FINAL DRAFT

CORRECTIVE MEASURE STUDY/REMEDY SELECTION/CORRECTIVE MEASURE IMPLEMENTATION WORKPLAN

PREPARED FOR:

TOPPAN ELECTRONICS, INC.

URS PROJECT NO. 27703049.10001
August 21, 2006

FINAL DRAFT

CORRECTIVE MEASURE STUDY/ REMEDY SELECTION/CORRECTIVE MEASURE IMPLEMENTATION WORKPLAN

Prepared for

Toppan Electronics, Inc.
7770 Miramar Road
San Diego, CA 92126

URS Project No. 27703049.10001

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August 21, 2006

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August 21, 2006

Ms. Nirupma Suryavanshi
State Regulatory Programs Division
Department of Toxic Substances Control
California Environmental Protection Agency
5796 Corporate Avenue
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Subject: Final Draft
Corrective Measure Study/Remedy Selection/
Corrective Measure Implementation Workplan
Toppan Electronics, Inc.
7770 Miramar Road
San Diego, California
URS Project No. 27703049.10001

Dear Ms. Suryavanshi:

URS Corporation (URS) is pleased to submit three copies of this Corrective Measure Study/Remedy Selection/Corrective Measure Implementation Workplan (CMS/RS/CMI) for the Toppan Electronics, Inc. (Toppan) facility located at 7770 Miramar Road in San Diego, California for your review. URS prepared this CMS/RS/CMI pursuant to the Corrective Action Consent Agreement (CACA) dated June 24, 2003, between the Respondent (Toppan) and the California Environmental Protection Agency, Department of Toxic Substances Control (DTSC).

If you have any questions or require further discussion, please call Tom Ryan at (619) 294-9400.

Sincerely,

URS CORPORATION

Thomas J. Ryan, P.E.
Principal Engineer
Project Manager

Robert K. Scott, P.G., C.Hg.
Vice President

TJR/RKS:ml

cc: Mike Hasukawa, Toppan Electronics, Inc. (three copies)
TR Hathaway, DTSC, Sacramento (one copy)

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SECTION 1 INTRODUCTION

This Corrective Measure Study/Remedy Selection/Corrective Measure Implementation (CMS/RS/CMI) Workplan document was prepared by URS Corporation (URS) for the Toppan Electronics, Inc. (Toppan) facility located at 7770 Miramar Road in San Diego, California (site). The site location is illustrated on Figure 1. A site plan is provided as Figure 2.

This CMS/RS/CMI was prepared pursuant to the Corrective Action Consent Agreement (CACA), Docket HWCA: SRPD01/02 SCC-1222, dated June 24, 2003, between the Respondent (Toppan) and the California Environmental Protection Agency, Department of Toxic Substances Control (DTSC). A copy of the CACA was included as Appendix A of the Facility Investigation (FI) Workplan and Current Conditions Report, dated October 3, 2003 (FI Workplan, URS, 2003). The CACA was selected as the appropriate mechanism to facilitate corrective action and ensure that the facility is suitably investigated and remediated, if necessary, under the oversight of DTSC.

The FI Workplan was approved by DTSC in a letter dated October 21, 2003 (DTSC, 2003). The FI Workplan also included a community profile. The scope of work for additional FI soil and soil vapor sampling was described in the Revised Technical Memorandum for Supplemental Sampling (Technical Memorandum, URS, 2004a) and the Addendum to Revised Technical Memorandum for Supplemental Sampling (Technical Memorandum Addendum, URS, 2005), both approved by DTSC in letters dated November 2, 2004 and May 11, 2005, respectively (DTSC, 2004a and 2005). The Baseline Risk Assessment (BRA) Workplan (URS, 2004b) was approved by DTSC in a letter dated March 18, 2004 (DTSC, 2004b). The FI Report was approved by DTSC in a letter dated January 18, 2006 (DTSC, 2006a), with the report finalized and dated February 6, 2006 (URS, 2006a). The BRA Report, dated May 5, 2006, was approved by DTSC in a letter dated June 29, 2006 (URS, 2006b and DTSC, 2006b, respectively).

This CMS/RS/CMI was prepared to include the following submittals required under the CACA:

- CMS/RS/CMI
- CMS/RS/CMI Report, with remedy selection
- CMS/RSCMI, to describes the detailed plan for implementation of the selected remedy

Other relevant CMI-related submittals specified in the CACA consist of the Operations and Maintenance (O&M) Plan, and the Construction and Corrective Measure Completion Reports. The O&M Plan and Construction and Corrective Measure Completion Reports will be submitted following implementation and documented completion of the selected corrective measure. The O&M Plan will be prepared to describe the plans for expected soil vapor monitoring, to be conducted after completion of soil excavation activities described in this report to ensure that the monitoring program is developed consistent with post-excavation site conditions. However, preliminary plans for soil vapor monitoring are included in this report based on anticipated post-excavation conditions.

SECTION 2 CORRECTIVE MEASURE STUDY WORKPLAN

2.1 INTRODUCTION

The purpose of this CMS/RS/CMI Workplan is to specify how the CMS/RS/CMI Workplan will be prepared, including identification of the proposed cleanup standards and corrective measure technologies and alternatives that will be studied in the CMS/RS/CMI. Corrective measure is required at this site to address elevated concentrations of several metal and VOC constituents that result in an unacceptable risk to human health. Characterization of the site is presented in the FI Report, with a site-wide summary provided in Section 2.2, below.

2.2 PROJECT SUMMARY

2.2.1 Background

In the CACA, DTSC identified 20 Solid Waste Management Units (SWMUs) based on the results of a site inspection conducted on June 18, 2002, and review of available information. URS and Toppan later added two Areas of Concern (AOCs) based on the results of a site visit conducted on April 24, 2003. These SWMUs and AOCs are listed in Table 1 with a description of each provided in the FI Workplan and FI Report. The location of each of the SWMUs and AOCs is illustrated on Figure 3. This figure also illustrates the soil vapor and soil boring locations advanced during the FI.

In the CACA, DTSC concluded that further investigation was needed at the site to evaluate the nature and extent of potential hazardous waste or hazardous waste constituents, particularly from the SWMUs. DTSC identified metals, volatile and semi-volatile organic compounds (VOCs and SVOCs), pH, and total petroleum hydrocarbons (TPH) as the constituents of concern (COCs). Cyanide and hexavalent chromium were added as COCs to selected SWMUs by DTSC in its letter approving the FI Workplan (DTSC, 2003). Additionally, Toppan and URS added formaldehyde to the list of potential COCs based on further review of site operations at SWMU #4, the Electroless Area.

Field soil and soil vapor sampling work were conducted during November and December 2003 and January, February, April, June, July, and August 2005. The results from this field sampling were presented in the Final FI Report, dated February 6, 2006 (URS, 2006a).

2.2.2 Site Description

The site encompasses approximately 5.5 acres and is located at 7770 Miramar Road (Figure 1). A two-story building of approximately 125,000 square feet is located on the site and formerly housed Toppan's offices and most manufacturing operations (Figure 2). The areas outside of the building were used primarily for wastewater treatment and chemical storage operations, as well as employee parking. With the exception of the driveway entrances, front landscaped areas, and parking areas along Miramar Road to the south; the site is enclosed by a six-foot-high chain-link fence topped with barbed wire.

The site is bounded by Miramar Road to the south, commercial properties to the east (café/bakery) and west (retail furniture stores), and a railroad spur and other commercial property to the north. The Marine Corps Air Station at Miramar (MCAS) is located south of Miramar Road. Adjacent businesses are identified in the Community Profile included as Appendix B of the FI Workplan (URS, 2003).

The site is generally flat with an approximately 4- to 6-foot drop to the railroad spur elevation at the northern edge of the property and an approximately 4- to 8-foot rise to the adjacent retail property to the east. Approximately 95% of the site is covered by the building footprint and asphalt or concrete paving, except for small landscaped areas along Miramar Road.

The general site vicinity is highly commercialized with no residences located within an approximately 0.4-mile radius of the site (URS, 2003, Appendix B). Also, no other sensitive receptors were identified within 0.4-mile radius of the site except for a gymnastics school and training facility located to the north of the site at 7698 Miramar Road.

2.2.3 Screening Criteria

In the Technical Memorandum (URS, 2004a), risk based criteria (RBCs) were calculated for specific COCs, except lead, under a hypothetical future unrestricted (residential) land use scenario and a current commercial land use scenario. RBCs were calculated for use in helping to focus the FI toward those areas and chemicals at the site that may correspond with a significant potential risk to human health.

Consistent with the approach described BRA Workplan, the Technical Memorandum also described the use of the exposure area concept; the spatial area over which sampling results are aggregated for exposure evaluation; and the criteria for combining individual SWMUs and AOCs into a single exposure area. A total of six exposure areas were defined for this site, with risk drivers identified as follows:

Exposure Area	Risk Drivers
A	Metals
B	VOCs
C	VOCs and arsenic
D	VOCs and metals
E	Metals
F	No risk drivers

Risk drivers are identified as those constituents that contribute most to an unacceptable level of potential human health risk. The exposure areas were illustrated on a figure provided in the Technical Memorandum and again in the BRA Report. This figure is also included in this report as Appendix A. The RBCs used in screening the FI data represent concentrations of COCs in soil matrix and soil vapor that correspond with a cancer risk of 1×10^{-6} and a non-cancer risk hazard (Hazard Index, or HI) of 1. For each COC, the RBC values were assigned as the lower of either the cancer-based concentration threshold or the non-cancer-based concentration threshold.

The site-specific RBCs were updated in the BRA Report to address revised toxicity criteria for several constituents (updated since completion of the Technical Memorandum) and to include RBCs for the Construction (Excavation) Worker receptor (URS, 2006b). The BRA Report also presented RBCs to correspond with $1x10^{-4}$, $1x10^{-5}$, and $1x10^{-6}$ cancer risk to be used in risk-based decision making during the development and evaluation of the effectiveness of the corrective measure alternatives. Tables summarizing the updated RBCs were excerpted from the BRA Report and are included as Appendix B as part of the update of current conditions provided in Section 3.2.

However, naturally occurring concentrations of arsenic in California soil typically exceed health risk based screening criteria, including the site-specific RBCs. Therefore, comparison to site-specific background concentrations is more relevant in the evaluation of the nature and extent of potential arsenic contamination.

In the BRA Work Plan (URS, 2004b), URS proposed that the toxicity evaluation and risk characterization for lead be performed using the DTSC LeadSpread 7.0 model. Accordingly, the RBC for lead was calculated as 150 milligrams per kilogram (mg/kg) using this model, applicable for both the residential and commercial land use scenarios.

Published background concentration data for metals were of limited use at this site as a screening criterion, since site-specific background data are available. Therefore, the FI Report analytical results were compared to site-specific background data. Use of site-specific background data is especially relevant for screening detected concentrations of arsenic, since the naturally occurring concentrations of arsenic in California soil typically exceed health risk based screening criteria, including the site-specific RBCs. Published background data for arsenic are useful in documenting the typical range of naturally occurring arsenic (Bradford, et al., 1996). This suggests that exceedances of the arsenic RBCs do not necessarily indicate that past operations have impacted the site. Accordingly, although detected concentrations of arsenic were compared to its respective RBCs for completeness, the evaluation of the nature and extent of potential arsenic contamination appearing herein is based primarily on a comparison to the maximum background concentration of arsenic detected at this site (11.5 mg/kg).

Accordingly, the screening criteria used in the evaluation of analytical data in the FI Report and in preliminary development of the corrective measure alternatives are as follows:

- Comparison to the RBCs for the COCs, with arsenic further evaluated in comparison to maximum site-specific background concentrations (11.5 mg/kg).
- Comparison to the RBC criteria calculated using the DTSC LeadSpread 7.0 model for lead (150 mg/kg).

2.2.4 Key Findings of the FI

The results of the soil and soil vapor sampling conducted under the FI were compared to site-specific screening criteria described above. Screening criteria include site-specific background concentrations and the RBCs, developed for both unrestricted land use (residential), construction worker, and continuing commercial use (commercial worker).

The following key findings were reported in the FI Report, based on the results of this comparison under a continued commercial land use scenario (commercial RBCs), potential construction worker exposure, and a $1x10^{-6}$ cancer risk and a HI of 1:

- Concentrations of arsenic detected in soil samples collected from SWMU #4, SWMU #7a, SWMU #8, SWMU #9, SWMU #12a, SWMU #14, and SWMU #18 exceed site-specific screening criteria (the maximum background concentration). The maximum concentration of arsenic detected in soil samples collected from SWMU #14 and SWMU #12a; however, only slightly exceed the screening criteria.
- Concentrations of lead detected in soil samples collected from SWMU #3, SWMU #9, SWMU #12a, and SWMU #19a exceed site-specific screening criteria (RBC based on the DTSC LeadSpread 7.0 model).
- Concentrations of formaldehyde detected in soil samples collected from SWMU #4 exceed site-specific screening criteria (RBC).
- Concentrations of methylene chloride detected in soil samples SWMU #2a exceed site-specific screening criteria (RBC).
- Concentrations of several VOCs, primarily 1,1-Dichloroethene (1,1-DCE), methylene chloride, and 1,1-Dichloroethane (1,1-DCA), detected in soil vapor samples collected primarily in the northeast corner of the site in the area of SWMU #1, SWMU #2a, SWMU #9, and SWMU #12a exceed site specific screening criteria for indoor exposure via vapor intrusion (RBC).

Again, these findings were based on the RBCs presented in the Technical Memorandum. Notably, formaldehyde no longer poses an unacceptable human health risk based on the updated RBCs presented in the BRA Report. Revised RBCs are discussed further in Section 3.2.

2.2.5 Key Findings of the BRA

The BRA quantitatively evaluated potential risk to human receptors and qualitatively evaluated the potential risk to environmental receptors. The BRA considered combined risk from the COCs. RBCs were also updated in the BRA, where applicable. Application of the quantitative risk assessment in the evaluation of corrective measure alternatives and development of cleanup standards are described further in Sections 3.6 and 3.3, respectively.

The Summary and Conclusions table in the BRA Report provided a summary of potential risk and identification of cancer and non-cancer risk driver COCs. This table is included as Appendix C.

2.3 PURPOSE OF THE CORRECTIVE MEASURE STUDY

The primary purpose of the CMS/RS/CMI is to identify, screen, evaluate, and select the most appropriate corrective measure in achieving site cleanup standards. For this site, the primary cleanup standard is to remediate soil impacted with elevated concentration of metals and VOCs to mitigate unacceptable levels of potential risk to human health and the environment.

2.4 IDENTIFICATION OF CORRECTIVE MEASURE TECHNOLOGIES AND ALTERNATIVES

Corrective measure technologies were identified based on their ability to effectively address elevated concentrations of metals and/or VOCs in soil and/or VOCs in soil vapor and achieve cleanup standards. Cleanup standards are discussed in Sections 2.5.4 and 3.3. Individual corrective measure technologies are later combined into alternatives as necessary to achieve cleanup standards in all media. URS identified several general classifications of technologies that may be appropriate for remediation of soil and/or soil vapor for this site (FRTR, 2002). These technologies are identified in Table 2 and are screened, combined into alternatives, and evaluated in Section 3. The application of Land Use Controls (LUCs) is discussed in Section 2.5, below.

2.5 GENERAL APPROACH

Corrective measure will be evaluated and implemented using a risk-based corrective action approach. Implementation of a risk-based corrective action approach provides for cleanup levels based on a site-specific evaluation of potential risk to human health and the environment. Implementation of this approach is described below.

2.5.1 Land Use Consideration

Characterization of potential risk requires consideration of the planned land use and corresponding exposure pathways and receptors. In the FI Report, results from soil and soil vapor sampling were compared to RBCs for both unrestricted (residential) and commercial/industrial use. Based on the results of this comparison, and given the current and expected long-term land use for this property, the CMS/RS/CMI will be conducted assuming continued commercial/industrial use. Corrective measure will be developed to generally achieve RBCs/cleanup standards for residential land use for COCs detected in soil (metals and VOCs); however, exceedances for soil vapor under the vapor intrusion pathway will be addressed for commercial worker RBCs/cleanup standards.

Toppan recognizes that restricting land use for commercial/industrial purposes will require implementation of an appropriate LUC mechanism. Accordingly, a LUC may be a necessary component of each of the corrective measure alternatives presented in this CMS/RS/CMI, depending on the results of the characterization of potential human health risk conducted after implementation of the selected alternative. The four general types of LUCs are private controls (e.g., deed restrictions), governmental controls (e.g., permit, zoning, and siting restrictions), enforcement tools (not typically effective for future owners), and information devices (e.g., deed notices) (ICMA, 2006). The most appropriate mechanism for establishing the LUC will be identified and implemented as part of a process conducted outside of this report, but will likely include a deed restriction to restrict the property to commercial/industrial land use.

Additionally, an O&M Plan will be required to describe the strategy and procedures for performing operations, long-term maintenance, and monitoring appropriate for a particular corrective measure alternative. The O&M Plan will be prepared to describe the requirements for soil vapor monitoring to verify the effectiveness of the selected alternative. Implementation of the O&M Plan by Toppan will be conducted under the existing CACA.

2.5.2 Technologies/Alternatives

The general approach to be taken in the CMS/RS/CMI will be based on identification and evaluation of technologies that are expected to be effective in achieving the cleanup standards for the site using a risk-based corrective action and based on continued commercial/industrial land use. Technologies will be combined, as necessary, to achieve site cleanup standards for relevant effected media and COCs. Developed technologies are preferred because of their greater certainty in achieving the cleanup standards; however, innovative technologies will be considered where sufficient information exists to validate their effectiveness in comparison to developed technologies. Potential technologies were identified in Section 2.4, Table 2.

2.5.3 Evaluation Criteria

The evaluation and selection of the most appropriate corrective measure will be based primarily on the nine corrective action standards and decision factors listed below (paraphrased from Attachment 5 of the CACA, included as Appendix A of the FI Workplan, URS, 2003):

- *Be protective of human health and the environment*
- *Attain media cleanup standards*
- *Control the sources of release* - in order to reduce or eliminate, to the extent practicable, further releases of hazardous wastes that may pose a threat to human health and the environment
- *Comply with any applicable standards for management of wastes*
- *Short- and long-term effectiveness* – including threats during construction or during long term O&M
- *Reduction of toxicity, mobility, and/or volume*
- *Long-term reliability*
- *Implementability* - both technical (e.g., construction and operation) and administrative (e.g., permitting, public acceptance) feasibility and availability of necessary services and materials for implementation
- *Cost* – net present value of both capital and O&M costs

Each alternative will be evaluated individually on these criteria. A comparative evaluation will also be conducted to select the most appropriate corrective action alternative.

2.5.4 Cleanup Standards

The BRA Report provided an assessment of the potential risks to human health and the environment resulting from an assumed exposure to the contaminants, assuming no action is taken to remediate the site. The summary and conclusions table from the BRA Report is included as Appendix C. The BRA Report also provided updated RBCs for individual constituents detected at the site. These updated RBCs are included in Appendix B. These updated RBCs were used in the CMS/RS/CMI process to preliminarily identify the areas of the site potentially requiring corrective action.

The RBCs, however, are based on exposure to a single constituent and do not address the potential combined risk from multiple constituents specific to each area. However, the RBCs used to develop preliminary corrective action alternatives are based on a $1x10^{-6}$ risk level for carcinogens and a Hazard Index (HI) of 1 for non-carcinogens. An HI exceeding 1 generally implies that unacceptable health effects may occur.

With those areas assumed to be remediated through implementation of the selected corrective measure (e.g., with implementation of excavation or soil vapor extraction [SVE]), the potential human health risk will be re-evaluated to confirm that the potential risk has been satisfactorily addressed considering the combined risk of the constituents in a particular area. This evaluation will include the range of target risk levels described in the BRA. For carcinogens, the target risk level is generally between $1x10^{-4}$ and $1x10^{-6}$. For non-carcinogens, the target risk level is based on the HI. Pathways to potential exposure are also considered.

Target risk levels and pathways are detailed further in the BRA Report (URS, 2006b). Site-specific cleanup standards are presented in Section 3.3 of this report.

2.6 TREATABILITY, PILOT, LABORATORY, AND BENCH SCALE STUDIES

At this time, treatability, pilot, laboratory, or bench scale studies are not recommended. Although SVE is a technology evaluated in this CMS/RS/CMI, use of performance data from an existing SVE system located in the vicinity of the Toppan facility and other locations with relevant site conditions were used in the evaluation of this technology under Section 3.

2.7 OUTLINE OF THE CMS/RS/CMI WORKPLAN

The outline for the CMS/RS/CMI Workplan is included as part of the Table of Contents of this report for Section 3. The outline was developed in accordance with Attachment 5 of the CACA.

2.8 PROJECT MANAGEMENT

Toppan has contracted with URS to conduct corrective action activities at this site. URS has assembled a project team of engineers, geologists, field technicians, and subcontractors to support anticipated activities. An updated project organizational chart is included as Figure 4. A description of the role and responsibilities of each key project team member is provided below.

