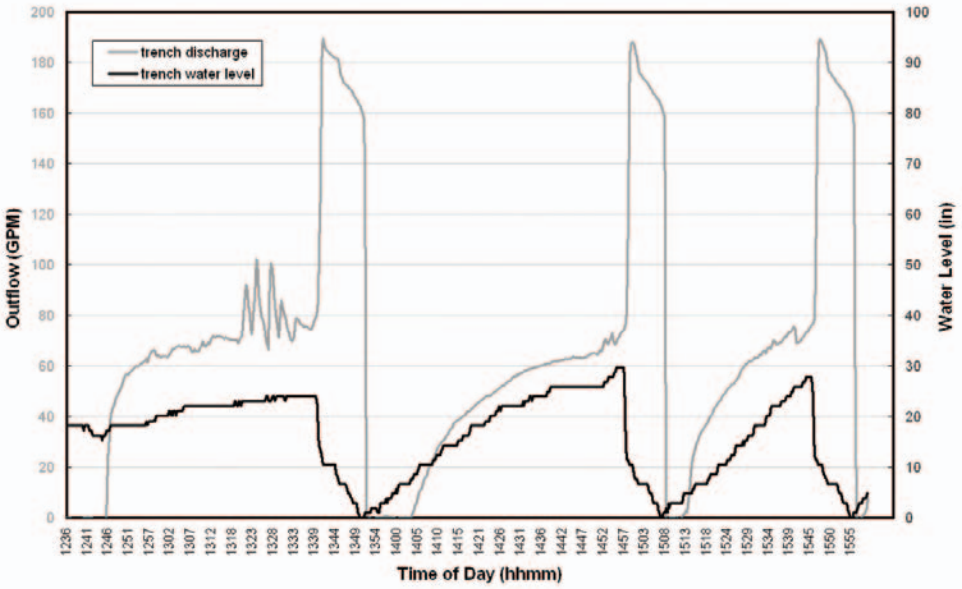
The siphon-infiltration trench is essentially an infiltration trench connected to a siphon at the outlet, and consists of a perforated water supply line, gravel backfill, the surrounding soil, and the siphon mechanisms, as shown in the illustration above. As the infiltration trench fills, water replaces the air at the top of the siphon mechanism, activating the siphon. Once activated, the siphon flushes water from the trench under high velocities until the trench empties, at which point air enters the system and breaks the siphon. When the siphon breaks, the trench begins to refill, thus repeating the cycle. Infiltration of water into the surrounding vadose zone occurs continuously during each phase of the cycle.

Self-Cleaning Ability

For a trench to be self-cleaning, discharge velocities must be greater than the velocity of flow into the trench. The maximum observed inflow rate in DBS&A's trench was approximately 0.62 meters per second (m/s). According to Stokes' Law and the Impact Law (Gibbs and others, 1971), this velocity will entrain a particle approximately 5 millimeters (mm) in diameter. During siphoning, observed velocities ranging from 1.33 m/s to 1.92 m/s were observed (see chart on page 9). These velocities can be expected to flush particles larger than 16 mm in diameter.

During a controlled experiment conducted on Aug. 29, 2002, substantial amounts of sediment previously deposited in the trench were discharged from the siphon during the first cycle. It is estimated that approximately 1,300 kilograms (kg) (0.5 cubic meters) of sand and small





Flow rates under siphoning and non-siphoning conditions. When water levels rise to an engineered height, the siphon is actuated. The three peaks in flow rate correspond to three separate siphoning events. After the trench drains, the siphon is broken, and water levels begin to rise again. Infiltration into the surrounding soil occurs continuously.

gravel were flushed during this one cycle. To quantify the siphon's capability to entrain particles further, known masses of different-sized particles were introduced to the trench during a controlled experiment conducted on Oct. 29, 2002. All sediment with a diameter less than 9.5 mm (40 kg) was discharged during one siphon cycle. Approximately 70 percent of the sediment with a diameter ranging from 9.5 to 19 mm (20 kg) was discharged, and the remaining sediment was near the upper end of this range.

Conclusions

The design of the siphon-infiltration trench is very flexible, making it suitable for a wide range of applications and site locations. Trench design must consider local flow regimes and potential sediment loads, and allow a period and magnitude of siphon discharge sufficient to prevent clogging. The design goal is to discharge only as much water as necessary to prevent the buildup of sediments, thus maximizing infiltration while maintaining long-term performance. A few of the applications for which siphon-infiltration trenches can be used are (1) increasing groundwater recharge, (2) vadose zone filtering and treatment of coliforms, pesticides, or other compounds, and (3) promoting plant growth to reduce erosion near unlined ephemeral waterways.

Contact James Kelsey at jkelsey@dbstephens.com or John Kay at jkay@dbstephens.com.

Reference

Gibbs, R.J., M.D. Mathews, and D.A. Link. 1971. The relationship between sphere size and settling velocity. J. of Sed. Petr. 41:7-18.

EXPLORATION & WELLS
WDC

COMPANY HEADQUARTERS
(877) 426-9355

NORTHERN CALIFORNIA
(800) 873-3073

SOUTHERN CALIFORNIA
(800) 974-2769

ARIZONA
(800) 584-6471

NEW MEXICO
(800) 914-7506

NEVADA
(775) 753-4414

www.wdcexploration.com

DRILLING 101 seminar!

WDC will present our drilling methods seminar at your office during a WDC provided lunch.
Our seminar's duration is about one hour and addresses the following topics:

- Drilling Fundamentals
- Site Safety
- Air Rotary Casing Hammer (ARCH)
- STRATEX Under-reaming Casing Advance
- Continuous Core Casing Advance
- Sonic Drilling
- Mud Rotary
- Large Diameter Reverse Circulation
- Hollow Stem Auger
- Geothermal Heat Exchange Wells
- Well Development & Abandonment
- Depth Discreet Water Sampling
- Permanent and Temporary Conductor Casing Installation to Avoid Cross Contamination When Drilling Through Perched Water Bearing Zones.

WDC Exploration & Wells (formerly Water Development Corp. & THF Drilling) is a 53 year old environmental, water supply and geotechnical drilling company with offices in Elko, Sacramento, Los Angeles, Phoenix and Albuquerque. We have 50 state of the art (all year 2000 or newer) rigs. WDC has drilled at virtually every superfund site, military base and landfill in the Western United States in addition to many commercial sites and gas stations. WDC offers exceptionally broad experience with multiple, complex drilling and well installation methods.

NO GROUP IS TOO SMALL OR LARGE
Call a WDC office near you to reserve your next complimentary seminar!

ENVIRONMENTAL | MINERAL | WATER SUPPLY | GEOTECHNICAL |

APPENDIX P

COST ESTIMATE SUMMARIES

Excavation and Off-Site Disposal – Conceptual Remedial Costs - Scenario 1

Task Description	Costs	Subtotal
Project Management, Permitting, Oversight, Reporting (20%)	$424,000	
Contingency (20%)	$85,000	
		$509,000
Well Abandonment/Re-Installation	$46,000	
Contingency (20%)	$9,000	
		$55,000
Shoring Design and Implementation (10,600 ft^2 @ $60/$ft^2$)	$635,000	
Contingency (20%)	$127,000	
		$762,000
Excavation (6,600 yd3 @ 37.50/yd^3)	$248,000	
Contingency (20%)	$50,000	
		$298,000
Transportation and Disposal (9,900 tons Class III LF @ $50/ton)	$495,000	
Contingency (20%)	$99,000	
		$594,000
Backfill and Compaction ($25/ton fill + $6/$yd^3$ backfill/compact)	$287,000	
Contingency (20%)	$57,000	
		$344,000
Site Restoration and Grading	$55,000	
Contingency (20%)	$11,000	
		$66,000
Contractor Markup (10%)	$212,000	$212,000
Conceptual Excavation and Off-Site Disposal Total		**$2,800,000**

Excavation and Off-Site Disposal – Conceptual Remedial Costs - Scenario 2

Task Description	Costs	Subtotal
Project Management, Permitting, Oversight, Reporting (20%)	$647,000	
Contingency (20%)	$129,000	
		$776,000
Well Abandonment/Re-Installation	$46,000	
Contingency (20%)	$9,000	
		$55,000
Shoring Design and Implementation (10,600 ft^2 @ $60/$ft^2$)	$635,000	
Contingency (20%)	$127,000	
		$762,000
Excavation (6,600 yd3 @ 37.50/yd^3)	$248,000	
Contingency (20%)	$50,000	
		$298,000
Transportation and Disposal (9,900 tons Class I LF @ $144/ton)	$1,426,000	
Contingency (20%)	$285,000	
		$1,711,000
Backfill and Compaction ($25/ton fill + $6/$yd^3$ backfill/compact)	$287,000	
Contingency (20%)	$57,000	
		$344,000
Site Restoration and Grading	$55,000	
Contingency (20%)	$11,000	
		$66,000
Contractor Markup (10%)	$324,000	$324,000
Conceptual Excavation and Off-Site Disposal Total		**$4,300,000**

LDA/ISCR and Off-Site Disposal – Conceptual Remedial Costs - Scenario 1

Task Description	Costs	Subtotal
Project Management, Permitting, Oversight, Reporting	$321,000	
Contingency (20%)	$64,000	
		$385,000
Well Abandonment/Re-Installation	$46,000	
Contingency (20%)	$9,000	
		$55,000
Mobilization/Demobilization	$340,000	
Contingency (20%)	$68,000	
		$408,000
LDA/ISCR Pilot Test	$60,000	
Contingency (20%)	$12,000	
		$72,000
LDA/ISCR (5,800 yd3 @ 161.50/yd^3)	$936,700	
Contingency (20%)	$187,000	
		$1,124,000
LDA/ISCR Production Contingency (580 yd3 @ 161.50/yd^3)	$94,000	
Contingency (20%)	$19,000	
		$113,000
Transportation and Disposal (1750 tons Class III LF @ $50/ton)	$87,000	
Contingency (20%)	$17,000	
		$104,000
Site Restoration and Grading	$55,000	
Contingency (20%)	$11,000	
		$66,000
Contractor Markup (10%)		$176,000
Conceptual LDA/ISCR - 100% Class III Disposal Total		**$2,500,000**

LDA/ISCR and Off-Site Disposal – Conceptual Remedial Costs - Scenario 2

Task Description	Costs	Subtotal
Project Management, Permitting, Oversight, Reporting	$359,000	
Contingency (20%)	$72,000	
		$431,000
Well Abandonment/Re-Installation	$46,000	
Contingency (20%)	$9,000	
		$55,000
Mobilization/Demobilization	$340,000	
Contingency (20%)	$68,000	
		$408,000
LDA/ISCR Pilot Test	$60,000	
Contingency (20%)	$12,000	
		$72,000
LDA/ISCR (5,800 yd3 @ 161.50/yd^3)	$936,700	
Contingency (20%)	$187,000	
		$1,124,000
LDA/ISCR Production Contingency (580 yd3 @ 161.50/yd^3)	$94,000	
Contingency (20%)	$19,000	
		$113,000
Transportation and Disposal (1750 tons Class III LF @ $144/ton)	$250,560	
Contingency (20%)	$50,000	
		$301,000
Site Restoration and Grading	$55,000	
Contingency (20%)	$11,000	
		$66,000
Contractor Markup (10%)		$195,000
Conceptual LDA/ISCR - 100% Class I Disposal Total		**$2,800,000**

Capping – Conceptual Remedial Costs - Scenario 1

Task Description	Costs	Subtotal
Project Management, Design, Permitting, Oversight (20%)	$85,000	
Contingency (20%)	$17,000	
		$102,000
Well Abandonment/Re-Installation	$46,000	
Contingency (20%)	$9,000	
		$55,000
Site Restoration and Grading	$55,000	
Contingency (20%)	$11,000	
		$66,000
Cap Installation (17,000 ft^2 @ $15/$ft^2$)	$255,000	
Contingency (20%)	$51,000	
		$306,000
Contractor Markup (10%)		$43,000
	Conceptual Capping Total	**$570,000**
	-20%	**$456,000.0**
	20%	**$684,000.0**

APPENDIX Q

GENERAL ORDER R4-2007-0019

STATE OF CALIFORNIA
CALIFORNIA REGIONAL WATER QUALITY CONTROL BOARD
LOS ANGELES REGION

ORDER NO. R4-2007-0019
REVISED GENERAL WASTE DISCHARGE REQUIREMENTS
FOR
GROUNDWATER REMEDIATION AT PETROLEUM HYDROCARBON FUEL, VOLATILE ORGANIC COMPOUND AND/OR HEXAVALENT CHROMIUM IMPACTED SITES
(FILE NO. 01-116)

The California Regional Water Quality Control Board, Los Angeles Region (Regional Board) finds:

1. Pursuant to Division 7 of the California Water Code, this Regional Board at a public hearing held on January 24, 2002, adopted the General Waste Discharge Requirements (WDRs) (Order No. R4-2002-0030) relative to the groundwater remediation at petroleum hydrocarbon fuel and/or volatile organic compound impacted sites. Subsequent to adoption of the initial general waste discharge requirements (WDRs), these WDRs have been revised to include the use of ozone as a treatment compound and the application and use of trace materials.

2. Since then, however, at sites throughout Los Angeles County, monitoring and municipal production wells have become polluted with dissolved hexavalent chromium. From the Pacoima – Sunland area in the northeastern San Fernando Valley to the basin's narrows in City of Los Angeles and from the northern edge of Central Basin to Long Beach, hexavalent chromium releases have threatened or have directly impacted monitoring or municipal supply wells.

3. Table I (Attachment A) of Order R4-2007-0019 includes a list of materials that can be used for in-situ remediation purposes. Newly added remedial compounds for in-situ reduction are calcium polysulfide, ferrous sulfate, sodium dithionite, and bioremediation agents such as molasses, lactose, cheese whey or starch and emulsified oil have demonstrated that they can effectively convert hexavalent chromium to chromium III, a less toxic and more stable compound. In addition, activated persulfate (Klozur ^{TM}) for chemical oxidation has proven to be effective for the remediation of petroleum impacted sites. The revised general WDRs are to include the above to the list of materials approved for in-situ remediation zone treatment purposes and include a brief list of tracer materials that can be utilized at sites to aid in determination of the effectiveness of clean up material application.

December 27, 2004
Revised January 5, 2005
Revised February 1, 2005
Revised April 19, 2005
Revised November 17, 2006
Revised March 1, 2007

4. The California Water Code (CWC), section 13260, subdivision (a)(1) requires that any person discharging wastes, or proposing to discharge wastes other than into a community waste water collection system, which could affect the quality of the waters of the State, shall file a Report of Waste Discharge with the Regional Board. The Regional Board shall then prescribe requirements for the discharge or proposed discharge of wastes.

5 Section 13263, subdivision (i) of the CWC provides that a Regional Board may prescribe general waste discharge requirements for discharges produced by similar operations, involving similar types of wastes, and requiring similar treatment standards.

6. The adoption of general WDRs for in-situ groundwater remediation/cleanup or the extraction of polluted groundwater with above ground treatment and the return of treated groundwater to the same aquifer zone would: a) simplify the application process for dischargers, b) allow more efficient use of Regional Board staff time, c) reduce Regional Board time by enabling the Executive Officer to notify the discharger of the applicability of the general WDRs, d) enhance the protection of surface water quality by eliminating the discharge of wastewater to surface waters, and e) provide a level of protection comparable to individual, site-specific WDRs.

7. Petroleum hydrocarbon fuel, volatile organic compound and hexavalent chromium contaminated groundwater at various sites throughout the Los Angeles region and cause or threaten to cause adverse impacts to existing and potential beneficial uses of the region's groundwater resources. Remediation/cleanup of groundwater at these sites includes the use and application of chemical, biological, and physical treatment processes, such as, chemical oxidation, chemical reduction, oxygen enhanced process, nutrient or chemical addition for enhanced biodegradation, or groundwater pump and treat technology with the return of treated groundwater to the same aquifer zone in some cases.

8. The application of any material to groundwater may result in unintended adverse impacts to groundwater quality. Any potential adverse water quality impacts that may result will be localized, of short-term duration, and will not impact any existing or prospective beneficial uses of groundwater. Groundwater quality will be monitored before addition of any materials, during treatment, and after treatment is completed to verify no long-term adverse impact to water quality.

9. The implementation of in-situ cleanup may require a small-scale pilot testing program or demonstration study prior to the design and implementation of a full-scale remediation project. The discharges from the pilot test programs or demonstration study are also covered under these general WDRs.

10 The Regional Board adopted a revised Water Quality Control Plan (Basin Plan) for the Los Angeles Region on June 13, 1994. The Basin Plan contains water quality objectives and lists the beneficial uses of groundwater in the Los Angeles region. Beneficial uses of groundwater in the Los Angeles region include, among others: municipal and domestic supply, industrial service and process supply, agricultural supply and groundwater recharge. Beneficial uses for individual hydrologic sub-areas are specified in the Basin Plan. See Attachment B Table 3-10 water quality objectives for selected constituents in regional groundwaters.

11 The release of petroleum hydrocarbon fuel, volatile organic compounds and hexavalent chromium, at many sites within the Los Angeles region affects only shallow groundwater sources. Many of the shallow groundwater zones contain general mineral content (total dissolved solids, chloride, and sulfate, etc.) in concentrations, which are considered to be naturally occurring and not the result of pollution that may exceed Basin Plan Objectives for these constituents. Treated groundwater that exhibits general mineral content that are naturally occurring and exceeds Basin Plan Objectives may be returned to the same groundwater formations from which it is withdrawn, with concentrations not exceeding the original background concentrations for the site.

12. Treated groundwater that exhibits general mineral content that is naturally occurring and exceeds Surface Water Basin Plan Objectives must be treated if discharged into surface waters under a separate National Pollutant Discharge Elimination System (NPDES) Permit.

