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Santa Monica-Malibu Unified School District

Removal Action Workplan Malibu Middle and High School Campus Improvements Project

30215 Morning View Drive
Malibu, California

August 5, 2010

ARCADIS

August 5, 2010
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August 5, 2010
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Removal Action Workplan

Malibu Middle and High School –
Campus Improvements Project

Prepared for:
Santa Monica-Malibu Unified School District

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Certification

ARCADIS U.S., Inc. has prepared this Draft Removal Action Work Plan (RAW) on behalf of the Santa Monica-Malibu Unified School District in a manner consistent with the level of care and skill ordinarily exercised by professional geologists and environmental scientists. This RAW was prepared under the technical direction of the undersigned California Professional Geologist and Registered Environmental Assessor II.

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Date

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1. Introduction

This Removal Action Work Plan (RAW) has been prepared by ARCADIS U.S., Inc. (ARCADIS, formerly LFR an ARCADIS Company) on behalf of the Santa Monica-Malibu Unified School District (SMMUSD) for areas of pesticide- and polychlorinated biphenyl (PCB)-affected soils within the Malibu Middle and High School campus located at 30215 Morning View Drive, Malibu, California (Figures 1 and 2). Specifically, environmental assessment activities performed by ARCADIS (LFR 2009a, 2009c; ARCADIS 2010) have focused on 20 proposed improvement areas located within the boundaries of the Malibu Middle and High School campus (Figure 3). For the purposes of this RAW, the Site consists of one area of pesticide-affected soils and multiple areas of PCB-affected soils totaling approximately 1,200 cubic yards (yds^3) near and/or within improvement Areas 3 and 9 through 13 (Figure 3).

SMMUSD retained ARCADIS to prepare this RAW to document the methods to be used to remediate pesticide- and PCB-affected soils identified on the Site during the Preliminary Environmental Assessment (PEA) previously conducted by ARCADIS (ARCADIS 2010). This RAW has been prepared in a manner consistent with the technical procedures approved by the Department of Toxic Substances Control (DTSC).

Information on past Site uses and existing Site conditions was presented in the document titled “Phase I Environmental Site Assessment, Malibu Middle and High School Campus, 30215 Morning View Drive, Malibu, California” (Phase I ESA) dated October 1, 2009 (LFR 2009a).

Based on the information presented in the Phase I ESA, a surface soil sampling investigation was conducted to establish whether the recognized environmental conditions (RECs) identified in the Phase I ESA posed a significant threat to human health or the environment at the Site, and to evaluate the potential risk, if any, to human health or the environment. Initial laboratory soil sample analysis indicated the presence of pesticides and PCBs at the Site. PCBs were not originally considered to be an REC, based on the ESA review. Additional soil samples were collected and analyzed to determine the extent of pesticide- and PCB-affected soils. ARCADIS presented the results of the soil investigation and an associated human health risk screening evaluation in the document titled “Preliminary Environmental Assessment Report, Malibu Middle and High School, Campus Improvements Project, 30215 Morning View Drive, Malibu, California,” dated June 14, 2010. The PEA was prepared to satisfy typical DTSC requirements for the environmental assessment of the Site such that it can be redeveloped with new school facilities.

The human health risk screening evaluation performed by ARCADIS during the PEA indicated that pesticides and PCBs were present in shallow Site soils at concentrations that presented an unacceptable health risk.

This RAW was prepared using data collected during the environmental assessment, and identifies and evaluates viable remedial alternatives for the affected soil and the elimination of exposure pathways.

Previous work has provided sufficient data to support the removal action as proposed by this RAW. As with any real property, if previously unidentified contamination is discovered at the Site, additional soil assessment, investigation, and/or cleanup may be required by the DTSC.

The proposed removal action will be:

- effective in reducing the mobility of the affected soil
- effective in reducing levels of chemicals at the Site to levels consistent with DTSC requirements
- cost effective
- effective in reducing environmental liability at the Site.

1.1 Proposed Removal Action

This RAW presents the proposed technical approach for the remediation of soil at the Site, and includes an Engineering Evaluation/Cost Analysis (EE/CA). The approach is based on the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) removal process, and focuses on the physical removal and appropriate disposal of affected soil, and reducing the potential risks to human health to acceptable levels.

1.2 Remedial Action Objectives

Remedial action objectives (RAOs) are developed by evaluating the results of the Site characterizations, risk assessment, and applicable or relevant and appropriate requirements (ARARs). RAOs describe the remedial actions needed to protect human health, environmental quality, or both. They are generally narrative statements; however, they can also include specific, quantitative concentrations of chemicals to be achieved by the remedial alternative.

The RAOs for the Site are to abate, prevent, minimize, stabilize, mitigate, or eliminate the release or potential release of a hazardous substance that may result in a threat to the public and/or the environment. The overall remedial action goal for the Site is to obtain an unrestricted future land use designation by preventing human exposure to affected media containing chemicals of concern (COCs) at concentrations presenting unacceptable human health risks and hazards. COCs are compounds that have been identified in Site soil at concentrations that present a human health and/or ecological risk. Specific preliminary cleanup goals were identified to provide a health-protective concentration for each COC identified as a risk driver in the PEA.

2. Site Background

2.1 Site Location and Description

The overall project area for environmental assessment activities included 20 proposed improvement areas within the boundaries of the Malibu Middle and High School campus located at 30215 Morning View Drive, Malibu, California (Figure 3). Eight of these 20 areas were identified as having the potential to have been impacted from current or historic activities.

The following areas within the campus were defined as areas of concern due to the presence of RECs within or adjacent to their boundaries (see PEA Section 3 for a description of corresponding RECs):

- Areas 9, 10, 11, and 12 consist of (or are adjacent to) existing structures referred to as Buildings A, B, and E (REC #1).
- Areas 3 and 13 are currently developed as an open quad area for students (REC #1 and REC #2).
- Areas 14 and 15 consist of vehicle parking areas (REC #2 and REC #3).
- Septic system 1 collects wastewater from the buildings that contain the woodshop and photography laboratory and drains to the seepage pits (1-1, 1-2, 2-1, and 2-2) located in Area 15 (GeoConcepts 2009; REC #3).
- Septic system 3 collects wastewater from Building D where the chemistry laboratories and chemical storeroom are located. This septic system drains to a set of six seepage pits (3-1 thru 3-6) located adjacent to Area 9 (GeoConcepts ; REC #3).

For the purposes of this RAW, the Site consists of one area of pesticide-affected soils and multiple areas of PCB-affected soils totaling approximately 1,200 yds^3 near and/or within improvement Area 3 and Areas 9 through 13 (Figure 3).

2.1.1 Site Name and Address

Malibu Middle and High School is located 30215 Morning View Drive, Malibu, California.

2.1.2 Contact Persons, Mailing Addresses, and Telephone Numbers

Contact	Attention	Address	Telephone
Santa Monica-Malibu Unified School District	Stuart Sam Director of Facility Improvement Projects	1651 Sixteenth Street Santa Monica, California 90404	310.450.8338
Parsons	Tom Tomeoni/ Julia Hawkinson Program Manager/ Project Manager	12100 Wilshire, Suite 1950 Los Angeles, California 90025	310.447.7895/ 310.954.2268

2.1.3 Assessor's Parcel Numbers and Maps

According to the City of Malibu records, the approximately 72-acre Malibu Middle and High School Campus that incorporates the Site occupies Assessor's Parcel Numbers (APNs) 4469-017-900, 4469-017-901, 4469-017-902, and 4469-017-903.

A Site vicinity map, a Site plan, and a proposed campus improvements project scope map are provided as Figures 1, 2 and 3, respectively. Aerial photographs of the Site vicinity may be found in Appendix B of the Phase I ESA report (LFR 2009a).

2.1.4 Property Ownership

The Site is reportedly owned by the Santa Monica-Malibu Unified School District.

2.1.5 Township, Range, Section and Meridian

The approximate geographic coordinates of the Site are 34.02470 degrees north latitude and minus 118.8259 degrees west longitude, according to information obtained from Environmental Data Resources, Inc. (EDR) of Milford, Connecticut.

According to the United States Geological Survey (USGS) 7.5-Minute Series Topographic Map of the Point Dume, California, Quadrangle dated 1999, the Site was mapped for the Topanga Malibu Sequit survey of land grants and civil colonies; no township or range information was listed by the survey.

2.1.6 Identification and Database Numbers

ARCADIS conducted a record search for the Site as part of a Phase I ESA; the results of the records search were included in Appendix A of the Phase I ESA report. An environmental database report prepared by EDR was reviewed for local, state, and federal listings for properties within the site vicinity. The Site was not listed as having been assigned an USEPA identification number or a CalSites database number.

2.2 Operational History and Status

ARCADIS was initially retained by the SMMUSD to conduct a Phase I ESA screening of the Site. The purpose of this screening was to identify RECs at the Site to the extent feasible pursuant to the processes prescribed in the American Society for Testing and Materials (ASTM) "Standard Practice for Environmental Site Assessments: Phase I ESA Process" (ASTM Designation E 1527 05) and the California Education Code. Background information obtained during the Phase I ESA screening indicated the need for additional investigations; therefore, ARCADIS conducted a full Phase I ESA for the Site, and background information was presented in the Phase I ESA report (LFR 2009a).

According to the Phase I ESA review of historical topographic maps, aerial photographs, and historical city directories, the Site and vicinity were undeveloped land from at least as early as 1903 until 1947. Scattered residential development in the Site vicinity was first apparent in 1951. The Site was depicted as mostly undeveloped land in the 1952 aerial photograph. The Site was depicted as improved with school buildings in the 1965 aerial photograph, with residences shown in the Site vicinity. The 1952 aerial photograph depicted limited agricultural use for dry land farming in the central portion of the Site. Additional school buildings were depicted in the 1976 aerial photograph. The Site was developed to the current configuration by 1990. Malibu High School was first listed at the current Site address in the 1991 city directory.

2.3 Topography

According to the USGS 7.5-Minute Series Topographic Map of the Point Dume, California, Quadrangle (1999), the Site is located at an elevation of approximately 147 feet above mean sea level (msl). The topography of the surrounding area is generally flat with a gradual slope to the south-southwest.

2.4 Geology and Hydrogeology

2.4.1 Site Geology and Soil Types

The geology of the Site is identified as part of the Miocene Series of the Tertiary System of the Cenozoic Era. According to the United States Department of Agriculture (USDA) Soil Conservation Service (SCS), the Site is underlain by a Millsholm loam soil. This soil type is described as clayey with very slow infiltration rates and intermediate water holding capacity.

Based on lithologic information from soil borings advanced at the Site, surface soils consist of approximately eight feet of moist sandy clays. The surface soils are underlain by moist clayey sand from approximately

8 feet to 15 feet below ground surface (bgs). Representative boring logs were included as Appendix C of the PEA.

2.4.2 Site Hydrogeologic Setting

The natural surface drainage in the Site vicinity is southwest, toward the Pacific Ocean. The Pacific Ocean is located approximately 0.5 mile southwest of the Site. Two ephemeral drainages are also located adjacent to the Malibu Middle and High School campus, one along the northwest boundary of the Site and one south-southeast of the campus.

The Site is located within the Malibu Valley Basin. Groundwater in the Malibu Valley Basin is found in Holocene alluvium comprised of clays, silts, sands, and gravels that range in thickness from 90 to 140 feet (California Groundwater Bulletin 2003). Four groundwater monitoring wells were installed on the property following removal of the former underground storage tanks (USTs). Depth to water in these wells ranged from approximately 27.6 to 38.7 feet bgs from May 1995 and July 1996, with a groundwater gradient to the south.

2.5 Surrounding Land Use and Sensitive Ecosystems

2.5.1 Surrounding Land Use

The Site vicinity consists of rural residential and recreational properties. The Malibu Middle and High School campus is bordered to the south by Morning View Drive, followed by residences; to the west by Cabrillo Elementary School and Via Cabrillo Street, followed by residences; to the north by residences; and to the east by Merritt Drive, followed by residences and recreational properties.

2.5.2 Sensitive Ecosystems

The Site is defined as portions of the greater Malibu Middle and High School campus; thus the Site is immediately surrounded by the campus itself. The land-use surrounding the campus is best described as rural-residential. Ecological resources are not present on the Site; however, an ecologically sensitive habitat area exists in the vicinity of the campus. The potential ecological exposure pathway from the chemicals of concern in Site soils is via surface water runoff. Although one portion of the defined Site, Parking Lot A, discharges stormwater into a stream course located at the west end of the adjacent Juan Cabrillo Middle School campus, affected soils were not identified in this portion of the Site. Affected surface soils identified within the course of this investigation are located within Areas 3, 9, 10, 12, and 13. Surface water runoff from these areas is transported offsite via stormwater drains and as surface runoff along curbs and gutters to the Pacific Ocean, and thus is not hydrologically connected to the ecologically sensitive habitat area. As such, a detailed ecological screening evaluation of the Site is not required.

The natural surface drainage in the Site vicinity is southwest, toward the Pacific Ocean. The Pacific Ocean is located approximately 0.5 mile southwest of the Site. The compounds detected in Site soils would not be likely to affect ecological resources in the Pacific Ocean due to the limited extent of affected soils and the distance from the Site to the ocean.

2.6 Site Climatological Setting

The Site is located within California Climate Zone 9. Average high temperatures in January and July at the Santa Monica Pier are 64 degrees Fahrenheit (ºF) and 71ºF, respectively. Average low temperatures in January and July are 49ºF and 61ºF, respectively. The majority of the area's precipitation occurs in the winter, with an average rainfall of 12.91 inches per year (WRCC 2009).

2.7 Regional Radon and Asbestos Information

2.7.1 Regional Radon Information

Radon is a naturally occurring, colorless, odorless, tasteless gas produced by the radioactive decay of the element uranium. Radon decays into a number of daughter elements, including polonium, bismuth, and lead. Polonium is of special concern because it causes damage to lung tissue, which can result in lung cancer. Radioactivity is commonly measured in picoCuries per liter (pCi/l).

The radon potential for an area is dependent on the subsurface geology, including such factors as the amount of uranium in the underlying soil and bedrock, the presence of clays and silts which can act as barriers, the presence of shallow groundwater, and the amount of radon released during the decay process (Otton et al. 1993). The speed at which radon moves through soil is controlled by the amount of water present in the pore space (the soil moisture content), the percentage of pore space in the soil (the porosity), and the "interconnectiveness" of the pore spaces (the permeability). Radon moves more readily through permeable soils, such as coarse sand and gravel, than through impermeable soils, such as clays. Radon moves more quickly through soils and rock that are fractured than through competent material, and more slowly through water than through air.

According to the U.S. Environmental Protection Agency (USEPA) Map of Radon Zones, Los Angeles County is located in Radon Zone 2, Moderate Potential, with an indoor average radon level that is >2 and <4 pCi/L of air. Additionally, the Site is not located in an area reported by the California Department of Health Services (DHS) as being at high risk for radon gas. According to a DHS study (DHS 2007), radon was detected above 4 pCi/L of air in 9 of the 69 tests performed within the Site vicinity (zip code 90265). The USEPA considers radon to be unhealthful at levels of 4.0 pCi/L of air or greater. Therefore, the potential for elevated radon levels at the Site appears to be low to moderate.

2.7.2 Vicinity Review of Naturally Occurring Asbestos

Natural occurring asbestos (NOA) deposits, which are located in many parts of California, are commonly associated with serpentine and can be either asbestiform (fibrous) or non-asbestiform (platy). Chrysotile, crocidolite, amosite, tremolite, actinolite, and anthophyllite are the principal forms of asbestos. Chrysotile breaks into curly fibers, while the remaining types tend to have a thin, needle-like appearance.

Serpentinite is rock composed almost entirely of serpentine and is the most common host rock for chrysotile. Generally, chrysotile and amphibole asbestos varieties occur in areas where the original rock has metamorphosed under elevated temperatures and pressures. Serpentinite and its parent material, ultramafic rock, are abundant in California's Coast Ranges. Typically, the asbestos content of these rocks ranges from less than 1 percent to about 25 percent, with higher concentrations sometimes found.

Disturbance of asbestos-containing rock and soil can result in a release of asbestos fibers to the air. This disturbance can be caused by driving over roads or driveways surfaced with these materials, construction activities (ripping of outcrops and bedrock), and/or weathering and erosion processes. Once released into the air, asbestos fibers are relatively stable and can remain airborne for long periods of time.

Asbestos fibers that have become airborne can be inhaled deep into the lungs, where they can remain for extended periods of time or be translocated to other parts of the body. If inhaled, asbestos fibers can result in health problems. The potential for developing health problems from asbestos exposure depends on the length and intensity of the exposure. Asbestos is classified as a known human carcinogen by state and federal agencies. Diseases related to asbestos exposure include asbestosis, lung cancer, and mesothelioma.

The closest mapped rock outcrops that are likely to contain NOA are located approximately 65 to 80 miles northwest of the Site in Santa Barbara County (DOC 2000; USGS 1969).

Based on the maps reviewed, outcrops of NOA rocks are well beyond the 10 mile distance criterion defined in the DTSC document titled "Interim Guidance, Naturally Occurring Asbestos (NOA) at School Sites" (DTSC 2004).

It should be noted that certain rocks, which sometimes have associated asbestos when metamorphosed, are shown within 10 miles of the Site on the *Geologic Map of the Topanga and Canoga Park (South ½) Quadrangle* (Dibblee 1992). However, these rocks are described as intrusive dikes and sills, and are not indicated as metamorphosed. Due to the lack of metamorphism, these rocks have a low probability of associated asbestos.

Based on these observations, the potential for NOA to be present on the Site is considered low.

2.8 Previous Site Actions

The objectives of this RAW were developed based on the results of the Phase I ESA (LFR 2009a) and subsequent PEA soil and soil-gas investigation (ARCADIS 2010).

2.8.1 PEA Soil and Soil-Gas Investigation

The soil and soil-gas investigation was performed in accordance DTSC guidance documents. A brief summary of the soil and soil-gas investigation and results is presented below.

2.8.1.1 Soil and Soil-Gas Sampling and Analysis Program

Based on the information obtained during the Phase I ESA, a sampling program was developed to address the RECs which may have impacted soils at the Site. The issues identified in the Phase I ESA were associated with concerns of potential use of lead-based paint (LBP) and termiticides, the potential presence of volatile organic compounds (VOCs) due to a former leaking underground storage tank (LUST) and the potential presence of altered levels of pH, metals, or VOCs due to possible releases of hazardous materials from laboratories and shops to the septic system. An additional issue was identified during the laboratory analysis of the original soil samples: elevated PCB levels in Site soils.

Soil and soil-gas sampling were conducted under the supervision of a California Professional Geologist, following ARCADIS sampling protocols (included as Appendix A of the PEA).

Soil sampling to address LBP, organochlorine termiticides, and PCBs followed the DTSC's "Interim Guidance, Evaluation of School Sites with Potential Soil Contamination as a Result of Lead from Lead-based Paint, Organochlorinated Pesticides from Termiticides, and Polychlorinated Biphenyls from Electrical Transformers" dated September 2006.

Soil samples were collected at various depths from the percolation zone of seepage pits associated with the septic system and analyzed for metals and pH. One sample location was added during fieldwork to investigate possible seepage from a previously unidentified collection tank for science laboratory wastewater in Area 13. Background soil samples were also collected and analyzed for metals and pH.

Shallow soil samples were collected and analyzed for lead and pesticides. During laboratory analysis of the soil samples for pesticides, the laboratory detected compound interference, possibly from PCBs in the samples. Shallow samples were subsequently analyzed for PCBs.

Following analysis of the first round of soil samples, which identified elevated concentrations of pesticides, lead, and PCBs, step-out soil samples were collected to delineate the extent of affected soils.

Soil vapor sampling was conducted in accordance with the most recent version (February 1997) of the Regional Water Quality Control Board's (RWQCB) "Interim Guidance for Active Soil Gas Investigations, Well Investigations and Program Procedures," as well as DTSC's January 2003 "Advisory – Active Soil-Gas Investigations." Soil vapor samples were collected at 5 and 10 feet bgs in the vicinity of seepage pits and near or downgradient from the former UST area to address potential releases of hazardous materials. The soil vapor samples were analyzed for VOCs by an onsite mobile laboratory.

2.8.1.2 Analytical Results

Tables 1 through 4 in the PEA report (ARCADIS 2010) present the analytical methods for the samples collected during the soil and soil vapor investigation and the analytical results for those samples (see Appendix B of this RAW). Figures showing the sample locations and the analytical results are presented in Appendix A of this RAW (Figures 4 through 7).

Metals and pH

Various metals were detected in both background soil samples and percolation zone soil samples (arsenic, barium, cadmium, chromium, cobalt, copper, lead, molybdenum, nickel, vanadium, and zinc; Appendix B). The concentrations of metals observed in percolation zone samples were generally comparable to those measured in background samples and were not indicative of hazardous materials releases. The maximum concentrations of most metals detected at the Site were below California Human Health Screening Levels (CHHSLs) for residential settings, indicating that the concentrations of most metals at the Site do not present a health concern, with the following exceptions:

- The maximum concentration of copper and zinc were both at least six times higher than the maximum concentration detected in background samples. However, maximum concentrations of copper and zinc were well below established CHHSLs and do not present a health concern.

- Arsenic and cadmium were detected at concentrations that exceeded established CHHSLs in both percolation zone samples and background samples. Arsenic and cadmium represent special cases in that both have relatively high natural background levels in California soils. Ninety-five percent upper confidence levels (95% UCL) of the detected concentrations at the Site for arsenic (8.93 milligrams per kilogram [mg/kg]) and cadmium (3.15 mg/kg) were comparable to the highest background concentrations (10.6 mg/kg arsenic and 4.77 mg/kg cadmium), suggesting that these concentrations are indicative of background. As such, the observed concentrations of arsenic and cadmium are not likely indicative of hazardous materials releases and do not represent a health concern; thus, no additional analysis or sampling activities were performed for arsenic or cadmium.

- Lead was detected in sample SS-PERC-9-10 at a concentration of 304 mg/kg, which exceeded the CHHSL of 80 mg/kg. This sample was collected from a depth of 10 feet bgs to screen for potential impacts in the percolation zone of a laboratory wastewater tank in Area 13. The elevated concentration of lead at 10 feet bgs does not necessarily pose a health risk due to lack of a complete exposure pathway at that depth; however, due to the exceedance of the CHHSL, additional investigation was conducted to assess if affected soils were present at shallower depths and could potentially be a health risk. LeadSpread was used to evaluate the potential risk and hazard to a future potential receptor. The results were presented in Section 6 of the PEA.

- Lead concentrations were below the CHHSL in all other soil samples collected throughout the Site.

The pH measured in the background samples ranged from 7.6 pH units to 7.7 pH units. In the percolation zone samples, pH measurements ranged from 7.0 pH units to 8.7 pH units. Soil samples were collected from the percolation zone of seepage pits in two areas and analyzed for pH to screen for possible modified pH impacts from hazardous materials releases over time. Although the range measured for the percolation zone samples was greater than that measured in the background samples, the measured range was not considered indicative of significantly modified pH.

<u>Pesticides</u>

Analyses for pesticides resulted in detectable concentrations of 4,4’-dichlorodiphenyltrichloroethylene (4,4’-DDE), 4,4’-dichlorodiphenyltrichloroethane (4,4’-DDT), alpha-chlordane, gamma-chlordane, and technical chlordane at the following maximum concentrations:

- 4,4’-DDE (361 micrograms per kilogram [µg/kg])

- 4,4’-DDT (46.7 µg/kg)

- alpha-chlordane (683 µg/kg)

- gamma-chlordane (305 µg/kg)

- technical chlordane (1,910 µg/kg).

The concentrations of alpha-chlordane and technical chlordane in sample SS-STRUCTURE-7 exceeded their respective residential CHHSLs, thus step-out samples were collected on a follow-up visit. Analyses for pesticides in the step-out samples resulted in detectable concentration of alpha-chlordane, gamma-chlordane, and technical chlordane at the following maximum concentrations:

- alpha-chlordane (21.2 µg/kg)
- gamma-chlordane (15.3 µg/kg)
- technical chlordane (155 µg/kg).

PCBs

Analyses for PCBS resulted in detectable concentrations of Aroclor 1254 in 13 of the original SS-STRUCTURE samples at the following maximum concentration:

- Aroclor 1254 (1,040 µg/kg).

Concentrations of Aroclor 1254 exceeded the residential CHHSL in multiple soil samples, thus step-out samples were collected on a follow-up visit. Analyses for PCBs in the step-out samples resulted in detectable concentrations of Aroclor 1254 in 10 of the step-out soil samples at the following maximum concentration:

- Aroclor 1254 (1,420 µg/kg).