Toppan

<u>Project Manager</u>

Mr. Mike Hasukawa is Manager of Special Projects for Toppan, including overall responsibility for decommissioning and closure activities of this facility. As Toppan's Project Manager, Mr. Hasukawa will be responsible for communication with DTSC and overall management of the CMS/RS/CMI contractor, URS.

URS

Project Manager

As Project Manager for URS, Mr. Thomas Ryan, PE will be responsible for overall technical direction (working closely with the QA/QC Advisor and Principal-in-Charge), management of URS project staff, subcontractor management, and controlling project budget and schedule. Mr. Ryan is a Registered Professional Engineer and has over 24 years of experience in management and implementation of hazardous waste and engineering projects, including over 15 years in southern California. Mr. Ryan has implemented corrective action activities and obtained site closure at a variety of commercial and governmental sites under DTSC, the RWQCB, and local oversight authorities. Mr. Ryan developed and is a former instructor of a class titled "Implementation of Remediation Projects" at the University of California at San Diego, Site Assessment and Remediation extension program.

Principal-in-Charge

As a Vice President of URS, Bob Scott, P.G. C. Hg., will serve as the designated Principal-in-Charge. He has the authority to commit company resources as needed for this project. As Principal-in-Charge, he will be responsible for ensuring that necessary resources are committed to meet the schedule requirements and will make regular contact with the Project Manager to ensure that project needs are being met. Mr. Scott also has extensive experience working on DTSC- and RWQCB-lead site investigation and corrective action projects. In particular, he has an extensive history of completing RCRA facility and unit-related investigations and closures. He understands the regulatory framework surrounding this project.

QA/QC Advisors

Mr. Julian Granier, P.G. our designated QA/QC Advisor, will be responsible for implementation of URS' QA/QC Plan, including providing support in the development of the technical approach for this project and review of deliverables. Mr. Granirer is a Professional Geologist and has over 16 years of experience in conducting site investigations and implementation of corrective action at a wide variety of commercial and industrial sites.

Database Management

As Database Manager, Mr. Steve Cole, will provide support in data management during implementation of the CMS/RS/CMI activities. Mr. Cole has over 10 years of experience in the development and implementation of facility investigations and database management on a wide variety of RCRA, CERCLA, and other projects.

Data Validation

Ms. Lily Bayati will provide validation of laboratory data generated from samples collected at this site. Ms. Bayati has over 16 years experience in validation of laboratory data following relevant US EPA standard operating procedures and guidelines.

Field Operations and Geology

As manager of field operations, Mr. Lowell Woodbury will be responsible for conducting field operations and direct subcontractor oversight for implementation of CMS/RS/CMI activities. Mr. Woodbury has over 14 years of experience in implementation of field investigation and corrective action activities, including soil, soil vapor, and groundwater sampling, excavation and off-site disposal of contaminated soil, and subcontractor field management.

Subcontractors

Key subcontractors selected as part of URS’ project team consist of the following:

- Aman Environmental Construction, and their waste disposal subcontractors listed below:
  - Allied Waste for disposal of non-hazardous waste (Otay Landfill) and non-RCRA hazardous waste (Copper Mountain Landfill)
  - Clean Harbors Environmental Services, Inc. for disposal of RCRA-hazardous waste, if any (Buttonwillow Landfill)
- Test America Drilling Corporation (formerly West Hazmat Drilling Corp.) for construction of the soil vapor monitoring probes.
- H&P Labs, to assist in construction of the soil vapor monitoring probes and laboratory analysis of the soil vapor samples.
- Calscience Environmental Laboratories, Inc., a California-certified laboratory, for laboratory analysis of the confirmation and other soil samples.
- ULS Services Company, to provide utility locating services prior to excavation.

Each of these companies has a proven track record of successful performance in their respective fields of expertise and has worked with URS on this and other sites.

2.9 SCHEDULE

A proposed project schedule is included as Figure 5.

SECTION 3 CORRECTIVE MEASURE STUDY

3.1 INTRODUCTION/PURPOSE

This CMS/RS/CMI Workplan was prepared primarily to identify, screen, evaluate, and select the most appropriate corrective measure for the site. A site description was provided in Section 2.1.

3.2 DESCRIPTION OF CURRENT CONDITIONS

A description of the current conditions was included in the FI Report, including a description of the nature and extent of contamination and a conceptual site model (CSM). Relevant new information obtained since completion of the FI Report includes updated RBCs presented in the BRA Report. These updated discussions regarding current site conditions do not change the characterization of the nature and extent of contamination or the conceptual site model presented in the FI Report, but only the screening level evaluation of areas requiring corrective action.

Updated RBCs

To address the updated RBCs presented in the BRA Report, revised tables providing a comparison of site-wide results to the RBCs has been included as Appendix E (included as updated FI Tables 6A and 6B). Additionally, revised tables providing a comparison of individual SWMUs and AOCs results to the updates RBCs have been included as Appendix F (included as updated FI Appendix I tables). The construction worker RBCs have been added to these tables. Also, tables were included for both $1x10^{-6}$ and $1x10^{-4}$ cancer risk, to aid in risk management decision making. Non-cancer risk is based on HI exceedances of 1. Correspondingly, the data presentation figures were also updated to highlight updated RBC exceedances and are included as Appendix D of this report (FI Appendix H figures), based again on only $1x10^{-6}$ cancer risk and an HI exceeding a value of 1.

Further Evaluation of Potential Off-site Migration of VOCs in Soil Vapor

DTSC requested that Toppan further address the lateral extent of soil vapor off site to the north as a condition of approval of the Final FI Report (DTSC, 2006a). To address this condition, URS created a series of concentration contour figures to illustrate the location of off-site buildings to the north of the Toppan facility relative to the estimated lateral extent of soil gas in that direction (Figures 40, 41, and 42, Appendix D). The nearest building to that portion of the site is located at 7698 Miramar Road and is occupied by a gymnastics school and training facility.

The lateral extent of 1,1-DCE in soil vapor for depth intervals of 5, 10, and 15 feet below ground surface (bgs) was estimated using the Surfer model to contour the data from on-site soil vapor sampling locations. These figures also highlight the RBC of 1,1-DCE for both commercial and residential land use, assuming that the residential land use scenario may be more appropriate for characterization of potential risk for the students participating in the gymnastics classes held at the building closest to that area of the site.

Based on URS' interpretation of the Surfer model results, Figures 40, 41, and 42 indicate that concentration of 1,1-DCE in soil vapor exceeding commercial or residential RBCs do not extend beneath the nearby off-site building. Additionally, an unpaved area between the two properties likely provides an opportunity for shallow soil vapor to escape to the atmosphere, thus limiting lateral migration. This unpaved area includes a significant slope and rail-spur (Section 2.2.2).

3.3 PROPOSED MEDIA CLEANUP STANDARDS

Cleanup standards for this site are established to protect human health and the environment. The cleanup standards are based on site-specific media of concern, identified COCs, exposure routes and receptors, and identification of acceptable concentrations or range of concentrations for each exposure route. The media of concern for this site are limited to vadose zone soil and soil vapor. The primary COCs for this site are identified as follows, as described in the FI Report and Section 3.2, above:

- Metals (vadose zone soil only)
  - Primarily arsenic and lead
- VOCs (vadose zone soil and soil vapor)
  - Primarily formaldehyde, Methylene Chloride, 1,1-DCE, and 1,1-DCA

Primary COCs are identified based on an assessment of their prevalence and contribution to site risk. Exposure routes and receptors are illustrated in the Conceptual Site Model for Human Exposure, excerpted from the BRA Report and included as Appendix G.

Accordingly, the cleanup standards for this site are:

- Reduce the concentration or eliminate the exposure pathway to soil with concentrations of arsenic exceeding the maximum background concentration of 11.5 mg/kg.
- Reduce the concentration or eliminate the exposure pathway to soil with concentrations of lead exceeding the threshold value of 150 mg/kg, based on the DTSC LeadSpread 7 model.
- Reduce the concentration or eliminate the pathway to exposure to soil with concentrations of metals or VOCs that exceed their combined potential human health risk of $1x10^{-4}$ to $1x10^{-6}$ or HI of 1 to 3 based on exposure via dust inhalation, incidental ingestion, or dermal contact.
- Reduce the concentration or eliminate the pathway to exposure to soil or soil vapor with concentrations of VOCs that exceed their combined potential human health risk of $1x10^{-4}$ to $1x10^{-6}$ or HI of 1 to 3 based on exposure via vapor inhalation, especially for indoor air via vapor intrusion.

3.4 IDENTIFICATION AND SCREENING OF CORRECTIVE MEASURE TECHNOLOGIES

Corrective measure technologies were identified in Section 2.4 (Table 2). These technologies were selected based primarily on previous URS or published experience in addressing site-specific media and

COCs. Each of these technologies is screened based on their expected effectiveness, implementability, and cost. These screening criteria are defined as follows:

- *Effectiveness*, with primary consideration of the ability of the technology to meet cleanup objectives and be protective of human health and the environment.
- *Implementability*, with primary consideration of the technical and administrative feasibility of and availability of necessary equipment and personnel for implementation. This criterion also includes consideration of expected state and community acceptance.
- *Cost*, including both capital and present value of operation and maintenance (O&M) costs, as applicable.

Screening of the technologies is presented in Table 2. This table provides a brief description of the technologies and an evaluation and comparison based on their expected effectiveness, implementability, and estimated cost. Key advantages, disadvantages, and/or limitation of each alternative are also identified in this table.

The results of the screening indicate that no single technology would be effective in addressing all media and COCs, except for excavation; provided that the extent of the excavation was extensive enough to address later and deep soil vapor exceedances; and containment; provided that the containment measure was properly operated and maintained and that future excavation work be conducted under proper H&S procedures.

3.5 DEVELOPMENT OF CORRECTIVE MEASURE ALTERNATIVES

Based on the identification and screening process conducted in Sections 2.4 and 3.4, respectively, corrective measure technologies were combined into alternatives to be evaluated in this CMS/RS/CMI. The alternatives are identified as follows:

- Alternative 1 – No Action
- Alternative 2 – Source Removal, Vapor Intrusion Control, and Monitoring
- Alternative 3 – Deep, Extensive Excavation and Monitoring
- Alternative 4 – Extensive Shallow Excavation, SVE, and Monitoring

Each of the alternatives above may also include appropriate LUCs, such as a deed restriction to restrict land use to commercial/industrial use, consistent with current land use. The need for a LUC will depend on the results of the characterization of potential human health risk conducted after implementation of the selected alternative. Monitoring of soil vapor was included to verify that the cleanup standards for the vapor intrusion pathway are achieved with implementation of the selected corrective measure alternative. Monitoring would be conducted to verify that the concentration of VOCs in soil vapor remain stable or decrease over time. Confirmation sampling of soil following excavation is also included as part of each alternative.

A description of each alternative is provided below. A more detailed description of the requirements for implementation of the selected alternative is included in Section 4.

3.5.1 Alternative 1 - No Action

In accordance with National Contingency Plan and Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), as amended, Alternative 1 has been included to provide a baseline for comparison to other remediation alternatives. This alternative includes no administrative or engineering controls, no removal or treatment of soil, and no monitoring. No cost is associated with this alternative. Additionally, since contaminated media remains on site, CERCLA requires review of site conditions every 5 years.

3.5.2 Alternative 2 – Source Removal, Vapor Intrusion Control, and Monitoring

Alternative 2 includes the following elements:

- Excavation and off-site treatment/disposal of soil impacted with metals that exceed residential, construction, and commercial worker RBCs to a maximum depth of 15 feet bgs. Below that depth, the pathway to exposure is considered incomplete.
- Excavation and off-site treatment /disposal of soil impacted with VOCs that exceed residential, construction, and commercial worker RBCs, and extended to the deeper soils in SWMU2a to a maximum depth of 25 feet bgs to reduce risk.
- Implementation of vapor control measures and/or demolition of the portions of the existing building to eliminate the pathway to the soil vapor plume that exceed commercial worker RBCs. Vapor control would be provided by either enhanced building ventilation or installation of a physical barrier to vapor migration. A LUC would be established to ensure long-term monitoring and maintenance of the vapor control measure and/or prohibition of building construction over the designated areas of the site.
- Implementation of a soil vapor monitoring program, consisting of four semi-permanent, multi-depth, soil vapor monitoring probes. Annual monitoring would be conducted to document that concentrations of VOCs in soil vapor remain stable or are decreasing. A schematic diagram of a typical soil vapor monitoring probe is included as Figure 9.

The scope of work for this alternative is illustrated on Figure 6.

Excavation and Off-site Treatment/Disposal

Soil excavation and off-site treatment/disposal is a developed technology for remediation of metal and VOC-impacted soil. It provides a means of direct removal of soil with concentrations of COCs exceeding the cleanup standards from the site for possible treatment and disposal at a properly licensed facility. Treatment prior to disposal, if necessary, would consist of either stabilization (metal-impacted soil) or thermal destruction (VOC-impacted soil). Transportation of the soil would be conducted under appropriate waste manifests using covered dump trucks.

Prior to excavation, necessary permits would be obtained (e.g., grading permits for the excavation and building permits for possible shoring and/or demolition) and underground utilities would be located by contacting Underground Service Alert (USA) and conducting other utility locating techniques, including review of available facility drawings. During excavation, dust and VOC monitoring would be conducted to protect worker and community safety. Monitoring data would be compared to criteria established in the Site-specific Health and Safety Plan (HSP) and evaluated to confirm compliance with San Diego Air Pollution Control District (SDAPCD) requirements under Rule 50, Visible Emissions, and Rule 51, Nuisance. If dust and VOC concentrations exceeded the established criteria, excavation work would be stopped until engineering controls could be implemented to reduce the exposure to acceptable levels. After excavation, confirmation soil samples would be collected and analyzed for the corresponding COCs (e.g., metals and VOCs) to confirm that cleanup standards for soil have been achieved.

For this alternative, approximately 3,632 cubic yards (or, 4,722 tons at 1.3 tons per cubic yard) of soil would be excavated from the areas illustrated in Figure 6. The estimated quantities of soil to be excavated are detailed in Table 4 by SWMU and exposure area. Soil would be excavated to a maximum depth ranging from approximately 5 to 25 feet bgs. Additional quantities of soil outside of the boundaries illustrated in Figure 6 may also have to be excavated and handled to provide suitable sloping, where necessary, especially for the deeper areas of excavation, to provide a stable excavation and access for excavation equipment or in possible combination with shoring. However, this soil could possibly be used for backfill at the site.

Excavation would be accomplished using a combination of a trackhoe and backhoe. Focused, deeper excavations may be accomplished using a large-diameter bucket auger. A front-end loader would be used to transfer the excavated soil to designated soil-stockpile areas for characterization sampling and analysis. After completion of soil characterization sampling and analysis, a front-end loader would be used to load the soil into covered dump trucks for transportation to a properly licensed treatment/disposal facility. All wastes would be transported under an appropriate waste manifest as a non-hazardous, California hazardous, or Resource Conservation and Recovery Act (RCRA) hazardous waste, as appropriate. Waste characterization would be based on the combined analytical data from the FI and possible new characterization sampling results obtained from the soil stockpiles. Assuming a capacity of approximately 22 tons per dump truck, a total of approximately 213 truck loads would be required to transport excavated soil from this site. Assuming that the excavation work could be completed within 4 weeks, approximately 11 trucks per day would be loaded. A similar number of trucks would be required to transport backfill soil to the site.

The deep excavation at this site would be difficult to accomplish, primarily because of the proximity to the building. Shoring or extensive sloping may be required along the perimeter of the excavation facing the building walls to protect the structural integrity of the building. As indicated above, additional quantities of soil may also have to be excavated for sloping, as necessary. These techniques would require a structural analysis to plan necessary shoring, bracing, or other suitable building stabilization techniques. Excavation may also be complicated by the presence of any existing subsurface utilities (e.g., electrical conduit, water piping, waste drain piping). Existing utilities would have to be located and protected and/or replaced.

After completion of excavation activities, confirmation samples would be collected from the sidewalls and bottom of the excavation areas to confirm that the excavation was successful in removing soil with concentrations of metals and VOCs exceeding the cleanup standards established for the site. Confirmation samples would be collected on an approximately 30 foot grid spacing.

After completion of the excavation work and evaluation of analytical results from the confirmation sampling, the excavation areas would be backfilled with imported, clean soil. Backfilling operations would require compaction and compaction testing to provide a suitable base for resurfacing and surface loads.

After completion of the excavation work and receipt of analytical reports and waste disposal documentation, construction and corrective measure completion reports would be prepared and submitted to DTSC to document the satisfactory completion of the corrective measure.

Vapor Control

Vapor control would consist of engineering and administrative controls to eliminate the pathway to exposure via vapor intrusion. Vapor control would consist of enhanced building ventilation, a physical barrier, or prohibition of building over the portions of the site where the concentration of VOCs exceed RBCs for vapor intrusion and result in an unacceptable human health risk. A minimum of approximately 19,000 square feet of the existing building would require vapor control (Figure 6), with options described below.

Enhanced building ventilation would require a detailed engineering analysis and corresponding building ventilation system modifications to provide sufficient and consistent positive pressure or number of air changes to prevent accumulation of VOCs in indoor air at concentrations that exceed risk-based criteria. After implementation of the modifications, testing would be required to verify system performance. Testing may include indoor air monitoring for VOCs. An O&M Plan would be prepared and implemented to ensure long-term reliability of this method. In addition, increased annual costs for O&M of the building ventilation system would be incurred (e.g., electricity).

Implementation of a physical barrier would also require a detailed engineering design to select the most appropriate configuration and establish requirements for installation. Installation would likely require demolition of the existing concrete floors, preparation, and application of the barrier. An example of an appropriate barrier material is the spray-on membrane coating developed by Liquid Boot, Inc. After application of the barrier, the concrete floors would be restored. After implementation of the modifications, sampling and analysis would be required to verify performance, including possible indoor air monitoring for VOCs. An O&M Plan would be prepared and implemented to ensure long-term reliability of this method, including periodic monitoring and possible maintenance and requirements for modification of the barrier consistent with possible modifications to site development.

Prohibition of building over the soil vapor plume would require partial demolition of the existing building and prohibition of new construction in the areas at which the concentrations of VOCs exceed risk-based criteria.

Land Use Controls

This alternative also includes implementation of a LUC, as described under Section 2.5.1. The LUC would be expected to consist of a deed restriction to limit land use to commercial/industrial use, consistent with current land use in the area and identify the requirements for O&M of continued vapor control measures as detailed in a Vapor Control O&M Plan.

Soil Vapor Monitoring

A Soil Vapor Monitoring O&M Plan would identify the requirement for O&M for short-term soil vapor monitoring using the four soil vapor monitoring wells described above. This data would be used to verify that concentrations of VOCs in soil vapor are stable or decreasing. This data would also be used to evaluate the effectiveness of the limited excavation conducted under this alternative in controlling the potential for further off-site migration of VOCs in soil vapor to the north, as described in Section 3.2. For purposes of estimating cost, 3 years of soil vapor monitoring was included.

3.5.3 Alternative 3 – Deep, Extensive Excavation and Monitoring

Alternative 3 includes the following elements:

- Excavation and off-site treatment/disposal of soil impacted with metals that exceed residential, construction worker, and commercial worker RBCs to a maximum depth of 15 feet bgs. Below that depth, the pathway to exposure is considered incomplete.
- Excavation and off-site treatment/disposal of soil impacted with VOCs that exceed residential, construction worker, and commercial worker RBCs and extended to the deeper soils in SWMU2a to a maximum depth of 30 feet bgs to reduce risk.
- Extensive, deep excavation and off-site treatment/disposal of soil impacted with VOCs in generalized, suspected source areas to a maximum depth of 40 feet bgs to reduce risk and address unacceptable risk posed by VOCs in the soil vapor without the use of vapor control measures or SVE.
- Implementation of a soil vapor monitoring program, consisting of four semi-permanent, multi-depth, soil vapor monitoring probes. Monitoring would be conducted to document that concentrations of VOCs in soil vapor remain stable or are decreasing and that VOCs in soil vapor no longer pose a potential unacceptable human health risk. A schematic diagram of the proposed vapor monitoring probes is included as Figure 9.

The scope of work for this alternative is illustrated in Figure 7. The scope of the excavation for this alternative was designed to be successful in addressing the concentrations of VOCs in soil vapor contributing to an unacceptable level of human health risk to a maximum depth of 40 feet bgs without the use of vapor control measures. It appears that an insufficient mass of VOCs exist beyond the extent of the excavation proposed under this alternative to pose an unacceptable risk via the vapor intrusion pathway. Further evaluation of this approach is provided in Section 4.9.