13. The general WDRs are applicable to groundwater remediation projects at, petroleum hydrocarbon fuel, volatile organic compound and hexavalent chromium impacted sites. Depending on the Report of Waste Discharge, the Executive Officer determines the annual fee based on the threat to water quality and complexity of the discharge. The general WDRs are to regulate groundwater discharges that have a threat to water quality of Category 3 and Complexity rating of A for a combined rating of 3-A.

14. Discharges with a rating of 3-A contain pollutants that could degrade water quality or cause a minor impairment of designated beneficial uses within the application area of the receiving groundwater. The discharges covered by these requirements will have a groundwater monitoring program to comply with requirements prescribed in this Order.

15. The requirements contained in this Order were established by considering, and are consistent with, all the water quality control policies, plans, and regulations mentioned above and, if they are met, will protect and maintain the existing beneficial uses of the receiving groundwater.

16. The permitted discharge is consistent with the antidegradation provisions of State Water Resources Control Board Resolution No. 68-16 (Anti-degradation Policy). The impact on

existing water quality will not be significant in comparison to individual WDRs, and the general WDRs will improve the quality of the affected groundwater.

17. These general WDRs are not intended to alter or supersede any existing restrictions or working arrangements relating to cleanup cases with local governmental agencies.

18. In accordance with the Governor's Executive Order requiring any proposed activity be reviewed to determine whether such activity will cause additional energy usage, this Regional Board has determined that implementation of these general WDRs will not result in a change in energy usage exceeding what would be used if site-specific WDRs were issued for cleanup at these sites.

19. The Regional Board has prepared an Initial Study and Mitigated Negative Declaration for the issuance of these general WDRs in accordance with the provisions of the California Environmental Quality Act (CEQA).

20. The Regional Board has notified interested agencies and persons of its intent to prescribe general WDR's for the discharges covered under these general WDRs, and has provided them with an opportunity to submit their written views and recommendations for the requirements.

21. The Regional Board, in a public meeting, heard and considered all comments pertaining to the tentative general WDRs.

IT IS HEREBY ORDERED THAT dischargers authorized under this Order shall meet the provisions contained in Division 7 of the California Water Code, and regulations adopted here under, by complying with the following:

A. ELIGIBILITY

1. A discharger may seek coverage under this Order for:
   a. existing and future discharges to groundwater of remediation compounds from the cleanup of petroleum hydrocarbon fuel, volatile organic compound and/or hexavalent chromium impacted sites and similar discharges.
   b. re-injection, percolation or infiltration of treated groundwater from a pump and treat remediation system(s).

2. To be covered under this Order, a discharge must meet the following criteria:
   a. The Executive Officer must find, based on the Report of Waste Discharge submitted pursuant to Provision C, that the groundwater discharges for which coverage under this Order are sought have a threat to water quality of Category 3

and Complexity rating of A for a combined rating of 3-A, using the rating criteria noted (see on the Regional Board website at: http://www.waterboards.ca.gov/losangeles/html/permits/fee_schedule/fee%20schedules%20(2004-005).pdf

b. The discharger must have an approved Remediation Action Plan (RAP). The discharger shall submit a copy of the approved RAP including any conditions of implementation with the Report of Waste Discharge for application of the general WDRs. At a minimum, the RAP shall include the following site-specific information:

- The background water quality of the aquifer of the groundwater remediation site(s) including contaminant types, total dissolved solids, sulfates, chlorides, nitrogen (NH_4, NO_3, NO_2), chemical oxygen demand, biological oxygen demand, phosphorus, pH, dissolved metals, nutrients, dissolved oxygen, dissolved carbon dioxide, methane, temperature, iron, and oxidation-reduction potential;
- Information on any potential adverse impacts to groundwater quality, and whether the impacts will be localized and short-term;
- The results of any pilot testing performed for the treatment technology to be used;
- Site-specific geology (lithology and physical parameters) and hydrogeologic parameters, hydrologic report;
- Infiltration rate;
- Characterization and extent of petroleum hydrocarbon fuel, volatile organic compound and hexavalent chromium plume(s);
- Description of the treatment system(s);
- Adequate groundwater monitoring network with historical groundwater monitoring report;
- Description of the aerial extent of the application area and identification of monitoring wells to be used to determine water quality upgradient, within the application area, downgradient from the application area and identify the compliance point;
- Material Safety Data Sheet (MSDS) information and other product technical information for any materials to be used for cleanup;
- Application rate(s), material type(s) and applied concentrations; and
- Evaluation of loading rates for nitrogen compounds, total dissolved solids, sulfate, and chloride compounds.

c. The General Waste Discharge Requirements would allow the following materials to be used for in-situ remediation purposes:

1. Oxidation/Aerobic Degradation Enhancement Compounds:

- Fenton's reagent (hydrogen peroxide, ferrous iron catalyst, and pH buffer)
- Hydrogen peroxide
- Potassium or sodium permanganate
- Oxygen release compound (ORC) magnesium peroxide
- Ozone
- Activated Persulfate (Klozur ^{TM})

2. Reducing/Reductive Degradation Enhancement Compounds (Table I):

- Calcium Polysulfide (Inorganic)
- Ferrous Sulfate (Inorganic)
- Ferrous Chloride (Inorganic)
- Sodium Dithionite (Inorganic)
- Zero-valent iron (Inorganic)
- Bio-remediation (Organic) using:
  - Molasses,
  - Lactose,
  - Cheese Whey and/or
  - Starch
  - Sodium Lactate
  - Ethanol
  - Emulsified Oil
  - Corn Syrup
  - Hydrogen Release Compound (HRC)–{proprietary}

3. Inorganics/Nutrients:

- Nitrate, ammonia, phosphate, vitamins

4. Carbon Sources/Electron Donors:

- Acetate, lactate, propionate, benzoate, oleate, ethanol, propanol, methanol, glucose, complex sugars such as molasses or corn syrup, other food process byproducts such as milk whey or yeast extract, other complex organic material such as wood chips

5. Study tracer compounds:

- The tracer compounds shall be highly contrast and not reactive with current contaminants to be treated. The tracers may be chloride-based and bromide-based salts, such as sodium-flouroscein, calcium chloride, sodium chloride, calcium bromide, sodium bromide, potassium bromide, potassium, iodide, Rhodamine WT, rhodamine (D), eosine, and fluoride salts, or similar materials as approved by the Executive Officer.

3. In applying these general WDRs, the monitoring program shall address changes in geochemistry that may alter the potential occurrence of transference of chromium (III) into chromium (VI), or vice versa, during the oxidation or reduction process in the in-situ remediation under these WDRs.

4. For the purpose of renewal of existing individual requirements with these general WDRs, provided that all the conditions of these general WDRs are met, renewal is effective upon issuance of a notification by the Executive Officer and issuance of a new monitoring and reporting program.

5. When the individual WDRs with more specific requirements are issued to a discharger, the applicability of this Order to that discharger is automatically terminated on the effective date of the individual WDRs.

B. AUTHORIZATION

To be authorized to discharge under this Order, the discharger must submit a Report of Waste Discharge in accordance with the requirements of Part C of this Order. Upon receipt of the application, the Executive Officer shall determine the applicability of this Order to such a discharge and the completeness of the application package. If the discharge is eligible, the Executive Officer shall notify the discharger that the discharge is authorized under the terms and conditions of this Order and prescribe an appropriate monitoring and reporting program. For new discharges, the discharge shall not commence until receipt of the Executive Officer's written determination and the discharger receives general WDRs to include a site specific monitoring and reporting program.

C. REPORT OF WASTE DISCHARGE

1. Deadline for Submission

a. Renewal of permits of existing dischargers covered under individual WDRs that meet the eligibility criteria in Part A and have submitted Report of Waste Discharge will consist of a letter of determination from the Executive Officer of coverage under this Order.

b. New dischargers shall file a complete application to include all information identified in Items A1, A2 and as above at least 60 days before planned commencement of any discharge.

2. Forms for Report of Waste Discharge

a. Dischargers shall use the appropriate forms (Standard Form 200) or equivalent forms approved by the State Water Resources Control Board or the Executive Officer of the Los Angeles Regional Board.

b. The discharger, upon request, shall submit any additional information that the Executive Officer deems necessary to determine whether the discharge meets the criteria for coverage under this Order, and/or in prescribing an appropriate monitoring and reporting program.

c. The Report of Waste Discharge shall be accompanied by the first annual fee (if appropriate) in accordance with the current version of California Code of Regulation, Title 23, Division 7, Chapter 9, Waste Discharge Report and Requirements Article 1 fees for a discharge. The check or money order shall be made payable to the "State Water Resources Control Board."

D. DISCHARGE PROHIBITIONS

1. The discharge of wastes other than those which meet eligibility requirements in Part A of this Order is prohibited unless the discharger obtains coverage under another general permit or an individual site specific permit that regulates the discharge of such wastes.

2. The discharge of any radiological, chemical, or biological warfare agent or high level radiological waste is prohibited.

3. Creation of a pollution, contamination, or nuisance, as defined by section 13050 of the California Water Code (CWC), is prohibited.

4. The surfacing as overflow of wastes from the treatment system at any time and at any location is prohibited.

5. The disposal of wastes in geologically unstable areas or so as to cause earth movement is prohibited.

E. DISCHARGE LIMITATIONS

1. The discharge of wastes shall not cause the pH of the receiving groundwater at the compliance point, downgradient outside the application area, beyond the range of 6.5 and 8.5.

2. The discharge of wastes shall not cause the mineral constituents of the receiving groundwater at the compliance point, downgradient outside the application area, in excess of applicable limits given in Attachment A. In the letter of determination, the Executive Officer shall indicate the groundwater limitations in Attachment An applicable to the particular discharge, and identify the compliance point(s) for the site.

3. The discharge of wastes shall not cause the concentrations of chemical constituents and radionuclides of the receiving groundwater designated for use as domestic or municipal supply at the compliance point, downgradient outside the application area, in excess of the Maximum Contaminate Levels (MCLs) specified in the following provisions of Title 22 of the California Code of Regulations which are incorporated by reference into the Basin Plan: Table 64431-A of section 64431 (inorganic chemicals), Table 64431-B of section 64431 (fluoride), Table 64444-A of section 64444 (organic chemicals), and Table 4 of section 64443 (radioactivity). This incorporation by reference is prospective including future changes to the incorporated provisions as the changes take effect.

4. Waste discharged shall not cause the concentration of coliform organisms over any seven days period greater than 1.1/100ml.

5. Waste discharged shall not contain salts, heavy metals, or organic pollutants at levels that would cause receiving groundwater at the compliance point, downgradient outside the application area, to exceed the water quality objectives for groundwater or groundwater that may be in hydraulic connection with surface waters designated for marine aquatic life or body contact recreation.

6. Waste discharged shall not cause the groundwater to contain concentrations of chemical substances or its by-products in amounts that adversely affect any designated beneficial use, outside the application area or treatment zone at the compliance point(s).

7. Waste discharged shall not cause the groundwater to contain residual taste or odor in concentrations that cause nuisance or adversely affect beneficial uses, outside the application area or treatment zone at the compliance point(s).

8. Waste discharged shall not cause the groundwater to contain in amounts that cause nitrogen as nitrate-nitrogen plus nitrite-nitrogen (NO_3-N+NO_2-N), 45 mg/L as Nitrate (NO_3), 10 mg/L as nitrate-nitrogen (NO_3-N), or 1 mg/L as nitrite-nitrogen (NO_2-N), outside the application area or treatment zone at the compliance point(s).

F. PROVISIONS

1. The Executive Officer may require any discharger authorized under this Order to apply for and obtain individual WDRs with specific requirements. The Executive Officer may require any discharger authorized to discharge under this permit to apply for individual WDRs only if the discharger has been notified in writing that a permit application is required. This notice shall include a brief statement of the reasons for this decision, an application form, a statement setting a deadline for the discharger to file the application, and a statement that on the effective date of the individual requirements, the authority to discharge under this General WDRs are no longer applicable.

2. This Order includes the attached "Tentative Standard Provisions Applicable to Waste Discharge Requirements." (Attachment C) If there is any conflict between provisions stated herein before and the attached "Standard Provisions," those provisions stated herein shall prevail.

3. Adequate facilities shall be provided to divert surface and storm water away from the application area and/or treatment system and areas where any pollutants are stored.

4. The application of materials or the re-injection of treated groundwater shall only be at a site owned or controlled by the discharger.

5. All work must be performed by or under the direction of a registered civil engineer, registered geologist, or certified engineering geologist. A statement is required in all technical reports that the registered professional in direct responsible charge actually supervised or personally conducted all the work associated with the project.

6. The discharge of wastes to or infiltration to a surface water system must be covered by separate WDRs under the National Pollution Discharge Elimination System (NPDES) permit.

7. This Order does not alleviate the responsibility of discharger to obtain other necessary local, state, and federal permits to construct facilities necessary for compliance with this Order; nor does this Order prevent imposition of additional standards, requirements, or conditions by any other regulatory agency. Additionally, the discharger shall notify the Native American Heritage Commission of any plans to disturb the soil in order to comply with California Environmental Quality Act (CEQA) guidelines as set forth in Section 15064.5(b)(c). Furthermore the discharger is required to provide local information prior to excavation to the California Historic Resources Information Center (CHRIS). This will serve as their due diligence record search to provide proximity to Native American historical and archeological resources. The discharger shall also be required to adhere to California Health and Safety Code Section 7050.5, Public Resources Code Section 5097.98, CEQA Section 15064.5(d) and Section 15064.5 (f) to ensure that mitigation plan provisions are in-place to identify, evaluate and consult with your commission about the discovery and disposition of any recovered human remains or artifacts, should the occasion arise, during the remediation process overseen by this agency.

8. The discharger shall notify Regional Board staff by telephone within 24 hours, followed by written notification within one week; in the event it is unable to comply with any of the conditions of this Order due to:

    a) Breakdown of waste treatment equipment,
    b) Accident caused by human error or negligence,
    c) Other causes such as acts of nature, or
    d) Site construction or development operations.

9. Any discharger authorized under this Order may request to be excluded from coverage of this Order by applying for an individual permit.

10. In accordance with section 13263(e) of the California Water Code, these requirements are subject to periodic review and revision by the Regional Board within a five (5) year cycle.

11. In accordance with Water Code section 13263(g), these requirements shall not create a vested right to continue to discharge and are subject to rescission or modification. All discharges of waste into waters of the state are privileges, not rights.

12. The discharger shall develop a contingency plan and maintain it on site. The contingency plan shall detail appropriate actions to be taken in order to protect human health and the

environment in case of any spill or failure related to the operation or mis-operation of the treatment system.

G. MONITORING AND REPORTING REQUIREMENTS

1. The Executive Officer is hereby authorized to prescribe a Monitoring and Reporting Program for each authorized discharger. This program may include participation of the discharger in a regional monitoring program.

2. The discharger shall file with the Regional Board technical reports on self-monitoring work conducted according to the Monitoring and Reporting Program specified by the Executive Officer and submits other reports as requested by the Regional Board.

3. The discharger shall retain records of all monitoring information and data used to complete the Report of Waste Discharge and application for coverage under this Order for at least five years from the date of permit issuance. The retention period shall be extended during any unresolved litigation regarding the discharge or when requested by the Executive Officer.

4. The discharger shall maintain all sampling, measurement and analytical results, including the date, exact place, and time of sampling or measurement; individual(s) who did the sampling or measurement; the date(s) analyses were done; analysts' names; and analytical techniques or methods used.

5. All sampling, sample preservation, and analyses must be conducted according to test procedures under title 40 Code of Federal Regulations, section 136, unless other test procedures have been specified in this Order or by the Executive Officer.

6. All chemical, bacteriological, and bioassay analyses shall be conducted at a laboratory certified for such analyses by the California Department of Health Services Environmental Laboratory Accreditation Program (CDHS-ELAP) or other state agency authorized to undertake such certification.

7. The discharger shall calibrate and maintain all monitoring instruments and equipment to insure accuracy of measurements, or shall insure that both activities will be conducted.

8. In reporting the monitoring data, the discharger shall arrange the data in tabular form so that the date, constituents, and concentrations are readily discernible. The data shall be summarized to demonstrate compliance with waste discharge requirements. Laboratory

analytical data from any soil testing and/or groundwater monitoring shall be reported in Electronic Deliverable Format in accordance with California Water Code section 13195 et. seq. requirements, if applicable.

9. For every item where the requirements are not met, the discharger shall submit a statement of the actions undertaken or proposed that will bring the discharge into full compliance with requirements at the earliest time and submit a timetable for correction.

10. The discharger shall file a report of any material change or proposed change in the character, location or volume of the discharge.

11. The discharger shall notify this Regional Board within 24 hours by telephone of any adverse condition resulting from the discharge; such notification shall be affirmed in writing within five working days.

12. Whenever wastes, associated with the discharge under this Order, are transported to a different disposal site, the following shall be reported in the monitoring report: type and quantity of wastes; name and address of the hauler (or method of transport if other than by hauling); and location of the final point(s) of disposal.

13. Each monitoring report must contain an affirmation in writing that:

> "All analyses were conducted at a laboratory certified for such analyses by _____ and in accordance with current USEPA procedures or as specified in this Monitoring and Reporting Program."

14. Each report shall contain the following completed declaration:

"I declare under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who managed the system or those directly responsible for gathering the information, the information submitted, is, to the best of my knowledge and belief, true, accurate and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

Executed on the___ day of_____ at _____.

_____ (Signature)
_____ (Title)"

H. EXPIRATION DATE AND CONTINUATION OF THIS ORDER

This Order expires on March 1, 2012; however, for those dischargers authorized to discharge under this Order, it shall continue in full force and effect until a new order is adopted.

I. REAUTHORIZATION

Upon re-issuance of a new general permit Order, dischargers authorized under this Order shall file a new Report of Waste Discharge within 45 days of notification by the Executive Officer.

I, Jonathan S. Bishop, Executive Officer, do hereby certify that the foregoing is a full, true, and correct copy of an Order adopted by the California Regional Water Quality Control Board, Los Angeles Region, on March 1, 2007.