VOCs

Analysis for VOCs resulted in detections of benzene and toluene. Benzene was detected in sample SV-1 at 5 feet bgs (0.1 µg/L) and in sample SV-9 at 10 feet bgs (0.16 µg/L). Toluene was detected in four samples, all at 10 feet bgs, at concentrations ranging from 1.1 µg/L to 4.3 µg/L. The maximum concentration of benzene detected at the Site exceeded the residential CHHSL.

2.8.1.3 Human Health Screening Evaluation

In accordance with the PEA Guidance Manual (DTSC 1999), a screening-level evaluation was conducted to provide an estimate of the potential chronic (long-term) human health risks that may be associated with soil at the Site. A detailed discussion of the Human Health Screening Evaluation is presented in Section 4, and the results of the evaluation are summarized within this section to provide the rationale for the RAW.

Analytical data from the PEA sampling events were used for this evaluation. The risk evaluation process included assessing exposure and toxicity, considering the maximum concentration of each selected constituent of potential concern (COPC) and quantifying estimates of potential health risks, assuming residential conditions. Consistent with DTSC and USEPA risk assessment policy, the potential for exposures to produce carcinogenic and non-carcinogenic health effects were both characterized. The following sections summarize the findings of the risk evaluation.

The data from the soil and soil-gas investigation were evaluated considering maximum detected concentrations in soil. Each detected chemical was initially considered for the human health screening-level evaluation.

Carcinogenic Effects

An estimate of the potential excess incremental cancer risk associated with exposure to a carcinogen (i.e., the incremental probability that an individual will develop cancer over the course of a lifetime) is obtained by multiplying the estimated chronic daily intake of the carcinogen by the chemical-specific cancer slope factor (CSF) for the appropriate exposure route. The estimated excess cancer risks for each chemical and exposure route are then summed to estimate the total excess cancer risk for the exposed individual.

4,4'-DDE, 4,4'-DDT, alpha-chlordane, gamma-chlordane, technical-chlordane, Aroclor 1254, and benzene were identified as carcinogens in Site soils and soil vapors. Ingestion, inhalation, and dermal contact pathways from shallow soils and soil vapors at the Site were considered. The estimated cancer risk for the carcinogenic compounds using the maximum concentrations collected during the PEA is 2×10^{-5}, which is above the cancer risk target risk management range for school sites of 5×10^{-6} (Table 8 of the PEA report [ARCADIS 2010; Appendix C]). One of the PCBs (Aroclor 1254) was the primary contributor (53%) to the overall carcinogenic risk. Organochlorine pesticides cumulatively contributed 42% to the overall carcinogenic risk. Alpha-chlordane and technical-chlordane were the secondary contributors (9.5% and 27%, respectively) to the overall carcinogenic risk.

The contributions of benzene and toluene detected in soil gas to the total estimated risk and hazard were below the level of concern. Therefore, the presence of benzene and toluene in the soil vapor does not appear to pose a vapor intrusion health risk.

Non-carcinogenic Effects

To assess the non-carcinogenic effects of chemicals, the estimated chronic daily intake of a chemical is divided by the oral or inhalation reference doses (RfDs). The resulting ratio, referred to as the Hazard Quotient (HQ), is an estimate of the likelihood that non-carcinogenic effects will occur as a result of that specific chemical exposure. An HQ less than or equal to 1 indicates that the predicted exposure to that chemical should not result in an adverse non-carcinogenic health effects (USEPA 1989). Consistent with DTSC risk assessment guidance, the chemical-specific HQs are added together to provide the Hazard Index (HI). A total multi-chemical, multi-pathway HI of less than or equal to 1 indicates that potential non-cancer health effects are not likely to occur.

The noncarcinogenic health hazard estimate for COPCs was also evaluated for inhalation and ingestion/ dermal pathways from shallow soil at the Site. As shown in Table 9 of the PEA report (ARCADIS 2010; Appendix C), the HI for noncarcinogenic effects using the maximum detected concentration collected during the PEA sampling activities is 2, which is above the HI of 1.0. Aroclor 1254 is the primary contributor (94.9%) to the overall HI, and pesticides (alpha-chlordane and technical chlordane) are the secondary contributors (4.2% in sum) to the overall HI.

<u>Lead Evaluation</u>

Blood-lead level calculations were performed using the DTSC's LeadSpread Model (Version 7.0) using the 95% UCL value for the Site (38.17 micrograms per gram [µg/g] in soil). These results are presented in Table 12. This pathway also includes direct exposure to lead-affected soil via the ingestion and dermal pathways, and indirect exposure via inhalation of lead-affected aerosols. According to ARCADIS calculations, the 99th percentile blood-lead levels for adults and children are 3.7 and 5.9 micrograms per deciliter (µg/dl), respectively, which are both below the 10 µg/dl criteria. This indicates that concentrations of lead detected at the Site likely do not present a health concern to the child receptor under residential exposure conditions.

2.8.1.4 PEA Conclusions

The following conclusions were based on the information obtained during ARCADIS' soil and soil-gas investigation activities as described in the PEA (ARCADIS 2010):

- In summary, using maximum concentrations of COPCs detected during the PEA, the total estimated cancer risk is 2×10^{-5} and the total HI is 2. PCBs are the primary contributor to the risk and hazard, and pesticides are the secondary contributors to the risk and hazard. The extent of PCB- and pesticide-affected soils has been identified and is estimated to be approximately 1,200 yd^3[1]. Soil removal activities are proposed to excavate the affected soils.

- Lead concentrations are within acceptable health ranges.

- Based on the results of the risk assessment, there does not appear to be a significant threat to public health or the environment with regard to COPCs following the removal activity (subject to appropriate

[1] Please note that volume reported in the PEA was a total of 1,017 yd^3 (995 yd^3 of PCB-affected soils and 22 yd^3 of pesticide-affected soils). Since the PEA was issued, and in preparation for the RAW, the boundaries of the PCB excavation were adjusted slightly, with the resulting total yardage estimate now at 1,200 yd^3.

confirmation sampling indicating that elevated concentrations of pesticides and PCBs are no longer present).

3. Nature, Source, and Extent of Contaminants in Soil

The data collected during the Site investigation indicate that soil affected with pesticides and PCBs is present on the Site. Information on the nature, source, and extent of contaminants is presented in the following sections.

3.1 Type, Source and Location of Contaminants

The results of the soil investigation revealed pesticides and PCBs above acceptable concentrations.

PCBs were identified in proximity to some of the building structures in Areas 3, 9, 10, 12, and 13, specifically, as indicated by Excavation Areas #1 through #8 on Figure 3a. The source of PCBs in this area is not known, as transformers or other activities potentially associated with PCBs are not known to have been associated with this area. Three potential origins include the use of PCB-contaminated import material, potential use of PCB-containing paint on nearby structures (as some historic paints are reported to have contained PCBs), or potential historic use of PCB-containing caulking/sealing materials on nearby structures (as caulking/sealing materials have been reported to have historically contained PCBs); however, all of these potential sources are speculative. Fill materials are a questionable source, as one might expect a more even distribution of PCBs in the subsurface materials and possibly existence in the quad area, although the results of testing to date identify the PCBs, where present, in near proximity to buildings. Building materials are also a questionable source, and it is noted that not all soil samples collected in the vicinity of and/or adjacent to buildings contained detectable concentrations of PCBs. Building materials have not been tested for the presence of PCBs.

According to the Agency for Toxic Substance and Disease Registry (ATSDR), PCBs were historically used both for nominally closed applications (e.g., capacitors and transformers, heat transfer, hydraulic fluids) and in open-ended applications (e.g., flame retardants, inks, adhesives, microencapsulation of dyes for carbonless duplicating paper, paints, pesticide extenders, plasticizers, slide-mounting mediums for microscopes, surface coatings, wire insulators, metal coatings). Pesticide extenders are not believed to be a source of PCBs at this Site, as pesticides were not detected in the primary location where the PCBs were encountered. To reiterate, the source of the PCBs has not been identified.

The pesticides were identified in the vicinity of Building 10 (Figure 2), specifically, as indicated by Excavation Area #9 on Figure 3b. The source of pesticides in this area is not known; however, the soil sample was collected adjacent to a tree stump that may have been treated with pesticides.

3.2 Extent and Volume of Contamination

The extent and volume of affected soils, as discussed below, are based on data collected during the PEA investigation. Based on analytical data for the soil samples collected during the PEA soil and soil-gas investigation, alpha-chlordane, gamma-chlordane, and technical chlordane were detected in Site soils at concentrations above the residential CHHSL of 430 µg/kg, and Aroclor-1254 (PCB) was detected in Site soils at concentrations above the residential CHHSL of 89 µg/kg (PEA, Appendix A, Figures 5 and 6).

Figures 3a and 3b present the areas of the Site to be excavated during implementation of the RAW. The total estimated volume of affected soil to be removed is 1,200 yd^3.

3.2.1 Extent of Affected Soils

3.2.1.1 Pesticide-Affected Soil

The area of pesticide-affected soils is depicted on Figure 3b. Concentrations of alpha-chlordane, gamma-chlordane, and technical chlordane above 430 µg/kg (the preliminary cleanup goal [PCG] for pesticides) were detected in shallow soil samples collected at the Site.

The lateral extent of pesticide-affected soil is defined by analytical results from soil sample locations SS-S0-18, SS-SO-19, and SS-SO-20. The pesticide-affected soil was found to be confined to an area approximately 20 feet long by 10 feet wide.

The vertical extent of pesticide-affected soil appears to be limited to the upper 3 feet, based on the pesticide concentration in soil sample SS-STRUCTURE-7-2.0’. It is noted that a deeper sample could not be collected at this location due to the presence of rock or other solid material just below the base of the 2 foot sample. As such, the excavation of soils to 3 feet is presumed to be the vertical extent of affected soils.

3.2.1.2 PCB-Affected Soils

The distribution of PCB-affected soils across the Site is shown on PEA Figure 6 (see Appendix A) with the area of PCB-affected soils depicted on Figure 3a. PCB concentrations above 89 µg/kg (the PCG for PCBs) were detected in shallow soil samples collected at the Site.

Soils with PCB concentrations above 89 µg/kg were identified at multiple boring locations at depths of approximately 0.5 and 2 feet bgs. The areal limits of PCB-affected soils are distributed in multiple areas across the Site, as shown on Figure 3b; in sum, the areas total approximately 16,000 square feet. PCB-affected soils do not appear to extend very far below the surface. Removal to a depth of 2 feet bgs is recommended to remove the PCB-affected soils.

3.2.2 Volume of Affected Soils

ARCADIS estimated volumes of affected soils for both pesticide-affected soil and PCB-affected soils as presented in the sections below. Confirmation soil samples will be collected following soil removal activities. In the event that concentrations of COCs exceeding the PCGs are identified in confirmation soil samples collected following the planned excavation activities, additional soil will be removed and confirmation samples will be collected from the removal area.

3.2.2.1 Pesticide-Affected Soil

ARCADIS estimates that approximately 22 yd^3 of pesticide-affected soil is present at the Site in a single area. The pesticide-affected area is approximately 200 square feet to a depth of 3 feet.

3.2.2.2 PCB-Affected Soils

ARCADIS estimates that a total of approximately 1,180 yd^3 of PCB-affected soils is present at the Site through eight excavation areas. The extent of PCB-affected areas total approximately 16,000 square feet to a depth of 2 feet.

3.3 Health Effect of Contaminants

Health effects of COCs identified on the Site are presented in Table 1.

3.4 Targets Potentially Affected by the Site

The conceptual site model (CSM) for the Site identifies the receptors that may come into contact with affected soil and dust and indicates potential exposure pathways. The CSM was based on the following conditions and assumptions:

- PCBs (Aroclor-1254) and pesticides (alpha-chlordane, gamma-chlordane, and technical chlordane) are the COPCs at the Site.

- Residential exposure conditions were assumed, per DTSC guidance (DTSC 1999); this is the most sensitive exposure scenario used to characterize properties without land restrictions.

- Exposure to soils during and following implementation of this RAW considered ingestion, inhalation, and dermal contact pathways from shallow soils at the Site.

- During implementation of this RAW, receptors will be Site workers.

- Following re-development of the Site, receptors will be students, faculty, administrative staff, maintenance workers, and janitorial workers.

As described in Section 7, methods to reduce exposures will be employed during work at the Site.

4. Risk Evaluation and Preliminary Cleanup Goals

In accordance with the National Oil and Hazardous Substances Pollution Contingency Plan (NCP), the following threats must be considered in evaluating the appropriateness of a non-time-critical removal action under 40 Code of Federal Regulations (CFR) Section 300.415(b)(2):

- actual or potential exposure to nearby human populations, animals or the food chain from hazardous substances, pollutants or contaminants
- actual or potential contamination of drinking water supplies or sensitive ecosystems
- hazardous substances, pollutants or contaminants in drums, barrels, tanks, or other bulk storage containers that may pose a threat of release
- high levels of hazardous substances, pollutants or contaminants in soils largely at or near the surface, which may migrate
- weather conditions that may cause hazardous substance, pollutants, or contaminants to migrate or be released
- threat of fire or explosion
- the availability of other appropriate federal or state response mechanisms to respond to the release
- other situations or factors that may pose threats to public health, welfare or the environment.

The first item primarily applies to current conditions at the area of impact. Pesticides and PCBs in surface and shallow soils pose potential health risks through several exposure pathways, including inadvertent ingestion of soil, dermal contact with soil, and inhalation of airborne particulates.

As the contaminants have been in the soils for an undetermined yet likely substantial period of time, the distribution of contaminants appears to be stable due to their characteristics toward immobility in the soil with no apparent sources(s) increasing the discharges. Their presence does not provide an imminent danger to students or staff. Now that the issue has been identified, it is in the District's interest to address these chemicals as soon as is practical, while in the meantime preventing disturbance to and/or contact with surface soils in the affected areas.

4.1 Risk Evaluation

A human health risk screening was performed as part of the PEA considering removal of the affected soils. Both carcinogenic and non-carcinogenic risks were estimated using the methodology presented in the PEA Guidance Manual (DTSC 1999). The purpose of the Human Health Screening Evaluation was to evaluate whether historical activities at the Site have resulted in releases of chemicals that could adversely affect the health of school children and/or adult school staff (including teachers, administrators, janitors, and landscapers) who will be present at the proposed school site.

4.1.1 Carcinogenic Risks

4.1.1.1 Using All Site Data – Current Conditions

4,4'-DDE, 4,4'-DDT, alpha-chlordane, gamma-chlordane, technical-chlordane, Aroclor 1254, and benzene were identified as carcinogens in site soils and soil vapors. Ingestion, inhalation, and dermal contact pathways from shallow soils and soil vapors at the Site were considered. As shown in Table 8 of the PEA (Appendix B), the estimated cancer risk for the carcinogenic compounds using the maximum concentrations collected during the PEA is 2×10^{-5}, which is above 1×10^{-6}, the cancer risk target for school sites.

One of the PCBs (Aroclor 1254) is the primary contributor (53%) to the overall carcinogenic risk. Organochlorine pesticides cumulatively contributed 42% to the overall carcinogenic risk. Alpha-chlordane and technical-chlordane were the secondary contributors (9.5% and 27%, respectively) to the overall carcinogenic risk.

The contributions of benzene and toluene detected in soil gas to the total estimated risk and hazard was below the level of concern. Therefore, the presence of benzene and toluene in the soil vapor does not appear to pose a vapor intrusion health risk.

4.1.1.2 Upon Completion of Proposed Removal Activity

The extents of pesticide- and PCB-affected soils have been identified, and soil removal activities are proposed. The proposed removal activities would involve excavation of all soils associated with those samples identified via red italic font in PEA Tables 2 and 3 (and collection of confirmation soil samples with associated results at or below the reported resulting maximum concentrations).

A second risk scenario was evaluated considering removal of the affected soils (as shown by the delineation outline on PEA Figures 8 and 9 and summarized on PEA Table 5b [Appendix B]). The hypothetical risk scenario involved the calculation of risk by removing pesticide- and PCB-affected soils containing the risk drivers (Aroclor 1254, alpha-chlordane, and technical chlordane) at concentrations above CHHSLs. Assuming completion of the removal action (and collection and analysis of confirmation samples), the risk from the resulting data set has been recalculated as follows:

- As shown in PEA Table 10 (Appendix B), the calculated cancer risk for the carcinogenic compounds using the maximum concentrations collected upon completion of the removal activities (assuming confirmation samples are below the remaining maximum concentrations) is 3×10^{-6}, which is above the 1×10^{-6} cancer risk target level but below the DTSC's 5×10^{-6} cancer risk management range[2].

4.1.2 Noncarcinogenic Hazards

4.1.2.1 Using All Site Data – Current Conditions

The noncarcinogenic health hazard estimate for COPCs was also evaluated for inhalation and ingestion/ dermal pathways from shallow soil at the Site. As shown in Table 9, the HI for noncarcinogenic effects using the maximum detected concentration collected during the PEA sampling activities is 2, which is above the hazard criteria of 1.0. The PCB Aroclor 1254 is the primary contributor (94.9%) to the overall HI, and pesticides (alpha-chlordane and technical chlordane) are the secondary contributors (4.2% in sum) to the overall HI.

4.1.2.2 Upon Completion of Proposed Removal Activity

The extents of pesticide- and PCB-affected soils have been identified and soil removal activities are proposed. A hypothetical scenario was evaluated considering removal of the affected soils (as shown by the delineation outline on PEA Figures 8 and 9; RAW Figures 3a and 3b). Assuming completion of the removal action (and collection and analysis of confirmation samples), the HI from the resulting data set has been recalculated as follows:

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[2] Although the target cancer risk level is 1×10^{-6}, DTSC often considers risks that are slightly above the target risk level to also be acceptable. DTSC's point of departure for acceptable risks based on risk management criteria is typically 5×10^{-6}.

- As shown in PEA Table 11 (Appendix B), the estimated HI for the noncarcinogenic effects using the maximum concentrations collected upon completion of the removal activities (assuming confirmation samples are below the remaining maximum concentrations) is 0.1, which is well below the hazard criteria of 1.0.

4.1.3 Risk Summary Following Proposed Removal

With the removal of the pesticide- and PCB-affected soils to below CHHSL concentrations, pesticides and PCBs would no longer contribute significantly to the risk or hazard (subject to appropriate confirmation sampling indicating that detectable concentrations of pesticides and PCBs are no longer present). Using maximum concentrations of the remaining COPCs detected during the PEA, the total estimated cancer risk would be 3×10^{-6} and the hazard would be 0.1. Although the resulting risk would still be slightly above the target risk level of 1×10^{-6}, the resulting risk would be below DTSC's typical target risk management range of 5×10^{-6}, which would be considered acceptable. The resulting HI is well below the hazard criteria of 1.0.

4.2 Preliminary Cleanup Goals

Compounds were selected for cleanup goal development if they were identified in the PEA with greater than a 1×10^{-6} risk or an HQ greater than 1. The following chemicals were selected for PCG development in soil:

- alpha-chlordane
- gamma-chlodane
- technical-chlordane
- Aroclor-1254 (PCBs).

The PCGs for COCs at the Site are presented in Table 2 and summarized in the following sections.

4.2.1 PCG for Pesticides

The CHHSLs developed by the California Environmental Protection Agency (CalEPA) Office of Environmental Health Hazard Assessment (OEHHA) were proposed for the PCGs for pesticides (CHHSL of 430 µg/kg for chlordane).

4.2.2 PCG for PCBS

The CHHSLs developed by the CalEPA OEHHA were proposed for the PCGs for PCBs (89 µg/kg for Aroclor-1254).

It should be noted that, upon completion of remediation activities, a human health screening evaluation will be conducted on the final confirmation sampling data set to ensure that the cumulative risk from any detected analytes is at or below the target of 1×10^{-6} and that the cumulative HI from any detected analytes is at or below the non carcinogenic HI of 1.0. Because there are only two COPCs, the CHHSL for each COPC is a representative PCG (e.g., if there were 10 COPCs, theoretically, PCGs should be developed below the CHHSL such that the cumulative risk/hazard is below their respective targets).

4.3 Ecological Screening Risk Evaluation

The Site is defined as portions of the greater Malibu Middle and High School campus (see Section 2.2), thus the Site is immediately surrounded by the campus itself. The land-use surrounding the campus is best described as rural-residential (Figure 1). Ecological resources are not present on the Site; however, an ecologically sensitive habitat area exists in the vicinity of the campus. The potential ecological exposure pathway from the COCs in Site soils is via surface water runoff. Although one portion of the defined Site, Parking Lot A, discharges stormwater into a stream course located at the west end of the adjacent Juan Cabrillo Middle School campus, affected soils were not identified in this portion of the Site. Affected surface soils identified within the course of this investigation are located within Areas 3, 9, 10, 12, and 13. Surface water runoff from these areas is transported offsite via stormwater drains and as surface runoff along curbs and gutters to the Pacific Ocean, and thus is not hydrologically connected to the ecologically sensitive habitat area. As such, a detailed ecological screening evaluation of the Site is not required.

4.4 Endangerment Determination

The results of the human health risk screening evaluation performed for the Site indicate that soil could pose a potential threat to human health under the residential exposure scenario. The nearest sensitive receptors are students and faculty of the school or children and adults at the residences. Additional receptors at risk in the area include workers and future hypothetical students.

There have been no documented instances of human exposure to the COPCs detected at the Site. However, disturbance of the COPC-affected soil may result in direct routes of exposure, including ingestion of soil, dermal contact with soil, and inhalation of airborne soil particles, and therefore should be avoided.

5. Engineering Evaluation/Cost Analysis

The EE/CA described in this section is based on the document titled "Guidance on Conducting Non-Time-Critical Removal Under CERCLA" (USEPA 1993).

RAOs are specific goals for protecting human health and the environment. The NCP (40 CFR Section 300) specifies that RAOs addressing the following site-specific elements must be developed:

- chemicals of concern
- media of concern
- receptors of concern
- complete or potentially complete exposure pathways.

RAOs are developed by evaluating the results of the site characterizations, risk assessment results, and ARARs. RAOs describe the remedial actions needed to protect human health, environmental quality, or both. They are generally narrative statements; however, they can also include specific, quantitative concentrations of chemicals to be achieved.

For the Site, the COCs include alpha-chlordane, gamma-chlordane, technical-chlordane, and Aroclor-1254 in shallow soil.

Under existing conditions, Site workers and school children are the receptors of greatest concern. The majority of the affected soils are located in landscaped areas and vegetated planters; a small portion remains covered by asphalt/concrete. The SMMUSD plans to replace some of the adjacent buildings with new buildings as well as renovate other portions of the Site where school children and adult school staff (including teachers, administrators, janitors, and landscapers) would be present. The DTSC considers this a sensitive land use and makes risk management decisions for a school site assuming a residential land use. Consequently, for this EE/CA, residential adults and children have been assumed to be the future receptors of concern.

The exposure pathways of concern for receptors (including students and school staff at the proposed school) are:

- incidental soil ingestion
- dermal (soil-to-skin) contact

- inhalation of airborne particulates.

The RAOs for this project are to:

- eliminate or minimize potential residential human contact with the COCs resulting from direct contact and wind erosion

- obtain unrestricted future land use designation.

5.1 Removal Action Scope

The goal of a removal action is to abate, prevent, minimize, stabilize, mitigate, or eliminate the release or potential release of a hazardous substance that may result in a threat to the public and/or the environment. The overall remedial action goal for the Site is to obtain an unrestricted future land use designation by preventing human exposure to soil containing COCs at concentrations that present unacceptable human health risks and hazards.

5.2 Evaluation of Removal Action Alternatives

In this section, remedial action alternatives are identified, individually analyzed, and comparatively evaluated to provide a basis for the selection of a preferred alternative. Section 7 describes the implementation of the preferred alternative.

This section presents remedial alternatives and a detailed analysis of each alternative to address the presence of pesticides and PCBs in Site soils. The detailed analysis was conducted to provide sufficient information to compare the alternatives, select an appropriate removal action for the Site, and demonstrate that the recommended action does not pose unacceptable health hazards following implementation. The extent to which actions are assessed during the detailed analysis is influenced by the available data.

The following remedial alternatives were considered for the Site:

- Alternative 1 – No Further Action (NFA)

- Alternative 2 – Capping and Deed Restriction (“capping”)

- Alternative 3 – Excavation and Offsite Disposal of Affected Soil (“removal”).