Excavation

Excavation would be conducted as described under Alternative 2; however, due to the increased lateral extent and depth of excavation, the estimated volume of soil increases to approximately 14,677 cubic yards (or, 19,080 tons at 1.3 tons per cubic yard). The estimated quantities of soil to be excavated are detailed in Table 4 by SWMU and exposure area. At 22 tons per truckload, a total of approximately 867 truck loads would be required to transport the soil off-site for disposal. Assuming that the excavation work could be completed within 6 weeks, approximately 29 trucks per day would be loaded. A similar number of trucks would be required to transport backfill soil to the site.

Because of the extent and depth of the planned excavation, building and worker protection during excavation is more complex than for Alternative 2. Accordingly, requirements for building protection would be extensive and costly. Therefore, implementation of this alternative would likely require partial building demolition across the area illustrated on Figure 7, totaling approximately 19,000 square feet. If required, demolition work would be conducted in advance of the excavation work described under this alternative.

Land Use Controls

LUC, if required depending on the results of the characterization of potential human health risk conducted after implementation of the selected alternative, would be expected to consist of a deed restriction to limit land use to commercial/industrial use, consistent with current land use in the area.

Soil Vapor Monitoring

A Soil Vapor Monitoring O&M Plan would be prepared to identify the requirements for O&M for short-term soil vapor monitoring using the four soil vapor monitoring wells described above. This data would be used to verify that concentrations of VOCs in soil vapor are stable or decreasing. This data would also be used to evaluate the effectiveness of the limited excavation conducted under this alternative in controlling the potential for further off-site migration of VOCs in soil vapor to the north, as described in Section 3.2. After confirmation that soil vapor poses no unacceptable risk under the current land use scenario, monitoring would be ended. However, because the design of this alternative is expected to address unacceptable human health risk resulting from soil vapor, O&M of a vapor control system would not be required. For purposes of estimating cost, 3 years of soil vapor monitoring was included.

3.5.4 Alternative 4 – Extensive Shallow Excavation, SVE, and Monitoring

Alternative 4 includes the following elements:

- Excavation and off-site treatment/disposal of soil impacted with metals that exceed residential, construction worker, and commercial worker RBCs to a maximum depth of 15 feet bgs. Below that depth, the pathway to exposure is considered incomplete.
- Excavation and off-site treatment/disposal of soil impacted with VOCs that exceed residential, construction worker, and commercial worker RBCs.

- Extensive shallow excavation and off-site treatment/disposal of soil impacted with VOCs in generalized, suspected source areas to a maximum depth of 5 feet bgs to reduce risk and partially address unacceptable risk posed by VOCs in the soil vapor without the use of vapor control measures.
- Implementation of SVE to address unacceptable risk posed by VOCs in deep soil vapor without the future use of vapor control measures. SVE would include construction and O&M of 10 multi-screened interval SVE wells, a vapor treatment system, and interconnecting piping The SVE wells would be screened at multiple depth intervals, as described below.
- Implementation of a soil vapor monitoring program, consisting of four semi-permanent, multi-depth, soil vapor monitoring probes. Monitoring would be conducted to document that concentrations of VOCs in soil vapor remain stable or are decreasing and that VOCs in soil vapor no longer pose a potential unacceptable human health risk. A schematic diagram of the proposed vapor monitoring probes is included as Figure 9.

The scope of work for this alternative is illustrated on Figure 8. The combined scope of the excavation and O&M of the SVE system was designed to be successful in addressing the concentrations of VOCs in soil vapor contributing to an unacceptable level of human health risk to a maximum depth of 50 feet bgs. Below that depth, the future pathway to exposure is considered incomplete.

Excavation

Excavation would be conducted as described under Alternative 2; however, approximately 3,955 cubic yards (or, 5,142 tons at 1.3 tons per cubic yard) of soil would be excavated. The estimated quantities of soil to be excavated are detailed in Table 4 by SWMU and exposure area. At 22 tons per truckload, a total of approximately 234 truck loads would be required to transport the soil for off-site disposal. Assuming that the excavation work could be completed within approximately 4 weeks, approximately 12 trucks per day would be loaded. A similar number of trucks would be required to transport backfill soil to the site.

Soil Vapor Extraction

For this alternative, SVE is included to address VOCs in the deeper soil vapor. SVE is a developed technology and recognized as the preferred presumptive remedy for the remediation of VOCs in soil (USEPA, 1993). SVE involves removal of VOCs from impacted soils with extracted soil vapor by applying a vacuum to extraction wells, constructed within the aerial boundary of the impacted soil at the site, using a blower and interconnecting piping. The SVE wells typically consist of slotted PVC casing installed in a vertical boring. The extraction wellfield design is based on economic optimization of the number and location of wells necessary to capture and remediate impacted soil in areas exceeding cleanup objectives. A schematic diagram of a typical SVE system is provided as Figure 10. Occasionally, pilot testing is conducted to obtain data necessary for detailed wellfield design (e.g., radius of influence [ROI]), equipment selection (e.g., initial concentrations and soil vapor flowrates), and optimization of the design of a full-scale SVE system. Based on URS' past experience on sites with similar conditions, the ROI of an SVE well is estimated to be approximately 20 feet. A total of 10 SVE wells would be constructed in the locations illustrated on Figure 8.

The extracted soil vapor is treated before discharge to the atmosphere typically using vapor phase carbon adsorption (VPCA) or thermally, using a catalytic oxidizer (for chlorinated VOCs). Based on the comparatively low concentration of VOCs in the deep soil vapor, VPCA would likely be the most cost effective choice for vapor treatment. The SVE system would remove the VOCs within the vadose zone by creating movement of air through the impacted soil. As the air passes through the impacted soil, VOCs volatilize from the liquid to the vapor phase. The VOCs are destroyed or removed from the off-gas of the vacuum unit by a thermal oxidizer or using vapor phase carbon adsorption (VPCA), respectively. Regular monitoring of the SVE system includes measuring the concentrations of VOCs in the soil vapor stream as it is removed from the extraction wells and from effluent stream from the vapor treatment unit.

Startup and operation of the SVE system involved periodic sampling and analysis of soil vapor influent and effluent and recording key operational data. System operation also includes periodic optimization, maintenance, and reporting.

Based on URS' past experience on sites with similar conditions, it is expected that an SVE system at this site would need to be in operation for approximately 2 to 4 years to achieve the cleanup standards in the deep soil vapor. However, the low permeability soil at this site and potential for preferential flow paths to be established indicates that the rate of extraction from each well will be low, potentially increasing the time to achieve the cleanup standards. A high vacuum blower will be required thereby increasing electrical power costs for operation, and consistent levels of performance across the area to be remediated will be difficult to achieve. During this time the SVE system would require regular monitoring that may include system maintenance, system performance monitoring, sampling of the vapors being removed from the soil, and sampling of the vapors being discharged to the atmosphere. SVE system O&M is normally continued until cleanup objectives are met or until concentrations of VOCs in the extracted soil vapor reach asymptotic levels and the rate of mass reduction is considered minimal. This would be an indication that SVE has been operated to the approximate limits of its effectiveness and continued operation would not result in an appreciable reduction in concentrations of VOCs in the vadose zone or in human health risk.

Typically for SVE, after operational data and confirmation samples indicate that the cleanup standards have been achieved or asymptotic performance has been reached, a closure report is prepared and submitted to DTSC to document system performance and rationale for closure. For this site confirmation sampling would be expected to consist of soil vapor sampling and analysis for VOCs for comparison to the cleanup standards. After DTSC concurrence that cleanup objectives have been achieved, the SVE system is demobilized and the SVE wells properly abandoned.

Monitoring

Soil vapor monitoring would be conducted as described under Alternative 3.

Land Use Control

Similar to Alternative 3, the LUC, if required depending on the results of the characterization of potential human health risk conducted after implementation of the selected alternative, would be expected to consist of a deed restriction to limit land use to commercial/industrial use, consistent with current land use in the area. The LUC may also include requirements for continued O&M of the SVE system until cleanup objectives are achieved, or approximately 2 to 4 years. Again, because the design of this alternative is expected to address unacceptable human health risk resulting from soil vapor through a combination of excavation and SVE, O&M of separate vapor control measures would not be required.

3.6 EVALUATION OF CORRECTIVE MEASURE ALTERNATIVES

Each corrective measure alternative is evaluated in this section using the nine criteria identified in Section 2.5. This evaluation is based on the detailed description of each alternative provided in Section 3.5.

3.6.1 Alternative 1 - No Action

Be protective of human health and the environment – Alternative 1 would not be protective since the unacceptable level of potential human health risk resulting from current conditions are not addressed.

Attain media cleanup standards – Media cleanup standards are not achieved since no corrective action is undertaken.

Control the sources of release – Source areas in the shallow soil are not controlled since no corrective action is undertaken.

Comply with any applicable standards for management of wastes – No waste would be generated as no corrective action is undertaken.

Short- and long-term effectiveness – Because no corrective action is undertaken, protection of workers or the community during implementation are not required. Cleanup standards, however, are not met which represents a potential current and future human health risk.

Reduction of toxicity, mobility, and/or volume - Because no corrective action is undertaken, toxicity, mobility, and volume are not reduced.

Long-term reliability - Because no remedial actions are undertaken and cleanup standards are not achieved, long-term effectiveness and permanence are not achieved and risks are not reduced.

Implementability – There are no technical implementability issues, however, agency and community acceptance would not be obtained.

Cost – There is essentially no cost associated with this alternative.

3.6.2 Alternative 2 - Source Removal, Vapor Intrusion Control, and Monitoring

Be protective of human health and the environment – Alternative 2 would be protective since the shallow soil with concentrations of COCs that pose an unacceptable level of potential human health risk via outdoor exposure are removed and the vapor intrusion pathway is addressed using vapor control. The alternative, however, is based on continued commercial/industrial land use; therefore, an LUC would be required. Monitoring is also included to verify achievement of the cleanup standards for vapor intrusion.

Attain media cleanup standards – Media cleanup standards are achieved for the outdoor exposure pathway. Numerical cleanup standards for the vapor intrusion pathway are not attained; however, the pathway is controlled using vapor control measures.

Control the sources of release – Soil in the identified source areas are excavated.

Comply with any applicable standards for management of wastes – Wastes generated during implementation would be managed in accordance with applicable regulatory requirements, including those during excavation, temporary stockpiling, transport, and off-site treatment/disposal.

Short- and long-term effectiveness – Protection of workers and the community during implementation are included to address short-term risk. Potential short-term risks to on-site workers, the community, and the environment could result from vapors, dust, or particulates that may be generated during excavation and soil handling activities. These risks could be mitigated using personal protective equipment (PPE) for on-site workers and engineering controls, such as dust suppression and additional traffic control and equipment operating safety procedures, for protection of the surrounding community. Ambient air monitoring would be conducted to identify if criteria are exceeded. The alternative is expected to provide long-term effectiveness because soil exceeding human health risk criteria is removed, with the soil vapor intrusion pathway addressed through implementation of vapor control measures. Long-term effectiveness, however, will require future land owners to continue O&M of vapor control measures, modified where necessary based on future site development activities.

Reduction of toxicity, mobility, and/or volume – This alternative provides a significant reduction in the toxicity, mobility, and volume of contaminants at the site with excavation of over 3,600 cubic yards of impacted soil. Mobility and potentially, toxicity and volume, would be further reduced at the off-site treatment/disposal facility.

Long-term reliability – Long-term reliability of excavation and off-site disposal of impacted soil is high, as COCs are removed from the site. LUCs are required, however, to ensure that O&M of the vapor control measures are continued.

Implementability – Excavation and off-site disposal is a well-proven, readily implementable technology that is a common method for cleaning up hazardous waste sites. It is a relatively simple process, with proven procedures. Equipment and labor required to implement this alternative are uncomplicated and readily available. The generally shallow depths of the excavation are achievable; however, the physical properties of the soil at this site are expected to limit the rate of excavation. Agency and community acceptance would be high since the alternative would achieve the cleanup standards and because short-term risks associated with implementation of the alternative can be mitigated as described above.

Cost – Estimated costs for implementation of each alternative is included in Table 5. For purposes of estimating cost, URS assumed that 30% of the excavated soil would be disposed as Non-RCRA hazardous waste and 70% as non-hazardous waste.

3.6.3 Alternative 3 – Deep, Extensive Excavation and Monitoring

Be protective of human health and the environment – Alternative 3 would be protective since the shallow and deep soil (and soil vapor) with concentrations of COCs that pose an unacceptable level of potential human health risk via outdoor exposure and the vapor intrusion pathway would be removed. The alternative, however, is based on continued commercial/industrial land use; therefore, a LUC would likely be required. Monitoring is also included to verify achievement of the cleanup standards for vapor intrusion.

Attain media cleanup standards – Media cleanup standards are achieved for the outdoor exposure and vapor intrusion pathway.

Control the sources of release – Soil in the identified source areas are excavated.

Comply with any applicable standards for management of wastes – Wastes generated during implementation would be managed in accordance with applicable regulatory requirements, including those during excavation, temporary stockpiling, transport, and off-site treatment/disposal.

Short- and long-term effectiveness – Protection of workers and the community during implementation are included to address short-term risk. Potential short-term risks to on-site workers, the community, and the environment could result from vapors, dust, or particulates that may be generated during excavation and soil handling activities. These risks could be mitigated using PPE for on-site workers and engineering controls, such as dust suppression and additional traffic control and equipment operating safety procedures, for protection of the surrounding community. Ambient air monitoring would be conducted to identify if criteria are exceeded. The alternative is expected to provide long-term effectiveness because soil exceeding human health risk criteria is removed. Long-term effectiveness, however, will require that remaining VOCs in soil vapor do not migrate to the imported backfill material to concentrations exceeding the cleanup standards as demonstrated through monitoring.

Reduction of toxicity, mobility, and/or volume – This alternative provides a significant reduction in the toxicity, mobility, and volume of contaminants at the site with excavation of approximately 15,700 cubic yards of impacted soil. Mobility and potentially, toxicity and volume, would be further reduced at the off-site treatment/disposal facility.

Long-term reliability – Long term reliability of excavation and off-site disposal of impacted soil is high, as COCs are removed from the site. LUCs may be required, however, to ensure that land use is limited to commercial/industrial purposes. However, monitoring will be required to demonstrate that residual concentrations of VOCs in deep soil gas do not pose an unacceptable human health risk after implementation.

Implementability – Excavation and off-site disposal is a well-proven, readily implementable technology that is a common method for cleaning up hazardous waste sites. It is a relatively simple process, with proven procedures. Equipment and labor required to implement this alternative are uncomplicated and readily available. The shallow depths of the excavation are achievable; however, the physical properties of the soil at this site are expected to limit the rate of excavation. Additionally, however, the deeper areas of excavation will require significant engineering analysis to ensure building stability and worker safety, during excavation. This analysis would select the most appropriate combination of shoring, partial building demolition, and/or modified excavation techniques to accomplish the planned excavation. Agency and community acceptance would be high since the alternative would achieve the cleanup standards and because short-term risks associated with implementation of the alternative can be mitigated as described above. However, there may be a greater sensitivity to the increased truck traffic resulting from the increased quantity of soil handled compared to Alternative 2.

Cost – Estimated costs for implementation of each alternative is included in Table 5. For purposes of estimating cost, URS assumed that 30% of the excavated soil would be disposed as Non-RCRA hazardous waste and 70% as non-hazardous waste.

3.6.4 Alternative 4 – Extensive Shallow Excavation, SVE, and Monitoring

Be protective of human health and the environment – Alternative 4 would be protective since the shallow soil with concentrations of COCs that pose an unacceptable level of potential human health risk via outdoor exposure and the vapor intrusion pathway would be removed. SVE provides a means of extracting VOCs from the deeper soils. SVE will require O&M for a period of approximately 2 to 4 years, however, the low permeability soil results in uncertainty of the actual time required to achieve the cleanup standards. The alternative is based on continued commercial/industrial land use; therefore, a LUC would likely be required. Monitoring is also included to verify achievement of the cleanup standards for vapor intrusion.

Attain media cleanup standards – Media cleanup standards are achieved for the outdoor exposure and vapor intrusion pathway.

Control the sources of release – Soil in the identified source areas are excavated.

Comply with any applicable standards for management of wastes – Wastes generated during implementation would be managed in accordance with applicable regulatory requirements, including those during excavation, temporary stockpiling, transport, and off-site treatment/disposal of soil as well as waste generated during O&M of the SVE system.

Short- and long-term effectiveness – Protection of workers and the community during implementation are included to address short-term risk. Potential short-term risks to on-site workers, the community, and the environment could result from vapors, dust, or particulates that may be generated during excavation and soil handling activities. These risks could be mitigated using PPE for on-site workers and engineering controls, such as dust suppression and additional traffic control and equipment operating safety procedures, for protection of the surrounding community. Ambient air monitoring would be conducted to identify if criteria are exceeded. The alternative is expected to provide long-term effectiveness because soil exceeding human health risk criteria is removed. Long-term effectiveness, however, will require that remaining VOCs in soil vapor do not migrate to the imported backfill material to concentrations exceeding the cleanup standards as demonstrated through monitoring.

Reduction of toxicity, mobility, and/or volume – This alternative provides a significant reduction in the toxicity, mobility, and volume of contaminants at the site with excavation of approximately 4,000 cubic yards of impacted soil and extraction of contaminated soil vapor using SVE. Mobility and potentially, toxicity and volume, would be further reduced at the off-site treatment/disposal facility.

Long-term reliability – Long term reliability of excavation and off-site disposal of impacted soil is high, as COCs are removed from the site through both excavation and SVE. LUCs may be required, however, to ensure that land use is limited to commercial/industrial purposes. However, monitoring will be required to demonstrate that residual concentrations of VOCs in deep soil gas do not pose an unacceptable human health risk after implementation.

Implementability – Excavation and off-site disposal is a well-proven, readily implementable technology that is a common method for cleaning up hazardous waste sites. It is a relatively simple process, with proven procedures. Equipment and labor required to implement this alternative are uncomplicated and readily available. The shallow depths of the excavation are achievable; however, the physical properties of the soil at this site are expected to limit the rate of excavation. Additionally, SVE is a developed technology for addressing VOCs in vadose zone soil. It is recognized as a presumptive remedy by EPA. Contractors and equipment are readily available and permits can be readily obtained, including a Permit to Construct/Permit to Operate issued by the SDAPCD.

Agency and community acceptance would be high since the alternative would achieve the cleanup standards and because short-term risks associated with implementation of the alternative can be mitigated as described above. However, there may be a greater sensitivity to the increased truck traffic resulting from the increased quantity of soil handled compared to Alternative 2. Noise from the SVE system would require abatement to satisfy occupants of the adjacent properties.

Cost – Estimated costs for implementation of each alternative is included in Table 5. For purposes of estimating cost, URS assumed that 30% of the excavated soil would be disposed as Non-RCRA hazardous waste and 70% as non-hazardous waste.

3.7 RECOMMENDED CORRECTIVE MEASURE ALTERNATIVE

This section provides a comparative analysis and selection of the most appropriate corrective measure alternative. The comparative analysis is based on the nine criteria identified in Section 2.5. The alternatives were described and evaluated individually in Section 3.6. Following the discussion of the comparative evaluation is a numerical ranking of alternatives is provided based on the degree to which each of the four alternatives satisfies the evaluation criteria in comparison to each other. With respect to cost, values are assigned relative to the lowest (“4”) to highest (“1”) total estimated cost (present value, where applicable). Alternatives with comparable overall performance are assigned the same value. Absent other controlling factors, the alternative with the highest total rating (score) is considered to be the most appropriate.

3.7.1 Comparative Analysis

Be protective of human health and the environment – Alternative 1 is not protective of human health and the environment. Although the remaining three alternatives are considered to be protective of human health and the environment, Alternatives 3 and 4 provide a higher level of protection than Alternative 2 based on the increased mass of VOCs that would be removed from the site (primarily by excavation for

Alternative 3 and by SVE for Alternative 4). Alternative 2 requires reliance on continued engineering controls for management of the vapor intrusion pathway with its configuration and O&M requirements dependent on future property development decisions. Alternative 4 requires O&M of an SVE system for a period of approximately 2 to 4 years. Alternatives 2, 3, and 4 are based on continued commercial/industrial land use; therefore, an LUC would be required, although this requirement would be verified for Alternatives 3 and 4 based on the results of the evaluation of potential human health risk conducted after implementation of the selected alternative. Monitoring is also required for all three alternatives to verify achievement of the cleanup standards for vapor intrusion.

Attain media cleanup standards – Media cleanup standards are not achieved for Alternative 1. Media cleanup standards are achieved for the outdoor exposure and vapor intrusion pathway for Alternatives 2, 3, and 4. However, the low permeability soils at the site will pose a challenge for successful application of SVE in achieving numerical cleanup standards. Low permeability soils result in a limited radius of influence and comparatively low flow rates of soil vapor. All three are subject to soil vapor monitoring to verify long-term performance.