Jonathan S. Bishop
Executive Officer

APPENDIX R

TRANSPORTATION AND DISPOSAL PLAN

APPENDIX R

TRANSPORTATION AND DISPOSAL PLAN

THE SPIRITO FAMILY TRUST PARCEL
4057 AND 4059 GOODWIN AVENUE
(INCLUDING THE FORMER EXCELLO PLATING CO., INC. FACILITY)
CITY OF LOS ANGELES,
COUNTY OF LOS ANGELES, CALIFORNIA

LARWQCB Reference:
Excello Plating Co., Inc.
CAO No. R4-2003-0038-R
LARWQCB Site ID No. 2040209
LARWQCB File No. 113.5243

Prepared by:

KLEINFELDER WEST, INC.
620 West 16th Street, Unit F
Long Beach, California 90813

Kleinfelder Project No. 101942

September 30, 2010

Copyright 2008 Kleinfelder

TABLE OF CONTENTS

Section **Page**

1 INTRODUCTION 1
1.1 BACKGROUND 2
1.2 PURPOSE AND OBJECTIVE 3
1.3 TRAINING REQUIREMENTS 3

2 CHARACTERISTICS AND QUANTITY OF WASTE TO BE TRANSPORTED ... 4
2.1 ESTIMATED WASTE QUANTITY 4
2.2 WASTE PROFILING 5
2.3 REGULATORY REQUIREMENTS FOR TRANSPORTATION AND DISPOSAL 5

3 DESTINATION OF WASTE 6

4 TRANSPORTATION MODE 8
4.1 HAZARDOUS WASTE SHIPMENT 9
4.2 NON-HAZARDOUS WASTE SHIPMENT 9
4.3 REQUIREMENTS OF TRANSPORTERS 10

5 TRANSPORT ROUTES 11
5.1 ROUTE SELECTION CRITERIA 11
5.2 ROUTE TO LANCASTER LANDFILL 11
5.3 ROUTE TO KETTLEMAN HILLS LANDFILL 12
5.4 ROUTE TO BUTTONWILLOW LANDFILL 12

6 TRAFFIC CONTROL AND LOADING PROCEDURES 14

7 RECORD KEEPING 15

FIGURES

Figure 1 Route to Lancaster Landfill
Figure 2 Route to Kettleman Hills Landfill
Figure 3 Route to Buttonwillow Landfill

Copyright 2008 Kleinfelder

1 INTRODUCTION

This Transportation and Disposal Plan has been prepared as part of the Final Remedial Action Plan (RAP) for the Spirito Family Trust parcel, defined by the legal description included in Appendix A of the RAP, and located at 4057 and 4059 Goodwin Avenue, in the City of Los Angeles, Los Angeles County, California (the Site). This Plan includes requirements intended to address the reduction of risks to human health and the environment posed by the presence of soil impacted with elevated concentrations of chemicals of concern (COCs), which include certain volatile organic compounds (VOCs) and metals designated as chemicals of concern (COCs), or chemicals of potential concern (COPCs) in soil beneath the Site.

The RAP has been prepared as a remedial alternative selection document according to the requirements of Health and Safety Code Section 25356.1, as specified in Senate Bill 1706 (Stats. 1994, Chapter 441). In addition, two guidance documents were used to develop this RAP: the United States Environmental Protection Agency (US EPA) Guidance on Conducting Non-Time Critical Removal Actions under Comprehensive Environmental Response, Compensation and Liability Act (CERCLA; U.S. EPA, 1993); and the Department of Toxic Substances Control (DTSC) memorandum on Removal Action Workplans, dated September 23, 1998.

The RAP proposes the use of large diameter augers (LDAs) for mixing calcium polysulfide (CaSx) into soil for in-situ chemical reduction (ISCR) and mobility reduction, followed by cement stabilization for added reduction of mobility, and then off-Site transportation and disposal of swell material from the Site. There is the possibility that impacted soil may also be transported off Site for disposal. The remedial action is being conducted to prevent, minimize, or mitigate potential impact to public health and the environment, as required by the CERCLA.

This Transportation and Disposal Plan describes waste disposal procedures that will be implemented at the Site, including waste characterization for disposal, waste material documentation, tracking, handling, management, stockpiling, temporary storage and all related activities required to remove, transport, and dispose of contaminated material in

Copyright 2010 Kleinfelder

accordance with Federal, State and local regulations including United States Department of Transportation (DOT) and US EPA.

1.1 BACKGROUND

The Site is defined by the legal description included in Appendix A of the RAP. The Site is located at 4057 Goodwin Avenue, in the City of Los Angeles, California (the Site has a post office address of Glendale, California 90039). The rear (northern) portion of the Site has also been known in the past as "4059 Goodwin Avenue." The Site is referred to as Los Angeles County Assessor's Parcel Number (APN) 5593-020-020, as shown on the assessor's parcel map attached in Appendix D of the RAP, and is located on the north side of Goodwin Avenue northwest of the termination of Brunswick Avenue.

A vacated former northward extension of Brunswick Avenue adjoins the Site to the east. The vacated street was formerly used by the Excello Plating Co., Inc. (Excello) as an employee parking lot, but is not part of the parcel owned in fee by The Spirito Family Trust and is not considered to be part of the Site.

A plating facility operated by Excello was located on the southern portion of the Site (4057 Goodwin Avenue), and an older plating facility was located on the rear, northern portion of the Site (4059 Goodwin Avenue). Operations at these two plating facilities resulted in the release of VOCs and metals to vadose zone soil beneath the Site, as documented by past assessments. Groundwater beneath the Site is also impacted with some of the VOCs and metals present in Site vadose zone soil. Furthermore, metals-contaminated groundwater (primarily with hexavalent chromium [Cr^{6+}]) has affected US EPA extraction well GS-3, which is one of four extraction wells near Goodwin Avenue. This well operates as part of the regional remedy for VOC-impacted groundwater in the Glendale South Operable Unit (GSOU) of the San Fernando Valley Superfund Site.

The Spirito Family Trust is the present owner of the Site and has been deemed by the Los Angeles Regional Water Quality Control Board (LARWQCB) to be the Responsible Party for Site cleanup, as indicated in documentation that includes a September 25, 2007 revised Corrective Action Order (CAO) prepared by LARWQCB. The RAP was

Copyright 2010 Kleinfelder

submitted on The Spirito Family Trust's behalf, but The Spirito Family Trust has reported that it has insufficient financial assets to pay for a Site cleanup that will meet regulatory requirements. A prospective purchaser of the Site has indicated a willingness to perform a regulatory-approved remediation of vadose soil beneath the Site to accommodate its use of the Site's surface, providing that such a cleanup can be performed on acceptable terms.

1.2 PURPOSE AND OBJECTIVE

The purpose of this Transportation and Disposal Plan is to reduce potential health, safety, and environmental risks resulting from the movement of soil and/or equipment during Site cleanup. The objective is the performance of the proposed work tasks in a manner that provides efficient use of time and resources, and maintains the safety of Site workers and the public.

1.3 TRAINING REQUIREMENTS

DOT Basic Hazardous Materials (HazMat) Employee training, HM-181, is required for any person involved in the transportation of hazardous waste and/or signing of hazardous waste manifests (see 49 CFR § 172.704 [Subpart H]). Contractors will take the basic hazmat employee training and renew the training as necessary to meet DOT requirements for hazardous waste transportation.

All employees and contractors working on Site will have the appropriate Occupational Safety and Health Administration (OSHA) hazardous waste operations (HAZWOPER) training and annual refresher training specified in 29 CFR § 1910.120.

Copyright 2010 Kleinfelder

2 CHARACTERISTICS AND QUANTITY OF WASTE TO BE TRANSPORTED

As indicated in Kleinfelder's *Supplemental Site Assessment* dated November 26, 2008, soils encountered during drilling at the Site consisted primarily of sands and silty sands, with lesser amounts of silty clay and clayey silt. The near-surface soils were generally loose to medium dense, while the deeper soils were dense to very dense. Soils below approximately 20 feet below ground surface (bgs) were noticeably coarser.

The material to be transported will generally consist of these soils treated by CaSx and stabilized with cement. The material will have been impacted, at varying concentrations, with cadmium, Cr^{6+}, total chromium, and/or nickel. VOCs may also be present in the treated swell material. A volume of approximately 5,800 cubic yards of soil is targeted for treatment via LDA/ISCR removal, which will generate approximately 1,000 to 2,500 cubic yards (cy) or approximately 1,500 to 3,750 tons of swell material. The soil may not exhibit visual evidence of the contamination detected by laboratory analysis.

2.1 ESTIMATED WASTE QUANTITY

Approximately 1,500 to 3,750 tons of swell material will be generated (in two waste streams) during remediation activities. One waste stream will be non-hazardous swell material (soil treated with CaSx and cement). The non-hazardous soil will be transported for disposal to the Lancaster Landfill, an approved Class III solid waste landfill facility located in the City of Lancaster, Los Angeles County, California. For the purposes of this document, the estimated quantity of non-hazardous soil is approximately 1,225 tons. The other waste stream will be Class I hazardous swell material. This material will be transported for disposal at the Kettleman Hills Landfill or the Buttonwillow Landfill, in Kings and Kern County, California, respectively. Both landfills are State of California-approved disposal facilities. For the purposes of this document, the estimated quantity of Class I swell material is approximately 1,225 tons.

Copyright 2010 Kleinfelder

2.2 WASTE PROFILING

It is anticipated that some level of characterization will be needed for final approval of disposition of the RCRA hazardous waste soils. Soils intended for disposal will be sampled and sent to the laboratory for analysis, and submitted to the disposal facilities as required for their independent analyses. The analytical results, along with a completed waste profile form, will be submitted to the appropriate disposal facilities for approval and disposal of waste. Once approval from the disposal facility is obtained, the waste will be eligible for transportation to the disposal facility.

Approval for Class III disposal of the non-hazardous swell material will be acquired on the basis of the sampling and analyses that have been performed during the LDA/ISCR treatment phase of work. The analytical results, a map showing sampling locations, and waste profiles will be submitted to the disposal facility for evaluation and approval.

2.3 REGULATORY REQUIREMENTS FOR TRANSPORTATION AND DISPOSAL

Waste materials will be directly loaded into off-Site transportation vehicles, or stockpiled on Site and subsequently loaded into off-Site transportation vehicles. Each transportation vehicle will have a transporter's permit, pursuant to the provisions set forth in applicable State regulations. Manifesting and transportation of all hazardous waste will be in accordance with 40 CFR Part 263. The supervising consultant will be responsible for providing complete and accurate manifests for The Spirito Family Trust (TSFT) signature. The completed manifest will accompany all shipments of hazardous waste while in transit.

Transportation of non-hazardous regulated waste will be in accordance with DOT regulations 49 CFR 172. Non-hazardous waste will be transported under a standard non-hazardous waste manifest.

Copyright 2010 Kleinfelder

3 DESTINATION OF WASTE

The excavated soil or swell material will be transported to the Lancaster Landfill, in Lancaster, Los Angeles County, California; Kettleman Hills Landfill in Kettleman City, Kings County, California; or the Buttonwillow Landfill, in Buttonwillow, Kern County, California.

The swell material with the lower leachable concentrations of COCs will be transported to:

- Lancaster Landfill (Class III landfill) at: 600 East Avenue F
  Lancaster, CA 93535.

This is a distance of 71 miles from the site, and a driving time of about 82 minutes each way. It is anticipated that approximately 60 loads of swell material, or 1,225 tons, will be transported to this site.

The soil with the higher leachable concentrations of COCs will be transported to:

- Chemical Waste Management, Inc. (CWMI)
  Kettleman Hills Landfill (Class I landfill) at: 35251 Old Skyline Road
  Kettleman City, CA 93239

This is a distance of 171 miles from the site, and a driving time of about 3 hours each way.

And/or, the soil with the higher leachable concentrations of COCs will be transported to:

- Buttonwillow Landfill (Class I landfill) at: 41751 Sullivan Road
  Buttonwillow, CA 93206

This is a distance of 123 miles from the Site, and a driving time of about 2 hours 15 minutes each way.

Copyright 2010 Kleinfelder

We anticipate that approximately a total 60 loads of swell material, or 1,225 tons, will be transported to one of these sites, or a portion of this total will be transported to each of these sites.

Copyright 2010 Kleinfelder

4 TRANSPORTATION MODE

Transportation of soil removed from the Site will be by an approved, properly licensed, trucking contractor. Personnel transporting wastes off Site will be trained in accordance with 49 USC § 1805(b) and 29 CFR 1910. Waste will be transported using DOT-approved shipping containers in accordance with 49 CFR Parts 171, 172, 173, 177, 178, 179, and other applicable local, State, and Federal transportation guidelines. Haulers will follow applicable requirements in 49 CFR Parts 174 through 177 with regard to loading, unloading, and general handling.

Trucks will be weighed on Site using axle scales attached to the vehicles or rollover scales. Once filled, trucks will be covered with fixed covers, tarpaulins or other means to prevent fugitive dust. Each truck will be visually inspected for proper loading, covering/sealing, decontamination, placarding, and manifesting prior to leaving the Site.

Bulk solid debris will be removed from each truck by scraping with shovels or other implements prior to the truck leaving the Site. Trucks may be pressure-washed prior to exiting the Site; however, pressure-washing will be used only if other methods are not acceptable, as this method requires containerizing wash liquids. Truck decontamination will be conducted near the Site entrance. Rinse water will be collected and retained in drums or other container type(s) for analysis and disposal.

Hazardous waste soil shipped to Kettleman Hills Landfill or Buttonwillow Landfill will be shipped under a hazardous waste manifest. Non-hazardous waste soil shipped to Lancaster Landfill will be shipped under a non-hazardous waste bill of landing. Records of all waste material hauled off Site will be maintained in the project files. These and other requirements are described below.

Transportation of hazardous wastes off Site will be in accordance with DOT regulations in 49 CFR and the California Hazardous Waste Control Law (Health and Safety Code § 25100 et seq.; 22 CCR § 66428 et Seq.). Hazardous waste haulers will have a valid Department of Health Services registration and will satisfy the following requirements:

Copyright 2010 Kleinfelder

- Vehicles will have passed an annual inspection.
- Vehicle operators will be trained in the safe handling of the waste.
- Haulers will maintain the ability to pay damages caused by their operations through proper insurance coverage.
- Haulers will have licenses issued by the California Highway Patrol (CHP) for the transportation of hazardous materials.
- Haulers will have EPA identification numbers.
- Haulers will comply with the Uniform Hazardous Waste Manifest System.
- Haulers will take certain actions in response to hazardous waste discharges during transport (i.e., covering the load to prevent the discharge of dust/particulates into the atmosphere during hauling).

Vehicles transporting hazardous wastes will be placarded according to DOT requirements. The appropriate placard will be selected based on its hazard class specified in 49CFR Part 173. Containers will be labeled as specified in 49CFR 172.102 Subpart E.

4.1 HAZARDOUS WASTE SHIPMENT

Hazardous waste transportation routes are selected to satisfy a number of criteria. A primary concern is to keep the trucks on modern, well maintained roads to decrease the chance of an accident. This objective is tempered somewhat by the need to avoid possible public exposure (residential areas), heavy traffic, and hazardous road conditions. The routes selected for this project are discussed in Sections 5.2 and 5.3.

4.2 NON-HAZARDOUS WASTE SHIPMENT

Non-hazardous waste transportation routes were selected to satisfy a number of criteria. A primary concern is to keep the trucks on modern, well maintained roads to decrease the chance of an accident. This objective is tempered somewhat by the need to avoid possible public exposure (residential areas), heavy traffic, and hazardous road conditions. The route selected for non-hazardous waste is discussed in Section 5.4.

Copyright 2010 Kleinfelder

4.3 REQUIREMENTS OF TRANSPORTERS

A combination of transporters may be used for transporting swell material to the disposal facilities. The non-hazardous swell material removed from the Site will be transported in bulk, using 18-wheel dump trailers, each with a capacity of 20-25 tons of soil per load. Transporters hauling hazardous swell material from the Site will each have a capacity of approximately 20 to 25 tons per load. Prior to leaving the Site, the trucks will be covered and secured with a tarping system that completely extends over the top of the trailer. Prior to trucks leaving the Site, they will be inspected to ensure that no soil has spilled on the sides or tires of the truck. If swell material is found, it will be dry-broom swept off the truck and removed from tires. If needed, the truck tires will be washed with a high pressure power wash. It is not anticipated that trucks will require cleaning prior to leaving the Site, since the trucks will remain on a clean gravel-overlain area and draped to prevent contact from the contaminated swell material.

Copyright 2010 Kleinfelder

5 TRANSPORT ROUTES

5.1 ROUTE SELECTION CRITERIA

Routes are selected to satisfy a number of criteria. A primary concern is to keep the trucks on modern, well maintained roads to decrease the chance of an accident. This objective is tempered somewhat by the need to avoid possible public exposure (residential areas), heavy traffic, and hazardous road conditions. The routes are selected below.

5.2 ROUTE TO LANCASTER LANDFILL

The primary route for the vehicles will be via the surface roads as shown on Figure 1, and described below:

- Exit north on West San Fernando Road.
- Proceed west on Colorado Street.
- North on Edenhurst Avenue.
- Enter the Colorado Street Freeway (Highway 134), which connects to northbound Golden State Freeway (Interstate 5).
- Continue north on Interstate 5 to northbound Antelope Freeway (State Route 14) to Lancaster/Palmdale
- Proceed on State Route 14 to Exit 46 for Avenue G.
- Turn right at West Avenue G.
- Turn left at Division Street.
- Turn right at East Avenue F and proceed approximately 400 feet.
- Turn right into the Lancaster Landfill.

It is estimated that a one-way trip, including 30 minutes of weigh-in and processing, will take approximately 1 hour and 40 minutes. It is anticipated that 60 end-dump trucks will make one trip to transport the approximately 1,225 tons of swell material. Three days will be required to complete the transportation of the material. Trucks will load throughout the morning and continue until all of the soil is loaded for transport.