5.2.1 Alternative 1: No Further Action

Under this NFA option, the Site would be left in its existing condition, and consequently there would be no reduction in the volume of affected soil. Although readily implementable and inexpensive, this alternative would not be effective in meeting the remedial goals for the Site, nor would it reduce the potential exposure to the Site occupants.

5.2.2 Alternative 2: Capping and Deed Restriction

Under the Capping and Deed Restriction option, a low-permeability surface cap (e.g., clay and/or asphalt) would be placed over affected soil at the Site. The cap would reduce the potential for human exposure to and leaching of contaminants from affected soil. To ensure that the potential for future exposure to contaminants is minimized, the cap would require periodic maintenance. Because affected soil would not be removed from the Site under this alternative, a deed restriction may be required to limit future use of the property.

This option is not likely feasible for all of the affected areas. The majority of the PCB-affected soils are located in the landscaped quad area, which could not be effectively capped.

This alternative provides for 30 years of Site maintenance to ensure the continuous integrity of the cap. Site maintenance would consist of an annual inspection of the cover, maintenance of the drainage structures, and biannual resurfacing of the cap.

Under this alternative, institutional controls would be needed to protect the cap. The institutional controls are likely to preclude reuse of the Site as a residence, a day care center for children, a long-term care hospital, or a public or private school for persons less than 21 years of age. As the use of the Site is as a school, this is not a viable option, but this scenario was explored for the purposes of this cost analysis.

The affected portions of the Site would require capping under the above scenario. Although the capping technology is readily implementable and could be completed in less than a week, the alternative would require an ongoing maintenance and monitoring program. Additionally, the cap would require complete replacement every 30 years.

Capping combined with institutional controls would be an effective method to reduce contaminant exposure, but would not meet the SMMUSD’s goal of fully eliminating the unacceptable risk from the school Site. Furthermore, the necessary maintenance activities and reporting requirements would represent an ongoing operations and maintenance cost for the SMMUSD.

5.2.3 Alternative 3: Excavation and Offsite Disposal of Affected Soils

The Excavation and Offsite Disposal of Affected Soil alternative would involve excavation of affected soils identified on the Site with COC concentrations above the PCGs using conventional earthmoving equipment as well has hand equipment around buildings (e.g., backhoes as well as shovels, picks, etc.). The excavated soil would be removed from the Site for disposal at an appropriate facility.

The initial steps for implementing this alternative would be plotting the Site boundaries and identifying underground utilities. Approximate Site boundaries are shown on Figure 4. Based on data collected for the PEA, the pesticide-affected soil appears to be limited to an area of approximately 275 square feet in the upper 3 feet of soil. The total volume of pesticide-affected soil to be excavated at the Site is estimated to be approximately 22 yd^3. The PCB-affected soils appear to be limited to multiple areas across the Site that in sum cover approximately 16,000 square feet in the upper 2 feet of soil. The total volume of PCB-affected soils to be excavated at the Site is estimated to be approximately 1,180 yd^3.

After the Site boundaries have been plotted and the underground utilities have been identified, the asphalt would have to be removed from the excavation area as necessary (one area). Additionally, several shrubs in the various planter beds would have to be removed. It is anticipated that any sub-ground surface green waste (i.e., rootballs) would be removed during excavation of the affected soil and disposed of at an offsite facility along with the affected soil.

Earthmoving equipment would then be used to excavate the affected soil, which would be temporarily stored onsite in stockpiles to allow collection and analysis of waste characterization samples to determine the appropriate disposal facility. Stockpiles will be covered and secured from student access.

Water supplied by either a water truck or by hoses from nearby buildings would be used to keep the excavation and surrounding area moist to minimize dust emissions. Monitoring equipment would be used to measure dust emissions. Additional watering or other dust suppression methods would be conducted in the event that airborne levels exceed action levels. Trucks would be checked for mud and dirt and cleaned, if necessary, prior to leaving the Site. The stockpiles would be covered to minimize wind erosion of the soil during transport.

Following excavation of the affected soils across the Site, samples would be collected to confirm that soils with pesticide and PCB concentrations above PCGs have been removed from the Site. ARCADIS proposes to collect a total of 52 confirmation soil samples, including 29 confirmation samples from the excavation floors and 23 confirmation samples from the sidewalls of the excavations. Based on the proposed sampling strategy, ARCADIS assumes that the floor and sidewall confirmation soil samples indicated on Figures 3a and 3b would be collected and submitted to a fixed laboratory for pesticide analysis using EPA Method 8081A and PCB analysis using EPA Method 8082.

A "C" will be added to the sample identification number for confirmation samples to assist in differentiating the PEA sample locations and laboratory analytical results from confirmation soil samples collected following soil excavation activities.

Additional soil will be excavated if COC concentrations exceeding the PCGs are present in confirmation soil samples collected following removal of the upper soils. Additional confirmation samples will be collected following the removal of additional affected soil. Excavation activities will cease once confirmation sample analytical results indicate that the concentrations of pesticides and PCBs remaining in Site soil are less than the PCGs.

If COCs are detected at concentrations above the PCGs, the additional excavated soil will be placed in an additional stockpile(s).

Under this option, the volume, toxicity, and mobility of contaminants in Site soils would be considerably reduced.

A probable range of costs for removal and disposal of the affected soil (Alternative 3) was calculated based on the estimated quantity of affected soil present at the Site. The estimated cubic yards to be removed, based on current data, are presented in Table 3. ARCADIS estimates that a total of 1,200 in-place cubic yards of affected soil would be removed from the Site. This quantity was converted to tons using a conversion factor of 1.5 tons/yd^3, for a total of 1,800 tons.

ARCADIS assumes that, based on the results of the PEA sampling, excavated soils will be disposed of as non-hazardous waste. The non-hazardous waste would likely be transported to a disposal facility such as TPS in Adelanto, California.

Table 3 presents the estimate cost for implementation of the preferred remedial alternative, including backfill material and compaction. The total cost for the remedial work (including preparation of removal plans, excavation, disposal, backfill and compaction, oversight, air monitoring, confirmation sampling, and preparation of a completion report) is estimated to be $508,000.

Selection of imported fill material would be based on the DTSC's clean fill material guidance document (DTSC 2001; included as Appendix H).

ARCADIS anticipates that completion of this alternative would require approximately 20 working days. Excavation of the affected soil would require approximately 10 to 15 working days (including mobilization and preparation). Following excavation, approximately one week would be required for laboratory analysis of the confirmation samples. If no additional excavation is necessary, backfill and compaction of the excavated area would require approximately 5 working days. It is anticipated that, once the removal action has been completed and regulatory approval has been received, SMMUSD would begin construction of the proposed new facilities.

No maintenance or ongoing reporting costs related to this alternative are anticipated.

5.2.4 Evaluation Criteria

The criteria of effectiveness, implementability, and estimated cost are used below to comparatively evaluate the alternatives and provide a basis for the selection of a preferred option, as required by the document titled "Guidance on Conducting Non-Time-Critical Removals under CERCLA" (USEPA 1993).

5.2.4.1 Effectiveness

Effectiveness is the primary criterion that a removal action must meet. The effectiveness of an alternative depends on its ability to (1) protect human health and the environment, (2) comply with ARARs, and (3) fulfill PCGs. A removal action is considered protective if it adequately eliminates, reduces, or controls current and potential risks posed through each exposure pathway at a site.

To fully assess an alternative's efficacy, both short- and long-term protection of human health and the environment should be considered. This is done by analyzing the alternative's ability to eliminate, reduce, or control exposures to COCs. Particular factors to consider include the following:

- Overall Protection of Human Health and the Environment. Each alternative should be evaluated on whether or not it protects the environmental, community, and worker health during implementation, and how risk posed through each exposure pathway is eliminated, reduced, or controlled through treatment, engineering controls, or institutional controls.

- Compliance with ARARs. Each alternative should be evaluated on whether or not it meets appropriate federal, state, and local environmental laws, regulations, and guidelines.

- Short-Term Effectiveness. Each alternative should be evaluated on whether or not it can be completed within the project's time frame, and what, if any, adverse impacts on human health and the environmental may be posed during the construction and implementation period until the PCGs are achieved.

- Long-Term Effectiveness. Each alternative should be evaluated on whether or not it can continue to offer reliable protection of human health and the environment over time after PCGs have been met.

- Reduction of Toxicity, Mobility, and Volume through Treatment. Each alternative should be evaluated on whether or not it can reduce the toxicity, mobility, and volume of COCs present at the Site.

- Protection of Workers. Each alternative should be evaluated on whether or not it protects the Site workers, as well as on the effectiveness and reliability of protective measures.

- Environmental Impacts. Each alternative should be evaluated on whether or not its implementation would adversely affect the environment, as well as on the reliability of mitigation measures in preventing or reducing the potential impacts.

- Time Until Response Objectives are Achieved. Each alternative should be evaluated on the length of time needed for implementation to achieve protection for the Site or for individual elements or threats associated with the Site.

Based on the above definition, various options have been evaluated. Alternative 1 (NFA) would not be effective. Alternative 2 (capping) would be effective in protecting human health and the environment and complying with ARARs, but would require long-term operations and maintenance of the Site's cap. The removal option (Alternative 3) would be the most effective of those evaluated in terms of cost and time effectiveness.

5.2.4.2 Implementability

Implementability addresses the technical and administrative feasibility of executing an alternative, and the availability of various services and materials required for its execution. The following factors should be evaluated:

- Technical Feasibility, including the ease of construction and operation of the alternative; the adaptation of the alternative to the environmental conditions at the Site; the reliability (maturity) of the technologies composing the alternative; prior use under similar conditions for similar wastes; the ease of undertaking additional removal action, if needed; and the ability to monitor the effectiveness of the remedy.

- Administrative Feasibility, such as obtaining operating permits and/or approvals; the ease of implementation of institutional controls; and coordination needed with other agencies for implementation of each alternative.

- Availability of Services and Materials, including the availability of personnel and technology; offsite treatment, storage, and disposal capacity and services; and availability of necessary services, equipment, materials, and specialists to implement an alternative within the time frame of the removal schedule.

- State and Community Acceptance, including acceptability of the alternatives by the applicable regulatory agencies based on their review of the available information and evaluating/addressing community concerns (e.g., does the community prefer one alternative over another, and are community concerns addressed by the alternative).

The evaluated alternatives are readily implementable with regard to technical, administrative, and availability considerations. However, Alternative 1 (NFA) and, perhaps to a lesser degree, Alternative 2 (capping) are not readily implementable because of anticipated difficulties with obtaining state and community acceptance. Overall, Alternative 3 (removal) would be the most implementable of the three options evaluated.

5.2.4.3 Cost

Removal action alternatives should be comparatively evaluated based on cost estimates, including total cost and capital costs that reduce risk in the most cost-effective manner and achieve the RAOs. The cost estimates have an accuracy of -30% to +50%. The accuracy of each cost estimate depends on the assumptions made and the availability of costing information.

The total cost is presented as the 30-year present worth and evaluates the direct capital cost, indirect capital cost, and operations and maintenance expenses. Capital costs consist of direct and indirect expenditures, which are typically derived from literature sources and vendor quotes. Direct costs include expenses incurred for construction, equipment, materials, buildings, services, treatment, and operational costs, while indirect costs include non-construction and overhead costs, including engineering and design expenses, construction supervision, legal fees, license fees, permit costs, start-up expenses, and other services that are not part of the actual alternative but are required to complete and/or maintain it.

No capital or indirect costs would be associated with Alternative 1 (NFA).

Direct costs for Alternative 2 (capping) would be about $120,000 for initial capping and $7,000 for annual maintenance. Additionally, about $60,000 in direct costs would be needed every 30 years for cap replacement. Indirect costs for Alternative 2 would increase the initial cost for capping to about $140,000 (total cost), annual cost for maintenance and reporting to $8,000, and the cost for replacement every 30 years to about $60,000 (total cost).

Alternative 3 (removal) has an estimated direct cost of $508,000; no maintenance or ongoing reporting costs are anticipated for this alternative. Estimated costs for the excavation alternative are summarized in Table 3.

5.3 Description of Selected Remedy

Based on effectiveness, implementability, and cost, Alternative 3 (removal) has been selected as the preferred removal action alternative for the Site. This alternative to address pesticide- and PCB-affected soils will be protective of human health and the environment, comply with regulatory criteria, avoid ongoing maintenance and administrative costs, and achieve the SMMUSD's goal of obtaining unrestricted land use for the Site. In addition, this alternative is anticipated to have community and state acceptance and would allow the Site to be developed as a school.

Implementation of this alternative would involve removal of affected soil with pesticide and PCB concentrations exceeding the PCGs, as noted above in Section 5.2.

Dust suppression measures (such as spraying the area with water or covering stockpiled or binned soil with plastic) will be implemented during excavation activities, as necessary. These suppression measures will continue until confirmation samples indicate that concentrations of COCs are below the PCGs.

A miniature real-time aerosol monitor (mini-RAM) will be used to monitor exposure to total dusts. If dust in excess of background levels is observed for a sustained period of time (greater than 5 minutes), appropriate dust suppression measures (e.g., spraying soil with water) will be undertaken. If during excavation activities dust is observed in the area being excavated, appropriate dust suppression measures (e.g., spraying soil with water) will be undertaken.

Noise may result primarily from the operation of excavating equipment and other mechanical equipment. For this reason, noise monitoring will be conducted if noise production is thought to be close to or exceed 80 decibels at the fence line, which is unlikely due to the type of equipment being used. If noise monitoring is conducted and results indicate that noise exceeds 80 decibels, appropriate mitigation measures will be undertaken.

Applicable transportation regulations, as defined in the California Department of Motor Vehicles (DMV) Vehicle Code Division 15, Chapters 2 through 5, will be met for this project. If California Vehicle Code regulations are not met during implementation of the RAW, the transportation contractor will be required to obtain the proper transportation permits.

Additional details on implementation of this alternative are presented in Section 7.

6. Application or Relevant and Appropriate Requirements

To select a feasible and effective remedial alternative for the Site, ARCADIS evaluated ARARs. In simple terms, ARARs are regulations or guidelines that apply to the assessment, cleanup, and/or monitoring of contamination at a particular site.

Federal, state, and local ARARs, which have been identified as either applicable or relevant to the Site, are presented in Tables 4, 5, and 6, respectively. Three types of ARARs are identified in the NCP: chemical-specific, location-specific, and action-specific. A summary of these ARARs is presented below.

<u>Chemical-specific ARARs</u> are health- or risk-based concentrations limits, numerical values, or methodologies for various environmental media (e.g., groundwater, surface water, air, and soil) that are established for a specific chemical that may be present in a specific medium at a property or that may be discharged to the property during remedial activities. Limits on concentrations of specific hazardous substances, pollutants, and contaminants that may be found in or discharged to the environment are set by these ARARs.

<u>Action-specific ARARs</u> are technology- or activity-based requirements that are triggered by the type of remedial activities under consideration for a site. Action-specific requirements do not establish the remedial alternative but do indicate how a selected alternative is to be achieved. Resource Conservation and Recovery Act (RCRA) regulations for waste treatment, storage, and disposal are examples of action-specific ARARs.

<u>Location-specific ARARs</u> set restrictions on certain types of activities based on site characteristics. Federal and state location-specific ARARs are restrictions placed on the concentration of a contaminant or the activities to be conducted because they are in a specific location such as a floodplain, wetland, historic place, or sensitive habitat.

6.1 Hazardous Waste Management

Based on the analytical data obtained for the Site to date, ARCADIS anticipates that the affected soil will be disposed of as non-hazardous waste. Waste classified as non-hazardous will be transported and disposed of at an appropriate disposal facility in accordance with local, state, and federal regulations. Acceptance criteria at selected disposal facilities that will likely be used during implementation of the RAW are presented below in Section 7.7. A weight ticket, a bill of lading, and/or a waste manifest will be completed for each load transported to a Class II or Class III disposal facility and maintained by the transportation contractor. Information to be included on these documents is summarized in Section 9 of the Transportation Plan. Copies of these documents or a summary of the volume of soil disposed of at each facility will be presented in the removal action completion report.

If hazardous waste is produced during implementation of this RAW, hazardous waste management will include several potential action-specific ARARs, as discussed in the following paragraphs.

RCRA establishes requirements for the management and disposal of hazardous wastes. In lieu of the RCRA program, the State of California is authorized to enforce the Hazardous Waste Control Act and implement regulations (California Code of Regulations [CCR] Title 22, Division 4.5, Chapter 14) subject to the authority retained by the USEPA in accordance with the Hazardous and Solid Waste Amendments of 1984. This regulation specifies the design, construction, operation, and closure of RCRA-permitted treatment, storage, and disposal facilities (TSDFs) within California. TSDF requirements may be ARARs if the selected remedy involves the treatment, storage or disposal of wastes that are sufficiently similar to RCRA hazardous wastes (CERCLA Compliance With Other Laws Manual, OSWER Directive 9234.1 01, August 8, 1988, pp. 2–6). Because PCBs are present in Site soils, the excavated soil could potentially classified as RCRA hazardous waste if soil profile results indicate PCB concentrations above certain levels and/or if the source was known (and known to contain PCB concentrations above the current hazardous waste levels). However, all concentrations detected at the Site to date are below the hazardous waste criteria of 50 parts per million (ppm) although above the health-based CHHSL criteria of 89 parts per billion (ppb; equivalent to 0.089 ppm) which is prompting its removal).

Under the Toxic Substance Control Act (TSCA), USEPA has specific rules governing PCB-contaminated soils. If the release occurred prior to 1979, and soil concentrations are below 50 ppm PCBs (the limit at which it is considered a hazardous waste), soil is not regulated under TSCA. If the release occurred after 1979 and concentrations in site soil are all below 50 ppm, it is not regulated under TSCA as long as the original source material also did not contain concentrations of 50 ppm or greater. As neither the source nor the release date are known, there are no indications that source material may have contained 50 ppm or greater, and the concentrations of all samples collected from the Site to date are well below 50 ppm, TSCA has been determined to not be applicable to this Site.

TSDF requirements may be ARARs for any offsite facility used for treatment/disposal of PCB-affected soil from the Site.

CCR Title 22, Section 66264.18 establishes location standards for TSDFs. Subsection 66264.18 (a) prohibits the placement of TSDFs within 200 feet of a fault displaced during the Holocene Epoch. Subsection 66264.18 (b) requires that TSDFs located within a 100-year floodplain be capable of withstanding a 100-year flood. Soil excavated as part of the remedial action will be transported to appropriate offsite facilities.

CCR Title 22 establishes requirements applicable to generators of hazardous waste. Implementation of the proposed removal alternative may result in the generation of potentially hazardous waste such as affected soil, decontamination rinse water, or used personal protective equipment (PPE). SMMUSD has a CalEPA number for disposal of the material as a California Hazardous Waste. If excavated soil is classified as RCRA hazardous, the SMMUSD (as the hazardous waste generator) will secure a USEPA identification number for proper management of the hazardous waste. Compliance with DTSC requirements for hazardous waste generation, temporary onsite storage, offsite transportation, and offsite disposal is required for hazardous waste. Containers or stockpiles used for onsite storage of hazardous waste will be properly labeled with hazardous waste labels. Within 90 days after its generation, the hazardous waste will be transported offsite for disposal. The hazardous waste will be transported by a registered hazardous waste hauler under a uniform hazardous waste manifest. Land ban requirements will be followed, as appropriate.

CCR Title 22, Section 66261.20 defines waste as hazardous if it meets one of the following four criteria: ignitability, corrosivity, reactivity, or toxicity. Soil to be excavated as part of this remedial action will be tested to assess its hazardous properties, if any, as required by the disposal facilities.

CCR Title 22, Chapter 18, Article 3 identifies specific hazardous wastes that are restricted from land disposal without treatment. Soil designated for landfill disposal will be tested to assess disposal requirements, as required by the disposal facilities.

Excavation, management, and disposal of affected soil will be performed in accordance with these ARARs and this RAW. Final determination of the landfill used for disposal will be based on the results of the waste characterization analyses and approval from the landfill. Once the disposal facility is selected, copies of waste profile reports used to secure disposal permission from the landfill will be obtained. In addition, compliance with the land disposal restrictions and land ban requirements for hazardous wastes will be documented. A weight ticket, bill of lading, and/or hazardous waste manifest will be completed for each load transported to a Class I disposal facility and maintained by the transportation contractor. Information to be included in these documents is summarized in Section 9 of the Transportation Plan (Appendix F). Copies of these documents or a summary of the volume of hazardous waste disposed of at each facility will be presented in the removal action completion report.

Wastewater will be temporarily stored on the Site in tanks (i.e., 55 gallon drums) that will be brought to the Site and removed from the Site by truck for proper disposal at a licensed facility (if necessary).

6.2 Air Quality Management District

Dust emissions during the potential remedial action are regulated by the California Air Resources Board, which implements the federal Clean Air Act as well as the Health and Safety Code (HSC) through local air-quality management districts. The local air district for the Site is the South Coast Air Quality Management District (SCAQMD). SCAQMD Regulation 4, Rule 403, which limits the quantity of particulate matter and visible emissions from any general operations and provides the best available control measures to minimize dust emissions, may be applicable during the implementation of the remedial action.

The SCAQMD regulations are considered chemical-specific ARARs and would be applicable to the Site, since removal and offsite disposal has been selected as the remedial alternative.

6.3 Health and Safety Plan

Action-specific ARARs include those in local, state, and federal HSCs.

Activities conducted during implementation of this RAW will be in compliance with applicable California Occupational Safety and Health Administration regulations, particularly those in CCR Title 8, Section 5192, 29 CFR 1910.120, and other applicable federal, state, and local laws, regulations, and statutes. The Health and Safety Plan (HSP) prepared by ARCADIS for use during the PEA fieldwork will be modified for use during implementation of this RAW.

The Safe Drinking Water and Toxics Enforcement Act of 1986 (Proposition 65) requires that warnings be posted with information on exposure to listed chemicals above specified concentrations or risk levels. If appropriate, a posting will be made for the Site.

HSC Section 25123.3 allows for the temporary accumulation of non-RCRA contaminated soil for 90 days or less, as long as specific requirements are met. Soil excavated from the Site as part of the removal action will not remain at the Site for more than 90 days.

6.4 Quality Assurance Project Plan

Preparation of a Quality Assurance Project Plan (QAPP) satisfies action-specific ARARs. A QAPP that details procedures for collection of representative data and appropriate completion of the remedial activities at the Site has been prepared and is attached as Appendix E.

7. Removal Action Implementation

Data from the PEA soil investigation indicate that affected soils with pesticide and PCB concentrations above their respective PCGs are present at the Site. The most effective remedial action has been determined to be removal consisting of soil excavation and offsite disposal. Upon receipt of SMMUSD approval, removal activities will be performed by a California certified contractor under the supervision of a California Professional Geologist or Professional Engineer. This RAW will be implemented using the guidelines presented herein and those presented in the Site-specific HSP (Appendix D), QAPP (Appendix E), and Transportation Plan (Appendix F).

ARCADIS anticipates that work hours at the Site will be between 8:00 A.M. and 6:00 P.M., Monday through Friday. According to the City of Malibu – Building and Safety Department, work hours (Monday through

Friday) must be performed within 7:00 A.M. and 7:00 P.M.; as such, the proposed hours of operation will be acceptable for this project. (Saturday hours, if necessary, are between 8:00 A.M. and 5:00 P.M. with no work allowed on Sunday).

The removal, transportation, and disposal activities will be performed in accordance with all applicable federal, state, and local laws, regulations, and ordinances.

A removal action completion report will be prepared after execution of the removal action at the Site.

7.1 Field Documentation

The remedial action contractor will be responsible for maintaining a field logbook during the remediation activities. The field logbook will serve to document observations, personnel on Site, equipment arrival and departure times, and other vital project information.

7.1.1 Field Logbooks

Field logbooks or daily field sheets will document where, when, how, and from whom any vital project information was obtained. Entries will be complete and accurate enough to permit reconstruction of field activities. Logbooks will be bound and have consecutively numbered pages. Each page of the logbook will be dated and the time of entry will be noted. Alternatively, daily field sheets may be used for the project. Logbook and daily field sheet entries will be legible, written in ink, and signed by the individual making the entries. Language will be factual, objective, and free of personal opinions or other terminology. If an error is made, corrections will be made by crossing a line through the error and entering the correct information. Corrections will be dated and initialed. No entries will be obliterated or rendered unreadable.