Control the sources of release – Soil in the identified source areas are excavated for all alternatives except Alternative 1. Alternative 3 provides for an increased reduction in potential sources because of the increased quantity of soil excavated from the site as a consequence of addressing soil vapor primarily through direct excavation. Within the limits of the performance of the extraction wells, SVE would also be effective in providing an increased reduction.

Comply with any applicable standards for management of wastes – Wastes generated during implementation of Alternatives 2, 3, and 4 would be managed in accordance with applicable regulatory requirements, including those during excavation, temporary stockpiling, transport, and off-site treatment/disposal of soil as well as wastes generated during O&M of the SVE system under Alternative 4. No wastes are generated under Alternative 1.

Short- and long-term effectiveness – Alternative 1 poses no short term risks, however, provide no long term effectiveness. Protection of workers and the community during implementation of Alternatives 2, 3, and 4 are included to address short-term risk. Potential short-term risks to on-site workers, the community, and the environment could result from vapors, dust, or particulates that may be generated during excavation and soil handling activities. These risks could be mitigated using PPE for on-site workers and engineering controls, such as dust suppression and additional traffic control and equipment operating safety procedures, for protection of the surrounding community. Ambient air monitoring would be conducted to identify if criteria are exceeded. These alternatives are expected to provide long-term effectiveness because soil exceeding human health risk criteria is removed. Long-term effectiveness of Alternatives 3 and 4, however, will require that remaining VOCs in soil vapor do not migrate to the imported backfill material to concentrations exceeding the cleanup standards as demonstrated through monitoring. Successful application of SVE in achieving numerical cleanup standards in low permeability soils, however, can be a challenge, thus resulting in uncertainty in the time required for O&M.

Reduction of toxicity, mobility, and/or volume – Alternative 1 provides no reduction in the toxicity, mobility, and volume of contaminants at the site. Alternatives 3 and 4 provide the greatest reduction with excavation of approximately 15,700 and 4,000 cubic yards of impacted soil, respectively, and extraction of deep contaminated soil vapor using SVE under Alternative 4. Mobility and potentially, toxicity and volume, would be further reduced at the off-site treatment/disposal facility.

Long-term reliability – Alternative 1 provides no long-term reliability. Long term reliability of excavation and off-site disposal of impacted soil under Alternatives 2, 3, and 4 is high, as COCs are removed from the site through excavation and also SVE, for Alternative 4. LUCs are likely required, however, to ensure that land use is limited to commercial/industrial purposes. Alternative 2 require proper O&M and management of vapor control measures to mitigate the vapor intrusion pathway. Monitoring will be required for Alternatives 2, 3, and 4 to demonstrate that residual concentrations of VOCs in deep soil gas do not pose an unacceptable human health risk after implementation. Monitoring for Alternative 2 would be especially important to evaluate the potential for continued off-site migration of soil vapor.

Implementability – Alternative 1 poses no technical implementability issues. Excavation and off-site disposal under Alternatives 2, 3, and 4 is a well-proven, readily implementable technology that is a common method for cleaning up hazardous waste sites. It is a relatively simple process, with proven procedures. Equipment and labor required to implement this alternative are uncomplicated and readily available. The shallow depths of the excavation are achievable; however, the physical properties of the soil at this site are expected to limit the rate of excavation. Additionally, the extensive deeper areas of excavation associated with Alternative 3 will require significant engineering analysis to ensure building stability and worker safety, during excavation. This analysis would select the most appropriate combination of shoring, partial building demolition, and/or modified excavation techniques to accomplish the planned excavation.

Additionally, SVE under Alternative 4 is a developed technology for addressing VOCs in vadose zone soil. It is recognized as a presumptive remedy by EPA. Contractors and equipment are readily available and permits can be readily obtained, including a Permit to Construct/Permit to Operate issued by the SDAPCD.

Agency and community acceptance of Alternatives 2, 3, and 4 would be high since the alternative would achieve the cleanup standards and because short-term risks associated with implementation of the alternative can be mitigated as described above. However, there may be a greater sensitivity to the increased truck traffic resulting from the increased quantity of soil handled under Alternative 3 compared to Alternatives 2 and 4. Noise from the SVE system under Alternative 4 would require abatement to meet local noise ordinances and satisfy occupants of the adjacent properties.

Cost – Estimated costs for implementation of each alternative is included in Table 5.

Based on the discussion provided above, score values for each of the criteria were assigned as follows:

Criteria	Alternative 1	Alternative 2	Alternative 3	Alternative 4
Be protective of human health and the environment	1	2	4	3
Attain media cleanup standards	1	2	4	3
Control the source of the release	1	2	4	3
Comply with applicable standards for management of wastes	1	2	4	3
Short- and long-term effectiveness	1	2	4	3
Reduction in toxicity, mobility, and volume	1	2	4	3
Long-term reliability	1	2	4	3
Implementability	1	4	2	3
Cost	4	3	1	2
Total Score	12	21	31	26

3.7.2 Selected Corrective Measure Alternative

Alternative 1 does not satisfactorily address the nine evaluation criteria and is not considered an appropriate alternative for this site. Alternative 2 satisfactorily addresses each of the nine evaluation criteria and is an appropriate alternative on that basis. However, this alternative relies more on long-term O&M measures (for mitigation of the vapor intrusion pathway) than Alternatives 3 and 4. Both Alternatives 3 and 4 satisfactorily address each of the nine evaluation criteria and are appropriate alternatives on that basis. However, Alternative 3 scored 31 in comparison to 26 for Alternative 4. The key difference between the two is in the method that is used to address VOCs in the deeper soil vapor. Alternative 3 relies on a more extensive excavation directly and quickly targeting VOCs in the deep soil. Alternative 4 relies on SVE in addressing these same areas. The performance of SVE in low permeability soils, however, is limited and successful removal of VOCs may require an extended period of operation. Therefore, Alternative 3 is preferred given its more certain performance compared to SVE and its ability to achieve the cleanup standards in a shorter period of time.

Activities and requirements associated with implementation of this alternative are detailed in the implementation provided Section 4.

SECTION 4 CORRECTIVE MEASURE IMPLEMENTATION

4.1 INTRODUCTION/PURPOSE

The purpose of this CMS/RS/CMI is to more fully develop and describe the scope of the selected corrective measure and requirements for implementation. A summary of site conditions was provided in Section 2.1. A summary description of the selected corrective measure alternative was provided in Section 3.5

4.2 MEDIA CLEANUP STANDARDS

The RBCs presented in the BRA Report were used for the screening purposes in site characterization and in screening of corrective measure. The final cleanup standard for the soil is based on an evaluation of the combined site-specific potential risk to human health and the environment using the technical approach and methodologies described in the BRA Report. This approach and methodologies were used in further evaluation of the corrective measure alternatives as described in Section 3 of this report.

During implementation of the selected corrective measure alternative, data obtained from confirmation soil and subsequent soil vapor monitoring will be used to verify that the cleanup standards have been achieved. This evaluation will include re-calculation of potential human health risk for each exposure area to verify that the combined potential human health cancer risk does not exceed $1x10^{-4}$ to $1x10^{-6}$ and that the non-cancer health risk does not exceed an HI of 1 to 3 for complete pathways (URS, 2006b). For arsenic, confirmation sample results will be compared to the maximum background concentration of 11.5 mg/kg. For lead, confirmation sample results will be compared to the RBC of 150 mg/kg, based on the LeadSpread 7 model results.

4.3 CONCEPTUAL MODEL OF CONTAMINANT MIGRATION

This section, also presented in the FI Report, provides the conceptual site model that describes potential source areas, migration pathways, and receptors. Although approximately 95% of the site is covered with asphalt or concrete surfacing (asphalt driveways and concrete building floors and containment structures), migration of a hypothetical aqueous phase release may have entered shallow vadose zone soil through seams or degraded sections of surfacing. Evidence of concrete or asphalt degradation was observed in several locations throughout the facility. Specific sample locations were selected to target these areas as summarized in the FI Workplan and subsequent Technical Memorandum, including the addendum. The most significant areas of concrete degradation were observed near boring SWMU09-01, although notable degradation was also observed near boring SWMU09-04, several boring locations associated with SWMU #12a, and the concrete and asphalt paving in SWMU #20 near the chemical handling area designated as SWMU #01.

Sampling evidence does indicate that several COCs have migrated into shallow vadose zone soil, possibly through degraded concrete sumps and trenches or concrete and asphalt surfacing in the adjacent parking lot (SWMU #20). The degree to which this migration may pose a potential human health or ecological risk was evaluated in the BRA based on an assessment of combined risk with the corrective measure alternatives developed and selected to address this risk.

The migration of metals through the vadose zone is attenuated by the presence of discrete areas of low permeability clay and cobble soils (conglomerate) with clay and clayey sand matrix that underlie the site. Metals adsorb onto the crystalline structure of the clay reducing mobility. Although elevated concentration of several metal COCs were detected, the depth at which they exceeded their respective screening criteria typically did not exceed 10 feet bgs, with the exception of arsenic. However, no known past industrial use of arsenic was identified.

Petroleum hydrocarbons and VOCs (including chlorinated solvents), although more mobile than metals, are subject to biodegradation under appropriate subsurface conditions. Evidence of this occurring is provided by the presence of typical degradation products detected in soil and soil vapor samples, such as 1,1-DCE and vinyl chloride. Other VOC COCs used at the site, including methylene chloride and toluene, were also detected in soil and soil vapor samples. Because the soils in the unsaturated zone beneath the facility are typically composed of what is mapped as cemented sandstone and conglomerate, and groundwater is at approximately 200 feet bgs, the migration of VOCs would be strongly attenuated and groundwater impacts unlikely. The concentrations of VOC were generally found to decrease with depth with vertical migration described in Section 2.2 and in the FI.

Based on this data, URS suspects that detected concentrations of 1,1-DCE, 1,1-DCA, 1,2-DCA, chloroethane, and vinyl chloride resulted from transformation of the parent chlorinated VOCs 1,1,1-TCA (reportedly used on site, HLA, 1988), PCA, PCE, and possibly TCE. TCE may also be present as a degradation product of either PCA or PCE. Prior owners of the facility have reportedly used chlorinated solvents at the site, including 1,1,1-TCA (HLA, 1988).

Primary degradation pathways of 1,1,1-TCA, under proper subsurface conditions, include the following (Vogel and McCarty, 1985 and 1987):

- 1,1,1-TCA to 1,1-DCA to chloroethane to ethane to carbon dioxide and water
- 1,1,1-TCA to 1,1-DCE to vinyl chloride to ethane or carbon dioxide and water
- 1,1,1-TCA to cis 1,2-DCE to chloroethane to ethane or carbon dioxide and water

Each of these chemical constituents have been detected at the site, inferring significant degradation of 1,1,1-TCA.

Additionally, tetrachloroethane (PCA) can degrade to 1,1,1-TCA or TCE. PCE can also degrade to TCE. 1,1,2-TCA can degrade to 1,2-DCA which then can also degrade to chloroethane. All of these constituents have been detected in soil vapor and/or soil samples collect at the site, inferring past use and release of the chlorinated solvents 1,1,1-TCA, 1,1,2-TCA, PCE, and possibly TCE (although TCE may only be a product of PCE degradation).

Because of the limited volatility of aqueous phase metal solutions, migration to the air would be unlikely. Migration of VOCs to air would be possible during a hypothetical release event or via vapor intrusion given the volatility of these compounds (compared to metals). This pathway was addressed in the BRA and in the evaluation and selection of corrective measure alternatives.

Migration to surface water would be limited primarily to potential transport to the Pacific Ocean through a release into the storm drain, as there are no other surface water bodies near the site (with the exception of shallow ponds at the MCAS Miramar golf course, located across Miramar Road). Previous storm water management programs established for the facility would be expected to control off-site migration via the storm drain and no known releases to the storm drain have been identified. Analytical results do not suggest that migration through the storm drain had occurred. Migration to the golf course ponds would be controlled by the previous facility storm water management program as well as the presence of Miramar Road lying between the site and the golf course. Miramar Road is a major six-lane road complete with a curb and gutter system that presents an obstruction to the flow of surface water across it. Again no known release to the surface outside of existing concrete trenches or containment sumps has been identified.

In summary, sampling evidence indicates that many COCs have migrated into shallow vadose zone soil, possibly from areas of degraded concrete containment trenches or sumps. The lateral and vertical extent of the COCs were detailed in the FI Report and summarized in this report. Elevated metal impacts appear to be limited to the shallow vadose zone soil (upper 5 to 10 feet). It is unlikely, however, that groundwater has been impacted because of the soil conditions underlying the site, depth to groundwater (estimated to be approximately 200 feet bgs), typically decreasing concentrations of COCs with increasing depth, and transport properties of metals in low permeability soils, and as indicated by the sampling evidence. Release to air may have occurred on an episodic basis from past releases, primarily of VOCs, however, continued release to air from vadose zone soil is limited because of the concrete or asphalt paving across much of the site, although the vapor intrusion pathway was identified as resulting in an unacceptable level if risk in the BRA and was addressed in the evaluation and selection of the most appropriate corrective measure for this site. No evidence of past releases to surface water has been identified.

4.4 DESCRIPTION OF THE CORRECTIVE MEASURE

Alternative 3 – Deep, Extensive Excavation and Monitoring would consist primarily of extensive excavation of soil as described in Section 3 and illustrated in Figure 7. Key activities required for implementation of the alternative are described in this section, although the best method of excavation (e.g., use of a long-reach excavator and/or large-diameter bucket auger) and requirements for partial building demolition and/or extensive shoring to facilitate excavation will be determined in consultation with the selected contractor.

4.4.1 Preparation

Permitting

Prior to mobilization to the site, permits necessary for implementation will be obtained from the various permitting and regulatory authorities. Permitting is discussed further in Section 4.16.

Utility Locating

Prior to excavation, techniques will be used to locate potential underground utilities and obstructions. Techniques will include review of available facility drawings, conducting a geophysical survey, and conducting a site reconnaissance. Four potential geophysical methods may be used: magnetics;

electromagnetics; ground penetrating radar (GPR), and electromagnetic line location. Magnetics and electromagnetics are used to identify potential conduits, drums, or USTs. These features are detected due to the ferrous and electrically conductive material of their construction. GPR is used as a follow up technology to characterize identified magnetic or electromagnetic anomalies.

Additionally, Underground Service Alert (USA) will be contacted at least 48 hours in advance to identify the location of utilities that enter the property. Proposed excavation areas will be clearly marked with white paint or surveyors flagging as required by USA. USA will contact utility owners of record within the Site vicinity and notify them of our intent to excavate. Utility owners of record will be expected to clearly mark the position of their utilities on the ground surface throughout the designated area, where applicable.

To improve the reliability of utility locating techniques due to interferences sometimes posed by concrete reinforcing bar, demolition of surfacing may be conducted prior to conducting utility locating activities.

Move-in and Hours of Operation

Move-in will consist primarily of mobilization of contractor equipment and materials to the site. Move-in will also include delineation of planned soil stockpile and handling areas. Because the site is located within a commercial/industrially developed area, onsite operations will typically be conducted between the hours of 7 AM through 5 PM daily, Monday through Friday.

4.4.2 Demolition

Existing Soil Vapor Monitoring Well

Existing soil vapor well SV-SWMU01-05/SWMU01-06, constructed to a total depth of approximately 90 feet bgs, will be abandoned in accordance with County of San Diego, Department of Environmental Health (DEH) Site Assessment and Mitigation (SAM) Manual guidelines and under permit from the DEH. The total depth of the well will be over-drilled using a mobile drill rig equipped with 8-inch hollow stem augers to remove well seal, filter pack, and soil vapor probe equipment. The boring will be backfilled with hydrated bentonite mixed at the surface and pumped into the boring using a tremie pipe and sealed at the surface with concrete or asphalt as appropriate.

Partial Building Demolition

At a minimum, partial demolition of building interior partitions will be required to facilitate access into the excavation areas. As discussed in Section 3, partial building (shell) demolition may also be performed in advance of implementation of the selected remedy to facilitate the deep and extensive excavation work planned for the northeast corner of the site. The extent of possible demolition is illustrated in Figure 7 and totals approximately 19,000 square feet or 15 percent of the total building square footage. Partial demolition would provide for more efficient and more complete excavation of soil in these areas, with improved worker safety during excavation. Worker safety would be improved by reducing the risk to the stability of the building structure and the possibility of accumulation of VOCs in an enclosed space (the building) that may exceed action levels during excavation. Monitoring and action levels are described in the HSP. However; shoring, improved temporary building ventilation, and other vapor control measures may also properly mitigate these potential risks.

Despite partial demolition, however, areas of the excavation performed in or adjacent to remaining portions of the building will require an assessment of shoring or other protective measures necessary to maintain building integrity. However, these areas are limited primarily to the more shallow excavation depths of 5 feet bgs.

Partial building demolition would include demolition of the interior partitions and removal of remaining ventilation or other equipment prior to demolition of the building shell. The building shell consists primarily of a steel frame and concrete walls. After implementation of the corrective measure, new temporary end walls would be constructed to restore the exterior building envelope. Permanent restoration would not be conducted given the uncertainty of future plans for development of the property.

Again, the extent of building demolition to be performed will be evaluated and coordinated with the selected excavation subcontractor, in consultation with DTSC, to ensure that building and worker safety issues are addressed in detail and with consideration of costs for excavation.

Surfacing

Throughout all planned areas of excavation, existing concrete and asphalt surfacing will be removed. Surfacing to be removed will be marked with paint, saw cut, removed, and separately stockpiled for possible recycling.

4.4.3 Excavation

Delineation

The saw cut surfacing will serve to delineate the outermost lateral extent of excavation. However, additional delineation will be required to illustrate the lateral extent of the various total depth of excavation in each of the SWMUs and AOCs. These areas and depths will initially be marked on the surface of the exposed soil, however, control will be provided by regular reference to the plans.

Excavation

Excavation will be accomplished likely using a combination of a large-diameter bucket auger, long reach excavator, and standard backhoe and front end loader equipment. Although the exact sequencing of the work will be developed in consultation with the excavation subcontractor, URS anticipates that the excavation work will be conducted using one of the two following methods:

1. Excavation of deep areas (to 40 feet bgs) first, using a large-diameter bucket auger or long-reach excavator, followed by general excavation using a standard excavator and backhoe.
2. General excavation to a maximum depth of 25 feet bgs using a standard excavator and backhoe, followed by completion of the deep excavation using a large-diameter bucket auger or long-reach excavator.

The first method has the advantage of reducing the need for the excavation workers to enter the excavation. The second alternative has the advantage of a more efficient method of excavation and would likely be selected. However, the method and sequence of excavation will be developed with the excavation subcontractor, with notification provided to DTSC.

Stockpile Management and Profiling

Excavated soils in each excavation area will be segregated between potentially hazardous and potentially non-hazardous stockpiles and by key constituents (e.g., metals and VOCs) based on the results of the FI sampling. The stockpiles will be underlain and will be covered with plastic to minimize possible dust and vapor emissions.

The excavated soil will be profiled in accordance with the Waste Disposal Requirements (WDRs) of the treatment/disposal facility including comparison to numerical criteria for disposal. Soil profiling will be conducted using data obtained during the FI and possible additional soil stockpile sampling and analysis. Based on preliminary contact with a possible waste treatment/disposal subcontractor, minimum analytical requirements include collection of one sample for each 1,000 cubic yards of soil and analysis for pH, total sulfides, total cyanides, total metals, VOCs, and possibly the toxicity characteristic leaching procedure (TCLP). Additional data, if necessary, would be used in conjunction with the existing data obtained during the FI in profiling the soil and determining its proper classification for disposal and possible treatment. Additional sampling, if required, will be conducted in general accordance with the applicable field procedures, QA/QC protocols, and QAPP presented in the FI Workplan. After collection, the samples will be transported to a California State-certified fixed analytical laboratory for chemical analyses, although a mobile State-certified laboratory may be used if necessary to facilitate timely implementation of the alternative.

While at the disposal facilities, each truck will be weighed before offloading their payload. Weight tickets or bills of lading will be provided to the removal action contractor after all the soil has been shipped offsite. Copies of the bills of lading will be provided in the final completion report.

Air Monitoring

VOCs are expected to be encountered and dust is likely to be generated during excavation activities. Air monitoring will be conducted using a direct reading Organic Vapor Analyzer (OVA) during excavation and soil handling activities to monitor for potential VOC emissions. In addition, airborne dust monitoring will be conducted. Monitoring will be conducted to verify and document the effectiveness of dust and VOC suppression measures. The monitoring will be conducted in accordance with the HSP and in accordance with SDAPCD requirements under Rule 50 and 51. Air monitoring activities will be conducted in the work zone and the perimeter of the site by the Site Safety Officer during the excavation activities. Copies of air monitoring records will be provided in the final completion report.