Copyright 2010 Kleinfelder

5.3 ROUTE TO KETTLEMAN HILLS LANDFILL

The primary route for the vehicles will be via the surface roads, as shown on Figure 2 and described below:

- Exit north on West San Fernando Road.
- Proceed west on Colorado Street.
- North on Edenhurst Avenue to Colorado Street Freeway (Highway 134), which connects to northbound Golden State Freeway (Interstate 5).
- Continue north on Interstate 5 to Exit 309 (State Route 41 South); turn left.
- Turn right at Old State Highway and proceed to Kettleman Hills Landfill.

It is estimated that a one-way trip, including 30 minutes of weigh-in and processing, will take approximately 3 hours and 30 minutes. If a portion of the soil is not being disposed at Buttonwillow Landfill, it is anticipated that 60 end-dump trucks will make one trip to transport the approximately 1,225 tons of swell material. Three days will be required to complete the transportation of the material. Trucks will load throughout the morning and continue until all of the soil is loaded for transport.

5.4 ROUTE TO BUTTONWILLOW LANDFILL

The primary route for the vehicles will be via the surface roads, as shown on Figure 3 and described below:

- Exiting north on West San Fernando Road.
- Proceed west on Colorado Street.
- North on Edenhurst Avenue to Colorado Street Freeway (Highway 134), which connects to northbound Golden State Freeway (Interstate 5).
- Continue north on Interstate 5 to Exit 309 (State Route 41 South); turn left.
- Turn right at Old State Highway and proceed to Buttonwillow Landfill.

It is estimated that a one-way trip including 30 minutes of weigh-in and processing will take approximately 2 hours and 40 minutes. If a portion of the soil is not being disposed at Kettleman Hills Landfill, then it is anticipated that 60 end dump trucks will

Copyright 2010 Kleinfelder

make one trip to transport the approximately 1,225 tons of swell material. Three days will be required to complete the transportation of the material. Trucks will load throughout the morning and continue until all of the soil is loaded for transport.

Copyright 2010 Kleinfelder

6 TRAFFIC CONTROL AND LOADING PROCEDURES

Because the work area occupies both commercial and residential zones at the end of a paved street, it is anticipated there will be a need for traffic control measures. Vehicles will enter and exit the Site from West San Fernando Road. Flagmen may be required at the point of ingress/egress when trucks enter the property so that no danger to or from oncoming traffic is present. Because there is ample open area in the vicinity of the proposed excavation area, it is anticipated that truck staging will occur on Site, close to the excavation activities. We do not anticipate that trucks will be staged outside of the Site.

Vehicles will not be allowed to idle for longer than approximately three minutes to reduce air emissions.

Copyright 2010 Kleinfelder

7 RECORD KEEPING

Hazardous waste transportation will comply with the California Vehicle Code (CVC); California Highway Patrol (CHP) Regulations (13 CCR); the California State Fire Marshal Regulations (19 CCR); DOT Regulations, Title 49, Code of Federal Regulations (49 CFR); the California Health and Safety Code (HSC), and 22 CCR. These requirements include keeping of appropriate records during transportation activities, and provisions that:

- The transporter will have proof of valid registration as a hazardous waste transporter (HSC Section 25163) on the transporting vehicle.
- A Uniform Hazardous Waste Manifest (or bill of lading if non-hazardous), properly completed and signed by the generator and the transporter (22 CCR Section 66263.20[a]):
    - The Uniform Hazardous Waste Manifest/bill of lading will identify the date, time, weight/volume, waste/material, transporting company, driver, and vehicle for each trip made.
    - The driver will have a manifest in his or her possession while transporting the hazardous waste (HSC Section 25160[d][1]).
- The generator will retain a copy of the manifest of every truckload leaving the Site.

A summary of the analytical results representing the load, and maps showing the proposed route to the disposal facility will accompany each truckload. California Senate Bill 1257 requires that drivers must open the doors at the direction of a peace officer, an authorized employee of the CHP, the DTSC Certified Unified Program Agencies, and local health officers. The law also requires working two-way communications devices in all vehicles used for the transportation of hazardous wastes or hazardous materials.

Copyright 2010 Kleinfelder

A field logbook will be maintained during the removal action activities. The date, time, volume, trucking company, driver, and vehicle used for each trip will be gathered and maintained in the logbook. This logbook will additionally serve to document observations, personnel on Site, equipment arrival and departure times, a truck exit inspection checklist, and other project information. Invoices from the trucking companies will have weight information for each load.

Field logbooks will document where, when, how, and from whom any vital project information is obtained. Logbook entries will be complete and accurate enough to permit reconstruction of field activities. Logbooks will be bound with consecutively numbered pages. Each page will be dated and the time of entry notice in 24-hour format. All entries will be legible, written in black ink, and signed by the individual making the entries. Language will be factual, objective, and free of opinions or inappropriate terminology. If an error is made, corrections will be made by crossing a line through the error and entering the correct information. Corrections will be dated and initialed. No entries will be obliterated or otherwise rendered unreadable.

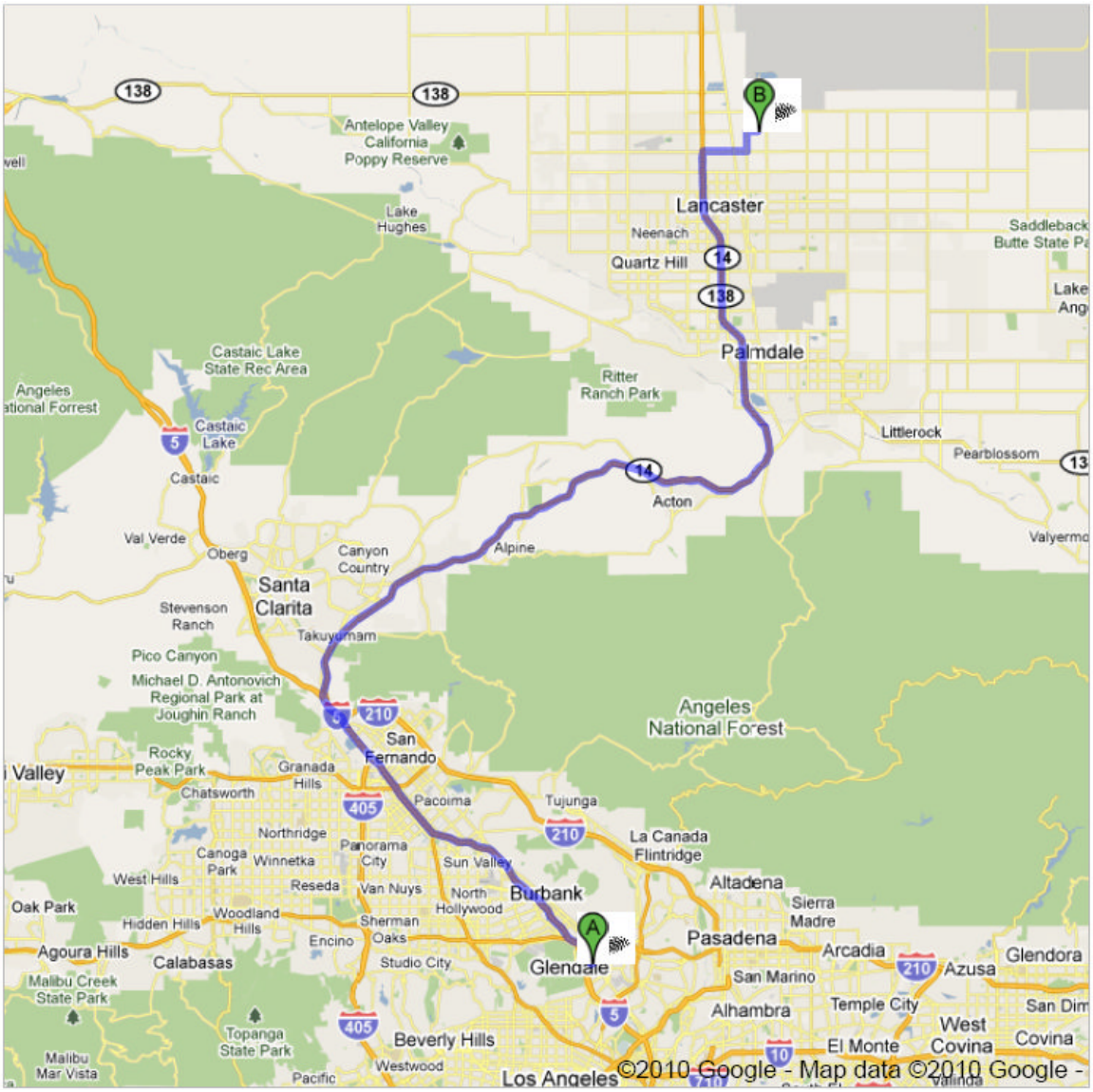
Entries in the field logbook related to hazardous soil transportation will include at a minimum the following for each fieldwork date:

- site name and address;
- recorder's name;
- date and time of Site arrival/entry on Site and departure;
- quantity of impacted soils in truckloads transported off Site;
- names of waste transporters and disposal facilities;
- type of vehicle and license number;
- copies of waste manifests or other shipping documents; and
- quantities of import fill material in truckloads.

The California Uniform Hazardous Waste Manifest will be completed as specified in 40 CFR § 262, and will be used to transport all hazardous waste. Shipping papers will accompany all hazardous waste transported off Site and will remain with the transport vehicle at all times in accordance with 49 CFR.

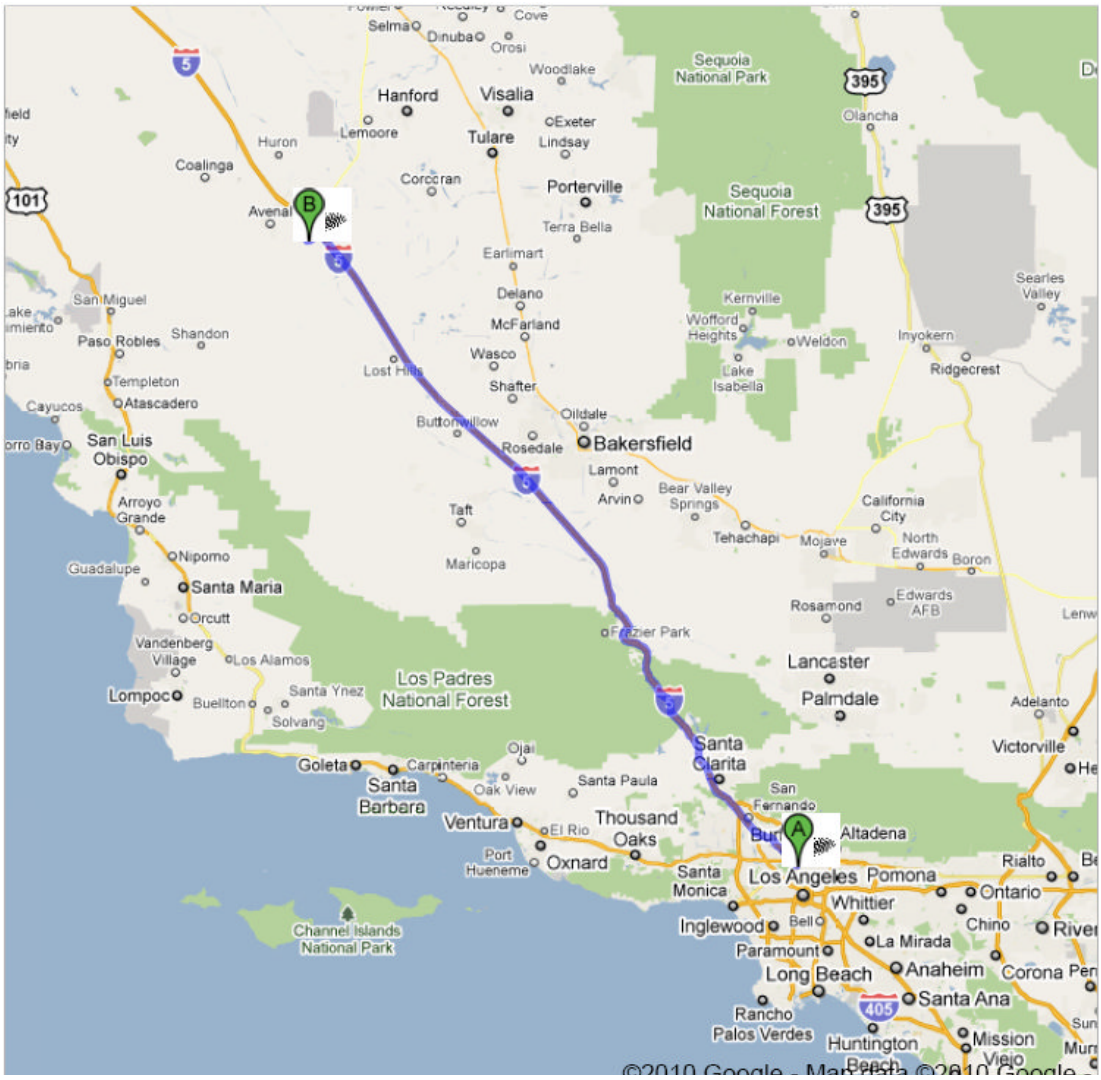
Copyright 2010 Kleinfelder

Figure 1
Route to Lancaster Landfill



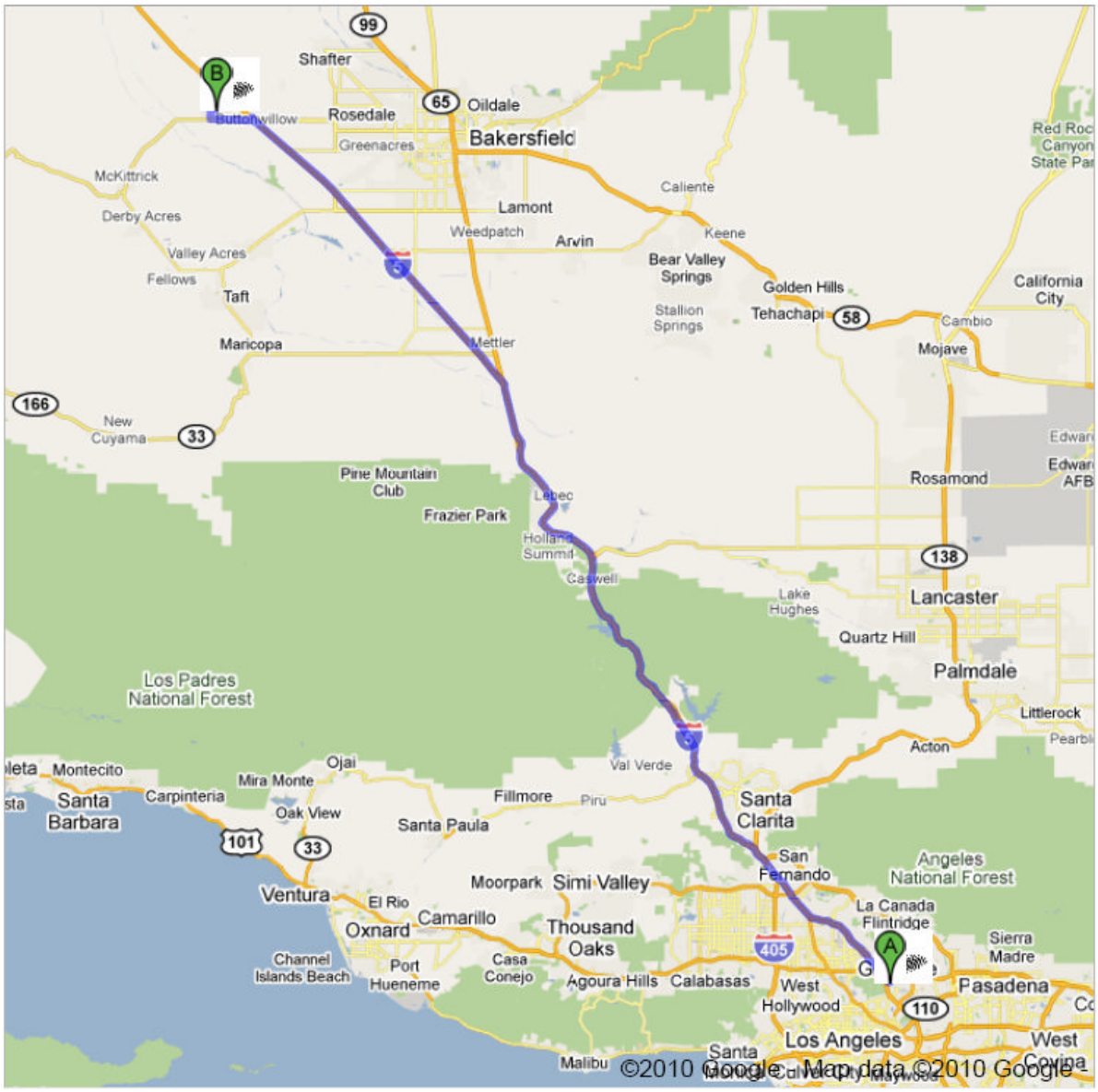
Copyright 2010 Kleinfelder

Figure 2
Route to Kettleman Hills Landfill



Copyright 2010 Kleinfelder

Figure 3
Route to Buttonwillow Landfill



Copyright 2010 Kleinfelder

APPENDIX S

INITIAL DRAFT HEALTH AND SAFETY PLAN

INITIAL DRAFT

SITE-SPECIFIC HEALTH AND SAFETY PLAN

Project No. 101942 – TSFT Excello **Date** September 30, 2010
Site Contact Michael Counte **Site Phone No**. (949) 727-4466
Job Location 4057/4059 Goodwin Avenue, Los Angeles, California

Work Objectives Remediate soil impacted by cadmium, nickel, total chromium, and hexavalent chromium, and soil vapor for trichloroethene (TCE) and perchloroethene (PCE).