Entries in the field logbook or on the daily field sheet entries will include, at a minimum, the following for each fieldwork date:

- Site name and address
- recorder’s name
- team members and their responsibilities
- time of arrival/entry on the Site and time of departure from Site
- other personnel onsite

- summary of any onsite meetings
- quantity of affected soil (in terms of RCRA hazardous wastes, non-RCRA hazardous wastes, and non-hazardous wastes) excavated
- quantity of affected soils (in terms of RCRA hazardous wastes, non-RCRA hazardous wastes, and non-hazardous wastes) temporarily stored onsite
- quantity of excavated soils in truckloads (in terms of RCRA hazardous wastes, non-RCRA hazardous wastes, and non-hazardous wastes) transported offsite
- names of waste transporters and proposed disposal facilities
- copies or numbers of manifests or other shipping documents (such as bill of landing) for waste shipments
- quantity of import fill material in truckloads
- deviations from this RAW and Site-specific HSP
- changes in personnel and responsibilities as well as reasons for the changes
- levels of safety protection
- calibration readings for any equipment used and equipment model and serial number.

At a minimum, the following information will be recorded during the collection of each sample:

- sample identification number
- sample location and description
- Site sketch showing sample location and measured distances
- sampler's name(s)
- date and time of sample collection

- designation of sample as composite or grab
- type of sample (i.e., matrix)
- type of preservation
- type of sampling equipment used
- field observations and details important to analysis or integrity of samples (e.g., heavy rains, odors, colors, etc.)
- instrument readings (e.g., miniram, etc.)
- chain-of-custody form numbers and chain-of-custody seal numbers
- transportation arrangements (courier delivery, lab pickup, etc.)
- recipient laboratory(ies).

7.1.2 Chain-of-Custody Records

Chain-of-custody records are used to document sample collection and shipment to laboratory for analysis. All sample shipments for analyses will be accompanied by a chain-of-custody record. Form(s) will be completed and sent with the samples for each laboratory and each shipment. If multiple coolers are sent to a single laboratory on a single day, chain-of-custody forms) will be completed and sent with the samples for each cooler. The chain-of-custody record will identify the contents of each shipment and maintain the custodial integrity of the samples. Generally, a sample is considered to be in someone's custody if it is either in someone's physical possession, in someone's view, locked up or kept in a secured area that is restricted to authorized personnel. Until they are received by the laboratory, the custody of the samples will be the responsibility of the sample collector. Chain-of-custody procedures are further discussed in the QAPP.

7.1.3 Photographs

At each excavation area, photographs will be taken of representative sample locations and other areas of interest onsite. The photographs will serve to verify information entered in the field logbook. When a photograph is taken, the following information will be written in the logbook or will be recorded on a separate field photography log:

- time, date, location, and (if appropriate) weather conditions
- description of the subject photographed
- name of person taking the photograph.

7.2 Site Preparation and Security Measures

Site preparations for the proposed removal action may include Site reconnaissance, surveying, boundary staking, sampling, demarcation of “hot spots,” utility connection or disconnection, and fencing installation. SMMUSD assistance will be necessary for evaluating utility connections and for assisting in the development of work-around strategies for the period of the removal action.

It is ARCADIS’ understanding that the buildings located adjacent to the Site will not be removed prior to soil removal activities.

7.2.1 Delineation of Excavation Areas

The areal limits of all excavations will be delineated before commencement of removal activities. The areas to be excavated shall be called the “excavation areas” and they will be marked (as will the exclusion zones) in the field with stakes and/or high visibility paint.

7.2.2 Utility Clearance

Clearance of utilities and other hazardous underground obstacles shall be performed prior to initiating any soil intrusion or subsurface investigation activities. Such possible obstacles may include water, electrical, gas, oil, communication cable, phone cable, TV cable, and sewer lines. No invasive activities will begin without a notification to Underground Services Alert (USA) at least 48 hours prior to the start of excavation work, and utility clearance performed by a private utility locating contractor, at a minimum.

7.2.3 Security Measures

Appropriate barriers and/or privacy fencing will be installed prior to beginning the excavation process to ensure that all work areas are secure and safe. To ensure trespassers or unauthorized personnel are not allowed near work areas, security measures may include, but are not limited to:

- Posting notices directing visitors to the Site manager.

- Maintaining a visitor's log. Visitors must have prior approval from the Site manager to enter the Site. Visitors shall not be permitted to enter the Site without first receiving Site-specific health and safety training from the Site safety officer.
- Installing barrier fencing to restrict access to sensitive onsite areas such as exclusion zones.
- Providing adequate Site security to ensure unauthorized personnel have no access to work areas and/or contaminated materials.
- Before leaving the Site, all personnel must sign out in the visitor's log.
- Maintaining a safe and secure work area, including areas where equipment is stored or placed at the close of each workday.

Persons requesting Site access will be required to demonstrate a valid purpose for access and provide appropriate documentation to demonstrate they have received the proper training required by the Site-specific HSP (Appendix D).

7.2.4 Contamination Control

In order to limit potential exposure of materials to the adjacent properties, the following measures will be implemented during soil excavation activities at the Site:

- Removal action will be conducted following approval of the RAW.
- SMMUSD will take necessary steps to minimize impacts to the community. Because dust control and strict monitoring procedures will be implemented during excavation activities at the Site, the covering of windows and doors at the nearby residences is not warranted or anticipated. Removal action activities will not be conducted during periods of unfavorable wind conditions.

7.2.5 Permits and Plans

As discussed in Section 5, all necessary permits or approvals will be obtained prior to the implementation of excavation activities at the Site.

7.3 Excavation

ARCADIS estimates that approximately 22 yd^3 of pesticide-affected soil and 1,180 yd^3 of PCB-affected soil will be excavated from the Site. The excavation areas are depicted on Figures 3a and 3b.

7.3.1 Confined Space and Excavation Entry

No excavations deeper than 3 feet and no confined space entries are anticipated for this project (the majority of the excavation is to 2 feet bgs). If for any reason deeper excavations are warranted based on new findings, workers will not enter excavations that exceed 4 feet in depth without appropriate protective systems such as benching, sloping, or shoring (if necessary), as described in the HSP (Appendix D). Access to the excavation by onsite personnel will be limited and strictly monitored.

7.3.2 Soil Staging and Storage Operations

The soil staging process will be monitored to ensure excessive dust is not created. Excavated soil will be placed in stockpiles placed on plastic sheeting. Figure 4 shows the proposed stockpile locations, staging, loading, and decontamination areas to be used during this project. Prior to offsite disposal, excavated soil within the stockpiles will be sampled for waste disposal characterization in accordance with the requirements of the selected waste disposal facility.

Excavated soil will be temporarily stored in the stockpiles on the Site until transported to an appropriate disposal facility. The stockpiles will be located in a suitable location within the fenced-in work area and secured from students. The stockpiles will be covered with plastic sheeting at the end of each work day or upon completion of excavation activities within a designated work area. The plastic sheeting will be secured to prevent dust emissions and silted runoff.

Stockpiles of excavated material, stockpiled backfill material, and excavation equipment will be stored near the high school quad area. This area is relatively flat and is currently an asphalt-paved parking area. Excavated soil will be placed in stockpiles located near the excavation area. Additionally, storage and staging areas will be located near the excavations. Decontamination areas will be set up near the Site exit.

The temporary onsite storage or excavated soil wastes will be secured and properly labeled with hazardous waste signs, as appropriate, until they are ready for loading for offsite transportation and disposal. In no case should the onsite storage of hazardous wastes be longer than 90 days after its generation. If waste soil is not considered hazardous, stockpiled soils will still be marked to indicate that they are slated for offsite disposal.

If COCs are detected at concentrations above the PCGs, additional soils will be removed and the given area will be resampled.

If waste characterization sampling reveals the presence of pesticides or PCBs at concentrations greater than the compound-specific PCG, this soil will be disposed of at an appropriately licensed disposal facility.

Wastewater will be temporarily stored onsite in drums (i.e., 55-gallon drums) that will be brought to the Site and removed from the Site by truck for proper disposal at a licensed facility (if necessary). ARCADIS does not anticipate the use of more than one 55-gallon drum to manage the potential equipment decontamination fluid (water/LiquiNox® mixture).

It is anticipated that backfill materials will be brought to the Site after the stockpiles have been removed; however, if backfill materials are brought to the Site prior to the removal of the stockpiles, they will be appropriately marked so that the integrity of the backfill material is maintained. The backfill material stockpile height will not exceed the top of the fence line.

7.3.3 Waste Segregation Operations

Prior to stockpiling/staging, the excavated soil will be segregated (in different stockpiles) to the extent possible to avoid mixture of non-hazardous soil and hazardous soil (if any). This segregation will minimize the amount of hazardous soil generated and its associated disposal cost. The hazardous soil (if any) and non-hazardous soil will be transported from the Site to an appropriate disposal facility. Based on the results of the PEA, soils are considered to be non-hazardous.

7.3.4 Decontamination Area

Each piece of equipment used for excavation will have a clean-out bucket and a continuous edge across the cutting face of its bucket.

Entry to the excavation area will be limited to avoid unnecessary exposure and related transfer of pesticide- and PCB-affected soil. In unavoidable circumstances, equipment or trucks will be decontaminated in a designated decontamination area before leaving the Site, as discussed in the following section.

7.3.4.1 Decontamination Procedures

Equipment or trucks that come into contact with potentially contaminated soil or water will be decontaminated to assure the quality of samples collected and/or to avoid cross-contamination. Disposable equipment intended for one-time use will not be decontaminated, but will be packaged for appropriate disposal. Decontamination will occur prior to and after each designated use of a piece of equipment or truck. Excavating, transporting, and storage devices used at the Site will be decontaminated using the dry brushing method, as necessary.

Sampling equipment (hand augers, sample probes, etc.) will be decontaminated using the following procedure:

- non-phosphate detergent and tap water wash, using a brush if necessary
- tap-water rinse
- initial deionized/distilled water rinse
- final deionized/distilled water rinse.

Equipment will be decontaminated in a pre-designated area on pallets or plastic sheeting, and clean bulky equipment will be stored on plastic sheeting in uncontaminated areas. Cleaned small equipment will be stored in plastic bags. Material to be stored more than a few hours will also be covered.

7.3.5 Excavation Plan

Initial Excavation: The initial excavations will produce approximately 1,200 yd^3 of in-place material, or approximately 1,800 tons, using a conversion factor of 1.5 tons/yd^3.

Confirmation Excavation: Additional excavation may be necessary depending on the results of confirmation sampling, as discussed in Section 7.6.2.

7.4 Air and Meteorological Monitoring

This section details the air and meteorological monitoring strategy and methodologies that will be used during the soil removal action. The strategy and methodologies are designed to achieve several goals:

- Identify and measure the potential air contaminants generated during the soil removal and decontamination activities to assign the appropriate PPE and safety systems specified for those activities.
- Provide feedback to Site operations personnel regarding potential hazards from exposure to hazardous air contaminants generated through Site activities.
- Identify and measure air contaminants at points outside of the soil removal and decontamination exclusion zones. Air monitoring will be conducted during work activities to measure potential exposure of sensitive receptors to Site chemical constituents as a result of removal activities.

7.4.1 Air Monitoring

Air monitoring will be performed during Site activities in which affected or potentially affected materials are being disturbed or handled. A mini RAM will be used to monitor total dust generated during Site work. Field staff will obtain and document total dust readings from the mini-RAM throughout each work day when soil excavation activities are occurring on the Site. These readings will be obtained from two to three designated air monitoring stations established along the perimeters of the active remediation area. It is anticipated that excavation will only occur within one particular area at a time. If multiple excavations are occurring simultaneously, additional air monitoring stations will be established such that each active remediation area has appropriate air monitoring. The largest excavations (Area 5 and Area 2) will include upwind and downwind monitoring, while the remaining smaller excavations will include one station downwind of the excavation area.

Background dust levels will be established by monitoring dust levels at the Site prior to initiation of any removal activities. Background dust levels will be documented at the designated air monitoring station established along the Site's perimeter. The same monitoring station will be used during implementation of the RAW.

If dust in excess of background levels (greater than 0.25 milligrams per cubic meter [mg/m^3] above background levels) is observed for a sustained period of time (greater than 5 minutes), appropriate dust suppression measures (e.g., spraying soil with water) will be undertaken. A total dust action level of 0.25 mg/m^3 above background levels would be conservative for the various COCs detected on the Site that would be likely to adhere to windblown dust, and would be protective of the onsite workers and members of the surrounding community.

If dust is observed in the area being excavated during excavation activities, appropriate dust suppression measures (e.g., spraying soil with water) will be undertaken.

In addition to monitoring for total dust using a mini-RAM, personal air monitors (PAMs) to record total dust readings will be worn by selected Site workers each work day when soil excavation activities are occurring on the Site. A PAM will be worn by at least one worker operating earth-moving equipment or another worker likely to have the highest exposure based on work activity. The cassettes will be submitted to a laboratory and analyzed for total dust, total chlordane, and PCBs, at a minimum.

A PID or flame ionization detector will not be used to monitor VOCs at the Site, since VOCs are not considered COCs at the Site and onsite worker exposure to VOCs is not anticipated.

7.4.2 Meteorological Monitoring

Onsite ambient weather conditions (wind speed, wind direction, and relative humidity) will be monitored by real time internet weather locations and the National Weather Service (if a local station can provide data relevant for the Site).

If storms that may result in significant rainfall are forecast for the Site vicinity, the excavations will be covered with plastic sheeting, as appropriate, to reduce the amount of storm water entering the excavations. In addition, the stockpiles will be covered with plastic sheeting to reduce runoff from the stockpiles.

If weather forecasts include periods of significant winds, the excavations will be sprayed with extra water and/or covered, depending upon the severity of the wind condition, to reduce the potential for wind-blown materials.

7.5 Dust Control Plan

The primary means of transport for COCs at the Site is dispersion in dust. Dust suppression measures and contaminant control will be implemented during excavation activities, as described below.

7.5.1 Dust Control

Dust control measures, such as spraying the area with water or covering stockpiled soil with plastic, will be employed during excavation and soil disposal activities to prevent the release of visible dust emissions beyond the immediate work zone.

Open excavations will continually be wetted as the excavations progress to minimize fugitive dust emissions. Excavation activities will be suspended when winds exceed 25 miles per hour.

A fence with dust-control fabric will be maintained around the excavation areas throughout the implementation of the RAW to help prevent dust from potentially migrating off the Site, especially to the surrounding campus.

Stockpiled soil will be placed on plastic sheeting for temporary storage and, if necessary, covered with plastic sheeting to minimize wind erosion, as described in Section 7.3.2.

The vehicles will be equipped with dust covers and other required equipment to prevent releases of material (if necessary). Before exiting the Site, the vehicles will be checked to make sure excess dust and soil is not present. Additional details are provided in the Transportation Plan (Appendix F).

7.5.2 Dust Monitoring

Monitoring at the Site will include observation for visible dust and documentation of dust levels using a mini RAM. If dust levels greater than 0.25 mg/m^3 above background levels are measured at the monitoring point for a sustained period of time (greater than 5 minutes), appropriate dust suppression measures (e.g., spraying soil with water) will be undertaken. If dust is observed in the area being excavated during remedial activities, appropriate dust suppression measures (e.g., spraying soil with water) will be undertaken.

7.6 Excavation Soil Sampling

7.6.1 Waste Profiling Sampling

Soil samples will be collected from each stockpile for waste characterization purposes. Waste profiling soil samples will be composited to achieve an overall characterization of each stockpile. Soil samples will be analyzed for Title 22 metals by EPA Method 6010B, total petroleum hydrocarbons (TPH) by EPA Method 8015M, PCBs by EPA Method 8082, and VOCs by EPA Method 8260B to confirm that excavated soil is classified as non-hazardous. Approximately one sample per 200 yd^3 (total of six samples) will be collected for profiling. After waste profiling, excavated soil will be disposed of at the appropriate facility.

7.6.2 Confirmation Sampling

Confirmation samples will be collected from the floor and sidewalls of the excavation, as noted on Figures 3a and 3b. Confirmation samples will be collected from the excavation floors and sidewalls using hand-sampling equipment and glass jars. Though not anticipated, in the event that an excavation extends deeper than 4 feet (due to additional soil removal following collection of confirmation soil samples), a backhoe will be used to remove soil from the excavation floor and sidewalls, and the confirmation soil samples will be collected directly from the backhoe bucket.

The confirmation samples will be placed in an ice-chilled cooler for transport to a California state-certified laboratory for analysis under standard chain of-custody protocol. The confirmation samples will be analyzed at a fixed laboratory using a normal 5 day laboratory turnaround time. Expedited turnaround times will be requested from the laboratory, if appropriate. ARCADIS anticipates that a normal 5 day laboratory response time would be acceptable for the confirmation samples because excavation work will cease during off-hauling of the affected soil. ARCADIS anticipates that the removal action, including off-hauling of the affected soil, will require up to 20 working days. It is anticipated that the primary removal can be completed within approximately 15 days but additional time is included due to laboratory analyses, the possibility of additional excavations based on the final confirmation sample results, and scheduling disposal of any additional excavated soils (based on confirmation sampling results).

The analytical results will be compared to the PCGs for the COCs. Excavation will cease in those areas where analysis of confirmation samples indicates that the COCs are less than the PCGs. If COC concentrations exceeding the PCGs are identified in the confirmation soil samples, then ARCADIS assumes an additional 6-inch-thick layer of affected soil will be removed across the continued affected areas. Additional confirmation samples will be collected following excavation of each layer of affected soil. Excavation activities will cease once analytical results for confirmation samples indicate that the affected soil has been removed from the Site.

For quality assurance/quality control purposes, ARCADIS will also collect 1 blind field duplicate soil sample for every 10 confirmation soil samples. The duplicate sampling program represents greater than 10% of the total number of samples proposed for analysis. Field blanks and equipment blanks will be collected as described in the QAPP (Appendix E).

Sampling equipment that comes into contact with potentially affected soil will be decontaminated consistently to ensure the quality of samples collected. Disposable equipment intended for one-time use may be used at the Site, as appropriate; such equipment will not be decontaminated, but will be packaged for appropriate disposal.

Confirmation soil samples will be analyzed for pesticides using EPA Method 8081A or PCBs using EPA Method 8082 at a fixed laboratory using a normal 5 day laboratory response time. At the present time, confirmation soil samples will include 29 bottom samples and 23 sidewall samples from the excavation areas (Figures 3a and 3b).

A “C” will be added to the sample identification number for confirmation samples to assist in differentiating the PEA sample locations and laboratory analytical results with confirmation soil samples collected following soil excavation activities.

7.7 Offsite Disposal of Waste

The waste material will be profiled and approval from the disposal facility will be received before excavation activities commence. The disposal facility will provide appropriate information to the RWQCB, as required, if the wastes are disposed of in-state (as they are anticipated to be done), in accordance with the facility’s specific requirements with the RWQCB. Soil excavated from the Site during the initial excavation will be handled, transported, and disposed of based on waste characterization results.

Final determination of the landfill used for disposal will be based on approval from the landfill. Once the disposal facility is selected, copies of waste profile reports used to secure disposal permission from the landfill will be provided. In addition, compliance with the land disposal restriction and land ban requirements for hazardous wastes will be documented and provided once it is established which disposal facility will be used.

Detailed information on waste transportation and disposal is described in the Transportation Plan (Appendix F).

7.8 Excavation Backfilling and Site Restoration

The excavation will be backfilled and compacted with clean fill material from an offsite source. The source location and data for the offsite fill material will be obtained prior to importing the material to the Site. An evaluation of the imported fill material will be performed in accordance with DTSC's advisory on clean imported fill. A copy of DTSC's advisory is presented in Appendix H.

8. Project Schedule and Removal Action Completion Report

The information obtained during the removal action will be evaluated and a removal action completion report will be prepared for the Site. The report will include the following elements:

- a summary of relevant information obtained
- a description of field investigation methods
- copies of daily field reports
- a tabular summary of analytical results
- figures showing the Site location and layout with pertinent analytical results
- copies of laboratory analytical reports
- copies of waste manifests and other relevant shipping documents.

A more detailed project schedule is presented in Appendix G.

9. Limitations

The opinions and recommendations presented in this report are based upon the scope of services, information obtained through the performance of the services, and the schedule as agreed upon by ARCADIS and the SMMUSD, the party for whom this report was originally prepared. This report is an instrument of professional service and was prepared in accordance with the generally accepted standards and level of skill and care under similar conditions and circumstances established by the environmental consulting industry. No certification, warranty, or guarantee, express or implied, is intended or given beyond that expressly made herein. ARCADIS makes no representation as to the accuracy or completeness of information prepared by other parties not under contract to ARCADIS. ARCADIS is unaware of any material inaccuracies of the information relied upon by ARCADIS. This report is expressly for the sole and exclusive use of the SMMUSD, California Department of Education, applicable landfill or disposal site, RWQCB, and DTSC for a particular purpose. Only the SMMUSD and/or other specifically named parties have the right to make use of and rely upon this report. Reuse of this report or any portion thereof for other than its intended purpose, or if modified, or if used by third parties, shall be at the user's sole risk.

Results of any investigations or testing and any findings presented in this report apply solely to conditions existing at the time when ARCADIS' investigative work was performed. It must be recognized that any such investigative or testing activities are inherently limited and do not represent a conclusive or complete characterization. Conditions in other parts of the project Site may vary from those at the locations where data were collected. ARCADIS' ability to interpret investigation results is related to the availability of the data and the extent of the investigation activities. As such, 100 percent confidence in environmental investigation conclusions cannot reasonably be achieved.

Nothing contained in this document shall relieve any other party of its responsibility to abide by contract documents and applicable laws, codes, regulations, or standards.

10. References

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Table 1. Health Effects of Compounds of Concern
Santa Monica-Malibu Unified School District
Malibu Middle and High School, Malibu, California

Compound of Concern	Health Effect
Chlordane	Chlordane is a manufactured chemical that can take the form of a thick liquid that ranges from colorless to amber and has either no odor or a mild, irritating smell. Technical chlordane is a mixture of two isomers called alpha-chlordane and gamma-chlordane along with byproducts from production. Between 1948 and 1983, chlordane was used as a pesticide on crops like corn and citrus and on home lawns and gardens. Because of concerns about damage to the environment and harm to human health, the U.S. Environmental Protection Agency (USEPA) banned the use of chlordane for all applications except termite control in 1983. USEPA banned all uses of chlordane in 1988. Chlordane is hydrophobic and sticks to soil particles in surface soils for many years as it has a very slow breakdown rate. Chlordane affects the nervous system, digestive system, and liver. Headaches, irritability, confusion, weakness, vision problems, vomiting, stomach cramps, diarrhea, and jaundice have occurred in humans who breathed air containing high concentrations or ingested small amounts of chlordane. Consuming large amounts of chlordane causes convulsions and death in humans. Chlordane has been linked to certain types of cancer.
PCBs	Polychlorinated biphenyls (PCBs) are mixtures of up to 209 individual chlorinated compounds (known as congeners). There are no known natural sources of PCBs. PCBs are either oily liquids or solids that are colorless to light yellow. Some PCBs can exist as a vapor in air. PCBs have no known smell or taste. The most commonly observed health effects in people exposed to large amounts of PCBs are skin conditions such as acne and rashes. Studies in exposed workers have shown changes in blood and urine that may be indicative of liver damage. PCB exposures in the general population are not likely to result in skin and liver effects. Few studies of workers indicate that PCBs were associated with certain kinds of cancer in humans, such as cancer of the liver and biliary tract. Rats that ate food containing high levels of PCBs for two years developed liver cancer. The Department of Health and Human Services (DHHS) has concluded that PCBs may reasonably be anticipated to be carcinogens. The USEPA and the International Agency for Research on Cancer (IARC) have determined that PCBs are probably carcinogenic to humans. Animals that ate food containing large amounts of PCBs for short periods of time had mild liver damage and some died. Animals that ate smaller amounts of PCBs in food over several weeks or months developed various kinds of health effects, including anemia; acne-like skin conditions; and liver, stomach, and thyroid gland injuries. Other effects of PCBs in animals included changes in the immune system, behavioral alterations, and impaired reproduction. PCBs are not known to cause birth defects (ATSDR, http://www.atsdr.cdc.gov/tfacts17.html#bookmark05).