Vapor/Dust Control

Suppression of VOCs and dust will be performed by lightly spraying or misting the work areas with water, BioSolve®, or a similar surfactant. Misting may also be used on soil placed in the transport trucks. Efforts will be made to minimize the soil drop height from the excavator’s bucket onto the soil pile or into the transport trucks. The excavator will be positioned so as to load or stockpile soil from the leeward side. After the soil is loaded into the transport trucks, the soil will be covered to prevent soil from spilling out of the truck during transport to the disposal facility.

While on the property, all vehicles operators will be instructed to maintain speeds to less than 5 miles per hour for safety purposes and to minimize the creation of dust.

Noise Monitoring

Noise monitoring will be conducted in accordance with the site-specific health and safety plan, described in Section 4.4.4.

4.4.4 Characteristics and Transportation / Disposal of Excavated Soil

Based on the analytical data described in the FI report and presented in Table 4, it is estimated that approximately 14,677 cubic yards, or 19,080 tons, of metal and VOC impacted soil may be transported offsite for disposal.

Waste classifications are determined by comparison to several criteria including the Total Threshold Limit Concentration (TTLC), Soluble Threshold Limits Concentration (STLC), and Toxicity Characteristic Leaching Procedure (TCLP) values determined by Federal and State regulators. Waste soil with total metals concentrations exceeding TTLC values in a mg/kg to mg/kg comparison will be classified as a California Regulated Waste (non-RCRA hazardous waste). For screening purposes, total metals concentration of a waste soil can be compared to ten times (10X) the STLC value in a mg/kg to mg/l comparison. If the waste exceeds the 10X STLC screening the waste may be classified as a California Regulated Waste and further testing may be required. Similarly, a waste soil may be screened against the twenty times (20X) TCLP value in a mg/kg to mg/l comparison. If the waste exceeds the 20X STLC screening the waste may be classified as a RCRA Hazardous Waste and further testing may be required.

Comparison to Total Threshold Limit Concentration (TTLC)

Based on data presented in the FI report, three metals (copper, lead and nickel) were detected at concentrations exceeding their respective TTLC values. Of the VOCs only TCE has been assigned a TTLC value. Based on the FI report there were no TCE detections exceeding the TTLC value of 2,040 mg/kg. Copper, lead and nickel were detected in every sample analyzed totaling 185, 205 and 188 total samples, respectively. Detected copper concentrations ranged from 2.59 mg/kg to 5,170 mg/kg but only three samples (1.6% of total samples) exceeded the TTLC value for copper of 2,500 mg/kg. Lead concentrations ranged from 0.696 mg/kg to 1,340 mg/kg with only two samples (0.97% of total samples) exceeding the TTLC value for lead of 1,000 mg/kg. Nickel concentrations ranged from 0.654 mg/kg to 4,670 mg/kg with only six samples (3.2% of total samples) exceeding the TTLC value for nickel of 2,000 mg/kg.

Screening Against the Soluble Threshold Limits Concentration (STLC)

In addition to copper, lead and nickel noted above, only barium was detected at concentrations exceeding the 10 X STLC value. As noted above, of the VOCs only TCE has been assigned an STLC value. Based on the FI report TCE was not detected at concentrations above the 10x STLC value of 2,040 mg/l. Barium was detected in all 165 total samples analyzed at concentrations ranging from 3.98 mg/kg to 4,690 mg/kg. However, barium was detected in only seven samples (4.2% of total samples) exceeding the 10X STLC value of 1,000 mg/l. Copper, lead and nickel were detected in 31 (16.7% of total samples), 17 (8.3% of total samples) and 17 samples (9.0% of total samples), respectively, at concentrations exceeding their respective 10X STLC values.

Screening Against the Toxicity Characteristic Leaching Procedure (TCLP)

Metals identified that exceed the 20X TCLP values include barium, chromium and lead. None of the VOCs detected in soil samples exceeded their respective 20X TCLP values. Like the metals identified above, total barium and chromium were detected in all sample analyzed (165 and 225 samples, respectively). Total barium was detected at concentrations ranging from 3.98 mg/kg to 4,690 mg/kg, but only one sample (0.01% of total samples) was detected at a concentration exceeding the 20X TCLP value of 2,000 mg/l. Total chromium was detected at concentrations ranging from 2.28 mg/kg to 218 m/kg. Chromium was detected in only six samples (2.6% of total samples) at concentrations exceeding the 20X TCLP value of 100 mg/l. Lead was detected in only nine samples (4.4% of total samples) at concentrations exceeding the 20X TCLP value of 100 mg/l.

As described in Section 4.4.3, analytical data will be provided in accordance with profiling requirements established under the Waste Disposal Requirements (WDRs) of the treatment/disposal facility. It is anticipated that existing data from the FI report will be sufficient for profiling the soil for disposal, however, additional sampling and analysis, if required, will be conducted.

Based on review of the above data it appears that the amount of soil that may be characterized as California Regulated (non-RCRA hazardous) is between 5% and 10% and the amount of soil that may be characterized as RCRA Hazardous is less than 5%. Further review of the data may indicate that the soils with the greatest potential to be characterized as California Regulated (non-RCRA hazardous) or RCRA hazardous lie in generally discrete areas and at shallow depths (less than 5 feet). It should be noted that for the purpose of estimating cost URS assumed 30% of the excavated soil may be characterized as California Regulated or RCRA hazardous as stated above in Section 3.6.

Traffic Control and Loading Procedures

Traffic control measures will be implemented to minimize disruption of traffic and potential threats to traffic safety resulting from the series of dump truck used to transport excavated soil from the site and imported backfill to the site. A traffic control permit will be obtained from the City prior to implementation. A traffic control plan will be prepared and submitted as part of the permit application process to describe detailed plans for traffic control.

It is anticipated that the trucks will enter and exit the site from Miramar Road via the east and west gates, respectively (Figure 11). A flag person will be located at the site to assist the truck drivers to safely enter and exit the site. Appropriate signage will also be provided. Trucks will be staged on the property while loading activities are being conducted. While on the property, all vehicles will be required to not exceed 5 miles per hour for worker safety purposes and to minimize generation of dust.

As mentioned above, the excavated soil will be temporarily stockpiled to allow for the soil to be profiled. After the soil is appropriately profiled, the soil will be loaded directly from the stockpile area into the end-dump trucks. While the soil is being loaded into the trucks, dust suppression will be performed by lightly spraying or misting the work areas with water. Efforts will be made to minimize the soil drop height from loader's bucket into the transport trucks. Additionally, the loader will be positioned so as to load or stockpile soil from the leeward side of the truck. After the soil is loaded into the transport trucks, the soil will be covered and otherwise contained to prevent soil from blowing or spilling out of the truck during transport to the disposal facility.

Prior to exiting, the truck drivers will be required to brush their tires clean and remove any overburdened soil from areas of their truck that is not covered or protected. This cleanup/decontamination area will be setup as close to the loading area as possible so as to minimize spreading the impacted soil. Before trucks leave the site, the removal action contractor's site manager will be responsible for inspecting each truck to ensure that the payloads are adequately covered, the trucks are cleaned of overburdened soil, and the soil is properly manifested.

The trucks will exit the property to Miramar Road. As the trucks leave the site, the flag person will assist the truck drivers so that they can safely merge into the westbound traffic.

Destination of Soil

Non-Hazardous Soil

Excavated soil characterized as non-hazardous will be transported to the following facility:

Otay Landfill, Inc.
1700 Maxwell Road
Chula Vista, CA 91911

The point of contact at Otay Landfill, Inc. is Mr. Don Johnson. The truck route that will be traveled from the site to Otay Landfill, Inc. is discussed below.

California Regulated Waste Soil

Excavated soil characterized as California regulated waste will be transported to the following facility:

Copper Mountain Landfill
34853 East County 12th Street
Wellton, Arizona 85356

The point of contact at Copper Mountain Landfill is Mr. Don Johnson. The truck route that will be traveled from the site to Copper Mountain Landfill is discussed below.

RCRA Hazardous Waste Soil

Excavated soil characterized as RCRA hazardous waste will be transported to the following facility:

Clean Harbors – Buttonwillow Facility
2500 North Lokern Road
Buttonwillow, CA 93268

The point of contact at Clean Harbors – Buttonwillow Facility is Ms. Cathleen Gordon. The truck route that will be traveled from the site to Clean Harbors – Buttonwillow Facility is discussed below.

Truck Transportation Route

To Otay Landfill - Non-Hazardous Waste Soil:

The trucks will exit the site by turning right (west) on Miramar Road. They will travel approximately 3 miles to the I-805 (Inland Freeway). Travel south on the I-805 for 25 miles to the Otay Valley Road/Main Street exit. They will go left (east) on Main Street. After approximately 100 yards the street changes its name to Auto Park Drive and after another 0.4 mile the street changes its name again to Main Street. Travel another 0.6 mile and turn left (north) onto Maxwell Road. The landfill is 0.1 mile on Maxwell Road.

A map showing the truck route is provided on Figure 11A. The anticipated travel time (one way) is 45 minutes.

To Copper Mountain - California Regulated Waste Soil:

The trucks will exit the site by turning right (west) on Miramar Road. They will travel approximately 3 miles to the I-805 (Inland Freeway). Travel south on the I-805 for 15 miles to I-8 (Mission Valley Freeway). The trucks will travel east on I-8 for approximately 219 miles to Exit 37. They will turn right (south) on Avenue 36E for approximately 2 miles and continue straight onto E County 12th street for one more mile to the landfill.

A map showing the truck route is provided on Figure 11B. The anticipated travel time (one way) is 4½ hours.

To Clean Harbors – Buttonwillow Facility - RCRA Hazardous Waste Soil:

The trucks will exit the site by turning right (west) on Miramar Road. They will travel approximately 3 miles to the I-805 (Inland Freeway). Travel north on the I-805 for 3 miles to junction of I-5 (Golden State Freeway). The trucks will continue north on the I-5 for approximately 123 miles to Exit 257 CA-58/Buttonwillow/McKittrick. The trucks will then turn right (east) on Tracy Ave and than right (west) on SR-58 for approximately 1 mile. Turn right (northwest) onto Lokern Road for approximately 4 miles to the Clean Harbors Buttonwillow facility.

A map showing the truck route is provided on Figure 11C. The anticipated travel time (one way) is five hours.

Given the relatively limited network of freeways within the San Diego area, there are limited alternate routes that can be taken to the disposal facilities in San Diego County and Arizona. Soil transported to Otay Landfill, Inc. will have never left San Diego County. Soil transported to the Copper Mountain Landfill will travel from San Diego County through Imperial County into Arizona. However, there is an extensive network of freeways within the Los Angeles area and numerous possibilities of alternate routes to the Buttonwillow disposal facility. Soil transported to the Clean Harbors Buttonwillow facility will travel from San Diego County, through Orange and Los Angeles Counties and into Kern County. In the event that an alternate route is taken, the removal action contractor will verify the new truck route with DTSC before initiating field activities. However, this route was selected as it minimizes the trucks' travel time on surface streets and provides the shortest distance traveled. Additionally, given the characteristics of the soil being transported, there are no apparent restrictions that would preclude the trucks from following this route to the disposal facility.

While at the disposal facilities, each truck will be weighed before offloading their payload. Weight tickets or bills of lading will be provided to the removal action contractor after all the soil has been shipped offsite. Given the total quantity of soil (19,080 tons) estimated to be removed from the site, it is anticipated that a total of approximately 954 truckloads (based on 20 tons per truckload) will be needed to transport the impacted soil. Approximately 30% of the total amount of excavated soil is assumed will be characterized as California Regulated or RCRA Hazardous and transported to Copper Mountain or to the Clean Harbors Buttonwillow facility. The potentially California Regulated or RCRA Hazardous characterized soils are assumed to generally consist of the shallow soil and will be excavated first. Assuming 20 truck loads per day, the California Regulated and/or RCRA Hazardous waste will be transported offsite in 14 days. For the remaining soil, assumed to be characterized as non hazardous and hauled to Otay Landfill, Inc., five trucks will be used in the transportation circuit resulting in an estimated roughly 20 truckloads transported offsite each day, for a total of approximately 34 days.

Before leaving the site, each truck driver will be instructed to notify the removal action contractor's site manager. Each truck driver will be provided with the cellular phone number for the removal action contractor's site manager. It will be the responsibility of the removal action contractor's site manager to notify DTSC and URS of any unforeseen incidences.

Additionally, the State of California has organized the Service Authority for Freeway Emergencies (SAFE) program which began in 1986. A total of 17 SAFEs have been formed, covering 31 of California's 58 counties including all counties (noted above) through which soil from the site will be transported. Together these SAFEs have installed over 15,000 call boxes in California. These call boxes are situated at roadside locations along the truck routes described above. The call boxes are intended to be used to report roadside emergencies to the California Highway Patrol (CHP) dispatch center. As such, each truck driver will be instructed to report any roadside emergency to the CHP using the Call Box System.

Contingency Plans

If a spill occurs during the transportation of the excavated soils, the driver of the truck will stop, secure the site, and immediately contact the dispatch office of the transport company. The dispatch office will, in turn, notify a Cal-Trans certified emergency response organization and the URS project manager. In the event a spill of RCRA-hazardous soils occurs, the driver will stop, secure the site, and immediately contact the dispatch office who will, in turn, notify the Office of Emergency Services of California (800) 852-7550 (for spills within California) or the National Response Center (800) 424-8802 (for spills outside California) and the URS project manager. Emergency contact phone numbers for RCRA-hazardous material can also be found on hazardous waste manifests accompanying the hazardous waste shipments. In the event of a breakdown of a vehicle transporting excavated soils, arrangements will be made with the dispatch office or the driver's supervisor for prompt repair or roadside service.

In the event of an accident involving no spillage of excavated soils, the driver will first inspect the vehicle quickly for any leaks, while avoiding contact with the excavated soils. The driver will then place emergency markers to divert traffic. The driver will report the accident to the transport company dispatch office and also contact 911 to inform the local police authority of the accident. The driver will arrange for repair of the vehicle in a prompt manner. The dispatch office will report the accident to the Department of Transportation as specified in CFR 49 and CFR 22.

In the event of an accident with the spillage of RCRA hazardous or California regulated waste, all of the above contingencies shall apply in addition to the following:

1. The driver shall remain with the vehicle and warn all pedestrians and motorists to stay away from the spillage.

2. If the driver is unable to contact 911, the Highway Patrol is most likely to be the first to respond. The officer will, through registration, manifesting, and placarding procedures, be able to identify the waste carried and the owner of the vehicle.

3. The containment of the material is critical to prevent excessive spread of contamination. If possible, the driver, wearing proper protective equipment such as Tyvek, should attempt to contain the spread of contamination until Emergency Response Personnel arrive.

Decontamination of the vehicle shall be performed at the site of the incident and before continuing transport of excavated soils. This includes any clothing or equipment the driver may have used during containment/decontamination efforts. Decontamination procedures include containerizing all contaminated clothing, tools, etc. Clean-up equipment can be swept clean or power washed, and the resulting material containerized in an acceptable DOT container.

The potential accumulation of surface water within the excavation from rain events is addressed in Section 4.15 below.

Record Keeping

A field logbook will be maintained during the excavation activities. The field logbook will serve to document observations, personnel on site, equipment arrival and departure times, and other vital project information. 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 noted. 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 personal opinions or other terminology that might prove inappropriate. 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.

In the event that the soil removed is profiled as a RCRA Hazardous Waste or a California Regulated Waste, the Uniform Hazardous Waste Manifest (hazardous waste manifest) form will be used to track the movement of soil from the point of generation to the point of ultimate disposition. The hazardous waste manifests will include information such as:

- Name and address of the generator, transporter, and the destination facility
- U.S. DOT description of the waste being transported and any associated hazards
- Waste quantity
- Name and phone number of a contact in case of an emergency
- EPA Hazardous Waste Generator Number
- Other information required either by EPA and DTSC

Soil that is profiled as non-hazardous and sent offsite for disposal will be documented using a Non-hazardous Waste Manifest form. At a minimum, this form will include the following information:

- Generator Name and Address
- Transportation Company
- Accepting Facility Name and Address
- Waste Shipping Name and Description
- Quantity Shipped
-

Before transporting the excavated soil offsite, an authorized representative of Toppan will sign each manifest. The removal action contractor's site manager will maintain one copy of the manifests onsite.

Health and Safety

Before the beginning of each day's activities, a tailgate health and safety meeting will be held. Everyone working at the site will be required to be familiar with the health and safety plan and attend the daily tailgate meetings or health and safety briefings. Everyone working at the site will be required to sign the site-specific health and safety plan to demonstrate that they are familiar with the health and safety plan and that they participated in the daily tailgate meeting. The removal action contractor's site manager will maintain this signature sheet.

4.4.5 Confirmation Sampling

Prior to collecting confirmation soil samples, a screening assessment will be conducted using visual observation of the excavation bottom and sidewalls and using a field instrument to screen for VOCs. Confirmation soil samples will be collected from the bottom and sidewalls of the completed excavation. Based on the results of the screening assessment, additional excavation may be conducted prior to collecting confirmation soil samples. However, Toppan and URS may also collect and analyze confirmation soil samples in the planned deeper excavation areas (maximum depth of 25 to 40 feet bgs, associated with SWMUs 01, 02a, 09, 11, 12a, 12b, 12c, and 20) after an excavation depth of 15 to 20 feet has been achieved. Toppan and URS would evaluate the analytical results of this sampling to determine if the cleanup standards were achieved, thus making deeper excavation unnecessary.

A grid system will be used to identify the areas of the excavation to be sampled. Confirmation samples will be collected on an approximately 30-foot grid spacing. The exact confirmation sample locations will target areas where the highest concentrations of COCs were previously detected, or, if obvious soil discoloration is noted during excavation activities. Additionally, confirmation sample locations will be selected with consideration of existing laboratory data available from the FI. Samples will be analyzed for metals using EPA Method 6010, formaldehyde using ASTM D-19M, and/or VOCs using EPA Method 8260B, corresponding to the COCs in a particular excavation area.

Two confirmation samples are proposed to be collected from each excavation area that is significantly smaller than the 30-foot grid spacing. One base and one sidewall confirmation sample will be collected from SWMU7a, SWMU16a and SWMU18. These samples, together with the existing FI data from these areas, will be used to confirm that cleanup objectives have been achieved.

Proposed confirmation samples and the analytical rationale are presented in Table 6 and the proposed sample locations are presented in Figure 12. Although Table 6 indicates that only one confirmation sample will be collected from SWMU11 and two from SWMU12b, the excavation in these areas are combined into the large excavation shown on Figure 7 and is addressed by the grid sampling program. A total of 101 sample locations are depicted on Figure 12. Of the 101 samples 79 are proposed for VOC analysis, eight for formaldehyde and one for TPH. A total of 111 individual metals analysis is proposed to be conducted. Sampling and data management will be conducted in general accordance with the FI Workplan with variances, if any, noted in the Completion Report.

The confirmation soil samples will be collected manually in accordance with the procedures described in the FI Workplan. The confirmation samples will be collected from an interval of 0 to 6 inches beneath the excavation bottom or beyond the excavation sidewall. All samples will be labeled with the date sampled, a unique identification number, and other identifying information. Soil sample analyses will be conducted using a State-certified mobile or fixed-base laboratory. If specific locations within the excavation cannot be safely accessed by sampling personnel, the confirmation sampling will be conducted using a backhoe.

Analytical results will be used to evaluate if cleanup standards have been achieved based on an evaluation of potential human health risk as described in Section 2.5.4. If cleanup standards are not achieved, Toppan and URS may conduct additional excavation.

4.4.6 Backfill and Compaction

Approximately 19,080 tons of imported soil will be required to backfill the excavation areas. This volume may be reduced, however, depending on quantity of excavated soil found to be non-hazardous and potentially acceptable for backfill at the site. Prior to implementation, potential sources for this imported soil will be identified and evaluated. To verify that the imported soil is satisfactory for use at the site, soil sampling and analysis will be conducted in general accordance with the DTSC Information Advisory – Clean Imported Fill Material (fill advisory, DSTC, 2001). The fill advisory was prepared to ensure that inappropriate (contaminated) fill material is not introduced onto sensitive land use properties under the oversight of DTSC. Although this site is not classified as a sensitive property, the advisory provides relevant recommendations for selection and documentation of suitable fill material, including recommendations for sampling and analysis prior to import and use.

Additionally, the soil will be characterized to ensure that its physical properties are satisfactory for use as fill. Characterization will include sampling and analysis and evaluation by a qualified Certified Engineering Geologist to verify its suitability. The excavated areas will be backfilled with the imported fill material.

Backfilling activities will be conducted in accordance with the grading permit requirements. Import fill material will be transported to the site in trucks and staged onsite in proximity to the excavation to facilitate conducting the backfill and compaction activities. Fill material will be placed and compacted in lifts (e.g., 12- or 18-thick-inch lifts) as specified in the permit. A soil technician, working under the direction of a licensed Geotechnical Engineer, will conduct compaction testing at the frequency specified in grading permit. Fill will be compacted to a minimum of 90 percent of the relative dry density, or in accordance with grading permit.