Key Individuals: **Project Manager** Michael Counte (949) 727-4466
Site Health and Safety Manager Bryan Reese
Prepared by John Donatucci **Reviewer/Approver** Michael Counte
Hospital/Clinic Glendale Memorial Hospital
Phone No. (818) 502-1900
Address: 14205 South Central Avenue, Glendale, California 91204
Paramedic 911 **Fire Dept.** 911 **Police Dept.** 911

Emergency/Contingency Plans: Notify emergency services and project manager. Provide site control as required.

>>>Hospital Route Map attached<<<

15 Minute Eyewash X **Fire Extinguisher** X **First Aid Kit** X

Site Control Measures: Site plan, Traffic control plans, 20 lb. fire extinguisher, visitors requirements, cones (min. with flags), delineators, site fencing, and caution tape.
Training Requirements: 40-hour HAZWOPER, and 8-hour HAZWOPER Refresher, Daily tailgate meetings or when changing tasks.

Personal Decontamination Procedures:

PHYSICAL HAZARDS

X	Heat	X	Slip, Trip, Fall	X	Excavations/Trench
X	Cold	X	Electrical Hazards	X	Moving Equipment
X	Wet	X	Underground Hazards		Confined Space
X	Noise	X	Overhead Hazards		

_____ Other _____

PERSONAL PROTECTIVE EQUIPMENT

R = Required A = As Needed

R	Hard Hat	R	Safety Eyegear: ANSI Approved
R	Safety Boots	A	Respirator (Type): Full-face _____ Half-face _____
R	Safety Vest	A	Filter Type: Organic vapor _X_ Acid gas ___ HEPA __
A	Hearing Protection	R	Gloves (Type): Leather X Nitrile X
R	Long Sleeve Shirt		Other _____
	5 Minute Escape Respirator		

MONITORING EQUIPMENT

	Organic Vapor Analyzer (FID)	X	PID with lamp of 10.6 eV, (in PPM)
	Oxygen Meter		Detector Tube (specify) _____
	Combustible Gas Meter		Passive Dosimeter Filter Media ____
	H_2S Meter		Air Sampling Pump
	W. B. G. T.	X	Multi-Gas Meter (O_2, PID, H_2S, LEL)

KLEINFELDER
Bright People. Right Solutions.

COMMON CHEMICAL HAZARDS

Chemical Name	Expected Concentration	Health Hazards
Trichloroethylene (TCE)	Soil: N/A Soil Vapor: 2.043 µg/L	Acute: dermatitis, headache, respiratory irritation, heart sensitizer Chronic: Carcinogen
Tetrachloroethylene (PCE)	Soil: N/A Soil Vapor: 105 µg/L	Acute: dermatitis, headache, respiratory irritation, heart sensitizer Chronic: Carcinogen
Nickel	Soil: 230 mg/kg	Acute: skin sensitizer, dermatitis Chronic: Carcinogen
Cadmium	Soil: 2,600 mg/kg	Acute: eye and skin irritant Chronic: Carcinogen
Total Chromium	Soil: 11,000 mg/kg	Acute: eye and skin irritant. May cause lung, kidney, and liver damage. Chronic: n/a
Hexavalent Chromium	Soil: 18,400 mg/kg	Acute: ulcerations of skin or mucous membranes. Chronic: Carcinogen
Calcium Polysulfide	Soil: N/A	Acute: can cause irreversible eye and skin damage. Can be fatal if swallowed Chronic: n/a
Portland Cement	Soil: N/A	Acute: moderate eye irritation to chemical burns or blindness. May cause irritation to mucous membranes of the nose, throat, and upper respiratory system. Chronic: prolonged exposure to respirable free silica in Portland cement can aggravate lung conditions, cause silicosis, or disabling and potentially fatal lung disease.

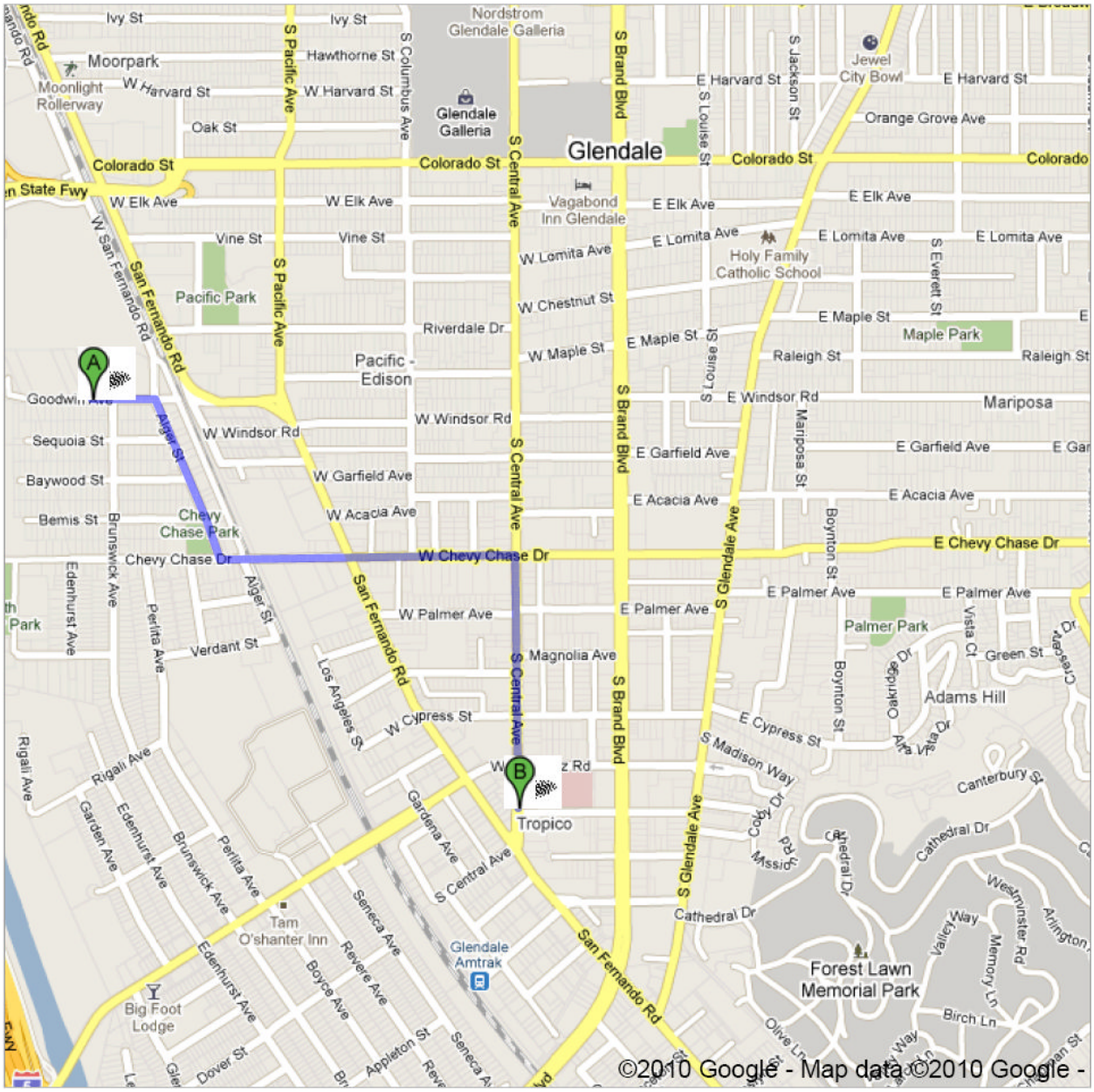
Other Chemicals Not On List: Contact Health and Safety Manager

ONSITE SAFETY MEETING ATTENDEES

Signature	Name (Printed)/Title	Date

PLATE 1

LOCATION OF NEAREST HOSPITAL



Glendale Memorial Hospital
1420 South Central Avenue
Glendale, California 91204
(818) 502-1900
(818)-502-2344 (Emergency Room)

APPENDIX T

SPILL CONTINGENCY PLAN

APPENDIX T

SPILL CONTINGENCY PLAN

THE SPIRITO FAMILY TRUST PARCEL
4057 AND 4059 GOODWIN AVENUE
(INCLUDING THE FORMER EXCELLO PLATING CO., INC. FACILITY)
CITY OF LOS ANGELES,
COUNTY OF LOS ANGELES, CALIFORNIA

LARWQCB Reference:
Excello Plating Co., Inc.
CAO No. R4-2003-0038-R
LARWQCB Site ID No. 2040209
LARWQCB File No. 113.5243

Prepared by:

KLEINFELDER WEST, INC.
620 West 16th Street, Unit F
Long Beach, California 90813

Kleinfelder Project No. 101942

September 30, 2010

Copyright Kleinfelder 2010

TABLE OF CONTENTS

Section **Page**

1.0 INTRODUCTION 1
1.1 PURPOSE 1
1.2 SITE DESCRIPTION 1
1.3 PLAN ORGANIZATION 2
1.4 TRAINING 3
2.0 HAZARDS ASSESSMENT 4
2.1 EQUIPMENT AND VEHICLE FLUIDS 4
2.2 CHEMICALS ASSOCIATED WITH LARGE DIAMETER AUGER/IN-SITU CHEMICAL REDUCTION 5
2.3 CHEMICAL TOILETS AND HUMAN WASTE 5
2.4 CHEMICALS OF CONCERN 5
2.5 UNKNOWN HAZARDOUS MATERIALS AND PETROLEUM PRODUCTS 6
3.0 SPILL PREVENTION AND CONTAINMENT 7
3.1 SPILL PREVENTION MEASURES 7
3.1.1 Vehicle Fluids 7
3.1.2 Chemicals Associated With Lda/Iscr 8
3.1.3 Chemical Toilets And Human Waste 8
3.1.4 Site COCs 8
3.1.5 Unknown Hazardous Materials And Petroleum Products 9
3.2 SPILL CONTAINMENT MEASURES 9
3.3 SPILL CONTAINMENT EQUIPMENT 10
4.0 SPILL RESPONSE PROCEDURES 11
4.1 COMMUNICATIONS 11
4.2 GENERAL RESPONSE PROCEDURES 12
4.3 SPECIFIC RESPONSE PROCEDURES 14
4.3.1 Equipment and Vehicle Spills 15
4.3.2 Chemicals Associated With LDA/ISCR 16
4.3.3 Chemical Toilet Spills 17
4.3.4 Site COCs 17
4.3.5 Unknown Hazardous Materials 17

Copyright Kleinfelder 2010

TABLE OF CONTENTS (CONTINUED)

Section **Page**

4.4 REPORTING OF RELEASES 18
5.0 CLOSEOUT OF SPILL RESPONSE 19
5.1 WASTE MANAGEMENT 19
5.2 CLOSEOUT REPORTING 19
5.3 FOLLOW-UP INVESTIGATION 20
6.0 LIMITATIONS 21

PLATES

Plate 1 Site Vicinity Map
Plate 2 Site Plan

APPENDIX

Appendix A Spill/Incident Report Form

Copyright Kleinfelder 2010

1.0 INTRODUCTION

1.1 PURPOSE

This Spill Contingency Plan (Plan) was prepared on behalf of The Spirito Family Trust for the remedial activities described in Sections 8.0 and 9.0 of the Remedial Action Plan (RAP). This Plan applies to remedial activities which will be performed to address chemicals of concern (COCs) in vadose zone soil. The Plan should be used as an initial reference guide and should accompany project specifications, design plans, and work plans, which will be prepared following approval of the Final RAP. The main purpose of the Plan is to help contractor personnel anticipate and be prepared to respond quickly and safely to hazardous spill incidents, should these occur. The Plan is intended to provide protocols and procedures that, if implemented properly, will facilitate an effective, comprehensive response to prevent injury or damage to construction personnel, the public, and environment during the project.

1.2 SITE DESCRIPTION

The Site is defined by the legal description included in Appendix A of the RAP. The Site is located at 4057 Goodwin Avenue, in the City of Los Angeles, California (the Site has a post office address of Glendale, California 90039). The rear (northern) portion of the Site has also been known in the past as "4059 Goodwin Avenue." The Site is referred to as Los Angeles County Assessor's Parcel Number (APN) 5593-020-020, as shown on the assessor's parcel map attached in Appendix D of the RAP.

Presently the southern portion of the Site is unoccupied, and the northern portion of the Site is used as a parking lot for a retail distribution facility. Redevelopment of the entire Site for use in connection with a neighboring retail distribution facility is contemplated. The proposed use of the Site is intended to be as a driveway and apron for the parking, maneuvering, and loading and unloading of trucks, although a commercial warehouse could possibly be constructed on the Site in the future. The contemplated apron is intended to be subject from time to time to maintenance, reconstruction, and modification so as to be compatible with the overall distribution facility's use.

Copyright Kleinfelder 2010

The Site consists of a trapezoid that has dimensions of 109 feet for the north and south property boundaries and 385.31 feet for the east and west property boundaries. The southern portion of the Site includes the approximately 13,832-square foot building formerly used by Excello Plating Company (Excello), which presently remains on the Site but is not currently in use. The Site is bordered on the north, east, and west by a retail distribution facility, and on the south by Goodwin Avenue, beyond which are residential neighborhoods. A Site Vicinity Map is presented on Plate 1 and a Site Plan is presented on Plate 2.

1.3 PLAN ORGANIZATION

The Plan is intended to inform the Contractor of potential hazardous materials, emergency spill response, and responsibilities associated with hazardous materials during implementation of the RAP. The contractor is expected to comply with procedures described in this document; liability for failure to do so rests with the Contractor.

The Plan outlines the responsibilities and procedures to be used by the Contractor when responding to hazardous spills on the Project, and includes:

1. Procedures for identification and management of spill response at the Site.
2. Identification of management, equipment, and other resources that can be used during a response operation.
3. Spill response procedures.
4. Notification and reporting requirements.

A copy of this Plan should be available to all personnel that may provide assistance during spill response activities. The Plan's content will be discussed at each daily Tailgate Health and Safety Meeting to ensure all applicable personnel have been properly prepared.

Copyright Kleinfelder 2010

1.4 TRAINING

All contractor employees and subcontractors involved with operating equipment or vehicles, refueling equipment, or maintaining construction equipment, will require spill response training prior to working at the Site. Contractors and subcontractors must maintain records of training. This training will supplement, not replace, daily Tailgate Health and Safety Meetings and related procedures.

Copyright Kleinfelder 2010

2.0 HAZARDS ASSESSMENT

Hazardous materials that may be encountered on Site during remedial activities include those associated with construction equipment and vehicles, and may include diesel fuel, gasoline, hydraulic fluid, brake fluid, coolants, and lubricants. Chemicals and materials associated with implementation of the RAP include calcium polysulfide (CaSx) and Portland cement. Other materials considered potentially hazardous are chemicals used in portable toilets. There is also the possibility of encountering buried hazardous or toxic materials during remediation and abatement activities. Each of these hazards is discussed briefly in the subsections below.

2.1 EQUIPMENT AND VEHICLE FLUIDS

Certain materials associated with equipment and vehicle operation and maintenance are potentially hazardous to humans and the environment. Spills of diesel fuel, gasoline, hydraulic fluid, brake fluid, engine oil, lubricants, and other related substances will require implementation of spill response procedures. These materials can be toxic to skin, eyes, respiratory system, and internal organs, and may also be flammable and combustible; therefore proper procedures must be used in addressing spills. Antifreeze and other non-petroleum products are also hazardous materials. Exposure pathways related to these materials may include inhalation, dermal absorption, and/or ingestion, depending upon the material.

Potential sources of vehicle fluid spills include construction equipment, personal vehicles, waste transporter trucks, fuel trucks, and other equipment, resulting from failure of fuel tanks; fuel overflow during refueling operations; leaks of fuel or lubricants during normal operation or storage; spills of oil or hydraulic fluid during on-Site vehicle and equipment servicing; and vehicle accidents.

Copyright Kleinfelder 2010

2.2 CHEMICALS ASSOCIATED WITH LARGE DIAMETER AUGER/IN-SITU CHEMICAL REDUCTION

Chemicals associated with the large diameter auger (LDA)/in-situ chemical reduction (ISCR) and cement stabilization remedial alternative include the following:

- CaSx
- Portland cement

These may be released during delivery to the Site, while in storage, or during application associated with soil remediation activities.

2.3 CHEMICAL TOILETS AND HUMAN WASTE

Portable toilets have the potential to release human waste and chemicals to surroundings. Proper disposal of human waste at the Site is required. Human waste may contain infectious materials and pathogens. Portable chemical toilets could overflow if not properly maintained, or could release hazardous substances if damaged.

2.4 CHEMICALS IN SOIL AND SOIL VAPOR

Based on evaluation of data from previous assessment activities, total chromium, hexavalent chromium (Cr^{6+}), cadmium, and nickel in soil, and TCE, PCE, and 1,1,1-TCA in soil vapor may be encountered at the Site.

In addition, asbestos and lead based paint may be encountered during building abatement, demolition, and transportation and disposal. **Asbestos and lead based paint will be addressed separately, as these have specific regulatory requirements and procedures for containment.**

Copyright Kleinfelder 2010

2.5 UNKNOWN HAZARDOUS MATERIALS AND PETROLEUM PRODUCTS

The potential exists for encountering unknown hazardous materials, petroleum products, and features containing hazardous materials such as free liquids, underground storage tanks, utility lines, drums, asbestos, or other materials. Construction personnel should be observant for these and other possible indicators of unknown buried hazardous materials/wastes, including unidentified drums or pipes; unusual odors; and unexpected readings with field monitoring equipment. If any of these are observed, or unknown potentially hazardous materials or petroleum products are encountered, immediate stoppage of Site activities will be required until the materials can be identified, assessed, and abated, if necessary. Spill response procedures, as described below, may be required.

Copyright Kleinfelder 2010

3.0 SPILL PREVENTION AND CONTAINMENT

3.1 SPILL PREVENTION MEASURES

Prevention of spills can be performed by:

- routine equipment and vehicle inspection and maintenance;
- proper placement and storage of equipment and vehicles; and
- proper storage of materials, chemicals, and fuels in protected areas.