Table 2. Preliminary Cleanup Goals for Compounds of Concern
Santa Monica-Malibu Unified School District
Malibu Middle and High School, Malibu, California

Compound of Concern	Preliminary Cleanup Goal
Alpha, Gamma, and Technical-Chlordane	430 µg/kg
PCBs – Aroclor 1254	89 µg/kg

Note: µg/kg = micrograms per kilogram

Table 3. Rough Order of Magnitude (ROM) Cost Estimate
for Removal of Lead- and Pesticide-Affected Soils
Malibu Middle and High School, Malibu, California

Task No.	Description		Unit	Qty.	Unit Cost	Sub-Total	Task Cost	Estimated Cost	Assumptions
1	***RAW Preparation***								
	LFR Labor						**$17,180**		
		Task 1 Subtotal						**$17,180**	
2	***Excavation & Backfill***		**AIS - All Areas**						
	LFR Labor						**$62,229**		Includes a total of 16 hours for pre- and postfield activities. Assumes 12 hour field days. Second person on-site to conduct additional tasks/air monitoring etc.
	LFR Equipment	Equipment/Materials/Transportation	day	20	$350	$7,000			
		Misc. Equipment	LS	1	$4,000	$4,000			
		LFR Equipment					**$11,000**		
	Surveyor	Surveyor (after excavation) - assuming not needed	LS		$4,000	$0	**$0**		- assuming not needed
	Permits	Malibu City Approval (Over the Counter Permit for Excavation)*							
		Labor	hrs	25	$100	$2,500			
		Permit Fees	LS	1	$2,000	$2,000	**$4,500**		
		Utility Clearance	LS	1	$2,070	$2,070			
	Subcontractors	Mobilization/Demobilization. Includes excavation of soil in accordance with figure (1,200 cy; 8 areas). Import up to 2000 tons of import fill sand for backfill; compaction to 90%; compaction testing and report. Asphalt patch in one area where asphalt removed (AIS budgetary quotation)	LS	1	$186,248	$186,248			Excludes: permits, bonding of project is not required, import of gravel for backfill material, shoring or bracing, dewatering, demolition of building or other aboveground items, removal, replacement, repair, or relocation of utilities, traffic control, replacement of landscape or irrigation.
		Air Monitoring/Dust Covers	Day	20	$1,000	$20,000			
		STLC sampling	sample	5	$71	$357			Budgetary;
		TCLP sampling	sample	5	$79	$397			
		Confirmation Soil Sampling (pesticides)	sample	12	$81	$966			
		Confirmation Soil Sampling (PCBs)	sample	80	$92	$7,360			
		Waste Characterization Soil Sample	sample	8	$526	$4,204			Assumes 1 composite sample per 200cy of removed soil, includes VOCs, TPH, metals, pesticides and PCBs (+ 2 contingency samples)
		Backfill Material Soil Sampling (need to document material is clean. Good practice is to collect representative soil samples to document material is clean (unless documentation of cleanliness is provided)	sample	8	$698	$5,584			This will depend on where backfill material comes from and how much documentation there is to support soils cleaness. This estimate includes 8 composite samples (if confidence that material is clean is high). Includes analysis for VOCs, SVOCs, TPH, Metals, Pesticides, and PCBs.

Table 3. Rough Order of Magnitude (ROM) Cost Estimate
for Removal of Lead- and Pesticide-Affected Soils
Malibu Middle and High School, Malibu, California

Task No.	Description		Unit	Qty.	Unit Cost	Sub-Total	Task Cost	Estimated Cost	Assumptions
		Contingency				$10,000			
	Subcontractor	Subcontractor					**$237,186**		
	Task 2 Subtotal							**$314,915**	
3	***Summary Report & Project Management***								
	LFR Labor						**$16,347**		
	Task 3 Subtotal							**$16,347**	
4	***Disposal***								
	Subcontractor	Subcontractor (Non-hazardous)	ton	1800	$81	$144,900			Includes disposal of affected soil from Areas 1 through 4
		10% weight contingency	ton	180	$81	$14,490			
		Subcontractor					**$159,390**		
	Task 4 Subtotal							**$159,390**	
	Total All Tasks							**$507,832**	

Notes:

For disposal purposes: Based on analyses conducted to date, soil will most likely be disposed of as non-hazardous

Assumptions:

Assumes all areas done consecutively

Assumes total cubic yards: 1,200 cy (8 PCB areas; 1 pesticide affected area)

To convert to tons (*1.5): 1,800 cy

Assumes 20 days of work for excavation contractors including excavation, disposal, backfill, compaction

Assumes excavation area does not need to be surveyed after removal

AIS Costs - assumes all unpaved surface with exception of asphalt in Area 6.

Assumes clean import fill will be brought in to replace volume excavated (can be taken out - and included in another contract document)

Assumes air monitoring and soil sampling will be provided by ARCADIS

Assumes no underground utilities are encountered, no shoring or bracing is needed, no dewatering, no hard digging or rock conditions, water will be available onsite, no overhead or surrounding area restrictions.

*Placeholder Estimate only.

Table 4. Potential Federal ARARs
Santa Monica-Malibu Unified School District
Malibu Middle and High School, Malibu, California

Requirement	Citation	Description	Applicable/ Relevant and Appropriate	Comments
Potential Federal Chemical-Specific ARARs				
TSCA	15 USC Section 2601 to 2692	Establishes management standards for toxic substances including PCBs.		
PCB Remediation Waste	40 CFR Section 761.61	Established self-implementing cleanup standards for PCB remediation waste under specified conditions	Yes/Potentially	Cleanup levels for unrestricted use are currently not relevant and appropriate because PCBs have not been detected in on-site soil at concentrations at or above hazardous waste criteria.
Safe Drinking Water Act	40 CFR 141-143	Regulates the quality of drinking water supply and lists maximum contaminant levels	No/No	Maximum Contaminant Levels are not considered relevant and appropriate for this remedial action because soil is the only media affected.
Clean Air Act	40 CFR 50.4–50.12	National Ambient Air Quality Standards include primary and secondary standards for ambient air quality to protect public health and welfare (including standards for particulate matter).	Yes/Potentially	These requirements will be evaluated in the state action specific ARARs.
Clean Air Act	40 USC 7410; portions of 40 CFR 52.220 applicable to South Coast Air Quality Management District	Provisions of State Implementation Plan (SIP) approved by EPA under Section 110 of Clean Air Act	Yes/Potentially	These requirements will be evaluated in the state action specific ARARs.

Table 4. Potential Federal ARARs
Santa Monica-Malibu Unified School District
Malibu Middle and High School, Malibu, California

Requirement	Citation	Description	Applicable/ Relevant and Appropriate	Comments
Potential Federal Action-Specific ARARs				
RCRA as amended by the HSWA	42 USC Sections 6901-6992k	Establishes standards for management of hazardous waste.		
Identification and Listing of Hazardous Waste	40 CFR Part 261	Criteria defining hazardous waste.	Yes/Potentially	Soils meeting these criteria must be managed as a hazardous waste. Concentrations identified during the PEA investigation are well below hazardous waste criteria. Though not anticipated, if soils are hazardous, these regulations will be followed.
Hazardous Waste Generator Standards	40 CFR Part 262	Requirements for waste identification; obtaining an EPA identification number; use of the hazardous waste manifest; packaging, marking, and labeling; accumulation time; recordkeeping, and reporting.	Yes/Potentially	Applicable to site activities involving generation of hazardous waste, such as generation of soils that may meet these criteria. If soils are hazardous, these regulations will be followed.
Hazardous Waste Generator Standards	40 CFR Part 265 Subpart C	Preparedness and prevention requirements.	Yes/Potentially	Applicable to site activities involving generation of hazardous waste; may be applicable if soils meet these hazardous waste designation. If so, these regulations will be followed.

Table 4. Potential Federal ARARs
Santa Monica-Malibu Unified School District
Malibu Middle and High School, Malibu, California

Requirement	Citation	Description	Applicable/ Relevant and Appropriate	Comments
Hazardous Waste Generator Standards	40 CFR Part 265.16	Training requirements.	Yes/Potentially	Applicable to site activities involving generation of hazardous waste; may be applicable if soils meet hazardous waste designation. If so, these regulations will be followed.
Hazardous Waste Generator Standards	40 CFR Part 265 Subpart I	Container management requirements.	Yes/Potentially	Applicable to on-site accumulation of hazardous waste, such as excavated soils in stockpiles. These requirements will be applied to stockpiled or containerized soils on site.
Land Disposal Restrictions	40 CFR Part 268	Prohibits land disposal of restricted hazardous waste without meeting treatment standards; recordkeeping requirements.	Yes/Potentially	If soils meet hazardous waste criteria they will meet appropriate treatment standards before being disposed to land.
Hazardous Waste Transportation Requirements	40 CFR Part 263	Requirements for hazardous waste transporters.	Yes/Potentially	Applicable to transportation of hazardous waste off site. Transporters of hazardous waste, if generated, will meet these requirements.

Table 4. Potential Federal ARARs
Santa Monica-Malibu Unified School District
Malibu Middle and High School, Malibu, California

Requirement	Citation	Description	Applicable/ Relevant and Appropriate	Comments
OSHA	29 U.S.C. Sections 651-678	Establishes workplace health and safety standards.		
OSHA Hazardous Waste Operations and Emergency Response Regulations	29 C.F.R. Section 1910.120	Standards for employee safety during specified hazardous waste operations.	Yes/Potentially	Worker protection standards applicable to cleanup operations. These regulations will be followed for the RAW work.
OSHA Safety and Health Standards for Construction	29 C.F.R. Part 1926	Standards for construction and excavation.	Yes/Yes	Applicable to specified construction and excavation activities. These regulations will be followed for the RAW work.
DOT Requirements for Hazardous Materials Transportation	40 C.F.R. Parts 171-177	Standards for transportation of hazardous materials.	Yes/Potentially	Applicable to off-site transportation of specified hazardous materials, including hazardous waste. These regulations will be followed for the RAW work.
Potential Federal Location-Specific ARARs				
Endangered Species Act	15 USC 1531 – 1544, 50 CFR Part 402, 40 CFR Part 6.302[h]	Standards to protect critical habitat upon which endangered species or threatened species depend.	No/No	No critical habitat upon which endangered species or threatened species depend is identified at the Site.

Table 4. Potential Federal ARARs
Santa Monica-Malibu Unified School District
Malibu Middle and High School, Malibu, California

Requirement	Citation	Description	Applicable/ Relevant and Appropriate	Comments
Executive Order 11990, Protection of Wetlands	40 CFR 6, Appendix A (excluding Sections 6 (a)[2], [4], and [6]); and 40 CFR 6.302	Standards to minimize the destruction, loss, or degradation of wetlands.	No/No	No wetlands have been identified at the Site.
Clean Water Act	40 CFR 230.10; 40 CFR 231 (excluding 231.1, 231.2, 231.7 and 231.8)	Standards prohibit discharge of dredged material into wetland without a permit. Mitigation may be required to avoid net loss of wetlands.	No/No	No dredged materials will be generated nor discharged at the Site.
Fish and Game Coordination Act, Section 662	16 USC 662	Standards to protect fish and other wildlife; prohibits diversion, channeling or other activity that modifies a stream or other water body and affects fish or wildlife.	No/No	No diversion, channeling or other activity that modifies a stream or other water body and affects fish or wildlife will be conducted at the Site.
Migratory Bird Treaty Act of 1972	16 USC 703	Standards that protect almost all species of native birds in the United States from unregulated “take” which can include poisoning at hazardous waste sites.	No/No	No unregulated “take” of native birds which can include poisoning at hazardous waste sites is expected at the Site.

Table 4. Potential Federal ARARs
Santa Monica-Malibu Unified School District
Malibu Middle and High School, Malibu, California

Requirement	Citation	Description	Applicable/ Relevant and Appropriate	Comments
National Historic Preservation Act	16 USC 470, 40 CFR Part 6.31(b), and 35 CFR Part 800	This statute and implementing regulations require federal agencies or federal projects to take into account the effect of any federally assisted undertaking or licensing on any district, site, building, structure, or object that is included in, or eligible for, the Register of Historic Places.	No/No	The proposed remedial action is not expected to have an adverse effect on cultural resources; none are known to be on the Site.
Archaeological and Historic Preservation Act	16 USC 469, 40 CFR Part 6.301 [c]	This statute and implementing regulations establish requirements for the evaluation and preservation of historical and archaeological data that may be destroyed through alteration of terrain as a result of a federal construction project or a federally licensed activity or program.	No/No	The proposed remedial action is not expected to result in the destruction of historical archaeological data.

Table 4. Potential Federal ARARs
Santa Monica-Malibu Unified School District
Malibu Middle and High School, Malibu, California

Requirement	Citation	Description	Applicable/ Relevant and Appropriate	Comments
Historic Sites, Buildings, and Antiquities Act	16 USC, Subsection 461-467, 40 CFR Part 6.301 [a]	This standard requires federal agencies to consider the existence and location of landmarks on the National Registry of Natural Landmarks to avoid undesirable impacts on such landmarks.	No/No	The remedial action contemplated for the Site is not anticipated to affect facilities regulated under this act.

Table 5. Potential State ARARs
Santa Monica-Malibu Unified School District
Malibu Middle and High School, Malibu, California

Requirement	Agency	Citation	Description	Applicable/ Relevant and Appropriate	Comments
Potential State Chemical-Specific ARARs					
Waste Discharge	RWQCB	California Water Code, Division 7, Section 13241, 13243, 13263 (a) and 13360 (Porter-Cologne Water Quality Control Act).	Authorizes State and RWQCB to establish Water Quality Control Plans that include beneficial uses and numerical and narrative standards to protect both surface and groundwater quality. Authorizes RWQCB to issue permits, including NPDES permits, for discharges to land surface or groundwater that could affect water quality and to take enforcement action to protect water quality.	No/No	Removal is expected to address these ARARs. No discharges to surface water or groundwater anticipated. No indications of discharges to surface water or groundwater have been documented.
Land Disposal Restrictions	DTSC	22 Cal. Code Regs. Division 4.5, Chapter 18	Prohibits land disposal of restricted hazardous waste without meeting treatment standards; recordkeeping requirements.	Yes/Potentially	Applicable to restricted hazardous waste disposed off site. If soils meet this designation, these requirements will be followed.
Land Disposal Restrictions	DTSC	H&SC Section 25157.8	Prohibits land disposal of any waste containing total lead in excess of 350 mg/kg in California to other than a Class 1 disposal facility.	Yes/Potentially	Lead-affected soil removed from the Site will be handled appropriately. Concentrations identified during the PEA investigation are well below this criterion.

Table 5. Potential State ARARs
Santa Monica-Malibu Unified School District
Malibu Middle and High School, Malibu, California

Requirement	Agency	Citation	Description	Applicable/ Relevant and Appropriate	Comments
Water Quality Objectives	RWQCB	Basin Plan for the Coastal Watersheds of Los Angeles and Ventura Counties	Describes water basins in coastal areas of Los Angeles and Ventura Counties, establishes beneficial uses of surface water and groundwater, establishes water quality objectives, including narrative and numerical standards, establishes implementation plans to meet water quality control objectives and protect beneficial uses, and incorporates statewide water quality control plans and policies.	Yes/Yes	Substantive provisions are ARARs, including beneficial use designations, water quality objectives, and water discharge limits. RAW implementation will be conducted in a manner to address these regulations.
General Permit for Storm Water Discharges Associated With Construction Activity	California Environmental Protection Agency State Water Resources Control Board – Division of Water Quality	Division of Water Quality, Water Quality Work Order 99-08-DWQ	Requires a general permit for discharging of storm water at a construction site	Yes/No	Permit is required to manage potential storm water discharge activities for a project that disturbs greater than 1 acre of earth movement. Not applicable for the Site as excavation activities will be less than 1 acre of earth movement.

Table 5. Potential State ARARs
Santa Monica-Malibu Unified School District
Malibu Middle and High School, Malibu, California

Requirement	Agency	Citation	Description	Applicable/ Relevant and Appropriate	Comments
Potential State Action-Specific ARARs					
Safe Drinking Water and Toxics Enforcement Act of 1986 (Proposition 65)	OEHHA	Cal. Health & Safety Code, Division 20, Chapter 6.6, Section 25249.5	Requires warnings of exposure to listed chemicals above specified concentrations or risk levels.	Yes/Potentially	Remediation activities will consider warning requirements if they result in exposures above specified "No significant risk" levels.
California Hazardous Waste Control Law	DTSC	Cal. Health & Safety Code, Division 20, Chapter 6.5	Establishes standards for management of hazardous waste.		
Remediation Waste Staging	DTSC	Cal. Health & Safety Code, Section 25123.3	Establishes standards for management of remediation waste in staging piles	Yes/Potentially	Applicable for excavated soil temporarily managed in on-site stockpiles. These regulations will be followed.
Criteria for Identification of Hazardous and Extremely Hazardous Waste	DTSC	22 Cal. Code Regs. Division 4.5, Chapter 11	Establishes numerical criteria for identification of hazardous and extremely hazardous waste.	Yes/Potentially	Concentrations identified during the PEA investigation are well below hazardous waste criteria. Though not anticipated, if results of stockpile sampling indicate hazardous waste criteria are met, excavated soils meeting these criteria will be managed as a hazardous waste.

Table 5. Potential State ARARs
Santa Monica-Malibu Unified School District
Malibu Middle and High School, Malibu, California

Requirement	Agency	Citation	Description	Applicable/ Relevant and Appropriate	Comments
Hazardous Waste Generator Standards	DTSC	22 Cal. Code Regs. Division 4.5, Chapter 12	Requirements for waste identification; obtaining an EPA identification number; use of the hazardous waste manifest; packaging, marking and labeling; accumulation time; recordkeeping and reporting.	Yes/Potentially	Applicable to site activities involving generation of hazardous waste. If excavated soils are classified as hazardous waste, these regulations will be followed.
Hazardous Waste Generator Standards	DTSC	22 Cal. Code Regs. Division 4.5, Chapter 15, Article 3	Preparedness and prevention requirements.	Yes/Potentially	Applicable to site activities involving generation of hazardous waste. If excavated soils are classified as hazardous waste, these regulations will be followed.
Hazardous Waste Generator Standards	DTSC	22 Cal. Code Regs. Division 4.5, Chapter 15, Article 4	Contingency Plan requirements.	Yes/Potentially	Applicable to site activities involving generation of hazardous waste. If excavated soils are classified as hazardous waste, these regulations will be followed.
Hazardous Waste Generator Standards	DTSC	22 Cal. Code Regs. Section 66265.16	Training requirements.	Yes/Potentially	Applicable to site activities involving generation of hazardous waste. If excavated soils are classified as hazardous waste, these regulations will be followed.

Table 5. Potential State ARARs
Santa Monica-Malibu Unified School District
Malibu Middle and High School, Malibu, California

Requirement	Agency	Citation	Description	Applicable/ Relevant and Appropriate	Comments
Hazardous Waste Generator Standards	DTSC	22 Cal. Code Regs. Division 4.5, Chapter 15, Article 9	Container management requirements.	Yes/Potentially	Applicable to on-site accumulation of hazardous waste in stockpiles or containers for less than 90 days. If excavated soils are classified as hazardous waste, these regulations will be followed.
Hazardous Waste Transportation Requirements	DTSC	22 Cal. Code Regs. Division 4.5, Chapter 13	Requirements for hazardous waste transporters.	Yes/Potentially	Applies to transportation of hazardous waste off-site. If excavated soils are classified as hazardous waste, these regulations will be followed.
Hazardous-Waste TSDF Requirements	DTSC	CCR, Title 22, Division 4.5, Chapter 14	Specifies hazardous-waste TSDF requirements regulating the design, construction, operation, and closure of RCRA-permitted TSDFs. TSDF requirements may be ARARs if the selected remedy involves treatment, storage or disposal of wastes that are sufficiently similar to RCRA hazardous wastes (*CERCLA Compliance With Other Laws Manual,* OSWER Directive 9234.1-01, August 8, 1988, pp. 2-5 and 2-6).	Yes/Potentially	Waste produced at the Site would probably be classified as a nonhazardous waste but some RCRA hazardous wastes could potentially be produced during remedial activities. If excavated soils are classified as hazardous waste, these regulations will be followed

Table 5. Potential State ARARs
Santa Monica-Malibu Unified School District
Malibu Middle and High School, Malibu, California

Requirement	Agency	Citation	Description	Applicable/ Relevant and Appropriate	Comments
Remedial Action Workplan Oversight Requirements	DTSC	Cal Health and Safety Code, Division 20, Chapter 6.8, Section 25356.1	Requirements for review and approval of Remedial Action Workplan as part of School Property Evaluation and Cleanup.	Yes/Yes	Requires DTSC to review and approve any Remedial Action Workplan for a school site. Although state funding is not being used for this project, workplan is included in MND (Mitigated Negative Declaration) being submitted to different agencies, including DTSC, for review.
California Occupational Safety and Health Act	Cal/OSHA	Cal. Labor Code, Division 5	Establishes workplace health and safety standards.		
Construction Safety Orders	Cal/OSHA	8 Cal. Code Regs. Chapter 4, Subchapter 4	Detailed construction safety requirements.	Yes/Yes	Applicable to on site construction activities. These regulations, to the extent they are applicable, will be followed.
Electrical Safety Orders	Cal/OSHA	8 Cal. Code Regs. Chapter 4, Subchapter 5	Detailed electrical safety requirements.	Yes/Potentially	Applicable to remediation activities involving electrical wiring and equipment. These regulations, to the extent they are applicable, will be followed.

Table 5. Potential State ARARs
Santa Monica-Malibu Unified School District
Malibu Middle and High School, Malibu, California

Requirement	Agency	Citation	Description	Applicable/ Relevant and Appropriate	Comments
General Industry Safety Orders	Cal/OSHA	8 Cal. Code Regs. Chapter 4, Subchapter 7	Detailed safety requirements of general applicability.	Yes/Potentially	Applicable to specific on site investigation and remediation activities. These regulations, to the extent they are applicable, will be followed.
Hazardous Waste Operations and Emergency Response Regulations	Cal/OSHA	8 Cal. Code Regs. Section 5192	Standards for employee safety during specified hazardous waste operations.	Yes/Potentially	Worker protection standards applicable to cleanup operations. These regulations will be followed.
CEQA	CDE	CCR, Title 14, Sections 15000 through 15387	Mandates environmental impact review of actions regulated by California governmental agencies.	Yes/Yes	The remedial alternatives for this Site may be subject to CEQA review. District has consultant working on CEQA issues.

Table 5. Potential State ARARs
Santa Monica-Malibu Unified School District
Malibu Middle and High School, Malibu, California

Requirement	Agency	Citation	Description	Applicable/ Relevant and Appropriate	Comments
Potential State Location-Specific ARARs					
Landfill Location Regulation	DTSC	CCR, Title 22, Section 66264.18 (a) and (b)	Establishes location standards for hazardous-waste treatment, storage or disposal facilities (TSDFs). Subsection 66264.18 (a) prohibits the placement of TSDFs within 200 feet of a fault displaced during the Holocene Epoch. Subsection 66264.18 (b) requires TSDFs located within a 100-year floodplain be capable of withstanding a 100-year flood.	Yes/Yes	Excavated soil will be transported to a licensed and permitted off-site disposal facility.
Fish and Game Code	Fish and Game	California Fish and Game Code Sections 2080, 5650(a), (b), and (f), 12015, and 12016	Prohibits discharge of harmful quantities of hazardous materials into places that may deleteriously affect fish, wildlife or plant life.	No/No	Excavated soil will be transported to an off-site disposal facility that will manage the waste properly.

Table 6. Potential Local ARARs
Santa Monica-Malibu Unified School District
Malibu Middle and High School
Malibu, California

Requirement	Agency	Citation	Description	Applicable/ Relevant and Appropriate	Comments	ARAR Will Be Met For Project
Potential Local Action-Specific ARARs						
Grading Permit	City of Malibu		May require over-the-counter permit	Yes/ Potentially	City requires grading permits for excavation/grading projects greater than 1,000 cy. While exempted from Coastal Commission review as this is a maintenance and repair type of activity and proposed activities are immediately adjacent to buildings, a review of the plans by the City may be warranted.	Yes
Noise	City of Malibu	Noise Control Ordinance of the City of Malibu. Chapter 2. Section 4200.	No permits are required for construction noise	Yes/Yes	No permits are required for the generation of construction noise during the excavation. However, construction noise is only permitted between the hours of 7 am and 7 pm, Monday through Friday, 8 am to 5 pm Saturday and no construction work allowed on Sunday. Noise levels will be maintained at allowable levels, and work will be done only during allowable hours.	Yes
Sanitary Landfills	SCAQMD	Air Quality Management District Regulations, Rule 1150	This rule applies to the excavation of sanitary landfills.	No/No	This rule does not apply to this project because the site is not a landfill.	NA

Table 6. Potential Local ARARs
Santa Monica-Malibu Unified School District
Malibu Middle and High School
Malibu, California

Requirement	Agency	Citation	Description	Applicable/ Relevant and Appropriate	Comments	ARAR Will Be Met For Project
Emissions of Volatile Organic Compounds (VOCs)	SCAQMD	Air Quality Management District Regulations, Rule 1166	This rule applies to the excavation of soils containing VOCs.	No/No	Rule 1166 does not apply to this project, as the constituents of concern are not volatile.	NA
Dust Emissions	SCAQMD	Air Quality Management District Regulations, Rule 403	Several elements of this rule, such as protocols for mitigation of potential fugitive dust emissions, have been incorporated into this RAW. Excavation, loading, and transport of impacted soils shall be in compliance with South Coast AQMD Rule 403 prevention, reduction, and mitigation measures for fugitive dust emissions. However, notification of South Coast AQMD is required only for large operations (disturbing more than 100 acres or moving more than 10,000 cubic yards per day).	No/No	No notification or filing of a Fugitive Dust Emission Control Plan is required due to project size.	NA
Potential Local Chemical-Specific ARARs						
No potential Local chemical-specific ARARs have been identified for this Site.						
Potential Local Location-Specific ARARs						
No potential Local location-specific ARARs have been identified for this Site.						