4.4.7 Restoration

Site restoration activities will be conducted after the excavation area has been backfilled and compacted. It is expected that site restoration would consist of final grading the excavation areas to match existing site grade and possible re-surfacing of the exterior excavation areas with asphalt concrete pavement. Exterior building walls left open as a result of partial demolition work conducted prior to implementation of this remedy will be enclosed.

4.4.8 Soil Vapor Monitoring

A total of four soil vapor monitoring locations will be constructed as part of the corrective measure. URS proposes to construct nested soil vapor monitoring probes in accordance with the FI Workplan, including the requirements of the DTSC and RWQCB Advisory-Active Soil Gas Investigations, dated January 28, 2003 (Soil Gas Advisory, DTSC, 2003b). The probes will be installed using a mobile drill rig as performed in the FI to total depths of approximately 40 feet bgs, except that the locations in SWMU19b and along the north fence line in SWMU20 will be constructed to a depth of 20 feet bgs.

Three sample zones will be constructed within each monitoring probe at approximately 5, 20 and 40 feet bgs. Two sample zones will be constructed within the monitoring probes located in SWMU19b and 20, as described above. The probes will be constructed using 1/8-inch nylon tubing attached to stainless steel probe tips anchored at the proposed sample depths. Approximately one foot of pre-washed #3 Monterrey filter sand will be placed at each sample probe interval to evenly bracket the sample probe tip. The sand pack will be covered with an approximately one-foot thick layer of dry granular bentonite to act as a barrier to preclude intrusion of hydrated bentonite grout. Hydrated granular bentonite will be emplaced above the dry bentonite barrier to the level of the next sample zone where the construction will be repeated two more times.

Each probe will be completed at the ground surface using a standard groundwater monitoring well flush-mount vault in accordance with San Diego County Department of Environmental Health Site Assessment and Mitigation (SAM) manual guidelines. The proposed soil vapor probe construction is presented in Figure 9.

Initial sampling will be conducted after a minimum of 72 hours following construction. The soil vapor probes will be purged and sampled in accordance with the Soil Gas Advisory. The samples will be analyzed using a mobile laboratory for VOCs using EPA Method 8260B with duplicate samples analyzed for VOCs at a fixed laboratory using EPA Method TO-14A. Duplicate samples will be collected at a rate of approximately 10 percent.

Subsequent soil vapor monitoring will be conducted six months after the initial event and is anticipated to continue on an annual basis in accordance with the details of the soil vapor monitoring program described in the O&M Plan, to be submitted following implementation and documented completion of the selected corrective measure. However, the frequency of monitoring may change based on evaluation of the actual monitoring data and in consultation with the DTSC.

4.4.9 Construction Completion Report

The Construction Completion Report will be prepared after completion of the site activities described above to document that the work was completed in accordance with the CMS/RS/CMI and relevant plans and specifications. The report will include the following elements:

- Purpose
- Summary description of the corrective measure
- Identification and explanation of modifications
- Test results, including laboratory reports and field compaction testing
- Summary of significant activities and inspection findings
- Re-evaluation of potential human health risk, as described in Section 2.5.4
- As-built drawings, where relevant
- Copies of bills of lading
- Copies of air monitoring records, and
- Photographs

The report will be submitted to DTSC for review.

4.4.10 Corrective Measure Completion Report

The Corrective Measure Completion Report will be prepared when Toppan believes that the corrective measure completion criteria, including the cleanup standards, have been met and to justify why the corrective measure and/or monitoring may cease. The report will include the following elements:

- Purpose
- Summary description of the corrective measure
- Description of corrective measure completion criteria
- Demonstration that the criteria have been met, including laboratory results of soil vapor monitoring
- Additional test results
- Summary of additional significant activities and inspection findings
- Additional photographs

Demonstration that the cleanup standards have been achieved will be based primarily on an evaluation of the laboratory results and documentation showing that the concentrations of VOCs in soil vapor are decreasing or stable and do not constitute an unacceptable risk to human health or the environment. The O&M Plan will be submitted following implementation and completion of the selected corrective measure. The O&M Plan will provide additional details, including criteria for cessation of soil vapor monitoring.

The report will be submitted to DTSC for review.

4.4.11 Vapor Control Contingency Piping

The design of Alternative 3 is based on the key assumption that the remaining concentrations of VOCs in soil vapor in the areas not subject to excavation will not pose an unacceptable potential human health risk through recontamination of the backfill soil or through continued migration to potential off-site receptors. This is especially true in the suspected source areas located in the northeast corner of the building. The basis of design, including the technical approach used in evaluation of the potential risk posed by residual VOCs in soil vapor, is described in Section 4.9. However, as a contingency against possible problems posed by residual VOCs in this area, Alternative 3 will include a deep vapor control piping system. A schematic and cross-sectional diagram of the piping system is included as Figure 13. If monitoring indicates that VOCs in this area continue to pose an unacceptable risk through vapor intrusion, the piping system could be used to mitigate upward migration of VOCs in soil vapor. Use of this piping would require future connection and operation of a small blower, similar to those used for mitigation of radon. Operation of the blower would create a pressure gradient resulting in collection and extraction of soil vapor from the gravel bed.

As indicated in Figure 11, a 2- to 3-inch diameter slotted PVC piping manifold would be set in a 12- to 18-inch thick gravel bed. The gravel bed would be placed at the nominal depth of excavation in this area, located at the horizontal interface between the native soil (still impacted with VOCs in soil vapor) and the new backfill material. Additionally, the piping system would be segregated into three zones, to provide a degree of control depending on the specific location of potentially persistent VOCs in soil vapor. Details for operation and monitoring of this piping system would be developed based on the specific nature of the potential problem, in consultation with DTSC.

Although installed during implementation of Alternative 3, this piping system would only be operated in the event that the cleanup standards cannot be met through excavation as described in the CMS/RS/CMI. After it can be demonstrated that excavation was successful in achieving the cleanup standards, the piping system would be abandoned in place by filling the riser pipes with concrete grout.

4.5 DATA SUFFICIENCY

Sufficient data is available to characterize the nature and extent of contamination, assess baseline human health and environmental risks, evaluate and select the most appropriate alternative, and implement the selected corrective measure alternative. The nature and extent of contamination was described in the Final FI Report (URS, 2006b), approved by DTSC on January 16, 2006 (DTSC, 2006). The baseline evaluation of potential human health and ecological risks was described in the draft BRA Report (URS, 2006a), currently under review by DTSC. The evaluation of corrective measure alternatives was presented in Section 2 of this report.

Correspondingly, sufficient data is available to implement the selected corrective measure. However, implementation will require confirmation soil sampling and periodic soil vapor sampling at selected locations to verify satisfactory performance of the selected corrective measure alternative and achievement of the cleanup standards. This monitoring program is described in the O&M Plan to be submitted following implementation and completion of the selected corrective measure.

4.6 PROJECT MANAGEMENT

The project management plan is described in Section 2.8.

4.7 PROJECT SCHEDULE

A project schedule for implementation of the selected corrective action alternative has been included as Figure 5, as described in Section 2.9.

4.8 DESIGN CRITERIA

The design criteria for the selected alternative is to excavate a sufficient volume of impacted soil to mitigate potential human health risk and achieve the cleanup standards described in Section 3.3. No process equipment is required for this alternative.

4.9 DESIGN BASIS

The basis of the design of this corrective measure is to achieve site-specific cleanup standards presented in the CMS/RS/CMI. The expected extent of soil excavation is based on the analytical results and conceptual site model presented in the FI Report, analysis of baseline human health and ecological risk presented in the BRA Report, and the expected extent of excavation to result in achieving the site-specific, health risk based cleanup standards. The most significant assumptions made is that remaining concentrations of VOCs in soil gas in the areas not subject to excavation will not pose an unacceptable human health risk through recontamination of the excavated areas or continued migration to potential off-site receptors. To address this risk, Toppan has included installation of a deep vapor control piping system as described in Section 4.4.11.

To further validate the technical approach of Alternative 3, URS conducted a screening level evaluation of post-remediation vapor intrusion for 1,1-DCE (Appendix H). In this evaluation, a mass-limited approach was used to estimate the average long-term exposure to building users. Based on the results of this evaluation, the extensive excavation planned under Alternative 3, is expected to reduce the mass of 1,1-DCE to the level that no longer poses a threat to commercial worker receptors via the vapor intrusion pathway.

Upon completion of the planned excavation, confirmation soil samples will be collected and analyzed and potential human health risk re-evaluated to verify that cleanup standards have be achieved. In addition, a soil vapor monitoring program has been included as part of this alternative to confirm that the cleanup standards for VOCs in soil vapor have been achieved and can be maintained. The monitoring program is detailed in the O&M Plan to be submitted following implementation and completion of the selected corrective measure.

4.10 CONCEPTUAL PROCESS/SCHEMATIC DIAGRAMS

Conceptual process and schematic diagrams are not relevant for the recommended corrective measure.

4.11 SITE PLAN

A site plan is included as Figure 11. The site plans illustrates the planned area of work, including identification of areas to be used to temporarily stockpile excavated soil and dump truck traffic flow. Areas of excavation are illustrated in Figure 7.

4.12 IDENTIFICATION OF MAJOR COMPONENTS

No permanent equipment is required for implementation of the selected corrective measure. Construction of the soil vapor monitoring wells is described in Section 4.4.8.

4.13 MASS BALANCES

Mass balances are not relevant for the recommended corrective measure.

4.14 SITE SAFETY AND SECURITY

Key site safety issues include proper management of excavation activities, control of potential volatilization of VOCs to the atmosphere, and truck traffic control. Excavation safety issues include the presence of subsurface utilities in the area of excavation, excavation stability, building protection, and potential confined space entry. Volatilization of VOCs must be monitored and controlled to protect site workers and the surrounding community. Staging and routing of dump trucks used to transport the excavated soil for off-site disposal will require coordination and control to protect site workers and vehicular traffic along Miramar Road. Site safety is addressed in the HSP, included as Appendix I.

Site security will be provided primarily by the existing chain link fencing and control of access to the site through the existing gates. Gates will be locked when site personnel are not present to reduce the potential for unauthorized personnel entering the site.

4.15 WASTE MANAGEMENT PRACTICES

Waste management practices for excavated soil were described in Section 4.4. Potential rainwater runoffs will be managed in accordance with the requirements of best management practices (BMP), which will include covering stockpiles of excavated soil, periodic sweeping of the adjacent surfacing, installation of silt fences along the perimeter of the site in the affected areas of work, and temporarily covering storm drain inlets in the area of work. To avoid the accumulation of rainwater in the excavations, the excavations will be covered, to the extent possible during rainfall events. Temporary berms will also be deployed to control run-on. Rainwater that does accumulate in the excavation will be removed within as close to 24 hours from the time of accumulation as practically possible, profiled, and disposed of.

4.16 REQUIRED PERMITS

Required permits necessary to implement the recommended corrective measure are expected to consist of the following:

City/County of San Diego

- County of San Diego, Department of Environmental Health (DEH)
- Fire Prevention Division – building demolition only
- Public Works and Building/Planning Department
- Grading and Public Right-of-Way
- Traffic Division

State of California

- Department of Industrial Safety – Notification of Excavation Activity
- Division of Occupational Safety and Health (CalOSHA), Department of Industrial Relations – Notification of Excavation Activities per 8 CCT 341.1 (f)
- San Diego Air Pollution Control District – possible for building demolition only

Permits will be obtained from the appropriate regulatory authority with copies provided to DTSC prior to implementation of the selected alternative.

4.17 LONG-LEAD PROCUREMENT CONSIDERATIONS

No long-lead procurement items have been identified, however, the permit application process may be extensive and will need to be initiated early ensure timely move-in to the site.

SECTION 5 REFERENCES

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Table 1
Solid Waste Management Units and Areas of Concern

Solid Waste Management Units	
SWMU #1	Chemical Loading/Unloading Area
SWMU #2	Etch HAL Area /Hot Oil Drain Pipe
	#2a – Etch HAL Area
	#2b – Hot Oil Drain Pipe Area
SWMU #3	Gold Tab
SWMU #4	Electroless
SWMU #5	Carbon Treatment Tank
SWMU #6	Chemical Logistics Storage Area
SWMU #7	Wastewater Treatment Vault/Container Storage Area
	#7a – Wastewater Treatment Vault
	#7b – Container Storage Area
SWMU # 8	West Trench Terminus
SWMU #9	Plating Trench
SWMU	Batch Treatment and Chemical Tank Area
SWMU	Ammonia Etch Tanks
SWMU	Plating Areas
	#12a – PAL 2000
	#12b – PAL 500
	#12c – Immersion Gold
SWMU	Oxide Area
SWMU	Screen Cleaning Area
SWMU	LPI and DF Preparation and Development Areas
	#15a – LPI Area
	#15b – DF Preparation Area
SWMU	Trenches
	#16a – West Trench
	#16b – East Trench
	#16c – Central or Electroless Trench
SWMU	Thermal Mask Screening and Cure Areas
	#17a – Cure Area
	#17b – Mask Screening Area
SWMU	Fabrication and Cleaning Area
SWMU	Etching Areas
	#19a – Strip-Etch-Strip (SES)
	#19b – Develop-Etch-Strip (DES)
SWMU	Driveway and Parking Areas
Areas of Concern	
AOC #1	Econo-Treat System
AOC #2	LPI Tack Dry

Table 2
Identification and Screening of Corrective Measure Technologies
Toppan Electronics, Inc.
San Diego, California

Technology	Description[1]	Effectiveness	Implementability	Cost Range	Retain for Detailed Evaluation
Excavation and Off-site Disposal	Contaminated soil is excavated and transported off-site to a permitted treatment and disposal facility. Pretreatment may be required prior to disposal.	• Expected to be effective in achieving cleanup goals for metals and VOCs in soil. • Not typically used to address VOCs in soil vapor, but may be effective with a sufficiently extensive excavation and monitoring to verify performance. • The excavated soil may require treatment prior to disposal to meet the standards of the permitted disposal facility.	• Personnel and equipment are generally available for implementation. • Permits can readily obtained. • Implementation may require partial demolition of the existing building to facilitate access and protection of the remaining structure in the area of the deep excavations. • Engineering controls will be required to mitigate potential vapor and dust during excavation. • Truck traffic will require implementation of a traffic control plan. • Agency and community acceptance would be high due to the expected effectiveness of the technology.	High	Yes
Soil Vapor Extraction	In situ process of removing VOCs from vadose zone soil. A vacuum is applied through a series of extraction wells to create a pressure and concentration gradient that induces gas-phase VOCs to be removed. Treatment of the extracted soil vapor to remove the VOCs is typically required prior to discharge to the atmosphere.	• Recognized as a Presumptive Remedy by US EPA for remediation of VOCs in soil and soil vapor. • Applicable for VOCs with a Henry's law constant greater than 0.01 or a vapor pressure greater than 0.5 mm Hg. • Performance is dependent on other factor including air permeability of the soil, organic content, and soil moisture. The low permeability of the soil at this site is expected to greatly reduce the effectiveness of this technology. • Not effective in addressing metal contamination, thereby requiring implementation in combination with other applicable technologies. • Effective implementation may require design for a comparatively small radius of influence and a comparatively long period of operation to achieve cleanup objectives.	• Personnel and equipment are generally available for implementation. • Permits can be readily obtained; however, the permit for discharge of the treated soil vapor would require approval from the SDAPCD. • This technology would have to be combined with another technology (e.g. excavation) to address metal-impacted soil. • Noise from the high-vacuum blower may require abatement to meet local noise ordinances and satisfy neighboring businesses.	Medium	Yes
Containment	Construction and long-term maintenance of a physical barrier to minimize exposure to contaminants from the surface, prevent vertical infiltration of water into contaminated soil that may create contaminated leachate and pose a continuing threat to groundwater, and to control the vertical migration of contaminated soil vapor into overlying buildings.	• Can be designed to provide effective control of the pathway to direct exposure to metal and VOC contaminated soil and the vapor intrusion pathway. Mitigation for a future construction/excavation worker, however, may be required. • Effectiveness will require long-term maintenance and monitoring. • May not effectively address long term risks associated with potential off-site migration of VOCs, unless combined with other alternatives (e.g. excavation or SVE).	• Personnel and equipment are generally available for implementation; however, specialized design services would be required for design (e.g., a Liquid Boot barrier or enhanced building ventilation). • Selection would require long term commitment from current or future property owners to ensure that the containment method is maintained and monitored.	Low	Yes
Solidification/ Stabilization	Solidification processes produce monolithic blocks of wastes resulting in mechanical locking of the contaminants in the solidified matrix. Stabilization processes include the addition of chemical binders to further limit the solubility or mobility of the wastes. Usually conducted ex situ, thereby requiring excavation prior to processing.	• Expected to be effective in achieving cleanup objectives for metals, but not typically effective for VOCs. • Combining this technology with others to address VOCs is not expected to be cost effective.	• Personnel and equipment are generally available for implementation, however, their may not be sufficient space at the site to conduct excavation and solidification/stabilization operations. • Other implementability issues associated with excavation would also apply, as described above. • This technology would have to be combined with another	Medium/High	No

Table 2 (cont'd)
Identification and Screening of Corrective Measure Technologies
Toppan Electronics, Inc.
San Diego,

Technology	Description[1]	Effectiveness	Implementability	Cost Range	Retain for Detailed Evaluation
			technology (e.g. containment) to address VOCs.		
In situ Bioremediation	May occur as a component of MNA, as described below, or may be enhanced through stimulation of naturally occurring microbes. Biodegradation may be stimulated through the introduction of nutrients, oxygen, or other amendments.	• Potentially effective in addressing VOCs in soil and soil vapor, however, conditions must be appropriately aerobic or anaerobic, depending on the VOC constituent and a long period of operation would be required. • Consistent delivery of amendments would be difficult given the low permeability soil conditions at the site. • Not effective in addressing metals.	• Personnel and equipment are generally available for implementation; however, specialized design work is required. • The nutrient delivery system would require a complicated piping arrangement potentially inhibiting development and use of a portion of the site. • This technology would have to be combined with another technology (e.g. containment) to address metals.	Medium/High	No
Monitored Natural Attenuation	Reliance on natural processes to achieve site-specific remedial objectives. These processes may include biodegradation, sorption, dispersion and dilution, chemical reactions, and/or volatilization. Requires verification that subsurface conditions are suitable for the processes, especially bioremediation, and monitoring to verify progress.	• MNA appears to be occurring at the site as described in the CSM presented in the FI Report with 1,1,1-TCA and other VOCs transforming to 1,1-DCE and other constituents via biodegradation. • The prevalence of 1,1-DCE may indicate the occurrence of "DCE stall", whereby subsurface conditions limit further degradation. 1,1-DCE is the primary VOC constituent of concern at the site. • Natural attenuation would be expected to continue occurring for residual concentrations of VOCs in soil and soil gas after implementation of the selected remedy.	• MNA requires only monitoring to verify progress; therefore, implementation is not complex. • Agency and community acceptance of this method alone may be low. • This technology would have to be combined with another technology (e.g. containment) to address metals.	Low	No

Notes:

1. Summary descriptions paraphrased from FRTR Remediation Technologies Screening Matrix and Reference Guide, Version 4.0.