Prior to moving any equipment on Site, the contractor is required to visually inspect each piece of equipment for cracks, excessive corrosion, or other flaws that may compromise the integrity of its fuel, hydraulic, or cooling systems. The Contractor will repair or replace leaking equipment immediately after a leak is detected and will be responsible for prompt reporting and mitigation of any fuel or lubricant spills from their equipment.

3.1.1 Vehicle Fluids

Contractors should train employees to properly inspect and maintain equipment and vehicles. Equipment or vehicles indicating the potential for future spills should be removed from the Site and repaired, and if necessary replaced. Contractors are responsible for preventing spills of hazardous materials, and subsequent cleanup, disposal, and restoration of impacted areas, should a release occur. Hazardous wastes will be disposed of at appropriately licensed disposal facilities in California (to be determined by the Contractor).

Limitations to on-Site equipment refueling, servicing, and maintenance activities will help to reduce the possibility of release of equipment and vehicle fluids. Oils, grease, lubricants, coolant, and related vehicle servicing materials shall be stored off Site, if possible, or in designated areas (equipped with proper containment) specifically designed to contain releases. On-Site refueling will be kept to a minimum, and performed off Site if feasible. Servicing of equipment will be done off Site when

Copyright Kleinfelder 2010

possible, or in designated areas equipped with spill containment kits consisting of absorbent material, drip pans, and other spill containment measures. Soil impacted by spills shall be sampled, profiled, and properly disposed of, and may not be added to swell material or soil stockpiles.

3.1.2 Chemicals Associated with LDA/ISCR

Chemicals associated with soil remediation, including CaSx and cement, are subject to spill or release in an uncontrolled manner into the environment. Restrictions will be placed on the method of delivery of these materials to the Site, the quantity of and location where materials may be stored, storage containers and containment area for the materials, location for handling and mixing of materials, and response equipment and measures to be available in the immediate area. Specific protocols to be followed will be provided in the Design Plans and LDA/ISCR Workplan to be prepared for the Project.

3.1.3 Chemical Toilets and Human Waste

Chemical toilets should be placed, and properly maintained, at a location(s) remote from Site activities, including driveways, truck traffic, equipment operations, or other areas requiring access for soil remediation activities. In addition, if possible, chemical toilets should be placed at least 100 feet away from storm drains or other Site features that would allow discharge of chemicals and human waste into the environment. Chemical toilets must be regularly inspected for leaks or damage, and regularly pumped-out to reduce the likelihood of overflow or release. In addition, containment berms or booms should be placed around the portable toilets to reduce the likelihood of release.

3.1.4 Site Chemicals of Concern

Chemicals of concern (COCs), as defined in the Final RAP, could be released during soil remediation activities as a result of wind-blown dust from exposed soils, or rainfall penetration into treatment or swell material stockpile areas. Dust suppression activities will be performed via water truck and/or fire hose, but will not be over-applied to prevent release of COCs in exposed soil to storms drains or surrounding properties. Berms will

Copyright Kleinfelder 2010

be installed and containment booms will be available to reduce this possibility. When swell material requires stockpiling, it will be placed on plastic sheeting in an area that has containment berms. In addition, stockpiled swell material will be covered with plastic sheeting when the stockpiles are not in active usage to avoid mobilization by wind or rainfall. Finally, if possible, swell material will not be stockpiled on Site, but directly loaded into trucks for off-Site disposal at a licensed facility.

Non-toxic chemical suppressants, such as Simple Green®, may be applied to exposed soils during RAP implementation to reduce volatilization of volatile organic compounds (VOCs) to ambient air, should these be encountered based on monitoring that will be performed during RAP implementation using a portable photo-ionization detector (PID).

3.1.5 Unknown Hazardous Materials and Petroleum Products

There is the potential of encountering unknown hazardous materials and petroleum products during implementation of the RAP; therefore awareness and early detection of potentially hazardous materials is best for avoiding emergencies. Contractors will observe areas of excavation or large diameter augering prior to and during soil remediation activities to assess for any evidence of hazardous materials or waste in the subsurface. Indicators of buried hazardous materials may include pipes, concrete pads, drums, tanks, or discolored or stained soils. If unusual objects or odors are encountered, contractors shall investigate the source before proceeding. Should underground tanks or pipelines be encountered, the hazard of flammable materials, toxic fumes, or explosion exists, so excavation activities should be stopped until the Consultant provides approval to proceed.

3.2 SPILL CONTAINMENT MEASURES

Several measures can be implemented to provide containment of potential spills prior to undertaking RAP implementation activities. First and foremost, each contractor shall keep adequate supplies of spill containment equipment at the Site. These shall include both specialized spill containment equipment (listed below in Section 3.3) and excess supplies of straw bales, silt fencing, and portable vacuum pumps, to be available as needed. Other spill containment measures include using drip pans and/or absorbent

Copyright Kleinfelder 2010

materials underneath vehicles and equipment during refueling, servicing, or maintenance.

3.3 SPILL CONTAINMENT EQUIPMENT

The following equipment should be on Site should spill or emergency response measures be necessary:

1. Emergency Spill Kit - (general contents may vary with manufacturer) contains at a minimum:
   - sorbent socks or booms
   - sorbent material such a clay or cat litter
   - disposal bags and ties
   - personal protective equipment (PPE) (e.g. goggles, gloves, etc.)
   - nitrile or other appropriate material gloves
   - sorbent pads
   - emergency Response Guide Book
   - hazardous waste labels
   - dedicated shovels and brooms
2. Absorbent Pads.
3. 55-gallon Department of Transportation (DOT)-approved drums with overpack liners.
4. First aid kit.
5. Fire extinguishers.
6. Barrier tape and delineators.
7. Hand radios or other communication devices.
8. Non-sparking tools.

The contractor must provide and ensure these materials are on Site at all times and that personnel are trained in their use and disposal.

Copyright Kleinfelder 2010

4.0 SPILL RESPONSE PROCEDURES

At a minimum, a training program shall be designed to ensure that personnel are able to respond effectively to spills by familiarizing them with spill response procedures. Proper communications will be key to an effective spill or emergency response.

4.1 COMMUNICATIONS

Key emergency contact personnel will be identified prior to the start of RAP implementation activities. The table provided below will be included in the Health and Safety Plans (HASPs) to be prepared specifically for the major RAP implementation tasks (Hazardous Building Materials Survey [HBMS] and hazardous building materials abatement, LDA/ISCR, and soil vapor extraction (SVE):

Emergency Contacts	
Project Manager	Name: TBD TBD (XXX) XXX-XXXX office TBD (XXX) XXX-XXXX mobile
Site Safety Officer (SSO)	Name: TBD TBD (XXX) XXX-XXXX office TBD (XXX) XXX-XXXX mobile
Contractor Spill Response Coordinator	Name: TBD TBD (XXX) XXX-XXXX office TBD (XXX) XXX-XXXX mobile

Copyright Kleinfelder 2010

Regulatory Agency	Telephone Number
Local Fire, Police, and/or Paramedics	911
National Response Center	1-800-424-8802 or (202) 267-2675
Poison Control	
Los Angeles RWQCB	
Response Contractor	**Telephone Number**
Spill Response Team (24-hour responder)	TBD
Contractor (Site characterization and cleanup)	TBD

4.2 GENERAL RESPONSE PROCEDURES

General spill response procedures for the site are summarized below, and should be **implemented only if these can be done safely:**

Stop the release or spill of hazardous materials, if possible.

1. Contact key personnel, as necessary, as identified in the major task specific HASP, including the Fire Department and/or Police Department if necessary.
2. Secure the spill area with barrier tape, delineators, or other appropriate equipment.
3. Identify the material spilled, quantity, extent, and potential of exposure to workers, visitors, public, and/or the environment.
4. Review material safety data sheets (MSDS) in the major task specific HASP, and relevant emergency response guidelines.
5. Contain the spill with appropriate spill kit materials and prevent the release from reaching a storm drain.

Copyright Kleinfelder 2010

6. If there is a fire, use the proper type of fire extinguisher to suppress the fire.
7. Once the spill or fire is under control, proceed with clean-up activities and restore the Site to normal conditions.
8. Prepare a spill incident report, which is included in Appendix A and will be added to the task-specific HASPs.
9. Contact regulatory agencies, if warranted (i.e., a released material exceeds its respective reportable quantity).

The initial observer of the spill is responsible for initiating notification and response procedures. Both the Consultant Project Manager and Contractor are responsible for providing spill identification and response training to its employees. The project personnel who must be notified and will assist in hazardous spill response include, but are not limited to:

- Spill Observer
- Project Manager
- Site Safety Officer
- Contractor Response Coordinator
- Spill Response Team

The initial Spill Observer shall assess the release of hazardous materials, stop further releases from occurring, and notify the Project Manager, Site Safety Officer, and Contractor Response Coordinator. The spill observer shall begin completing the Spill/Incident Report Form in Appendix A.

The Project Manager (or Site Safety Officer) shall:

- coordinate with the Contractor Response Coordinator;
- complete all reporting to the property owner; and
- complete reporting to regulatory agencies, if needed.

Copyright Kleinfelder 2010

The Contractor Response Coordinator shall:

- determine if the spill response team is needed;
- coordinate with the Project Manager to initiate spill response;
- mobilize the Spill Response Team for containment, cleanup, and disposal of contaminated materials;
- ensure that the Spill/Incident Report Form (Appendix A) has been initiated; and
- complete all reporting to the property owner and Resident Project Engineers.

The Spill Response Team will consist of Contractor employees and/or outside companies hired by the Contractor to respond to spills. The Spill Response Team shall:

- follow the specific spill response procedures outlined in the Plan; and
- take direction from the contractor response coordinator.

4.3 SPECIFIC RESPONSE PROCEDURES

Response procedures have been developed for spills that consist of:

- equipment/vehicle fluids;
- chemicals associated with LDA/ISCR;
- chemical toilet and human waste spills;
- known hazardous materials or petroleum products; and
- unknown hazardous material.

Many response procedures are common to all types of spills described above, as discussed in Section 4.2. In addition, specific procedures may be required, including those discussed below.

Copyright Kleinfelder 2010

4.3.1 Equipment and Vehicle Spills

Loss of fluids from equipment or vehicles will be considered a spill. Security measures shall be implemented immediately, if safe to do so, to ensure that workers and visitors are kept away. Proper PPE must be worn during response to released hazardous materials.

In general, follow the steps listed below:

1. When the spill is discovered, begin making notations on the Spill/Incident Report Form.
2. Determine if the Spill Team Response is needed to complete the cleanup.
   a. If the answer is **NO**, submit incident reports to the property owner and the Resident Project Engineer.
   b. If the answer is **YES**, go to step 3.
3. Activate the local Spill Response Team. Generally these are personnel designated on the Contractor staff present on Site, but the team may be supplemented by other personnel.
4. Determine if additional cleanup contractors are necessary for a major incident.
   a. If the answer is **NO** and the incident is determined to be a minor spill, conduct internal cleanup, review and evaluate the cleanup, and determine if the cleanup is beyond the Local Response Team ability or equipment. If the answer is **NO**, complete the cleanup, restore the damaged areas, properly dispose of all waste, and submit incident reports to the property owner and the Resident Project Engineer. If during cleanup, the incident is determined to be beyond the abilities of the Local Response Team, hire additional contractors to help with the cleanup.
   b. If the answer is **YES**, hire additional contractors to help with the cleanup.
5. The local Spill Response Team shall coordinate cleanup activities with the property owner, the Resident Project Engineer, and agencies, as appropriate.

Copyright Kleinfelder 2010

6. Arrange for proper testing of the material in question.
7. Closely monitor all cleanup activities.
8. Ensure proper disposal of absorbent materials, containers, and soils, as required.
9. Complete the cleanup and restore damaged areas.
10. Submit incident reports to the property owner and the Resident Project Engineer. Cleanup may range from a simple removal of minor spills, to installation of skimmers around large spills or between sensitive areas and spills for longer, prolonged cleanups. Cleanups can be performed on pavement or on soil surfaces. Contractor personnel shall be trained in the proper use of the cleanup materials.

    All spills on pavement shall be thoroughly removed with absorbent socks, pillows, or pads and Lite-Dry (or equal) granules. After absorption the granules shall also be removed. All materials used in cleanup shall then be profiled and disposed of properly. Place all contaminated materials in a 55-gallon lined drum, seal it, and label the contents. The drum must then be transported to a designated disposal site. A manifest must accompany the drum (provided by disposal company). It is strongly recommended that all contractors determine a disposal site in advance of a spill incident.

    All spills on soil require the same treatment as on pavement, with the exception that contaminated soil is also part of the generated waste and must be handled as such and removed from the Site. Absorbent materials shall remain in use until it has been determined by the property owner and Contract Compliance Inspectors that a spill cleanup is complete and the incident is closed.

4.3.2 Chemicals Associated with LDA/ISCR

Chemicals that will be used during remedial activities for metals in soil include CaSx and Portland cement. These chemicals pose certain threats to human health and the environment, and preventive measures within this document should be implemented to ensure they are not released.

Copyright Kleinfelder 2010

General response procedures described above will be adequate to address this type of potential release.

4.3.3 Chemical Toilet Spills

Portable toilets are self-contained and pose little threat to the Site. Chemicals used in portable toilets are biodegradable and generally non-toxic to humans, but could pose a danger to the environment. These should be pumped out regularly, as needed, to ensure there is not an overflow problem. Chemical toilets should not be placed near storm drains.

General response procedures described above will be adequate to address this type of release. If a portable toilet is found to be leaking, absorbent materials should be used to contain and remedy the situation. Absorbent materials will be handled and disposed as deemed appropriate by the provider of the chemical toilet.

4.3.4 Site COCs

General response procedures described above will be adequate to address this type of release.

4.3.5 Unknown Hazardous Materials

There is always a possibility that personnel may unexpectedly encounter a hazardous situation when working in the field. Materials that may be encountered during field work include underground tanks, utility pipelines, drums, or asbestos pipe. If unknown hazardous materials are encountered, do the following:

1. Stop work immediately and do not handle the materials.
2. Secure the area, and ensure that workers and/or visitors are alerted to the situation, and extinguish or stop ignition sources (e.g., equipment engines).
3. Initiate contact with those identified as Emergency Contacts.
4. Secure the proper staff trained to identify the unknown hazardous materials.

Copyright Kleinfelder 2010

5. Note the following:
    - site location;
    - unknown hazard encountered (e.g., tank, drum, pipe, etc.);
    - size of object;
    - odors;
    - soil staining;
    - material released to surroundings; and
    - estimated amount of chemical released.

Workers and visitors should be directed on how to proceed, including what response actions should be taken. Securing the location of the unknown hazard and keeping personnel from entering a zone with unknown hazards by proper communication can reduce the likelihood of exposure or injury.

4.4 REPORTING OF RELEASES

If a major release of a hazardous material exceeding reportable quantities occurs, then proper notification and immediate response are necessary. Notification of personnel should be as described above so that appropriate spill response can be implemented. After initial spill response has begun, notification and reporting to agency personnel shall occur, as required by law. The following guidelines should be followed when reporting major spills:

1. Only include verifiable information;
2. Promptly provide notifications, even if complete information is not available;
3. Notify persons/agencies and document notification and the content of the message; and
4. Complete the Spill/Incident Report Form (Appendix A).

Copyright Kleinfelder 2010

5.0 CLOSEOUT OF SPILL RESPONSE

5.1 WASTE MANAGEMENT

Response kit materials, such as absorbent materials, PPE, impacted soil, or residual liquids must be properly containerized, labeled, transported, and disposed at an appropriately licensed waste disposal facility. If contaminants are unknown, analytical sampling and profiling of the waste material shall be performed.

Proper manifesting of containerized waste materials shall be provided; if appropriate, manifests shall accompany the waste material to a licensed disposal facility. Copies of these documents shall be attached to the Spill/Incident Report and be provided to the property owner and Project Manager.

Transporting hazardous waste is regulated by federal and state agencies under the Resource Conservation and Recovery Act (RCRA) and other statutes. The contractor should consult the Transportation and Disposal Plan for the proper disposal of all waste and understanding the responsibilities under federal and state statutes.

5.2 CLOSEOUT REPORTING

Spill incidents that require cleanup shall be reported on the Spill/Incident Report. Notifications shall be provided as described above. The Spill/Incident Report shall be submitted to the property owner and Project Manager as soon as it is complete, and no more than 5 days after an incident has been closed. As stated above, copies of the waste manifests and the chains-of custody for waste disposal shall be attached to the Spill/Incident Report, and these documents must be kept on file for no less than 5 years. Additional reporting may be required by regulatory agencies.

Copyright Kleinfelder 2010

5.3 FOLLOW-UP INVESTIGATION

A spill response follow-up investigation will be beneficial to identifying the cause for an unplanned release of hazardous materials or petroleum products, and improving the spill response actions implemented. This will also allow for an update to the Site-specific HASP and Job Loss Analyses that guide Site activities. Recommendations and suggested modifications will be made to prepare for the possibility of future spills.

All contractors and subcontractors are responsible for their actions and will be liable for any costs incurred by the property owner, as a result of negligence regarding hazardous materials or petroleum products.

Copyright Kleinfelder 2010

6.0 LIMITATIONS

This work was performed in a manner consistent with that level of care and skill ordinarily exercised by other members of Kleinfelder's profession practicing in the same locality, under similar conditions, and at the date the services are provided. Our conclusions, opinions, and recommendations are based on a limited number of observations and data. We have, however, satisfied ourselves that the quantity and nature of the existing observations and data are appropriate in our professional opinion to support our work per the standard of care to which we adhere. It is possible that conditions could vary between or beyond the data evaluated. Kleinfelder makes no other representation, guarantee, or warranty, express or implied, regarding the services, communication (oral or written), report, opinion, or instrument of service provided.