MAP SOURCE: Google Earth Pro™ 2007, 34°01'25.93"N, 118°49'36.74"W

SITE BOUNDARY

0 600' 1,200'

GRAPHIC SCALE

MALIBU HIGH SCHOOL
30215 MORNING VIEW DRIVE, MALIBU, CALIFORNIA
CAMPUS IMPROVEMENTS PROJECT

VICINITY MAP

ARCADIS

FIGURE
1

CITY:COSTA MESA DIV/GROUP:ENV_CAD DB:ENV_CAD LAYOUT: LAYOUT1 SAVED: 3/16/2010 3:09 PM ACADVER: 17.1S (LMS TECH) PAGESETUP: ---- PLOTSTYLETABLE: KMEP.CTB PLOTTED: 3/17/2010 2:32 PM BY: LOVING, JEFFREY
K:\Data\Graphics\CM011000\CM011144\0003\CM011144.0003 Vicinity Map.dwg

PROJECT SCOPE

1. New Parking
2. Interim Housing
3. New I.T. Room
4. New Ramp & Stairs
5. Secure Perimeter
6. Relocated Equestrian Trail
7. Storm Water Management System
8. Fill Site
9. New Administration/Library/ Classroom Building
10. Renovated Classroom Building
11. New Student Drop-Off
12. Middle School Quad
13. High School Quad
14. Track Circle & Modified Parking
15. Modified Stairs/Visitor Parking
16. Secondary Treatment System
17. New Bleachers
18. New Field Lights
19. New Tennis Courts
20. New Artificial Turf

Malibu Middle and High School
Campus Improvements Project

Approx. Area of Construction: 1,007,300 SF (23.1 Acres)

HMC

2009.06.09

MALIBU HIGH SCHOOL
30215 MORNING VIEW DRIVE, MALIBU, CALIFORNIA
CAMPUS IMPROVEMENTS PROJECT

PROPOSED
CAMPUS IMPROVEMENTS PROJECT

ARCADIS

FIGURE
2

CITY:Costa Mesa DIV/GROUP:ENV_CAD DB:ENV_CAD
K:\Data\Graphics\CM011000\CM011144\0003\CM011144.0003 Improvements REV.ai

PROJECT SCOPE

NOTE: SEE FIGURE 3 FOR COMPLETE LIST

- 3 NEW I.T. ROOM
- 9 NEW ADMINSTRATION/LIBRARY/CLASSROOM BUILDING
- 10 RENOVATED CLASSROOM BUILDING
- 11 NEW STUDENT DROP-OFF
- 12 MIDDLE SCHOOL QUAD
- 13 HIGH SCHOOL QUAD
- 14 TRACK CIRCLE & MODIFIED PARKING

LEGEND

OLDER STRUCTURES
SOIL SAMPLES
SAMPLED AT 0.5 AND 2.5 FT. BGS
- ANALYZED DISCRETE SAMPLES FOR:
PCBs (EPA METHOD 8082)

STEP-OUT SAMPLE
(PCBS 0.5 AND 2.5 FT BGS)

STEP-OUT SAMPLE
(PCBS 2.5 FT BGS)

PROPOSED REMOVAL AREAS (1-8)

PROPOSED EXCAVATION FLOOR CONFIRMATION SOIL SAMPLE LOCATION

PROPOSED EXCAVATION SIDEWALL CONFIRMATION SOIL SAMPLE LOCATION

CAMPUS BOUNDARY

1 FOR DISCUSSION PURPOSES, THE NUMBERS REPRESENT THE EXCAVATION AREA

N

0 50 FEET

APPROX. AREA OF CONSTRUCTION :
1,007,300 SF (23.1 ACRES)

MALIBU HIGH SCHOOL
30215 MORNING VIEW DRIVE, MALIBU, CALIFORNIA
CAMPUS IMPROVEMENTS PROJECT

PROPOSED CONFIRMATION SAMPLING LOCATIONS - PCBs

ARCADIS

FIGURE
3A

CITY:COSTA MESA DIV/GROUP:ENVCAD DB:ENVCAD
G:\ENVCAD\CostaMesa\ACT\CM011000\CM011144\0003\CM011144.0013 Site Plan3_PCB Excav_recover.dwg LAYOUT: 3A SAVED: 6/18/2010 11:24 AM ACADVER: 18.0S (LMS TECH) PAGESETUP: --- PLOTSTYLETABLE: KMEP.CTB PLOTTED: 6/18/2010 11:40 AM BY: LOVING, JEFFREY

PROJECT SCOPE

NOTE: SEE FIGURE 3 FOR COMPLETE LIST

10 RENOVATED CLASSROOM BUILDING

LEGEND

OLDER STRUCTURES
SOIL SAMPLES
SAMPLED AT 0.5 AND 2.5 FT. BGS
- ANALYZED DISCRETE SAMPLES FOR: PCBs (EPA METHOD 8082)

STEP-OUT SAMPLE
(PESTICIDES 0.5 AND 2.5 FT BGS)

PROPOSED REMOVAL AREA (9)

PROPOSED EXCAVATION FLOOR CONFIRMATION SOIL SAMPLE LOCATION

PROPOSED EXCAVATION SIDEWALL CONFIRMATION SOIL SAMPLE LOCATION

CAMPUS BOUNDARY

9 FOR DISCUSSION PURPOSES, THE NUMBERS REPRESENT THE EXCAVATION AREA

0 20 FEET

APPROX. AREA OF CONSTRUCTION : 1,007,300 SF (23.1 ACRES)

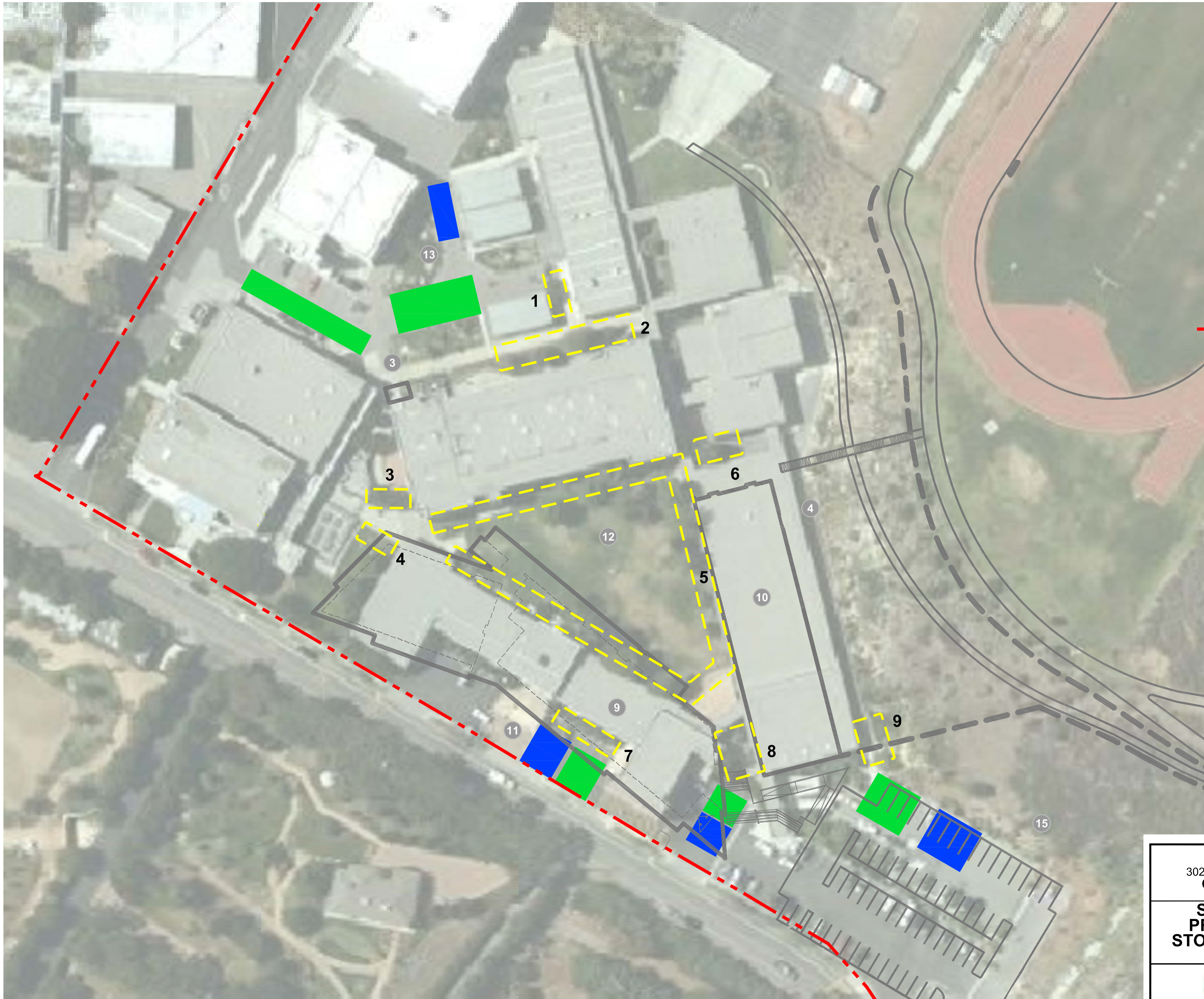
MALIBU HIGH SCHOOL
30215 MORNING VIEW DRIVE, MALIBU, CALIFORNIA
CAMPUS IMPROVEMENTS PROJECT

PROPOSED CONFIRMATION SAMPLING LOCATIONS - PESTICIDES

ARCADIS

FIGURE
3B

CITY:COSTA MESA DIV/GROUP:ENVCAD DB:ENVCAD
G:\ENVCAD\CostaMesa\ACT\CM011000\CM0114400013 Site Plan3_PCB Excav_recover.dwg LAYOUT: 3B SAVED: 6/18/2010 12:04 PM ACADVER: 18.0S (LMS TECH) PAGESETUP: ---- PLOTSTYLETABLE: KMEP.CTB PLOTTED: 6/18/2010 12:04 PM BY: LOVING, JEFFREY



PROJECT SCOPE

NOTE: SEE FIGURE 3 FOR COMPLETE LIST

- 3 NEW I.T. ROOM
- 9 NEW ADMINSTRATION/LIBRARY/CLASSROOM BUILDING
- 10 RENOVATED CLASSROOM BUILDING
- 11 NEW STUDENT DROP-OFF
- 12 MIDDLE SCHOOL QUAD
- 13 HIGH SCHOOL QUAD
- 14 TRACK CIRCLE & MODIFIED PARKING

LEGEND

- PROPOSED EXCAVATION AREA
- CAMPUS BOUNDARY
- 1 FOR DISCUSSION PURPOSES, THE NUMBERS REPRESENT THE EXCAVATION AREA
- PROPOSED STAGING, STORING AND SOIL STOCKPILE AREAS
- PROPOSED DECONTAMINATION AREAS

0 80 FEET

APPROX. AREA OF CONSTRUCTION : 1,007,300 SF (23.1 ACRES)

MALIBU HIGH SCHOOL
30215 MORNING VIEW DRIVE, MALIBU, CALIFORNIA

CAMPUS IMPROVEMENTS PROJECT

SITE LOCATION MAP SHOWING PROPOSED STAGING, STORAGE, STOCKPILE AND DECONTAMINATION AREAS

ARCADIS

FIGURE 4

CITY:COSTA MESA DIV/GROUP:ENVCAD DB:ENVCAD
G:\ENVCAD\CostaMesa\ACT\CM011000\CM011144\0013\CM011144.0013 Site Plan Proposed Features.dwg LAYOUT: 4 SAVED: 6/25/2010 2:09 PM ACADVER: 18.0S (LMS TECH) PAGESETUP: ---- PLOTSTYLETABLE: KMEP.CTB PLOTTED: 6/25/2010 4:13 PM BY: LOVING, JEFFREY

ARCADIS

Appendix A

Figures from PEA Report

MAP SOURCE: Google Earth Pro™ 2007, 34°01'25.93"N, 118°49'36.74"W

SITE BOUNDARY

0 600' 1,200'

GRAPHIC SCALE

MALIBU HIGH SCHOOL
30215 MORNING VIEW DRIVE, MALIBU, CALIFORNIA
CAMPUS IMPROVEMENTS PROJECT

VICINITY MAP

ARCADIS

FIGURE
1

CITY:COSTA MESA DIV/GROUP:ENV_CAD DB:ENV_CAD
K:\Data\Graphics\CM011000\CM011144\0003\CM011144.0003 Vicinity Map.dwg LAYOUT: LAYOUT1 SAVED: 3/16/2010 3:09 PM ACADVER: 17.1S (LMS TECH) PAGESETUP: ---- PLOTSTYLETABLE: KMEP.CTB PLOTTED: 3/17/2010 2:32 PM BY: LOVING, JEFFREY

SITE BOUNDARY

0 300 FEET

MALIBU HIGH SCHOOL
30215 MORNING VIEW DRIVE, MALIBU, CALIFORNIA
CAMPUS IMPROVEMENTS PROJECT

SITE PLAN

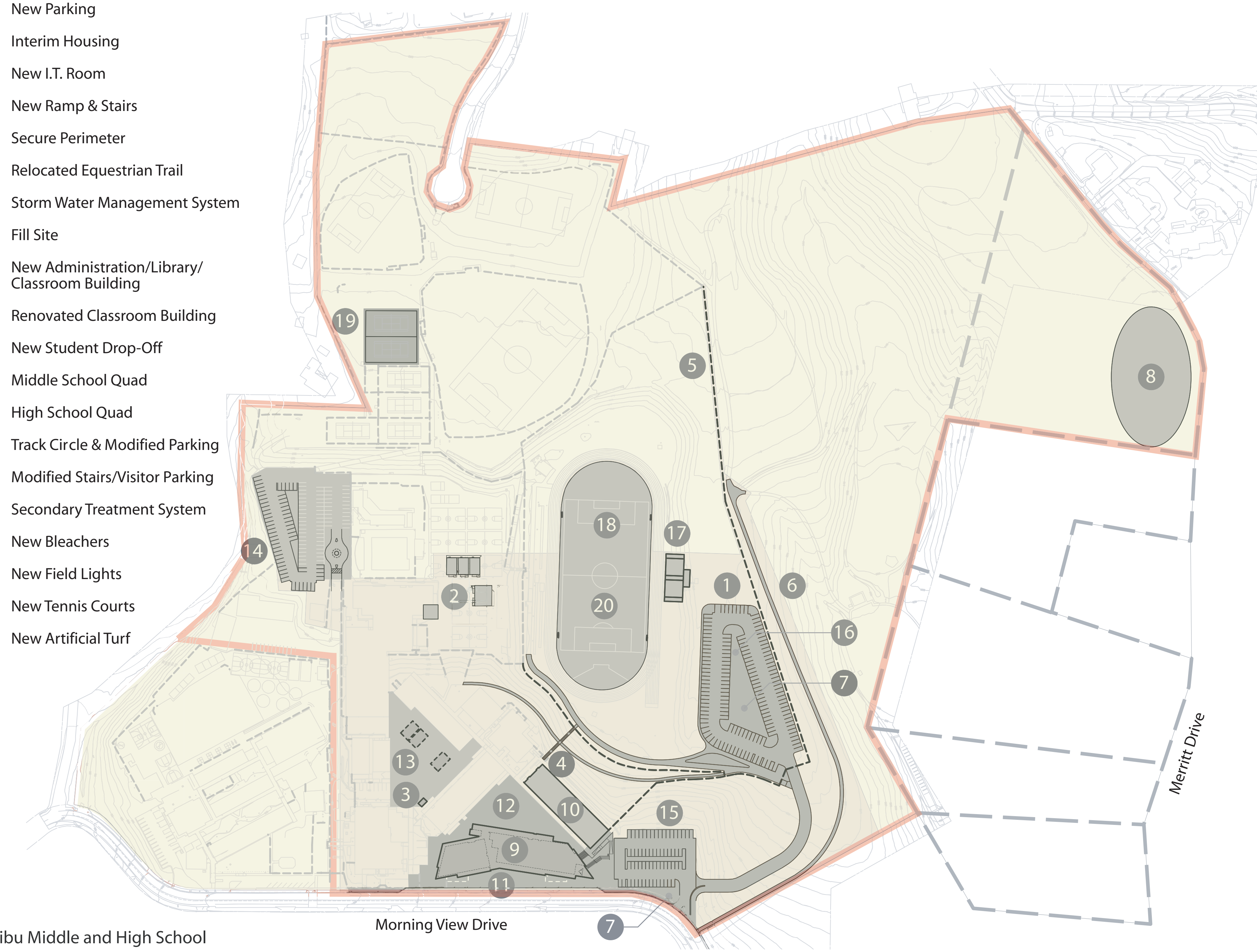
ARCADIS

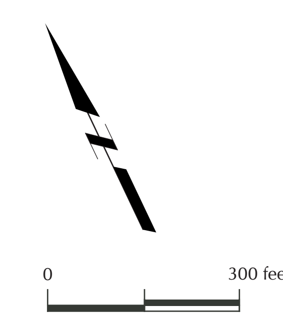
FIGURE
2

CITY:(Reqd) DIV/GROUP:(Reqd) DB:(Reqd) LD:(Opt) PIC:(Opt) PM:(Reqd) TM:(Opt) LYR:(Opt)ON=*;OFF=*REF* ACADVER: 17.1S (LMS TECH) PAGESETUP: ---- PLOTSTYLETABLE: KMEP.CTB PLOTTED: 3/16/2010 2:53 PM BY: LOVING, JEFFREY
K:\Data\Graphics\CM011000\CM01144\0013 Site Plan.dwg LAYOUT: ENTIRE SAVED: 3/12/2010 3:48 PM

PROJECT SCOPE

1. New Parking
2. Interim Housing
3. New I.T. Room
4. New Ramp & Stairs
5. Secure Perimeter
6. Relocated Equestrian Trail
7. Storm Water Management System
8. Fill Site
9. New Administration/Library/ Classroom Building
10. Renovated Classroom Building
11. New Student Drop-Off
12. Middle School Quad
13. High School Quad
14. Track Circle & Modified Parking
15. Modified Stairs/Visitor Parking
16. Secondary Treatment System
17. New Bleachers
18. New Field Lights
19. New Tennis Courts
20. New Artificial Turf





Malibu Middle and High School
Campus Improvements Project

Approx. Area of Construction: 1,007,300 SF (23.1 Acres)

HMC Architects

2009.06.09

MALIBU HIGH SCHOOL
30215 MORNING VIEW DRIVE, MALIBU, CALIFORNIA
CAMPUS IMPROVEMENTS PROJECT

PROPOSED
CAMPUS IMPROVEMENTS PROJECT

ARCADIS

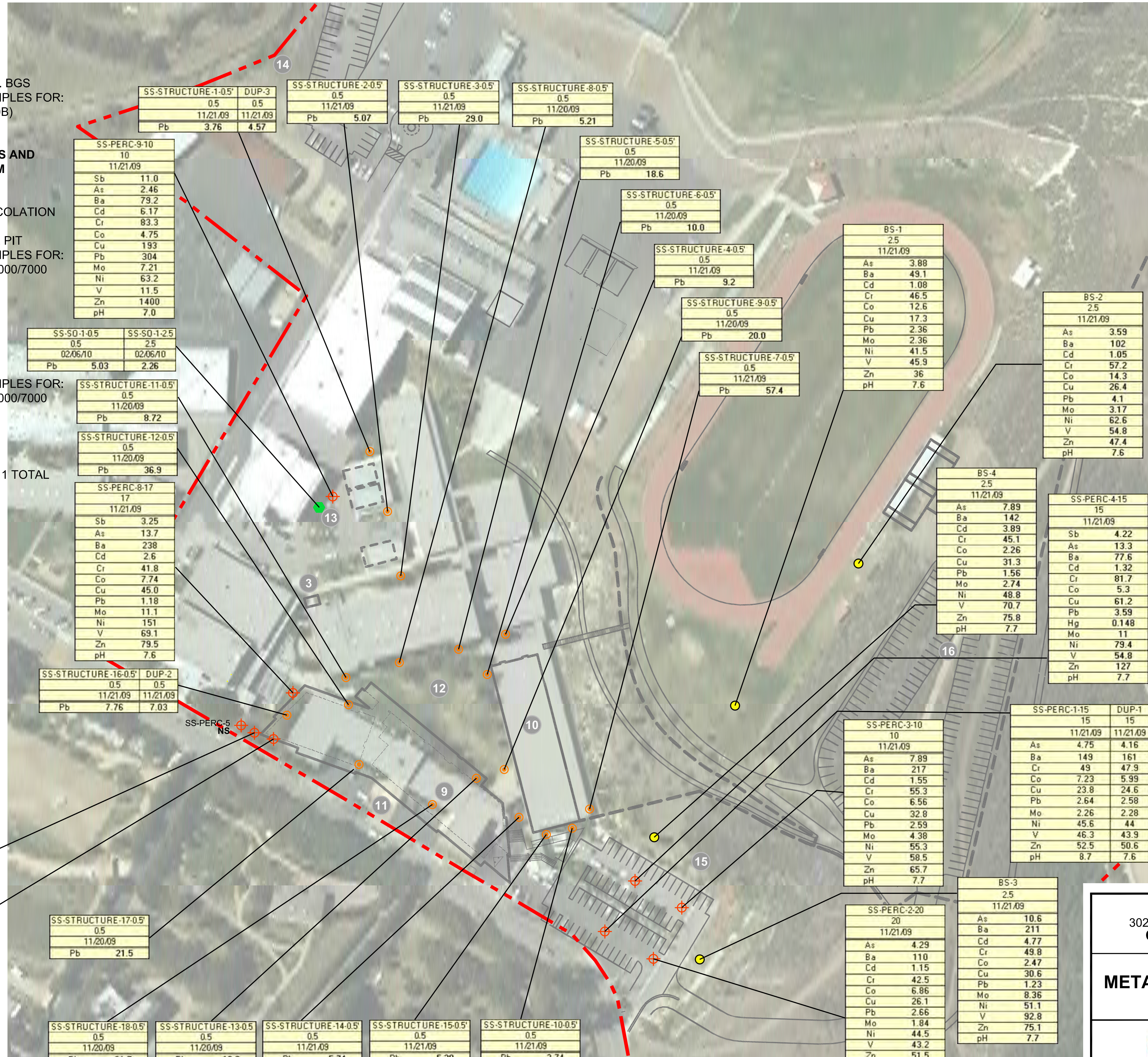
FIGURE
3

OLDER STRUCTURES
SOIL SAMPLES
SAMPLED AT 0.5 AND 2.5 FT. BGS
- ANALYZED DISCRETE SAMPLES FOR:
LEAD (EPA METHOD 6010B)

CHEMISTRY LABORATORIES AND PHOTOGRAPHY DARKROOM BUILDINGS
SOIL SAMPLES
SAMPLED WITHIN THE PERCOLATION ZONE
OF THE NEAREST SEEPAGE PIT
- ANALYZED DISCRETE SAMPLES FOR:
METALS (EPA METHOD 6000/7000 SERIES)
pH (EPA METHOD 9045)

BACKGROUND SAMPLES
SOIL SAMPLES
SAMPLED AT 2.5 FT. BGS
- ANALYZED DISCRETE SAMPLES FOR:
METALS (EPA METHOD 6000/7000 SERIES)
pH (EPA METHOD 9045)

STEP-OUT SAMPLE
(LEAD 0.5 AND 2.5 FT BGS) - 1 TOTAL



PROJECT SCOPE

NOTE: SEE FIGURE 3 FOR COMPLETE LIST

- 3 NEW I.T. ROOM
- 9 NEW ADMINSTRATION/LIBRARY/CLASSROOM BUILDING
- 10 RENOVATED CLASSROOM BUILDING
- 11 NEW STUDENT DROP-OFF
- 12 MIDDLE SCHOOL QUAD
- 13 HIGH SCHOOL QUAD
- 14 TRACK CIRLE & MODIFIED PARKING
- 15 MODIFIED STAIRS/VISITOR PARKING

ND = NOT DETECTED ABOVE LABORATORY REPORTING LIMIT INDICATED

CONCENTRATIONS REPORTED IN MILLIGRAMS PER KILOGRAMS (mg/kg)

CONCENTRATIONS IN BOLD TYPEFACE AND SHADING WERE REPORTED ABOVE THE METHOD DETECTION LIMIT.