Definitions:

1,1-DCE – 1,1-Dichloroethene
1,1,1-TCA – 1,1,1-Trichloroethane
CSM – Conceptual Site Model
FI – Facility Investigation
Hg – Mercury
mm – millimeters
MNA – Monitored Natural Attenuation
SDAPCD – San Diego Air Pollution Control District
SVE – soil vapor extraction
US EPA – US Environmental Protection Agency
VOCs – Volatile Organic Compounds

Table 3
Deep Soil Vapor Investigation Results
Toppan Electronics
Miramar Road Facility
San Diego, California

Sample Depth (ft. bgs)	DCE CONCENTRATIONS					
	SV-SWMU02A-01		SV-SWMU01-02, -04, and -05		SV-SWMU20-06	
	Soil Gas (ug/l)	Soil (ug/kg)	Soil Gas (ug/l)	Soil (ug/kg)	Soil Gas (ug/l)	Soil (ug/kg)
1	-	110	-	-	-	-
5	3,000	43	7,800	210	2,800	-
9	-	-	-	2,600	-	-
10	11,000	ND (a)	11/26/03 - 9,600/ 9,400D 1/19/05 - 6,500 06/15/05 - 5,800 08/08/05-23,000/ 22,000D 08/08/02 - 5,700 ext.	-	12,000	-
15	34,000	100	-	ND	5,500	-
20	12,000	16	-	120	-	-
25	-	-	1/19/05 - 12,000 06/15/05 - 25,000 P 8/8/05- 31,000 /33,000 ext.	82	8,600	-
27	-	-	-	-		28
30	2,200	3.9	-	-	4,000	-
35	-	-	-	6.3	-	50
36	1,400	-	-	-	-	-
39.5	-	-	6/15/05 - 13,000 8/8/05- 21,000 /17,000 ext.	-	-	-
40	-	-	20,000	32	3,600	-
45	-	-	-	-	-	6.6
47	-	-	7,000 (D)	1.9	-	-
50	5.2	ND	-	-	310 (D)	-
53			-	-		1.6
60			-	ND		
70			06/15/05 – 1,100 8/85/05 - 1,200/ 1,800 ext.	ND (b)		
80			-	ND (b)		

Table 3 (Cont'd)
Deep Soil Vapor Investigation Results
Toppan Electronics
Miramar Road Facility
San Diego

Sample Depth (ft. bgs)	DCE CONCENTRATIONS					
	SV-SWMU02A-01		SV-SWMU01-02, -04, and -05		SV-SWMU20-06	
	Soil Gas (ug/l)	Soil (ug/kg)	Soil Gas (ug/l)	Soil (ug/kg)	Soil Gas (ug/l)	Soil (ug/kg)
90			06/15/05 – 38 08/08/05 – 80 / 23 ext.	ND (b)		

Definitions:

- = sample not collected at this depth

ext. = extended purge sample result, approximately equal to the relevant sand pack volume

D = duplicate sample result, higher than original sample result
P = highest detected concentration from three volume purge test

ft.bgs = feet below ground surface

ND = less than the method detection limit for that compound

u/l = micrograms per liter

ug/kg = micrograms per kilogram

Footnotes:

a. Concentration of methylene chloride reported as 6,900 ug/kg in this sample.

b. Sample collected direct from recovered core. Unable to drive sampler due to soil conditions.

c. Risk based concentrations for DCE in soil gas are 49.2 ug/l and 387 ug/l for residential and commercial sites, respectively.

d. Risk based concentrations for DCE in soil are 36,000 ug/kg and 72,000 ug/kg for residential and commercial sites, respectively.

Table 4
Excavation Quantities and Summary of Alternatives
Toppan Electronics
San Diego, California

Corrective Measure Alternative	Exposure Area	SWMU	Quantity of Soil Excavated						Approximate Area Requiring Vapor Control (square feet)	Soil Vapor Monitoring Wells	Soil Vapor Extraction Wells
			Primarily Metal-Impacted		Primarily VOC-Impacted		Total				
			Cubic Yards	Tons	Cubic Yards	Tons	Cubic Yards	Tons			
1	---	---	0.0	0.0	0	0	0	0	0	0	0
2	A	SWMU03	370	481	0	0	370	481	18,640	4	0
		SWMU07A	77	101	0	0	77	101			
	B	SWMU12A	158	205	0	0	158	205			
		SWMU19A	201	261	0	0	201	261			
		SWMU02A	156	202	741	963	896	1,165			
	C	SWMU18	62	81	0	0	62	81			
	D	SWMU08	181	235	0	0	181	235			
		SWMU04	150	195	109	142	259	337			
		SWMU19B	0	0	632	822	632	822			
	F	SWMU13	0	0	360	468	360	468			
		SWMU16	36	46	0	0	36	46			
		SWMU20	0	0	121	158	121	158			
Alternative 2 Estimated Totals			1,668	2,169	1,964	2,553	3,632	4,722			
3	A	SWMU03	370	481	0	0	370	481	0	4	0
		SWMU07A	77	101	0	0	77	101			
		SWMU12B	0	0	109	142	109	142			
		SWMU12C	0	0	707	919	707	919			
	B	SWMU01	0	0	1,994	2,593	1,994	2,593			
		SWMU02A	156	202	1,185	1,541	1,341	1,743			
		SWMU12A	215	279	2,810	3,653	3,025	3,933			
		SWMU19A	329	428	804	1,045	1,133	1,473			
	C	SWMU18	62	81	0	0	62	81			
	D	SWMU04	463	602	157	205	621	807			
		SWMU08	247	322	0	0	247	322			
		SWMU19B	0	0	632	822	632	822			
	E	SWMU09	388	504	384	499	771	1,003			
	F	SWMU13	0	0	360	468	360	468			
		SWMU16	30	39	0	0	30	39			
		SWMU20	0	0	3,196	4,155	3,196	4,155			
Alternative 3 Estimated Totals			2,337	3,038	12,340	16,042	14,677	19,080			

Table 4 (continued)
Excavation Quantities and Summary of Alternatives
Toppan Electronics
San Diego, California

Corrective Measure Alternative	Exposure Area	SWMU	Quantity of Soil Excavated						Approximate Area Requiring Vapor Control (square feet)	Soil Vapor Monitoring Wells	Soil Vapor Extraction Wells
			Primarily Metal-Impacted		Primarily VOC-Impacted		Total				
			Cubic Yards	Tons	Cubic Yards	Tons	Cubic Yards	Tons			
4	A	SWMU03	370	481	0	0	370	481	0	4	10
		SWMU07A	77	101	0	0	77	101			
		SWMU12B	0	0	109	142	109	142			
		SWMU12C	0	0	94	123	94	123			
	B	SWMU02A	156	202	148	193	304	395			
		SWMU12A	491	639	0	0	491	639			
		SWMU19A	329	428	0	0	329	428			
	C	SWMU18	62	81	0	0	62	81			
	D	SWMU04	300	390	109	142	409	532			
		SWMU08	247	322	0	0	247	322			
		SWMU19B	0	0	632	822	632	822			
	E	SWMU09	278	362	40	52	318	413			
	F	SWMU13	0	0	360	468	360	468			
		SWMU16	30	39	0	0	30	39			
		SWMU20	0	0	121	158	121	158			
Alternative 4 Estimated Totals			2,341	3,043	1,614	2,099	3,955	5,142			

Table 5
Estimated Costs for Corrective Measure Alternatives

	Corrective Measure Alternatives		
	Alternative 2	Alternative 3	Alternative 4
Direct Capital Costs			
Demolition	20,000	100,000	20,000
Excavation	45,500	285,000	49,500
Transport and Disposal	234,500	1,021,000	253,000
Purchase and Import Backfill Soil/Backfill and Compaction	105,000	457,000	116,500
Vapor Control Contingency Piping	N.A.	50,000	N.A.
Vapor Monitoring Wells and Initial Sampling Event	35,000	35,000	35,000
Vapor Control Measures (enhanced building ventilation, LiquidBoot membrane, or partial building demolition)	100,000 – 312,000	N.A.	N.A.
SVE System Construction	N.A.	N.A.	250,000
Demobilization	10,000	10,000	20,000
Indirect Capital Costs			
Engineering/Completion and Closure Reports	68,000	83,000	88,000
Permitting	18,000	31,000	17,000
Total Capital Cost	636,000	2,072,000	849,000
Annual Post Removal Action Site Control Costs			
Soil Vapor Monitoring @ $10,000 per year for three years	30,000	30,000	30,000
SVE Maintenance Costs @ $3,000 per month	N.A.	N.A.	120,000-240,000
PV of O&M of Soil Vapor Intrusion Control Method (0-10,000 per year over 30 years)	0 - 154,000	N.A.	N.A.
TOTAL	666,000- 1,032,000	2,102,000	999,000-1,119,000

Table 6
Proposed Confirmation Sample Locations and Analysis
Toppan Electronics
San Diego, California

SWMU	Sample	Depth	Analysis								Rationale
			VOCs	Pb	Cu	Ni	Cr*	As	TPH	Form.	
SWMU01	CS-SWMU01-01-40	40	X					X			VOCs detected in soil vapor; As RBC exceeded in SWMU12a-02-13
	CS-SWMU01-02-35	35	X					X			VOCs detected in soil vapor; As RBC exceeded in SWMU12a-02-13
	CS-SWMU01-03-35	35	X					X			VOCs detected in soil vapor; As RBC exceeded in SWMU12a-02-13
	CS-SWMU01-04-35	35	X								VOCs detected in soil vapor
	CS-SWMU01-05-25	25	X								VOCs detected in soil vapor
SWMU02a	CS-SWMU02a-01-15	15	X								VOCs detected in soil vapor
	CS-SWMU02a-02-30	30	X								VOCs detected in soil vapor
	CS-SWMU02a-03-15	15	X								VOCs detected in soil vapor
	CS-SWMU02a-04-25	25	X								VOCs detected in soil vapor
	CS-SWMU02a-05-25	25	X	X	X		X	X			VOCs detected in soil vapor; Pb, Cu, Cr, As RBC exceeded in SWMU09-01-01 and SWMU09-01-20; Speciated chromium analyzed at DTSC request
	CS-SWMU02a-06-15	15	X								VOCs detected in soil vapor
	CS-SWMU02a-07-05	5	X						X		VOCs detected in soil vapor. Location of former oil drain pipe.
	CS-SWMU02a-08-15	15	X								VOCs detected in soil vapor
SWMU03	CS-SWMU03-01-03	3				X	X				Ni RBC exceeded within SWMU03; Speciated chromium analyzed at DTSC request
	CS-SWMU03-02-05	5				X	X				Ni RBC exceeded within SWMU03; Speciated chromium analyzed at DTSC request
	CS-SWMU03-03-10	10				X	X				Ni RBC exceeded within SWMU03; Speciated chromium analyzed at DTSC request
	CS-SWMU03-04-07	7				X	X				Ni RBC exceeded within SWMU03; Speciated chromium analyzed at DTSC request
	CS-SWMU03-05-03	3				X	X				Ni RBC exceeded within SWMU03; Speciated chromium analyzed at DTSC request
	CS-SWMU03-06-03	3				X	X				Ni RBC exceeded within SWMU03; Speciated chromium analyzed at DTSC request
	CS-SWMU03-07-05	5				X	X				Ni RBC exceeded within SWMU03; Speciated chromium analyzed at DTSC request

SWMU	Sample	Depth	Analysis								Rationale
			VOCs	Pb	Cu	Ni	Cr*	As	TPH	Form.	
SWMU04	CS-SWMU04-01-03	3	X				X	X			VOCs detected in soil vapor; As RBC exceeded within SWMU04; Speciated chromium analyzed at DTSC request
	CS-SWMU04-02-05	5	X				X	X			
	CS-SWMU04-03-03	3	X				X	X			
	CS-SWMU04-04-02	2	X				X	X			
	CS-SWMU04-05-07	7	X				X	X		X	VOCs detected in soil vapor; As RBC exceeded within SWMU04; Form detected in central SWMU04; Speciated chromium analyzed at DTSC request
	CS-SWMU04-06-03	3	X				X	X		X	VOCs detected in soil vapor; As RBC exceeded within SWMU04; Form detected in central SWMU04; Speciated chromium analyzed at DTSC request
	CS-SWMU04-07-10	10	X				X	X		X	VOCs detected in soil vapor; As RBC exceeded within SWMU04; Form detected in central SWMU04; Speciated chromium analyzed at DTSC request
	CS-SWMU04-08-05	5	X				X	X		X	VOCs detected in soil vapor; As RBC exceeded within SWMU04; Form detected in central SWMU04; Speciated chromium analyzed at DTSC request
	CS-SWMU04-09-05	5	X				X	X		X	VOCs detected in soil vapor; As RBC exceeded within SWMU04; Form detected in central SWMU04; Speciated chromium analyzed at DTSC request
	CS-SWMU04-10-02	2	X				X	X		X	VOCs detected in soil vapor; As RBC exceeded within SWMU04; Form detected in central SWMU04; Speciated chromium analyzed at DTSC request
	CS-SWMU04-11-02	2	X				X	X		X	VOCs detected in soil vapor; As RBC exceeded within SWMU04; Form detected in central SWMU04; Speciated chromium analyzed at DTSC request;
	CS-SWMU04-12-12	2	X				X	X		X	VOCs detected in soil vapor; As RBC exceeded within SWMU04; Form detected in central SWMU04; Speciated chromium analyzed at DTSC request
	CS-SWMU04-13-10	10	X				X	X			
	CS-SWMU04-14-05	5	X				X	X			
SWMU07a	CS-SWMU07a-01-05	5			X			X			Cu and As RBCs exceeded within SWMU07a
	CS-SWMU07a-02-03	3			X			X			Cu and As RBCs exceeded within SWMU07a
SWMU08	CS-SWMU08-01-15	15						X			As RBC exceeded within SWMU08
	CS-SWMU08-02-05	5						X			As RBC exceeded within SWMU08
	CS-SWMU08-03-05	5						X			As RBC exceeded within SWMU08
	CS-SWMU08-04-10	10						X			As RBC exceeded within SWMU08

SWMU	Sample	Depth	Analysis								Rationale
			VOCs	Pb	Cu	Ni	Cr*	As	TPH	Form.	
	CS-SWMU08-05-03	3						X			As RBC exceeded within SWMU08
	CS-SWMU08-06-05	5						X			As RBC exceeded within SWMU08
	CS-SWMU08-07-03	3						X			As RBC exceeded within SWMU08
	CS-SWMU08-08-05	5						X			As RBC exceeded within SWMU08
SWMU09	CS-SWMU09-01-03	3			X		X	X			Cu and As RBCs exceeded in SWMU07a-03-01; Speciated chromium analyzed at DTSC request
	CS-SWMU09-02-10	10	X				X				VOCs detected in soil vapor; Speciated chromium analyzed at DTSC request
	CS-SWMU09-03-10	10	X				X				VOCs detected in soil vapor; Speciated chromium analyzed at DTSC request
	CS-SWMU09-04-30	30	X	X			X	X			VOCs detected in soil vapor; Pb and As RBCs exceeded in SWMU09-04-01 and SWMU09-02-05; Speciated chromium analyzed at DTSC request
SWMU11	CS-SWMU11-01-25	25	X								VOCs detected in soil vapor

SWMU	Sample	Depth	Analysis								Rationale
			VOCs	Pb	Cu	Ni	Cr*	As	TPH	Form.	
SWMU12a	CS-SWMU12a-01-25	25	X	X			X	X			VOCs detected in soil vapor; Pb and As RBCs exceeded in SWMU09-02-03, SWMU09-04-01 and SWMU12a-07-01; Speciated chromium analyzed at DTSC request
	CS-SWMU12a-02-30	30	X	X			X	X			VOCs detected in soil vapor; Pb and As RBCs exceeded in SWMU09-02-03, SWMU09-04-01 and SWMU12a-07-01; Speciated chromium analyzed at DTSC request
	CS-SWMU12a-03-40	40	X	X			X	X			VOCs detected in soil vapor; Pb and As RBCs exceeded in SWMU09-02-03, SWMU09-04-01 and SWMU12a-07-01; Speciated chromium analyzed at DTSC request
	CS-SWMU12a-04-30	30	X	X			X	X			VOCs detected in soil vapor; Pb and As RBCs exceeded in SWMU09-02-03, SWMU09-04-01 and SWMU12a-07-01; Speciated chromium analyzed at DTSC request
	CS-SWMU12a-05-25	25	X	X			X	X			VOCs detected in soil vapor; Pb and As RBCs exceeded in SWMU09-02-03, SWMU09-04-01 and SWMU12a-07-01; Speciated chromium analyzed at DTSC request
	CS-SWMU12a-06-25	25	X	X	X		X	X			VOCs detected in soil vapor; Pb, Cu, Cr, As RBCs exceeded in SWMU09-01-05, SWMU12a-04-05 and SWMU12a-04-11; Speciated chromium analyzed at DTSC request
	CS-SWMU12a-07-10	10	X				X				VOCs detected in soil vapor; Speciated chromium analyzed at DTSC request
	CS-SWMU12a-08-15	15	X				X				VOCs detected in soil vapor; Speciated chromium analyzed at DTSC request
SWMU12b	CS-SWMU12b-01-02	2	X				X				VOCs detected in soil vapor; Speciated chromium analyzed at DTSC request
	CS-SWMU12b-02-02	2	X				X				VOCs detected in soil vapor; Speciated chromium analyzed at DTSC request
SWMU12c	CS-SWMU12c-01-15	15	X				X				VOCs detected in soil vapor; Speciated chromium analyzed at DTSC request
	CS-SWMU12c-02-10	10	X				X				VOCs detected in soil vapor; Speciated chromium analyzed at DTSC request
	CS-SWMU12c-03-15	15	X				X				VOCs detected in soil vapor; Speciated chromium analyzed at DTSC request

SWMU	Sample	Depth	Analysis								Rationale
			VOCs	Pb	Cu	Ni	Cr*	As	TPH	Form.	
SWMU13	CS-SWMU13-01-05	5	X				X				VOCs detected in soil vapor; Speciated chromium analyzed at DTSC request
	CS-SWMU13-02-03	3	X				X				VOCs detected in soil vapor; Speciated chromium analyzed at DTSC request
	CS-SWMU13-03-03	3	X				X				VOCs detected in soil vapor; Speciated chromium analyzed at DTSC request
	CS-SWMU13-04-03	3	X				X				VOCs detected in soil vapor; Speciated chromium analyzed at DTSC request
	CS-SWMU13-05-05	5	X				X				VOCs detected in soil vapor; Speciated chromium analyzed at DTSC request
	CS-SWMU13-06-03	3	X				X				VOCs detected in soil vapor; Speciated chromium analyzed at DTSC request
	CS-SWMU13-07-10	10	X				X				VOCs detected in soil vapor; Speciated chromium analyzed at DTSC request
	CS-SWMU13-08-10	10	X				X				VOCs detected in soil vapor; Speciated chromium analyzed at DTSC request
	CS-SWMU13-09-10	10	X				X				VOCs detected in soil vapor; Speciated chromium analyzed at DTSC request
	CS-SWMU13-10-15	15	X				X				VOCs detected in soil vapor; Speciated chromium analyzed at DTSC request
SWMU16a	CS-SWMU16a-01-06	6					X				Cr RBC exceeded within SWMU16a; Speciated chromium analyzed at DTSC request
	CS-SWMU16a-02-03	3					X				Cr RBC exceeded within SWMU16a; Speciated chromium analyzed at DTSC request
SWMU18	CS-SWMU18-01-05	5						X			As RBC exceeded within SWMU18
	CS-SWMU18-02-03	3						X			As RBC exceeded within SWMU18
SWMU19a	CS-SWMU19a-01-02	2	X								VOCs detected in soil vapor
	CS-SWMU19a-02-02	2	X								VOCs detected in soil vapor
	CS-SWMU19a-03-15	15	X								VOCs detected in soil vapor
	CS-SWMU19a-04-25	25	X	X							VOCs detected in soil vapor; Pb RBC exceeded in SWMU19a-05
	CS-SWMU19a-05-15	15	X	X							VOCs detected in soil vapor; Pb RBC exceeded in SWMU19a-05
SWMU19b	CS-SWMU19b-01-03	3	X								VOCs detected in soil vapor
	CS-SWMU19b-02-03	3	X								VOCs detected in soil vapor
	CS-SWMU19b-03-05	5	X								VOCs detected in soil vapor
	CS-SWMU19b-04-05	5	X								VOCs detected in soil vapor
	CS-SWMU19b-05-03	3	X								VOCs detected in soil vapor

SWMU	Sample	Depth	Analysis								Rationale
			VOCs	Pb	Cu	Ni	Cr*	As	TPH	Form.	
	CS-SWMU19b-06-03	3	X								VOCs detected in soil vapor
	CS-SWMU19b-07-05	5	X								VOCs detected in soil vapor
	CS-SWMU19b-08-05	5	X								VOCs detected in soil vapor
	CS-SWMU19b-09-03	3	X								VOCs detected in soil vapor
	CS-SWMU19b-10-03	3	X								VOCs detected in soil vapor
	CS-SWMU19b-11-03	3	X								VOCs detected in soil vapor
SWMU20	CS-SWMU20-01-15	15	X								VOCs detected in soil vapor
	CS-SWMU20-02-15	15	X								VOCs detected in soil vapor
	CS-SWMU20-03-25	25	X								VOCs detected in soil vapor
	CS-SWMU20-04-20	20	X								VOCs detected in soil vapor
	CS-SWMU20-05-15	15	X								VOCs detected in soil vapor
	CS-SWMU20-06-25	25	X								VOCs detected in soil vapor
	CS-SWMU20-07-25	25	X								VOCs detected in soil vapor
	CS-SWMU20-08-15	15	X								VOCs detected in soil vapor
	CS-SWMU20-09-15	15	X								VOCs detected in soil vapor

* Speciated chromium reported as total chromium, hexavalent chromium (CrVI) and trivalent chromium (CrIII)