This document may be used only by Kleinfelder's Client, and only for the purposes stated for this specific engagement within a reasonable time from its issuance, but in no event later than 2 years from the date of the document. The foregoing notwithstanding, this document may be submitted by The Spirito Family Trust to LARWQCB in accordance with LARWQCB's requirements. However, by this action, no rights of reliance are granted to The Spirito Family Trust. Non-commercial, educational, and scientific use of this report by regulatory agencies is regarded as a "fair use" and not a violation of copyright.

It should be recognized that definition and evaluation of geologic and environmental conditions comprise a difficult and inexact science. Judgments leading to conclusions and recommendations are generally made with incomplete knowledge of the subsurface conditions present due to the limitations of data from field studies. Although risk can never be eliminated, more-detailed and extensive studies yield more information, which may help understand and manage the level of risk. More extensive studies, including subsurface studies or field tests, may be performed to reduce uncertainties.

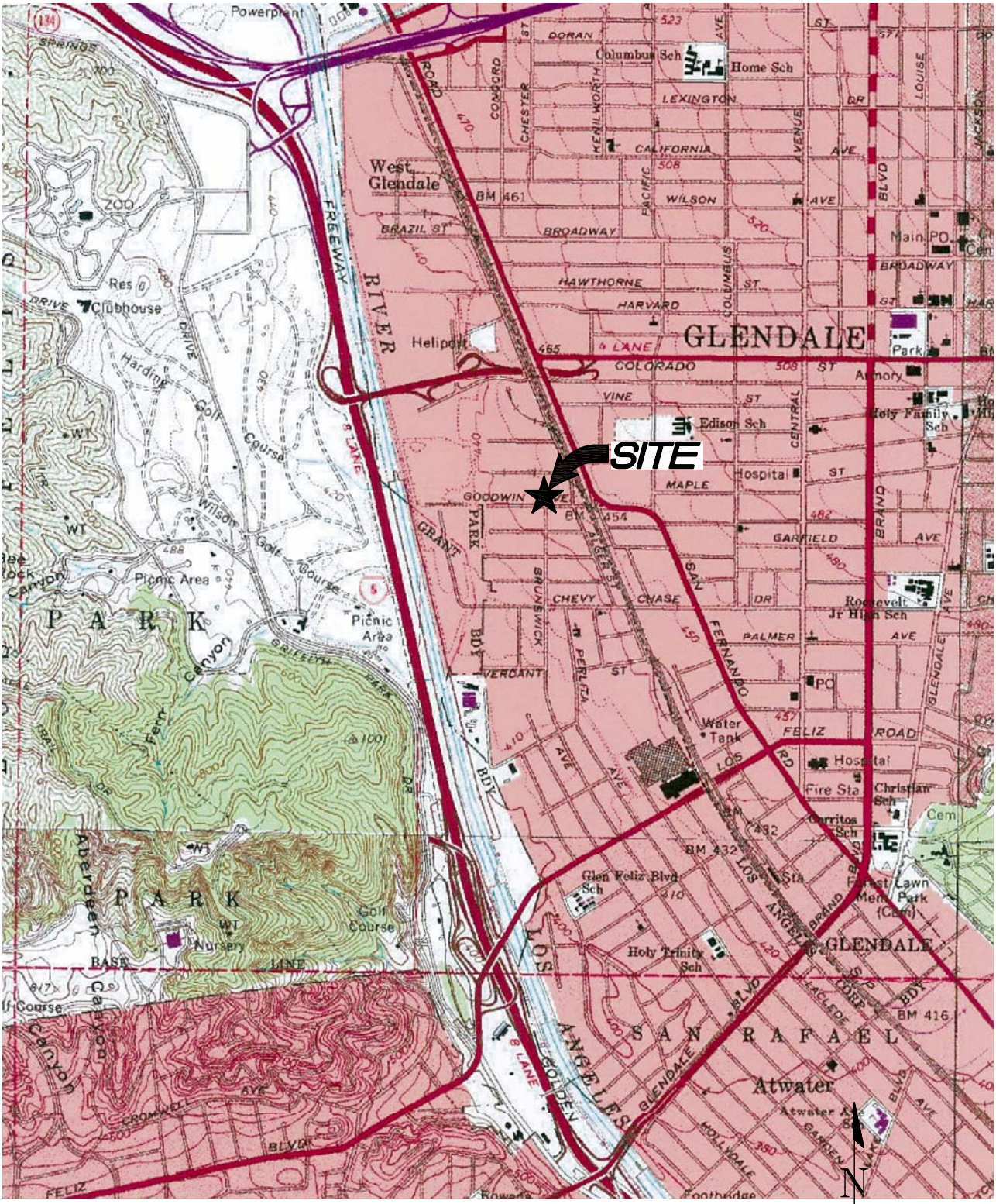
Copyright Kleinfelder 2010

During the course of the performance of Kleinfelder's services, hazardous materials may be discovered. Kleinfelder assumes no responsibility or liability whatsoever for any claim, loss of property value, damage, or injury that results from pre-existing hazardous materials being encountered or present on the Site, or from the discovery of such hazardous materials. Nothing contained in this document should be construed or interpreted as requiring Kleinfelder to assume the status of an owner, operator, or generator, or person who arranges for disposal, transport, storage, or treatment of hazardous materials within the meaning of any governmental statute, regulation, or order. The Client/owner is solely responsible for directing notification of all governmental agencies, and the public at large, of the existence, release, treatment, or disposal of any hazardous materials observed at the Site, either before or during performance of Kleinfelder's services.

Health-based screening evaluations, such as the J&E Model, are subject to limitations imposed by the scientific information available at the time of the assessment. The work described in this document is not designed to quantify or identify all potential risks to human health that might be associated with the chemical releases at the Site. The work also does not provide a guarantee regarding the amount of risk at the Site. Risks quantified reflect only the CSM and exposure pathways identified in the document. In addition, risk estimates may change as new scientific or technical information becomes available that may modify the CSM, exposure assessment parameters, and toxicity values. Other risk assessment professionals may reasonably employ different approaches and methods to those described herein.

Copyright Kleinfelder 2010

PLATES



SOURCE: U.S.G.S. 7.5' topographic series, Burbank, California quadrangle dated 1966, photorevised 1972.

The Information included on this graphic representation has been compiled from a variety of sources and is subject to change without notice. Kleinfelder makes no representations or warranties, express or implied, as to accuracy, completeness, timeliness, or rights to the use of such information. This document is not intended for use as a land survey product nor is it designed or intended as a construction design document. The use or misuse of the information contained on this graphic representation is at the sole risk of the party using or misusing the information.

KLEINFELDER
Bright People. Right Solutions.
www.kleinfelder.com

PROJECT NO.	101942
DRAWN:	9/2010
DRAWN BY:	MRG
CHECKED BY:	PD
FILE NAME:	101942p1.dwg

SITE VICINITY MAP

EXCELLO PLATING CO., INC.
4057 AND 4059 GOODWIN AVENUE
LOS ANGELES, CALIFORNIA

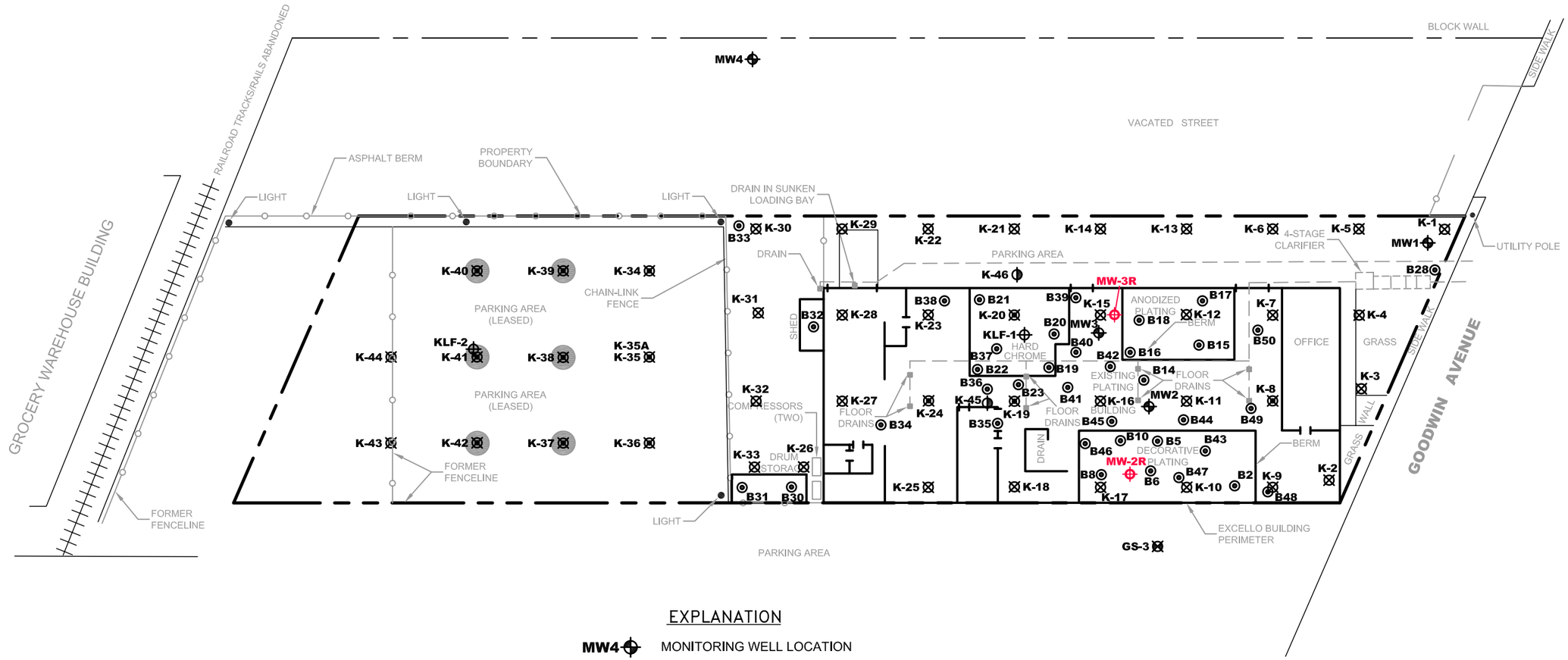
PLATE **1**

ATTACHED IMAGES: Images: 92124p1.JPG
ATTACHED XREFS:
Diamond Bar, CA

CAD FILE: L:\2010\CADD\101942\ LAYOUT: 1

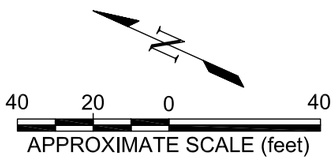
PLOTTED: 24 Sep 2010, 11:18am, mgriffin

PLOTTED: 24 Sep 2010, 11:19am, mgriffin
CAD FILE: L:\2010\CADD\101942\ LAYOUT: 2
ATTACHED IMAGES:
ATTACHED XREFS:
DIAMOND BAR, CA



EXPLANATION

MW4	MONITORING WELL LOCATION
K-33	KLEINFELDER VAPOR PROBE LOCATION
B50	CERES SOIL BORING LOCATION
K-44	KLEINFELDER SOIL BORING AND VAPOR PROBE LOCATION
K-46	KLEINFELDER SOIL BORING LOCATION
GS-3	EXTRACTION WELL LOCATION
KLF-2	PHYSICAL PARAMETER SOIL BORING LOCATION
MW-3R	PROPOSED REPLACEMENT WELL
	BURIED CONCRETE LAYER ENCOUNTERED



The information included on this graphic representation has been compiled from a variety of sources and is subject to change without notice. Kleinfelder makes no representations or warranties, express or implied, as to accuracy, completeness, timeliness, or rights to the use of such information. This document is not intended for use as a land survey product nor is it designed or intended as a construction design document. The use or misuse of the information contained on this graphic representation is at the sole risk of the party using or misusing the information.

KLEINFELDER
Bright People. Right Solutions.
www.kleinfelder.com

PROJECT NO.	101942
DRAWN:	9/2010
DRAWN BY:	MRG
CHECKED BY:	PD
FILE NAME:	101942p2_SP.dwg

SITE PLAN

EXCELLO PLATING CO., INC.
4057 AND 4059 GOODWIN AVENUE
LOS ANGELES, CALIFORNIA

PLATE
2

APPENDIX A

SPILL/INCIDENT REPORT FORM
FACILITY NAME

SPILL/INCIDENT REPORT NO_____ **FILE NO**_____ **REPORT DATE**_____

REPORT RECEIVED BY_____ **EXT**_____

CONTACTED BY_____ **EXT**_____

Spill/Incident Date:_____ Time of Spill/Incident:_____

Location:_____ Department:_____

Incident Type (Check all that apply): ☐ Spill ☐ Fire ☐ Other Quantity: _____

Description of Spill/Incident:_____

_____

_____

Equipment Type/Description:_____ Serial Number:_____

Hazardous Material or Wastes Spilled/Identified:_____

MSDS Attached: ☐ YES ☐ NO

Discharged to: ☐ Water ☐ Soil ☐ Sewer ☐ Oil/Water Separator ☐ Other

Approximate Dimensions of Spill: _____ (Provide Drawings if Necessary)

Spill Area Well Defined? ☐ YES ☐ NO

Amount of Clean-up Material Used: _____

Was pre-cleanup sampling done? ☐ YES ☐ NO

Describe: _____

Provide Drawing of Sampling Grid and Samples Taken.

Description of response/clean-up actions taken: _____

_____

_____

Notification of any Regulatory agencies required? ☐ YES ☐ NO

AGENCIES NOTIFIED:

CITY/COUNTY

TO: _____

Phone No: _____

Date: _____ Time: _____

By: _____

STATE

To: _____

Phone No: _____

Date: _____ Time: _____

By: _____

FEDERAL

TO: _____

Phone No: _____

Date: _____ Time: _____

By: _____

OTHER

To: _____

Phone No: _____

Date: _____ Time: _____

By: _____

Cleanup Required? ☐ YES ☐ NO Amount of Soil Removed: _____ (cubic yards)

Date Cleanup was Completed: _____ Time: _____

Was Cleanup Delayed? ☐ YES ☐ NO Duration of Delay: _____

Reason for Delay: _____

Was Post-Cleanup Verification Sampling Completed? ☐ YES ☐ NO

Special Instructions: _____

Final Follow-up Action Taken (mark appropriate attachments):

☐ Agency Reports ☐ Employee Training ☐ Prevention Action ☐ Equipment Repair/ Replacement