DATA EXPLANATION:

SAMPLE ID	
SAMPLE DEPTH (ft bgs)	
SAMPLE DATE	
ANALYTE	CONCENTRATION

0 140 FEET

APPROX. AREA OF CONSTRUCTION : 1,007,300 SF (23.1 ACRES)

MALIBU HIGH SCHOOL
30215 MORNING VIEW DRIVE, MALIBU, CALIFORNIA
CAMPUS IMPROVEMENTS PROJECT

METALS & pH SAMPLE LOCATION MAP

ARCADIS

FIGURE
4

CITY:COSTA MESA DIV/GROUP:ENVCAD DB:ENVCAD
G:\ENVCAD\CostaMesa\ACT\CM011000\CM011144\0003\CM011144.0013 Site Plan1_DATA.dwg LAYOUT: METALS SAVED: 4/7/2010 11:04 AM ACADVER: 18.0S (LMS TECH) PAGESETUP: ---- PLOTSTYLETABLE: KMEP.CTB PLOTTED: 4/7/2010 11:19 AM BY: LOVING, JEFFREY

OLDER STRUCTURES
SOIL SAMPLES
SAMPLED AT 0.5 AND 2.5 FT. BGS
- ANALYZED DISCRETE SAMPLES FOR:
PESTICIDES (EPA METHOD 8081A)

STEP-OUT SAMPLE
(PESTICIDES 0.5 AND 2.5 FT BGS) - 3 TOTAL

PROJECT SCOPE

NOTE: SEE FIGURE 3 FOR COMPLETE LIST

- 3 NEW I.T. ROOM
- 9 NEW ADMINSTRATION/LIBRARY/CLASSROOM BUILDING
- 10 RENOVATED CLASSROOM BUILDING
- 11 NEW STUDENT DROP-OFF
- 12 MIDDLE SCHOOL QUAD
- 13 HIGH SCHOOL QUAD
- 14 TRACK CIRCLE & MODIFIED PARKING
- 15 MODIFIED STAIRS/VISITOR PARKING

4,4'-DDD = 4,4'-DICHLORODIPHENYLDICHLOROETHANE
4,4'-DDE = 4,4'-DICHLORODIPHENYLTRICHLOROETHYLENE
4,4'-DDT = 4,4'-DICHLORODIPHENYLTRICHLOROETHANE

ND = NOT DETECTED ABOVE LABORATORY REPORTING LIMIT INDICATED

CONCENTRATIONS REPORTED IN MICROGRAMS PER KILOGRAMS (µg/kg)

CONCENTRATIONS IN *RED ITALIC TYPEFACE* ARE PROPOSED FOR REMOVAL AND AS SUCH, ARE NOT INCLUDED IN POST-REMOVAL STATISTICAL CALCULATIONS.

DATA EXPLANATION:

SAMPLE ID	
SAMPLE DEPTH (ft bgs)	
SAMPLE DATE	
ANALYTE	CONCENTRATION

0 140 FEET

APPROX. AREA OF CONSTRUCTION : 1,007,300 SF (23.1 ACRES)

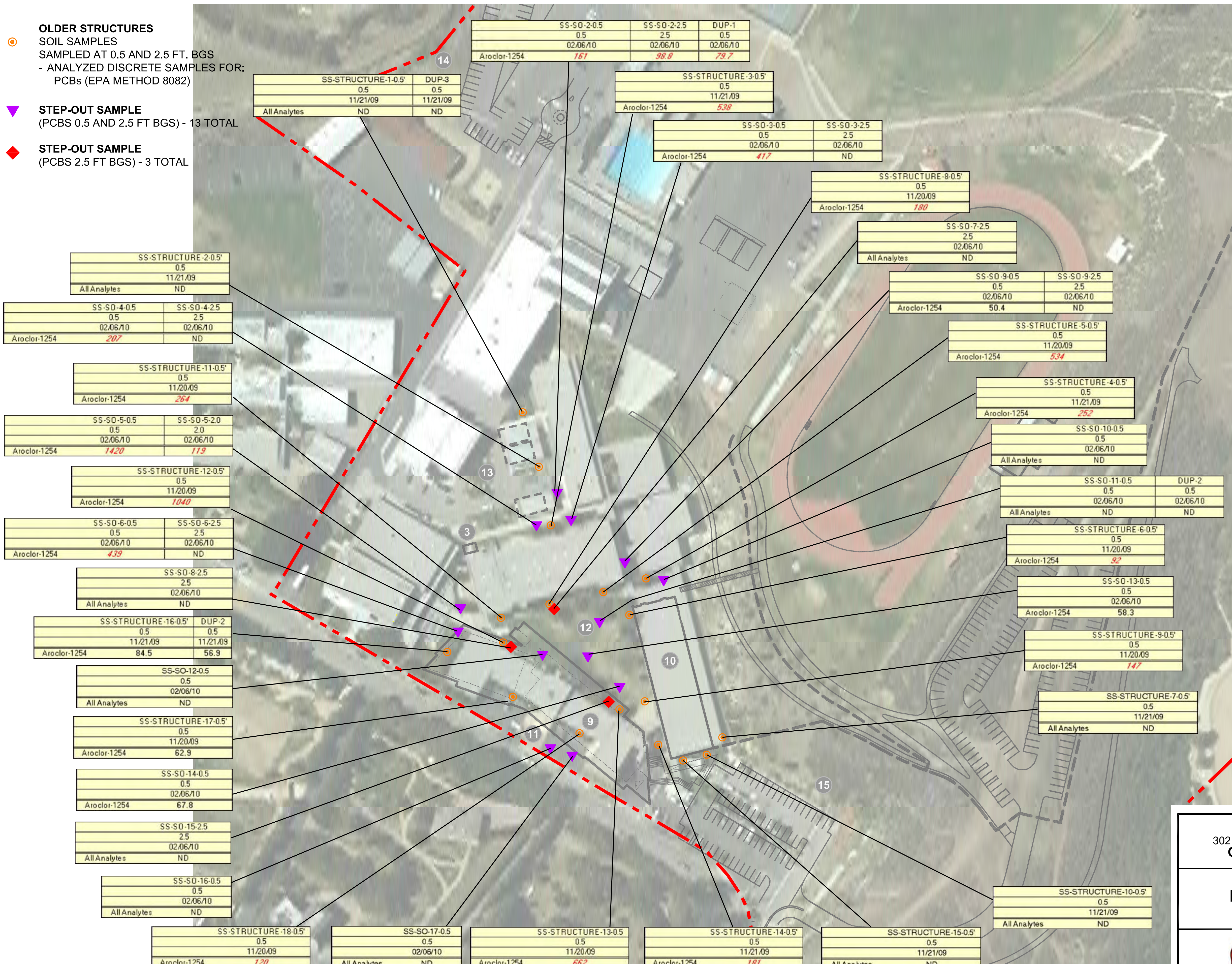
MALIBU HIGH SCHOOL
30215 MORNING VIEW DRIVE, MALIBU, CALIFORNIA
CAMPUS IMPROVEMENTS PROJECT

PESTICIDES SAMPLE LOCATION MAP

ARCADIS

FIGURE
5

CITY:COSTA MESA DIV/GROUP:ENVCAD DB:ENVCAD
G:\ENVCAD\CostaMesa\ACT\CM011000\CM011144\0003\CM011144.0013 Site Plan1_DATA.dwg LAYOUT: PEST SAVED: 4/7/2010 11:35 AM ACADVER: 18.0S (LMS TECH) PAGESETUP: ---- PLOTSTYLETABLE: KMEP.CTB PLOTTED: 4/7/2010 11:47 AM BY: LOVING, JEFFREY



PROJECT SCOPE

NOTE: SEE FIGURE 3 FOR COMPLETE LIST

- 3 NEW I.T. ROOM
- 9 NEW ADMINSTRATION/LIBRARY/CLASSROOM BUILDING
- 10 RENOVATED CLASSROOM BUILDING
- 11 NEW STUDENT DROP-OFF
- 12 MIDDLE SCHOOL QUAD
- 13 HIGH SCHOOL QUAD
- 14 TRACK CIRCLE & MODIFIED PARKING
- 15 MODIFIED STAIRS/VISITOR PARKING

PCBS = POLYCHLORINATED BIPHENYLS

ND = NOT DETECTED ABOVE LABORATORY REPORTING LIMIT INDICATED

CONCENTRATIONS REPORTED IN MICROGRAMS PER KILOGRAMS (µg/kg)

CONCENTRATIONS IN BOLD TYPEFACE AND SHADING WERE REPORTED ABOVE THE METHOD DETECTION LIMIT.

CONCENTRATIONS IN *RED ITALIC TYPEFACE* ARE PROPOSED FOR REMOVAL AND AS SUCH, ARE NOT INCLUDED IN POST-REMOVAL STATISTICAL CALCULATIONS.

DATA EXPLANATION:

SAMPLE ID	
SAMPLE DEPTH (ft bgs)	
SAMPLE DATE	
ANALYTE	CONCENTRATION

0 140 FEET

APPROX. AREA OF CONSTRUCTION : 1,007,300 SF (23.1 ACRES)

MALIBU HIGH SCHOOL
30215 MORNING VIEW DRIVE, MALIBU, CALIFORNIA
CAMPUS IMPROVEMENTS PROJECT

PCB SAMPLE LOCATION MAP

ARCADIS

FIGURE
6

FORMER UST AND WOODSHOP AND ART STUDIOS BUILDINGS
SOIL VAPOR SAMPLES SAMPLED AT 5 AND 10 FT. BGS
- ANALYZED:
  - VOCS (EPA METHOD 8260B)

PROJECT SCOPE

NOTE: SEE FIGURE 3 FOR COMPLETE LIST

- 3 NEW I.T. ROOM
- 9 NEW ADMINSTRATION/LIBRARY/CLASSROOM BUILDING
- 10 RENOVATED CLASSROOM BUILDING
- 11 NEW STUDENT DROP-OFF
- 12 MIDDLE SCHOOL QUAD
- 13 HIGH SCHOOL QUAD
- 14 TRACK CIRCLE & MODIFIED PARKING
- 15 MODIFIED STAIRS/VISITOR PARKING

VOCS = VOLATILE ORGANIC COMPOUNDS

CONCENTRATIONS REPORTED IN MICROGRAMS PER LITER (µg/L)

DATA EXPLANATION:

SAMPLE ID	
SAMPLE DEPTH (ft bgs)	
SAMPLE DATE	
ANALYTE	CONCENTRATION

N

0 140 FEET

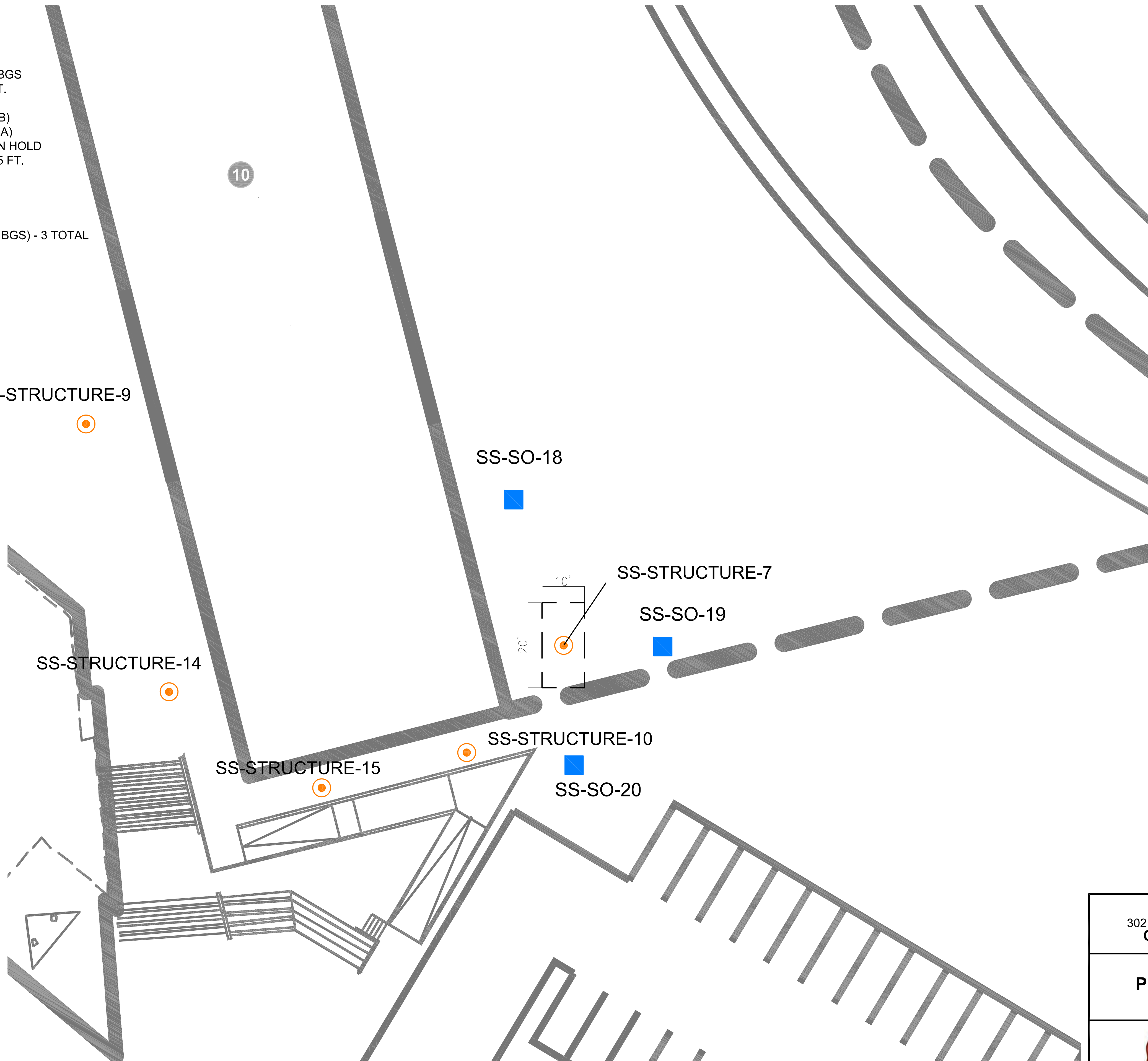
APPROX. AREA OF CONSTRUCTION : 1,007,300 SF (23.1 ACRES)

MALIBU HIGH SCHOOL
30215 MORNING VIEW DRIVE, MALIBU, CALIFORNIA
CAMPUS IMPROVEMENTS PROJECT

VOC SAMPLE LOCATION MAP

ARCADIS

FIGURE 7



OLDER STRUCTURES
SOIL SAMPLES
SAMPLE AT 0.5 AND 2.5 FT. BGS
- ANALYZE DISCRETE 0.5 FT. SAMPLES FOR:
  LEAD (EPA METHOD 6010B)
  OCPS (EPA METHOD 8081A)
- PLACE 2.5 FT.SAMPLES ON HOLD PENDING ANALYSIS OF 0.5 FT. SAMPLES

STEP-OUT SAMPLE
(PESTICIDES 0.5 AND 2.5 FT BGS) - 3 TOTAL

PROJECT SCOPE

NOTE: SEE FIGURE 3 FOR COMPLETE LIST

10 RENOVATED CLASSROOM BUILDING

EXCAVATION

0 25 FEET

APPROX. AREA OF CONSTRUCTION : 1,007,300 SF (23.1 ACRES)

MALIBU HIGH SCHOOL
30215 MORNING VIEW DRIVE, MALIBU, CALIFORNIA
CAMPUS IMPROVEMENTS PROJECT

PROPOSED EXCAVATION AREA

ARCADIS

FIGURE
8

CITY:COSTA MESA DIV/GROUP:ENVCAD DB:ENVCAD
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ARCADIS

Appendix B

Tables from PEA Report

Table 1
Summary of Soil Analytical Results - Metals and pH
SMMUSD Malibu Middle and High School
30215 Morning View Drive, Malibu, California
CM011144.0003

		Analyte:	Antimony	Arsenic	Barium	Beryllium	Cadmium	Chromium	Cobalt	Copper	Lead	Mercury	Molybdenum	Nickel	Selenium	Silver	Thallium	Vanadium	Zinc	pH
		Method:	EPA 6010B	EPA 6010B	EPA 6010B	EPA 6010B	EPA 6010B	EPA 6010B	EPA 6010B	EPA 6010B	EPA 6010B	EPA 7471A	EPA 6010B	EPA 6010B	EPA 6010B	EPA 6010B	EPA 6010B	EPA 6010B	EPA 6010B	EPA 9045C
		Units:	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	pH Units
Sample Name	**Depth (feet)**	**Sample Date**																		
BS-1	2.5	11/21/09	2.5	**3.88**	**49.1**	<1.0	**1.08**	**46.5**	**12.6**	**17.3**	**2.36**	0.1	**2.36**	**41.5**	<1.0	<1.0	<1.0	**45.9**	**36**	**7.6**
BS-2	2.5	11/21/09	2.5	**3.59**	**102**	<1.0	**1.05**	**57.2**	**14.3**	**26.4**	**4.1**	0.1	**3.17**	**62.6**	<1.0	<1.0	<1.0	**54.8**	**47.4**	**7.6**
BS-3	2.5	11/21/09	2.5	**10.6**	**211**	<1.0	**4.77**	**49.8**	**2.47**	**30.6**	**1.23**	0.1	**8.36**	**51.1**	<1.0	<1.0	<1.0	**92.8**	**75.1**	**7.7**
BS-4	2.5	11/21/09	2.5	**7.89**	**142**	<1.0	**3.89**	**45.1**	**2.26**	**31.3**	**1.56**	0.1	**2.74**	**48.8**	<1.0	<1.0	<1.0	**70.7**	**75.8**	**7.7**
Statistical Analysis -- Background Samples																				
		Number of Samples:	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
		Number of Detects:	0	4	4	0	4	4	4	4	4	0	4	4	0	0	0	4	4	4
		Minimum Concentration:	2.5	**3.59**	**49.1**	<1.0	**1.05**	**45.1**	**2.26**	**17.3**	**1.23**	0.1	**2.36**	**41.5**	<1.0	<1.0	<1.0	**45.9**	**36**	**7.6**
		Maximum Concentration:	2.5	**10.6**	**211**	<1.0	**4.77**	**57.2**	**14.3**	**31.3**	**4.1**	0.1	**8.36**	**62.6**	<1.0	<1.0	<1.0	**92.8**	**75.8**	**7.7**
		Average Concentration:	2.50	6.49	126.03	1.00	2.70	49.65	7.91	26.40	2.31	0.10	4.16	51.00	1.00	1.00	1.00	66.05	58.58	7.65
		Standard Deviation:	0.00	3.37	68.24	0.00	1.92	5.41	6.44	6.44	1.28	0.00	2.82	8.75	0.00	0.00	0.00	20.57	20.04	0.06
		95% UCL:	NA	10.46	206.32	NA	4.96	56.01	15.48	33.98	3.82	NA	11.37	61.30	NA	NA	NA	90.26	82.15	7.73
Sample Name	**Depth (feet)**	**Sample Date**																		
SS-PERC-1-15	15	11/21/09	2.5	**4.75**	**149**	<1.0	<1.0	**49**	**7.23**	**23.8**	**2.64**	0.1	**2.26**	**45.6**	<1.0	<1.0	<1.0	**46.3**	**52.5**	**8.7**
SS-PERC-2-20	20	11/21/09	2.5	**4.29**	**110**	<1.0	**1.15**	**42.5**	**6.86**	**26.1**	**2.66**	0.1	**1.84**	**44.5**	<1.0	<1.0	<1.0	**43.2**	**51.5**	**8.2**
SS-PERC-3-10	10	11/21/09	2.5	**7.89**	**217**	<1.0	**1.55**	**55.3**	**6.56**	**32.8**	**2.59**	0.1	**4.38**	**55.3**	<1.0	<1.0	<1.0	**58.5**	**65.7**	**7.7**
SS-PERC-4-15	15	11/21/09	**4.22**	**13.3**	**77.6**	<1.0	**1.32**	**81.7**	**5.3**	**61.2**	**3.59**	**0.148**	**11**	**79.4**	<1.0	<1.0	<1.0	**54.8**	**127**	**7.7**
SS-PERC-6-18	18	11/21/09	2.5	**1.12**	**258**	<1.0	<1.0	**25.1**	**1.15**	**12.0**	**0.59**	0.1	**1.21**	**16.7**	<1.0	<1.0	<1.0	**26.6**	**36.4**	**7.5**
SS-PERC-6-30	30	11/21/09	2.5	**1.26**	**41.6**	<1.0	<1.0	**18.3**	**3.06**	**5.21**	**0.827**	0.1	**1.54**	**12.8**	<1.0	<1.0	<1.0	**15.7**	**13.5**	**7.7**
SS-PERC-7-15	15	11/21/09	2.5	**5.1**	**160**	<1.0	<1.0	**51.6**	**8.74**	**27.4**	**1.76**	0.1	**3.51**	**97.7**	<1.0	<1.0	<1.0	**56.5**	**90.4**	**8.2**
SS-PERC-8-17	17	11/21/09	**3.25**	**13.7**	**238**	<1.0	**2.6**	**41.8**	**7.74**	**45.0**	**1.18**	0.1	**11.1**	**151**	<1.0	<1.0	<1.0	**69.1**	**79.5**	**7.6**
SS-PERC-9-10	10	11/21/09	**11.0**	**2.46**	**79.2**	<1.0	**6.17**	**83.3**	**4.75**	**193**	**304**	0.1	**7.21**	**63.2**	<1.0	<1.0	<1.0	**11.5**	**1400**	**7.0**
SS-STRUCTURE-1-0.5'	0.5	11/21/09	NA	NA	NA	NA	NA	NA	NA	NA	**3.76**	NA	NA	NA	NA	NA	NA	NA	NA	NA
SS-STRUCTURE-2-0.5'	0.5	11/21/09	NA	NA	NA	NA	NA	NA	NA	NA	**5.07**	NA	NA	NA	NA	NA	NA	NA	NA	NA
SS-STRUCTURE-3-0.5'	0.5	11/21/09	NA	NA	NA	NA	NA	NA	NA	NA	**29.0**	NA	NA	NA	NA	NA	NA	NA	NA	NA
SS-STRUCTURE-4-0.5'	0.5	11/21/09	NA	NA	NA	NA	NA	NA	NA	NA	**9.2**	NA	NA	NA	NA	NA	NA	NA	NA	NA
SS-STRUCTURE-5-0.5'	0.5	11/20/09	NA	NA	NA	NA	NA	NA	NA	NA	**18.6**	NA	NA	NA	NA	NA	NA	NA	NA	NA
SS-STRUCTURE-6-0.5'	0.5	11/20/09	NA	NA	NA	NA	NA	NA	NA	NA	**10.0**	NA	NA	NA	NA	NA	NA	NA	NA	NA
SS-STRUCTURE-7-0.5'	0.5	11/21/09	NA	NA	NA	NA	NA	NA	NA	NA	**57.4**	NA	NA	NA	NA	NA	NA	NA	NA	NA
SS-STRUCTURE-8-0.5'	0.5	11/20/09	NA	NA	NA	NA	NA	NA	NA	NA	**5.21**	NA	NA	NA	NA	NA	NA	NA	NA	NA
SS-STRUCTURE-9-0.5'	0.5	11/20/09	NA	NA	NA	NA	NA	NA	NA	NA	**20.0**	NA	NA	NA	NA	NA	NA	NA	NA	NA
SS-STRUCTURE-10-0.5'	0.5	11/21/09	NA	NA	NA	NA	NA	NA	NA	NA	**2.74**	NA	NA	NA	NA	NA	NA	NA	NA	NA
SS-STRUCTURE-11-0.5'	0.5	11/20/09	NA	NA	NA	NA	NA	NA	NA	NA	**8.72**	NA	NA	NA	NA	NA	NA	NA	NA	NA