Exposure Area	Receptor	Cancer Risk	Non-Cancer Hazard	Blood Lead (ug/dl)	Significance	Cancer Risk Driver[a]	Non-Cancer Risk Driver[a]
Site-Wide	Resident	5.2×10^{-4} (outdoor) 8.4×10^{-4} (indoor) *1.4×10^{-3} (total)*	8.5 (outdoor) 673 (indoor) *682 (total)*	16.6 (adult) 55.1 (child)	Exceeds target(s) Exceeds target(s) *Exceeds target(s)*	Arsenic, chromium, 1,2-DCA, methylene chloride 1,1-DCA, 1,2-DCA, benzene, chloroform, methylene chloride, PCE, TCE, vinyl chloride Listed above	Arsenic, barium, copper, nickel, vanadium 1,1,1-TCA, 1,1-DCE, 1,2,4-trimethylbenzene, methylene chloride, toluene Listed above
	Commercial/ Industrial Worker	2.7×10^{-5} (outdoor) 2.9×10^{-4} (indoor) *3.2×10^{-4} (total)*	0.10 (outdoor) 205 (indoor) 205 (*total*)	3.4	Within risk management range Exceeds target(s) *Exceeds target(s)*	Arsenic 1,1-DCA, 1,2-DCA, benzene, chloroform, methylene chloride, PCE, TCE, vinyl chloride Listed above	-- 1,1-DCE Listed above
	Construction/ Excavation Worker	3.1×10^{-5} (outdoor) *3.1×10^{-5} (total)*	22 (outdoor) *22 (total)*	6.2	Exceeds target(s) *Exceeds target(s)*	Arsenic, chromium, nickel Listed above	Arsenic, barium, nickel Listed above
A	Resident	3.2×10^{-4} (outdoor) 2.4×10^{-5} (indoor) *3.4×10^{-4} (total)*	7.1 (outdoor) 34 (indoor) *41 (total)*	8.5 (adult) 24.5 (child)	Exceeds target(s) Exceeds target(s) *Exceeds target(s)*	Arsenic PCA, 1,1-DCA, methylene chloride Listed above	Arsenic, copper, nickel, vanadium 1,1-DCE Listed above
	Commercial/ Industrial Worker	3.3×10^{-5} (outdoor) 7.3×10^{-6} (indoor) *4.0×10^{-5} (total)*	0.47 (outdoor) 10 (indoor) *11 (total)*	3.5	Within risk management range Exceeds target(s) *Exceeds target(s)*	Arsenic PCA, 1,1-DCA, methylene chloride Listed above	-- 1,1-DCE Listed above

Exposure Area	Receptor	Cancer Risk	Non-Cancer Hazard	Blood Lead (ug/dl)	Significance	Cancer Risk Driver[a]	Non-Cancer Risk Driver[a]
	Construction/ Excavation Worker	2.3 x 10^{-5} (outdoor) *2.3 x 10^{-5} (total)*	21 (outdoor) *21 (total)*	3.9	Exceeds target(s) *Exceeds target(s)*	**Arsenic**, chromium, nickel Listed above	Barium, **nickel** Listed above
B	Resident	2.2 x 10^{-4} (outdoor) 6.9 x 10^{-4} (indoor) *9.2 x 10^{-4} (total)*	2.8 (outdoor) 672 (indoor) *675 (total)*	**13.4 (adult)** **43.0 (child)**	Exceeds target(s) Exceeds target(s) *Exceeds target(s)*	**Arsenic**, chromium, 1,2-DCA, methylene chloride 1,1-DCA, **1,2-DCA**, benzene, chloroform, **methylene chloride**, PCE, TCE, vinyl chloride Listed above	Arsenic, **barium**, copper, vanadium 1,1,1-TCA, **1,1-DCE**, methylene chloride, toluene Listed above
	Commercial/ Industrial Worker	2.9 x 10^{-5} (outdoor) 3.3 x 10^{-4} (indoor) *3.5 x 10^{-4} (total)*	0.10 (outdoor) 205 (indoor) *206 (total)*	3.4	Within risk management range Exceeds target(s) *Exceeds target(s)*	**Arsenic** 1,1-DCA, **1,2-DCA**, benzene, chloroform, **methylene chloride**, PCE, TCE, vinyl chloride Listed above	-- **1,1-DCE**, methylene chloride, toluene Listed above
	Construction/ Excavation Worker	1.6 x 10^{-5} (outdoor) *1.6 x 10^{-5} (total)*	3.1 (outdoor) *3.1 (total)*	5.3	Exceeds target(s) *Exceeds target(s)*	**Arsenic**, chromium Listed above	**Barium** Listed above
C	Resident	2.3 x 10^{-4} (outdoor) 2.8 x 10^{-8} (indoor) *2.3 x 10^{-4} (total)*	1.4 (outdoor) 0.01 (indoor) *1.4 (total)*	3.4 (adult) 4.8 (child)	Exceeds target(s) De minimus *Exceeds target(s)*	**Arsenic** -- Listed above	**Arsenic, vanadium** -- Listed above
	Commercial/ Industrial Worker	4.0 x 10^{-5} (outdoor) 1.3 x 10^{-8} (indoor) *4.0 x 10^{-5} (total)*	0.10 (outdoor) 0.004 (indoor) *0.10 (total)*	3.3	Within risk management range De minimus *Within risk management range*	**Arsenic** -- Listed above	-- -- --

Exposure Area	Receptor	Cancer Risk	Non-Cancer Hazard	Blood Lead (ug/dl)	Significance	Cancer Risk Driver[a]	Non-Cancer Risk Driver[a]
	Construction/ Excavation Worker	1.0×10^{-5} (outdoor) *1.0×10^{-5} (total)*	0.62 (outdoor) *0.62 (total)*	2.4	Within risk management range *Within risk management range*	Arsenic Listed above	-- --
D	Resident	5.1×10^{-4} (outdoor) 4.0×10^{-4} (indoor) *9.1×10^{-4} (total)*	2.7 (outdoor) 8.4 (indoor) *11 (total)*	4.3 (adult) 8.5 (child)	Exceeds target(s) Exceeds target(s) *Exceeds target(s)*	Arsenic 1,1-DCA, benzene, chloroform, methylene chloride, vinyl chloride Listed above	Arsenic, vanadium 1,1-DCE, 1,2,4-trimethylbenzene, methylene chloride Listed above
	Commercial/ Industrial Worker	3.2×10^{-5} (outdoor) 1.8×10^{-4} (indoor) *2.1×10^{-4} (total)*	0.07 (outdoor) 2.2 (indoor) *2.3 (total)*	3.3	Within risk management range Exceeds target(s) *Exceeds target(s)*	Arsenic 1,1-DCA, benzene, chloroform, methylene chloride, vinyl chloride Listed above	-- 1,1-DCE, methylene chloride Listed above
	Construction/ Excavation Worker	2.5×10^{-5} (outdoor) *2.5×10^{-5} (total)*	1.4 (outdoor) *1.4 (total)*	2.7	Exceeds target(s) *Exceeds target(s)*	Arsenic, cadmium Listed above	Arsenic Listed above
E	Resident	3.3×10^{-4} (outdoor) 4.3×10^{-4} (indoor) *7.6×10^{-4} (total)*	2.5 (outdoor) 94 (indoor) *96 (total)*	16.6 (adult) 55.1 (child)	Exceeds target(s) Exceeds target(s) *Exceeds target(s)*	Arsenic 1,1-DCA, 1,2-DCA, methylene chloride Listed above	Arsenic, copper 1,1-DCE, methylene chloride, toluene Listed above
	Commercial/ Industrial Worker	3.2×10^{-5} (outdoor) 1.0×10^{-4} (indoor) *1.3×10^{-4} (total)*	0.20 (outdoor) 28 (indoor) *28 (total)*	5.9	Within risk management range Exceeds target(s) *Exceeds target(s)*	Arsenic 1,1-DCA, 1,2-DCA, methylene chloride Listed above	-- 1,1-DCE, methylene chloride Listed above
	Construction/ Excavation Worker	1.4×10^{-5} (outdoor) *1.4×10^{-5} (total)*	1.5 (outdoor) *1.5 (total)*	6.2	Exceeds target(s) *Exceeds target(s)*	Arsenic Listed above	Arsenic Listed above

Exposure Area	Receptor	Cancer Risk	Non-Cancer Hazard	Blood Lead (ug/dl)	Significance	Cancer Risk Driver[a]	Non-Cancer Risk Driver[a]
F	Resident	1.4 x 10^{-6} (outdoor) 2.4 x 10^{-4} (indoor) *2.4 x 10^{-4} (total)*	1.3 (outdoor) 236 (indoor) *237 (total)*	3.5 (adult) 5.1 (child)	Exceeds target(s) Exceeds target(s) *Exceeds target(s)*	Chromium 1,1-DCA, benzene, chloroform, methylene chloride, PCE, TCE, vinyl chloride Listed above	Vanadium 1,1-DCE Listed above
	Commercial/ Industrial Worker	9.1 x 10^{-8} (outdoor) 4.8 x 10^{-5} (indoor) *4.8 x 10^{-5} (total)*	0.10 (outdoor) 72 (indoor) *72 (total)*	3.3	De minimus Exceeds target(s) *Exceeds target(s)*	-- 1,1-DCA, benzene, chloroform, methylene chloride, PCE, TCE, vinyl chloride Listed above	-- 1,1-DCE Listed above
	Construction/ Excavation Worker	6.9 x 10^{-6} (outdoor) *6.9 x 10^{-6} (total)*	1.2 (outdoor) *1.2 (total)*	2.4	Exceeds target(s) *Exceeds target(s)*	Chromium Listed above	Barium Listed above

APPENDIX F Updated Comparison of SWMU and AOC Results to RBCs

M E M O R A N D U M

TO: Thomas Ryan (URS-San Diego)

FROM: Bart Eklund (URS-Austin)

DATE: August 16, 2006

RE: Evaluation of Post-Remediation Vapor Intrusion for 1,1-DCE

This memorandum documents an evaluation of the potential for vapor intrusion (VI) of selected volatile organic compounds (VOCs) at the Toppan facility on Miramar Road in San Diego, CA. The evaluation addressed post-remediation VI; i.e., after contaminated soils have been excavated and replaced down to a depth of 6m or more.

Introduction

The site has been characterized and the results documented in a Facility Investigation Report (FIR)(URS, 2006). A baseline risk assessment (BRA) has been performed (URS, undated). Shallow soils at the site are contaminated with 1,1-dichloroethylene (1,1-DCE) and, to a lesser extent, other VOCs. Soil gas has appreciable levels of 1,1-DCE in both shallow and relatively deep soils. The contamination is largely confined to the eastern portion of the building. The depth to groundwater at this site is approximately 200 ft below ground surface (bgs) and it is believed that groundwater is not impacted. One option being considered is to remove contaminated soil and replace it with clean fill material.

Background

The US EPA provides spreadsheets that incorporate the Johnson & Ettinger (1991) model and use chemical-specific and site-specific information to estimate the risk from exposure to breathing indoor air contaminated from subsurface contamination. A user’s guide also is available (US EPA, 2003). EPA is in the process of revising the spreadsheets and user’s guide and a new version is expected in late 2006.

Fate and transport models, such as the Johnson & Ettinger (J&E) model, generally assume that an infinite source of contamination is present in the subsurface environment. In other words, the starting concentration in soil-gas, soil, or groundwater is assumed to remain constant over time. Estimates of average indoor air concentration are made for long averaging periods (e.g., 25 years) to evaluate typical total exposures.

It has long been recognized that for some scenarios, fate and transport models may predict more mass emitted than is originally present. Such scenarios are said to be mass limited. For example, the US EPA model for estimating VOC emissions during excavation (EPA, 1997) includes an equation for determining the total mass of contaminants in soil and the following guidance is given:

> *"As a sanity check, it should be demonstrated that any short-term emission rate estimates do not predict a greater mass of contamination being emitted over some time period than the total mass of contamination present in the soil."*

A mass limited approach has been suggested for vapor intrusion at sites with contaminated ground water (McHugh, et al., 2003) and at sites with contaminated groundwater or soil (Health Canada, 2004). In each case, a mass limited approach is presented to calculate an upper bound estimate for average long-term exposures.

Modeling Approach

A mass-limited approach was used to estimate the average long-term exposure to building users. Target compounds were selected and the total mass of each target compound in the subsurface soil and soil gas after remediation was estimated. This mass was assumed to enter the building over the 25-year averaging period for commercial exposures. The resulting average indoor air concentration was compared with California EPA health-based concentrations (i.e., the target concentration). The number of years the target concentration could be maintained within the building was calculated. If this was less than 25 years, VI at the site is mass limited. Additional details about the modeling approach are given below.

The Summary and Conclusions section of the BRA identifies 1,2-dichloroethane (1,2-DCA) and methylene chloride as the VOCs with the highest estimated site-wide cancer risk and 1,1-DCE at the VOC with the highest estimated site-wide non-cancer risk. The site characterization results were reviewed to identify the soil-gas and soil results for these compounds at depths of $\geq$20 ft bgs. Two other VOCs were found to have appreciable concentrations in these samples and were included in the evaluation: 1,1-dichloroethane (1,1-DCA) and 1,1,1-trichloroethane (1,1,1-TCA).

Soil-gas and soil data are given in Tables 5A and 5C of the FIR, respectively. The results also are plotted by depth in various figures in the FIR. The data indicate that the VOCs are present in small "hot spots" and individual VOCs in many locations at a given depth were not detected (ND). The maximum values for soil gas and soil at various depths are summarized in Tables 1 and 2 (all tables appear at the end of this memo).

1,1-DCE is present in the soil at concentrations up to 2 ppm (1 μg/kg = 1 ppm) and other target compounds generally are present in the soil at <0.1 ppm. 1,1-DCE is present in the soil gas at concentrations up to 33,000,000 $\mu g/m^3$ (1 μg/L = 1,000 $\mu g/m^3$) and other target compounds are present in the soil gas at <500,000 $\mu g/m^3$.

The soil-gas and soil data sets are reasonably consistent in that the measured soil gas concentrations are comparable within an order of magnitude to the soil gas concentrations predicted from the soils data. For example, the J&E model predicts a headspace concentration of 1,1-DCE about 5,000 μg/L above a soil concentration of 2,000 μg/kg and a headspace concentration of 1,1,1-TCA of 150 μg/L above a soil concentration of 100 μg/kg. Example calculations also can be found in Table 25 of the BRA.

All compounds are present at concentrations in soil and in soil-gas that are far below the saturated level, therefore no free product is believed to be present at these depths. The data for 1,1-DCE suggest that the maximum soil values may be biased low by less than one order of magnitude (i.e., the maximum soil value predicts a headspace soil-gas concentration that is less than the maximum value measured in the field).

The site characterization data are, of course, limited in number and it is possible that the various borings missed the area of maximum concentration at a given depth. To be conservative, the maximum value measured anywhere within a 10 ft deep soil layer was assumed to represent the average value for that soil layer. This is an extremely conservative assumption and likely biases the results high by at least two orders of magnitude compared to using an average concentration value for each soil layer.

The mass of contaminants present as soil gas in each soil layer was calculated using the values in Table 1 and an assumed air-filled porosity of 0.231. The mass of contaminants present in soil in each soil layer was calculated using the values in Table 2 and an assumed bulk density of 1.5. In both cases, the contamination was conservatively estimated to underlie 20% of the building footprint. The results of these calculations are summarized in Table 3. The calculations indicate that the majority of the mass of 1,1-DCE at depth is present as soil gas.

The remediation plan is still being developed and it is not known to what depth soil will be removed. The calculations were repeated for soil layers at depths ≥30 ft bgs and those results are summarized in Table 4. As shown in Table 4, it is estimated there will be <1 kg of each VOC left at the site after soil removal, with the exception of 1,1-DCE.

The building has a footprint of 125,000 ft^2 (11,600 m^2). The ventilation air flowing through the building is estimated to be 35,000 m^3/hr based on an assumed ceiling height of 3m and one air change per hour (ACH).

Results

The target concentrations used in this evaluation are shown in Table 5. Both cancer and non-cancer risk were evaluated, but the primary compound of interest (1,1-DCE) is not a carcinogen.

Results were calculated for assumed excavation depths of 20 ft (6 m) and 30 ft (9 m) and are shown in Table 6 in terms of years to deplete the entire subsurface mass if the target concentration is maintained within the building. All VOCs of interest were found to be mass limited for both scenarios.

For non-cancer risk, all VOCs except 1,1-DCE would be depleted within 0.1 years for either scenario: excavating to 6 m or excavating to 9 m. There is not enough mass of 1,1-DCE in the soil-gas beneath the site to exceed the relevant concentration of concern for indoor air of 70 μg/m^3. Based on very conservative assumptions, there is only enough mass of 1,1-DCE to maintain an indoor air concentration of 70 μg/m^3 for 7 years if soils are excavated to 6 m. In other words, for a 25-yr exposure, the average concentration would be <20 μg/m^3 (i.e., 7/25 of the 70 μg/m^3 target). If soils are excavated to 9 m, there is only enough mass of 1,1-DCE to maintain an indoor air concentration of 70 μg/m^3 for 4 years; i.e., the average concentration would be $\leq$11 μg/m^3.

Estimates for carcinogens also are included in Table 6. The results show that each carcinogen is mass limited and target concentrations could be maintained for, at most, 3 years.

Uncertainty

The estimates are uncertain. The uncertainty, however, is not equally distributed above and below the estimates. The input data are strongly biased towards worst-case values, so the estimates are biased towards worst-case. The "true" value should be no greater than the estimate and almost certainly is less than the estimate.

The site characterization data are limited to about a half dozen to a dozen borings depending on the depth being considered. As previously noted, to be conservative the maximum value measured anywhere within a 10 ft deep soil layer was assumed to represent the average value for that soil layer.

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Table 1. Summary of Maximum Soil-Gas Results for Selected VOCs

Soil Layer (ft bgs)	Maximum Soil-Gas Concentration (μg/L)				
	1,1,1-TCA	1,1-DCA	1,1-DCE	1,2-DCA	MeCl
20 - 29	200	65	26,000	16	480
30 - 39	470	89	33,000	9	150
40 - 49	76	83	20,000	3	11
50 - 59	--	43	7,000	--	--
60 - 69	--	--	3,600	--	--
70 - 79	--	--	1,800	--	--
80 - 89	--	--	--	--	--
90 - 99	--	--	80	--	--
100+	--	--	--	--	--

Table 2. Summary of Maximum Soil Results for Selected VOCs

Soil Layer (ft bgs)	Maximum Soil Concentration (μg/kg)				
	1,1,1-TCA	1,1-DCA	1,1-DCE	1,2-DCA	MeCl
20 - 29	93	35	2,200	38	1,100
30 - 39	3.40	12	130	20	70
40 - 49	--	--	32	--	--
50 - 59	--	--	1.60	--	--
60 - 69	--	--	--	--	--
70 - 79	--	--	--	--	--
80 - 89	--	--	--	--	--
90 - 99	--	--	--	--	--
100+	--	--	--	--	--

Table 3. Summary of Subsurface Mass $\geq$20 ft bgs for Selected VOCs

Media	Total Mass $\geq$20 ft bgs (Kg)				
	1,1,1-TCA	**1,1-DCA**	**1,1-DCE**	**1,2-DCA**	**MeCl**
Soil Gas	0.98	0.23	126.01	0.04	0.92
Soil	0.92	0.45	22.49	0.55	11.13
Sum	1.9	0.67	148	0.59	12

Assumptions: 140 ft x 160 ft area of contamination with average air-filled porosity of 0.231.

Table 4. Summary of Subsurface Mass $\geq$30 ft bgs for Selected VOCs

Media	Total Mass $\geq$30 ft bgs (Kg)				
	1,1,1-TCA	**1,1-DCA**	**1,1-DCE**	**1,2-DCA**	**MeCl**
Soil Gas	0.69	0.13	87.91	0.01	0.22
Soil	0.03	0.11	1.56	0.19	0.67
Sum	0.72	0.24	89	0.20	0.89

Assumptions: 140 ft x 160 ft area of contamination with average bulk density of 1.5.

Table 5. Target Indoor Air Concentrations for Selected VOCs

Parameter	Compound				
	1,1,1-TCA	**1,1-DCA**	**1,1-DCE**	**1,2-DCA**	**MeCl**
CAS #	71556	75343	75354	107062	75092
Chronic Inhalation REL (μg/m^3)	1,015*	490*	70	400	400
Inhalation Unit Risk (μg/m^3)$^{-1}$	NA	1.6E-06	NA	2.5E-05	1E-06
Indoor Concentration at 1E-06 risk level (μg/m^3)**	NA	8	NA	0.6	12

* Based on values from Table 55 of BRA. All values taken from Cal EPA website.
** Adjusted for industrial exposure of 40 hrs/wk, 50 wk/yr for 25 yrs.

Table 6. Results of VI Evaluation for Selected VOCs

Parameter	Years to Deplete Entire Subsurface Mass				
	1,1,1-TCA	**1,1-DCA**	**1,1-DCE**	**1,2-DCA**	**MeCl**
≥20 ft bgs					
Non-Cancer	<0.1	<0.1	7	<0.1	0.1
Cancer	NA	0.3	NA	3	3
≥30 ft bgs					
Non-Cancer	<0.1	<0.1	4	<0.1	<0.1
Cancer	NA	0.1	NA	1	0.2