Report Completed by: _____ Date: _____

Reviewed by: _____ Date: _____

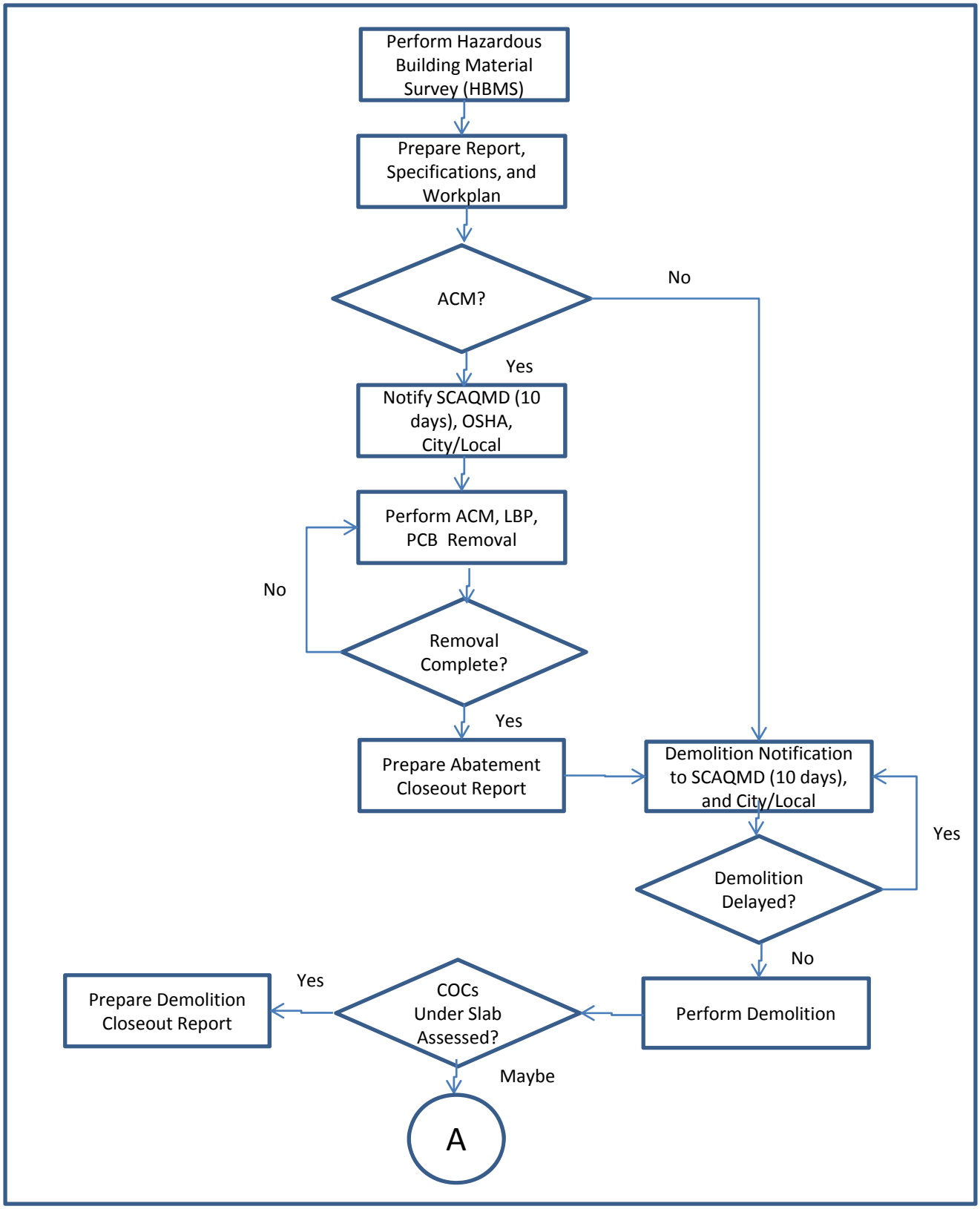
Facility Emergency Coordinator

APPENDIX U

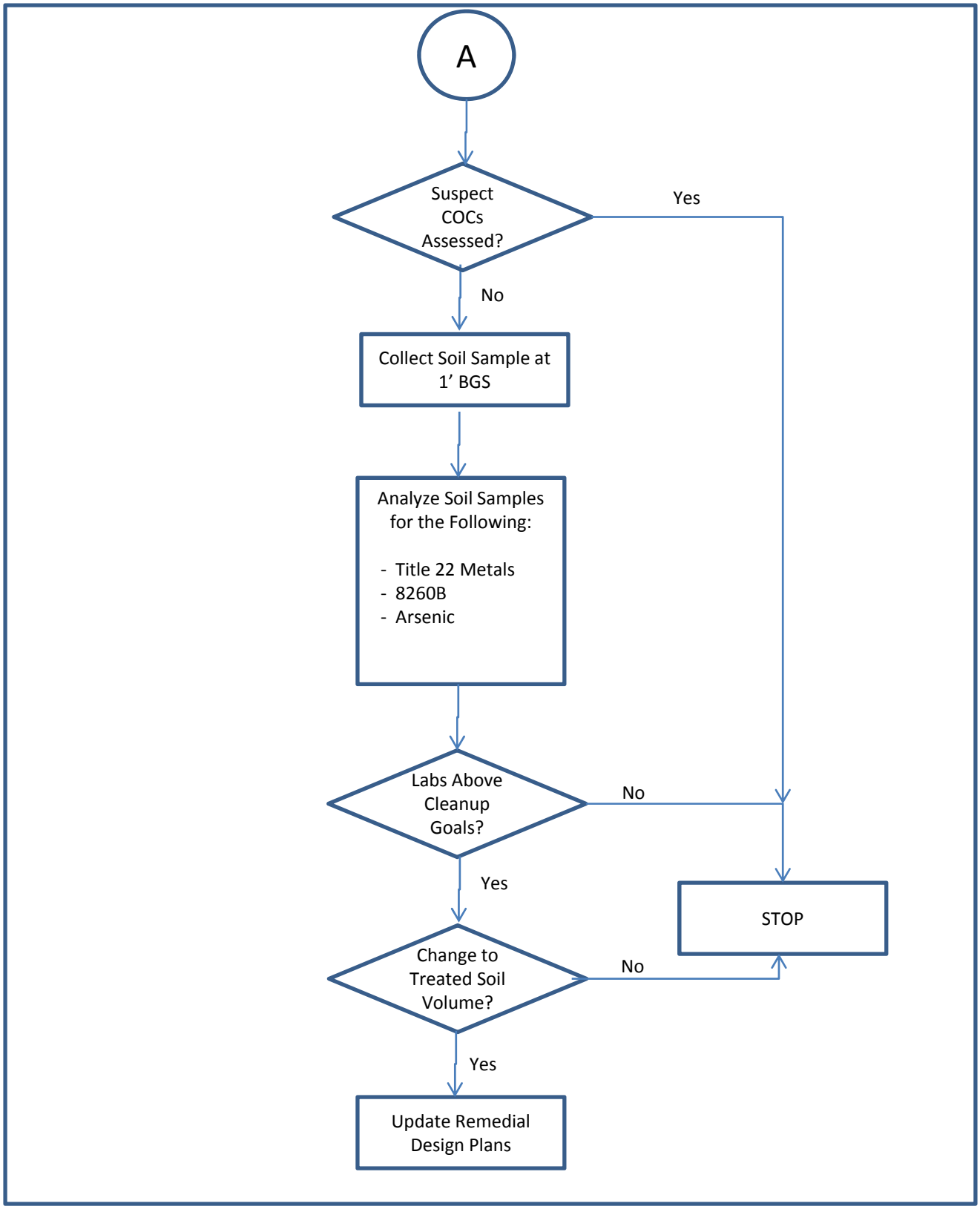
FLOWCHARTS

HBMS and Demolition Decision Flowchart

(The Spirito Family Trust – Former Excello Plating Co. Inc.)



Sub-Slab Sampling and Analysis Decision Flowchart
(The Spirito Family Trust – Former Excello Plating Co. Inc.)

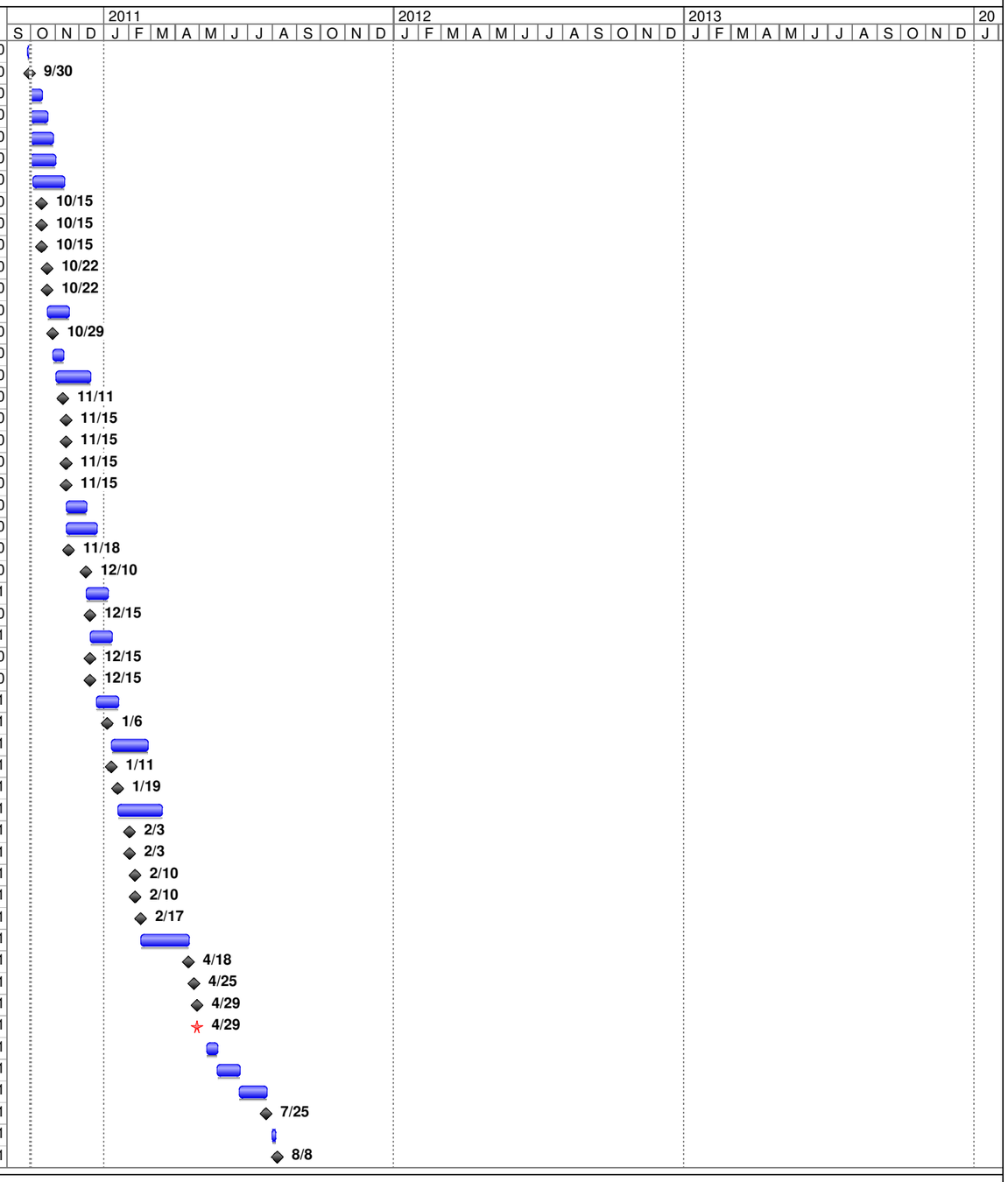


APPENDIX V

CONCEPTUAL REMEDIAL ACTION PLAN IMPLEMENTATION SCHEDULE

Conceptual Remedial Action Plan Implementation Schedule

ID	Task Name	Start	Finish
1	Prospective Purchaser Capital Meeting for Project Capital Authorization Approval	Mon 9/27/10	Fri 10/1/10
2	Kleinfelder Submit Remedial Action Plan (RAP)	Thu 9/30/10	Thu 9/30/10
3	Agency Review of RAP	Thu 9/30/10	Fri 10/15/10
4	Kleinfelder Prepare Waste Discharge Requirements (WDR) Permit	Fri 10/1/10	Fri 10/22/10
5	Kleinfelder Prepare Hazardous Building Materials Survey (HBMS) Workplan	Fri 10/1/10	Fri 10/29/10
6	Kleinfelder Prepare Draft Public Participation Meeting Fact Sheet	Fri 10/1/10	Mon 11/1/10
7	Client Engineered Cap Design	Mon 10/4/10	Fri 11/12/10
8	Prospective Purchaser and LARWQCB Reach Agreement in Principle on Complete Text of Prospective Purchaser Agreement	Fri 10/15/10	Fri 10/15/10
9	Prospective Purchaser and US EPA Reach Agreement in Principle on Complete Text of Prospective Purchaser Agreement	Fri 10/15/10	Fri 10/15/10
10	Trust and Prospective Purchaser Sign Purchase and Sale Agreement, with Price	Fri 10/15/10	Fri 10/15/10
11	Trust Submits Ability to Pay Request to LARWQCB and US EPA	Fri 10/22/10	Fri 10/22/10
12	Kleinfelder Submit WDR Permit	Fri 10/22/10	Fri 10/22/10
13	Agency Review WDR Permit	Fri 10/22/10	Thu 11/18/10
14	Kleinfelder Submit HBMS Workplan	Fri 10/29/10	Fri 10/29/10
15	Agency Review HBMS Workplan	Fri 10/29/10	Thu 11/11/10
16	Kleinfelder Prepare LDA/ISCR and SVE Pilot Test Workplan	Tue 11/2/10	Wed 12/15/10
17	Agency Approve HBMS Workplan	Thu 11/11/10	Thu 11/11/10
18	LARWQCB Approves Ability to Pay Settlement	Mon 11/15/10	Mon 11/15/10
19	US EPA Approves Ability to Pay Settlement	Mon 11/15/10	Mon 11/15/10
20	US EPA Federal Register Publication of Prospective Purchaser Agreement (signed by RP) for Comment	Mon 11/15/10	Mon 11/15/10
21	Public Notice of LARWQCB Public Participation Meeting and Documents	Mon 11/15/10	Mon 11/15/10
22	Kleinfelder Prepare Cap Installation and Maintenance Plan	Mon 11/15/10	Fri 12/10/10
23	Kleinfelder Perform HBMS	Mon 11/15/10	Thu 12/23/10
24	Agency Approve WDR Permit	Thu 11/18/10	Thu 11/18/10
25	Kleinfelder Submit Cap Installation and Maintenance Plan	Fri 12/10/10	Fri 12/10/10
26	Agency Review Cap Installation and Maintenance Plan	Fri 12/10/10	Thu 1/6/11
27	Kleinfelder Submit LDA/ISCR and SVE Pilot Test Workplan	Wed 12/15/10	Wed 12/15/10
28	Agency Review LDA/ISCR and SVE Pilot Test Workplan	Wed 12/15/10	Tue 1/11/11
29	LARWQCB Public Meeting	Wed 12/15/10	Wed 12/15/10
30	LARWQCB Public Participation Period Closes	Wed 12/15/10	Wed 12/15/10
31	Kleinfelder Prepare HBMS Report	Thu 12/23/10	Wed 1/19/11
32	Agency Cap Installation and Maintenance Plan Approval	Thu 1/6/11	Thu 1/6/11
33	LDA/ISCR Design Package Preparation	Tue 1/11/11	Fri 2/25/11
34	Agency Approve LDA/ISCR and SVE Pilot Test Workplan	Tue 1/11/11	Tue 1/11/11
35	Kleinfelder Submit HBMS Report	Wed 1/19/11	Wed 1/19/11
36	Kleinfelder Prepare HBMS Specifications and Bid Package	Wed 1/19/11	Tue 3/15/11
37	PPA Approval by LARWQCB Board Meeting	Thu 2/3/11	Thu 2/3/11
38	US EPA Approves Prospective Purchaser Agreement	Thu 2/3/11	Thu 2/3/11
39	Department of Toxic Substances Control (DTSC) Provides Comfort Letter Regarding Prospective Purchaser Agreement	Thu 2/10/11	Thu 2/10/11
40	Agency Signature of Prospective Purchaser Agreements	Thu 2/10/11	Thu 2/10/11
41	Trust Initiates Probate Proceedings (60 days minimum)	Thu 2/17/11	Thu 2/17/11
42	Trust Probate Proceedings (60 days minimum)	Thu 2/17/11	Mon 4/18/11
43	Probate Court Approval of Trust's Conveyance of Title	Mon 4/18/11	Mon 4/18/11
44	US EPA Releases Lien	Mon 4/25/11	Mon 4/25/11
45	Escrow Closes	Fri 4/29/11	Fri 4/29/11
46	All Tasks Listed Below will be Performed Following the Close of Escrow, for which a Conceptual Only Date is Included	Fri 4/29/11	Fri 4/29/11
47	Kleinfelder Abatement SCAQMD Notification	Wed 5/11/11	Tue 5/24/11
48	Kleinfelder Performs Hazardous Building Materials Abatement	Tue 5/24/11	Tue 6/21/11
49	Kleinfelder Prepare HBMS Closeout Documentation	Tue 6/21/11	Mon 7/25/11
50	Kleinfelder Submit HBMS Closeout Documentation	Mon 7/25/11	Mon 7/25/11
51	Kleinfelder Prepare Building Demolition Permitting	Mon 8/1/11	Fri 8/5/11
52	Kleinfelder Submit Building Demolition Permit	Mon 8/8/11	Mon 8/8/11

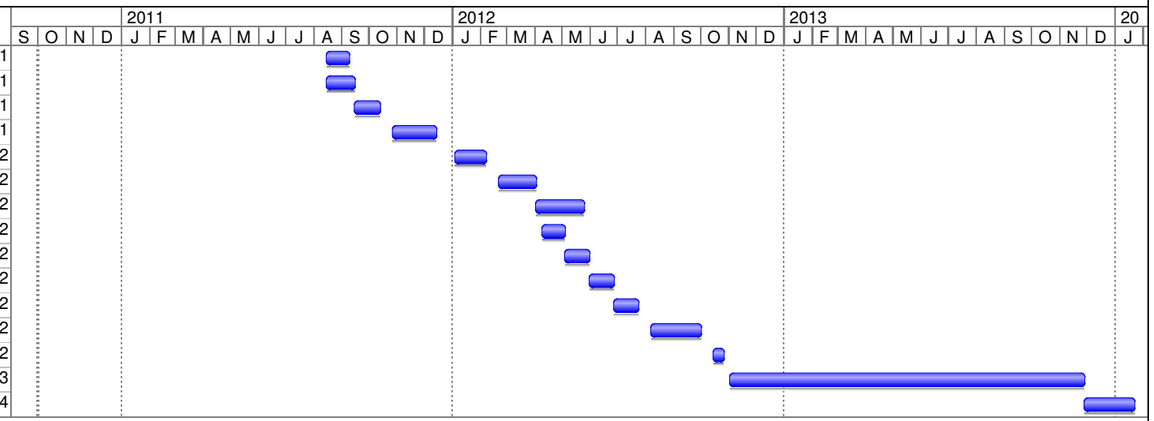


Project:
Excello RAP Implementation Schedule
CONCEPTUAL
Date: Thu 9/30/10

Task | Progress | Summary | External Tasks | Deadline
Split | Milestone | Project Summary | External Milestone

Conceptual Remedial Action Plan Implementation Schedule

ID	Task Name	Start	Finish
53	Kleinfelder Perform Building Demolition	Mon 8/15/11	Fri 9/9/11
54	Kleinfelder Pilot Test LDA Rig and Equipment Mobilization	Mon 8/15/11	Thu 9/15/11
55	Kleinfelder Perform LDA/ISCR Field Pilot Test	Thu 9/15/11	Thu 10/13/11
56	Kleinfelder LDA/ISCR Field Implementation	Thu 10/27/11	Wed 12/14/11
57	Kleinfelder LDA Rig and Equipment Demobilization and Site Restoration	Wed 1/4/12	Tue 2/7/12
58	Engineered Cap Installation	Tue 2/21/12	Mon 4/2/12
59	Kleinfelder Prepares LDA/ISCR Closeout Report	Mon 4/2/12	Fri 5/25/12
60	Kleinfelder Install SVE Pilot Test Wells	Mon 4/9/12	Fri 5/4/12
61	Kleinfelder Perform SVE Pilot Test and Prepare Report	Fri 5/4/12	Thu 5/31/12
62	Kleinfelder Prepare SVE System Design	Thu 5/31/12	Wed 6/27/12
63	Kleinfelder Perform SVE System Permitting	Wed 6/27/12	Tue 7/24/12
64	Kleinfelder Install SVE Wells, Piping, and SVE System	Tue 8/7/12	Mon 10/1/12
65	Kleinfelder Perform SVE System Start-Up	Mon 10/15/12	Fri 10/26/12
66	Kleinfelder Perform SVE System O&M and Rebound Testing	Fri 11/2/12	Thu 11/28/13
67	Kleinfelder Prepare RAP Implementation Closeout Report	Thu 11/28/13	Wed 1/22/14



Project:
Excello RAP Implementation Schedule
CONCEPTUAL
Date: Thu 9/30/10

Task | Progress | Summary | External Tasks | Deadline
Split | Milestone | Project Summary | External Milestone