Table 1
Summary of Soil Analytical Results - Metals and pH
SMMUSD Malibu Middle and High School
30215 Morning View Drive, Malibu, California
CM011144.0003

		Analyte:	Antimony	Arsenic	Barium	Beryllium	Cadmium	Chromium	Cobalt	Copper	Lead	Mercury	Molybdenum	Nickel	Selenium	Silver	Thallium	Vanadium	Zinc	pH
		Method:	EPA 6010B	EPA 6010B	EPA 6010B	EPA 6010B	EPA 6010B	EPA 6010B	EPA 6010B	EPA 6010B	EPA 6010B	EPA 7471A	EPA 6010B	EPA 6010B	EPA 6010B	EPA 6010B	EPA 6010B	EPA 6010B	EPA 6010B	EPA 9045C
		Units:	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	pH Units
Sample Name	**Depth (feet)**	**Sample Date**																		
SS-STRUCTURE-12-0.5'	0.5	11/20/09	NA	NA	NA	NA	NA	NA	NA	NA	**36.9**	NA	NA	NA	NA	NA	NA	NA	NA	NA
SS-STRUCTURE-13-0.5	0.5	11/20/09	NA	NA	NA	NA	NA	NA	NA	NA	**13.0**	NA	NA	NA	NA	NA	NA	NA	NA	NA
SS-STRUCTURE-14-0.5'	0.5	11/21/09	NA	NA	NA	NA	NA	NA	NA	NA	**5.74**	NA	NA	NA	NA	NA	NA	NA	NA	NA
SS-STRUCTURE-15-0.5'	0.5	11/21/09	NA	NA	NA	NA	NA	NA	NA	NA	**5.38**	NA	NA	NA	NA	NA	NA	NA	NA	NA
SS-STRUCTURE-16-0.5'	0.5	11/21/09	NA	NA	NA	NA	NA	NA	NA	NA	**7.76**	NA	NA	NA	NA	NA	NA	NA	NA	NA
SS-STRUCTURE-17-0.5'	0.5	11/20/09	NA	NA	NA	NA	NA	NA	NA	NA	**21.5**	NA	NA	NA	NA	NA	NA	NA	NA	NA
SS-STRUCTURE-18-0.5'	0.5	11/20/09	NA	NA	NA	NA	NA	NA	NA	NA	**21.7**	NA	NA	NA	NA	NA	NA	NA	NA	NA
SS-SO-1-0.5	0.5	02/06/10	NA	NA	NA	NA	NA	NA	NA	NA	**5.03**	NA	NA	NA	NA	NA	NA	NA	NA	NA
SS-SO-1-2.5	2.5	02/06/10	NA	NA	NA	NA	NA	NA	NA	NA	**2.26**	NA	NA	NA	NA	NA	NA	NA	NA	NA
Statistical Analysis -- Primary Samples																				
		Number of Samples:	9	9	9	9	9	9	9	9	26	9	9	9	9	9	9	9	9	9
		Number of Detects:	3	9	9	0	5	9	9	9	26	1	9	9	0	0	0	9	9	NA
		Minimum Concentration:	2.5	**1.1**	**41.6**	<1.0	<1.0	**18.3**	**1.2**	**5.2**	**0.6**	0.1	**1.2**	**12.8**	<1.0	<1.0	<1.0	**11.5**	**13.5**	**7.0**
		Maximum Concentration:	**11.0**	**13.7**	**258.0**	<1.0	**6.2**	**83.3**	**8.7**	**193.0**	**304.0**	**0.148**	**11.1**	**151.0**	<1.0	<1.0	<1.0	**69.1**	**1400.0**	**8.7**
		Average Concentration:	3.72	5.99	147.82	1.00	1.87	49.84	5.71	47.39	20.99	0.11	4.89	62.91	1.00	1.00	1.00	42.47	212.94	7.81
		Standard Deviation:	2.79	4.75	77.10	0.00	1.69	22.06	2.41	57.07	56.81	0.02	3.94	42.70	0.00	0.00	0.00	20.18	446.34	0.49
		95% UCL:	7.65	8.93	195.62	NA	3.15	63.52	7.21	95.38	38.17	NA	8.62	89.38	NA	NA	NA	54.98	438.08	8.12
Comparison Criteria																				
CHHSLS			30	0.07	5,200	16	1.7	100,000	660	3,000	80	18	380	1,600	380	380	5	530	23,000	NA
Is maximum concentration below CHHSL?			YES	NO	YES	YES	NO	YES	YES	YES	NO	YES	YES	YES	YES	YES	YES	YES	YES	NA
Quality Control Samples																				
Equipment Blanks (mg/L)																				
SS-STRUCTURE-18-EQRB	NA	11/20/09	NA	NA	NA	NA	NA	NA	NA	NA	<0.01	NA	NA	NA	NA	NA	NA	NA	NA	NA
SS-STRUCTURE-7-EQRB	NA	11/21/09	NA	NA	NA	NA	NA	NA	NA	NA	<0.01	NA	NA	NA	NA	NA	NA	NA	NA	NA
EQBLK	NA	02/06/10	NA	NA	NA	NA	NA	NA	NA	NA	<0.01	NA	NA	NA	NA	NA	NA	NA	NA	NA
Duplicate Samples																				
SS-PERC-1-15	15	11/21/09	2.5	**4.75**	**149**	<1.0	<1.0	**49**	**7.23**	**23.8**	**2.64**	0.1	**2.26**	**45.6**	<1.0	<1.0	<1.0	**46.3**	**52.5**	**8.7**
DUP-1	15	11/21/09	2.5	**4.16**	**161**	<1.0	<1.0	**47.9**	**5.99**	**24.6**	**2.58**	0.1	**2.28**	**44**	<1.0	<1.0	<1.0	**43.9**	**50.6**	**7.6**
RPD(%)			0%	13%	8%	0%	0%	2%	19%	3%	2%	0%	1%	4%	0%	0%	0%	5%	4%	13%
SS-STRUCTURE-16-0.5'	0.5	11/21/09	NA	NA	NA	NA	NA	NA	NA	NA	**7.76**	NA	NA	NA	NA	NA	NA	NA	NA	NA
DUP-2	0.5	11/21/09	NA	NA	NA	NA	NA	NA	NA	NA	**7.03**	NA	NA	NA	NA	NA	NA	NA	NA	NA
RPD(%)			NA	NA	NA	NA	NA	NA	NA	NA	10%	NA	NA	NA	NA	NA	NA	NA	NA	NA
SS-STRUCTURE-1-0.5'	0.5	11/21/09	NA	NA	NA	NA	NA	NA	NA	NA	**3.76**	NA	NA	NA	NA	NA	NA	NA	NA	NA
DUP-3	0.5	11/21/09	NA	NA	NA	NA	NA	NA	NA	NA	**4.57**	NA	NA	NA	NA	NA	NA	NA	NA	NA
RPD(%)			NA	NA	NA	NA	NA	NA	NA	NA	19%	NA	NA	NA	NA	NA	NA	NA	NA	NA

Soil samples analyzed by Positive Lab Services, Los Angeles, California

NOTES:
< = not detected above laboratory reporting limit indicated
mg/kg = milligrams per kilogram
mg/L = milligrams per liter
CHHSL = California Human Health Screening Level (California Office of Environmental Health Hazard Assessment)
NA = not analyzed
RPD = relative percent difference
95% UCL = 95% upper confidence limit above the mean concentration, calculated using Pro UCL and using 1/2 the detection limit for those concentrations reported as non-detections.
Concentrations in bold typeface and shading were reported above the method detection limit.

QA/QC: AMH

Table 2
Summary of Soil Analytical Results - Pesticides
SMMUSD Malibu Middle and High School
30215 Morning View Drive, Malibu, California
CM011144.0003

Sample Name	Depth (feet)	Sample Date	4,4´-DDD	4,4´-DDE	4,4´-DDT	Aldrin	alpha-BHC	alpha-Chlordane	beta-BHC	delta-BHC	Dieldrin	Endosulfan I	Endosulfan II	Endosulfan sulfate	Endrin	Endrin aldehyde	Endrin ketone	gamma-BHC (Lindane)	gamma-Chlordane	Heptachlor	Heptachlor epoxide	Methoxychlor	Technical Chlordane	Toxaphene
		Method:	EPA 8081A	EPA 8081A	EPA 8081A	EPA 8081A	EPA 8081A	EPA 8081A	EPA 8081A	EPA 8081A	EPA 8081A	EPA 8081A	EPA 8081A	EPA 8081A	EPA 8081A	EPA 8081A	EPA 8081A	EPA 8081A	EPA 8081A	EPA 8081A	EPA 8081A	EPA 8081A	EPA 8081A	EPA 8081A
		Units:	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg
SS-STRUCTURE-1-0.5'	0.5	11/21/09	16	16	16	<8.0	<8.0	<8.0	<8.0	<8.0	12	<8.0	16	16	16	16	16	<8.0	<8.0	<8.0	<8.0	60	40	200
SS-STRUCTURE-2-0.5'	0.5	11/21/09	16	16	16	<8.0	<8.0	<8.0	<8.0	<8.0	12	<8.0	16	16	16	16	16	<8.0	<8.0	<8.0	<8.0	60	40	200
SS-STRUCTURE-3-0.5'	0.5	11/21/09	16	**171**	16	<8.0	<8.0	**9.27**	<8.0	<8.0	12	<8.0	16	16	16	16	16	<8.0	**16.2**	<8.0	<8.0	60	**109**	200
SS-STRUCTURE-4-0.5'	0.5	11/21/09	16	**37.9**	16	<8.0	<8.0	**73.1**	<8.0	<8.0	12	<8.0	16	16	16	16	16	<8.0	**46.3**	<8.0	<8.0	60	**274**	200
SS-STRUCTURE-5-0.5'	0.5	11/20/09	16	**82**	16	<8.0	<8.0	**8.54**	<8.0	<8.0	12	<8.0	16	16	16	16	16	<8.0	<8.0	<8.0	<8.0	60	**183**	200
SS-STRUCTURE-6-0.5'	0.5	11/20/09	16	**17.1**	16	<8.0	<8.0	<8.0	<8.0	<8.0	12	<8.0	16	16	16	16	16	<8.0	<8.0	<8.0	<8.0	60	40	200
SS-STRUCTURE-7-0.5'	0.5	11/21/09	16	16	*42.9*	<8.0	<8.0	*683*	<8.0	<8.0	12	<8.0	16	16	16	16	16	<8.0	*305*	<8.0	<8.0	60	*1910*	200
SS-STRUCTURE-7-2.5'	2.5	11/21/09	16	16	16	<8.0	<8.0	*108*	<8.0	<8.0	12	<8.0	16	16	16	16	16	<8.0	*66*	<8.0	<8.0	60	*601*	200
SS-STRUCTURE-8-0.5'	0.5	11/20/09	16	**22.2**	16	<8.0	<8.0	<8.0	<8.0	<8.0	12	<8.0	16	16	16	16	16	<8.0	<8.0	<8.0	<8.0	60	40	200
SS-STRUCTURE-9-0.5'	0.5	11/20/09	16	**28.9**	16	<8.0	<8.0	<8.0	<8.0	<8.0	12	<8.0	16	16	16	16	16	<8.0	<8.0	<8.0	<8.0	60	40	200
SS-STRUCTURE-10-0.5'	0.5	11/21/09	16	16	16	<8.0	<8.0	**19.6**	<8.0	<8.0	12	<8.0	16	16	16	16	16	<8.0	<8.0	<8.0	<8.0	60	**58.2**	200
SS-STRUCTURE-11-0.5'	0.5	11/20/09	16	**69.1**	16	<8.0	<8.0	<8.0	<8.0	<8.0	12	<8.0	16	16	16	16	16	<8.0	<8.0	<8.0	<8.0	60	40	200
SS-STRUCTURE-12-0.5'	0.5	11/20/09	16	**169**	16	<8.0	<8.0	**18.6**	<8.0	<8.0	12	<8.0	16	16	16	16	16	<8.0	**26**	<8.0	<8.0	60	**240**	200
SS-STRUCTURE-13-0.5	0.5	11/20/09	16	**361**	16	<8.0	<8.0	<8.0	<8.0	<8.0	12	<8.0	16	16	16	16	16	<8.0	**8.93**	<8.0	<8.0	60	**132**	200
SS-STRUCTURE-14-0.5'	0.5	11/21/09	16	16	16	<8.0	<8.0	<8.0	<8.0	<8.0	12	<8.0	16	16	16	16	16	<8.0	<8.0	<8.0	<8.0	60	40	200
SS-STRUCTURE-15-0.5'	0.5	11/21/09	16	16	**19**	<8.0	<8.0	**33.5**	<8.0	<8.0	12	<8.0	16	16	16	16	16	<8.0	**8.68**	<8.0	<8.0	60	**67.8**	200
SS-STRUCTURE-16-0.5'	0.5	11/21/09	16	16	**18.9**	<8.0	<8.0	**21.8**	<8.0	<8.0	12	<8.0	16	16	16	16	16	<8.0	<8.0	<8.0	<8.0	60	**81.2**	200
SS-STRUCTURE-17-0.5'	0.5	11/20/09	16	16	**29.2**	<8.0	<8.0	**12.2**	<8.0	<8.0	12	<8.0	16	16	16	16	16	<8.0	**11.3**	<8.0	<8.0	60	**52.3**	200
SS-STRUCTURE-18-0.5'	0.5	11/20/09	16	16	**46.7**	<8.0	<8.0	<8.0	<8.0	<8.0	12	<8.0	16	16	16	16	16	<8.0	<8.0	<8.0	<8.0	60	**40.7**	200
SS-SO-18-0.5	0.5	02/06/10	16	16	16	<8.0	<8.0	<8.0	<8.0	<8.0	12	<8.0	16	16	16	16	16	<8.0	<8.0	<8.0	<8.0	60	40	200
SS-SO-19-0.5	0.5	02/06/10	16	16	16	<8.0	<8.0	<8.0	<8.0	<8.0	12	<8.0	16	16	16	16	16	<8.0	<8.0	<8.0	<8.0	60	40	200
SS-SO-20-0.5	0.5	02/06/10	16	16	16	<8.0	<8.0	**21.2**	<8.0	<8.0	12	<8.0	16	16	16	16	16	<8.0	**15.3**	<8.0	<8.0	60	**155**	200

Table 2
Summary of Soil Analytical Results - Pesticides
SMMUSD Malibu Middle and High School
30215 Morning View Drive, Malibu, California
CM011144.0003

Sample Name	Depth (feet)	Sample Date	4,4´-DDD	4,4´-DDE	4,4´-DDT	Aldrin	alpha-BHC	alpha-Chlordane	beta-BHC	delta-BHC	Dieldrin	Endosulfan I	Endosulfan II	Endosulfan sulfate	Endrin	Endrin aldehyde	Endrin ketone	gamma-BHC (Lindane)	gamma-Chlordane	Heptachlor	Heptachlor epoxide	Methoxychlor	Technical Chlordane	Toxaphene
		Method:	EPA 8081A	EPA 8081A	EPA 8081A	EPA 8081A	EPA 8081A	EPA 8081A	EPA 8081A	EPA 8081A	EPA 8081A	EPA 8081A	EPA 8081A	EPA 8081A	EPA 8081A	EPA 8081A	EPA 8081A	EPA 8081A	EPA 8081A	EPA 8081A	EPA 8081A	EPA 8081A	EPA 8081A	EPA 8081A
		Units:	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg
Statistical Analysis																								
Number of Samples:			22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22
Number of Detects:			0	9	5	0	0	11	0	0	0	0	0	0	0	0	0	0	9	0	0	0	13	0
Minimum Concentration:			16	16	16	<8.0	<8.0	<8.0	<8.0	<8.0	12	<8.0	16	16	16	16	16	<8.0	<8.0	<8.0	<8.0	60	40	200
Maximum Concentration:			16	**361**	**46.7**	<8.0	<8.0	**683**	<8.0	<8.0	12	<8.0	16	16	16	16	16	<8.0	**305**	<8.0	<8.0	60	**1910**	200
Average Concentration:			16	**53.01**	**19.49**	<8.0	<8.0	**49.86**	<8.0	<8.0	12	<8.0	16	16	16	16	16	<8.0	**27.62**	<8.0	<8.0	60	**193.83**	200
Standard Deviation:			0	82.86	8.70	0	0	143.53	0	0	0	0	0	0	0	0	0	0	63.63	0	0	0	404.48	0
95% UCL:			NA	228.89	24.01	NA	NA	353.65	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	161.92	NA	NA	NA	1051.82	NA
Comparison Criteria																								
CHHSLS			2,300	1,600	1,600	33	- -	430	- -	- -	35	- -	- -	- -	21,000	- -	- -	500	430	130	- -	340,000	430	460
Is maximum concentration below CHHSL?			YES	YES	YES	YES		NO			YES				YES			YES	YES	YES		YES	NO	YES
Quality Control Samples																								
Equipment Blanks (µg/L)																								
SS-STRUCTURE-18-EQRB	NA	11/20/09	0.05	0.05	0.01	0.01	0.02	0.05	0.02	0.02	0.01	0.03	0.02	0.02	0.01	0.02	0.1	0.02	0.05	0.02	0.02	0.5	NA	<5.0
SS-STRUCTURE-7-EQRB	NA	11/21/09	0.05	0.05	0.01	0.01	0.02	0.05	0.02	0.02	0.01	0.03	0.02	0.02	0.01	0.02	0.1	0.02	0.05	0.02	0.02	0.5	NA	<5.0
EQBLK	NA	02/06/10	0.05	0.05	0.01	0.01	0.02	0.05	0.02	0.02	0.01	0.03	0.02	0.02	0.01	0.02	0.1	0.02	0.05	0.02	0.02	0.5	NA	<5.0
Duplicate Samples																								
SS-STRUCTURE-16-0.5'	0.5	11/21/09	16	16	**18.9**	<8.0	<8.0	**21.8**	<8.0	<8.0	12	<8.0	16	16	16	16	16	<8.0	<8.0	<8.0	<8.0	60	**81.2**	200
DUP-2	0.5	11/21/09	16	16	**19.6**	<8.0	<8.0	**10.6**	<8.0	<8.0	12	<8.0	16	16	16	16	16	<8.0	<8.0	<8.0	<8.0	60	**47.5**	200
RPD(%)			0%	0%	4%	0%	0%	69%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	52%	0%
SS-STRUCTURE-1-0.5'	0.5	11/21/09	16	16	16	<8.0	<8.0	<8.0	<8.0	<8.0	12	<8.0	16	16	16	16	16	<8.0	<8.0	<8.0	<8.0	60	40	200
DUP-3	0.5	11/21/09	16	16	16	<8.0	<8.0	<8.0	<8.0	<8.0	12	<8.0	16	16	16	16	16	<8.0	<8.0	<8.0	<8.0	60	40	200
RPD(%)			0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
SS-SO-20-0.5	0.5	02/06/10	16	16	16	<8.0	<8.0	**21.2**	<8.0	<8.0	12	<8.0	16	16	16	16	16	<8.0	**15.3**	<8.0	<8.0	60	**155**	200
DUP-3-020610	0.5	02/06/10	16	16	16	<8.0	<8.0	**19.5**	<8.0	<8.0	12	<8.0	16	16	16	16	16	<8.0	**14.5**	<8.0	<8.0	60	**164**	200
RPD(%)			0%	0%	0%	0%	0%	8%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	5%	0%	0%	0%	6%	0%

Soil samples analyzed by Positive Lab Services, Los Angeles, California

NOTES:

QA/QC: AMH

< = not detected above laboratory reporting limit indicated
µg/kg = micrograms per kilogram
µg/L = micrograms per liter
RPD = relative percent difference
95% UCL = 95% upper confidence limit above the mean concentration, calculated using Pro UCL and using 1/2 the detection limit for those concentrations reported as non-detections.
NA = not analyzed
CHHSL = California Human Health Screening Level (California Office of Environmental Health Hazard Assessment)
\- - = No established CHHSL for analyte
4,4'-DDD = 4,4'-dichlorodiphenyldichloroethane
4,4'-DDE = 4,4'-dichlorodiphenyltrichloroethylene
4,4'-DDT = 4,4'-dichlorodiphenyltrichloroethane
Concentrations in bold typeface and shading were reported above the method detection limit.
Concentrations in *red italic typeface* are slated for removal and as such, are not included in post-removal statistical calculations.

Table 3
Summary of Soil Analytical Results - PCBs
SMMUSD Malibu Middle and High School
30215 Morning View Drive, Malibu, California
CM011144.0003

Sample Name	Depth (feet)	Analyte: / Method: / Units: / Sample Date	Aroclor-1016 EPA 8082 µg/kg	Aroclor-1221 EPA 8082 µg/kg	Aroclor-1232 EPA 8082 µg/kg	Aroclor-1242 EPA 8082 µg/kg	Aroclor-1248 EPA 8082 µg/kg	Aroclor-1254 EPA 8082 µg/kg	Aroclor-1260 EPA 8082 µg/kg
SS-STRUCTURE-1-0.5'	0.5	11/21/09	50	50	50	50	50	50	50
SS-STRUCTURE-2-0.5'	0.5	11/21/09	50	50	50	50	50	50	50
SS-STRUCTURE-3-0.5'	0.5	11/21/09	50	50	50	50	50	***538***	50
SS-STRUCTURE-4-0.5'	0.5	11/21/09	50	50	50	50	50	***252***	50
SS-STRUCTURE-5-0.5'	0.5	11/20/09	50	50	50	50	50	***534***	50
SS-STRUCTURE-6-0.5'	0.5	11/20/09	50	50	50	50	50	***92***	50
SS-STRUCTURE-7-0.5'	0.5	11/21/09	50	50	50	50	50	50	50
SS-STRUCTURE-8-0.5'	0.5	11/20/09	50	50	50	50	50	***180***	50
SS-STRUCTURE-9-0.5'	0.5	11/20/09	50	50	50	50	50	***147***	50
SS-STRUCTURE-10-0.5'	0.5	11/21/09	50	50	50	50	50	50	50
SS-STRUCTURE-11-0.5'	0.5	11/20/09	50	50	50	50	50	***264***	50
SS-STRUCTURE-12-0.5'	0.5	11/20/09	50	50	50	50	50	***1040***	50
SS-STRUCTURE-13-0.5	0.5	11/20/09	50	50	50	50	50	***662***	50
SS-STRUCTURE-14-0.5'	0.5	11/21/09	50	50	50	50	50	***181***	50
SS-STRUCTURE-15-0.5'	0.5	11/21/09	50	50	50	50	50	50	50
SS-STRUCTURE-16-0.5'	0.5	11/21/09	50	50	50	50	50	***84.5***	50
SS-STRUCTURE-17-0.5'	0.5	11/20/09	50	50	50	50	50	***62.9***	50
SS-STRUCTURE-18-0.5'	0.5	11/20/09	50	50	50	50	50	***120***	50
SS-SO-2-0.5	0.5	02/06/10	50	50	50	50	50	***161***	50
SS-SO-2-2.5	2.5	02/06/10	50	50	50	50	50	***98.8***	50
SS-SO-3-0.5	0.5	02/06/10	50	50	50	50	50	***417***	50
SS-SO-3-2.5	2.5	02/06/10	50	50	50	50	50	50	50
SS-SO-4-0.5	0.5	02/06/10	50	50	50	50	50	***207***	50
SS-SO-4-2.5	2.5	02/06/10	50	50	50	50	50	50	50
SS-SO-5-0.5	0.5	02/06/10	50	50	50	50	50	***1420***	50
SS-SO-5-2.0	2.0	02/06/10	50	50	50	50	50	***119***	50
SS-SO-6-0.5	0.5	02/06/10	50	50	50	50	50	***439***	50
SS-SO-6-2.5	2.5	02/06/10	50	50	50	50	50	50	50
SS-SO-7-2.5	2.5	02/06/10	50	50	50	50	50	50	50
SS-SO-8-2.5	2.5	02/06/10	50	50	50	50	50	50	50
SS-SO-9-0.5	0.5	02/06/10	50	50	50	50	50	**50.4**	50
SS-SO-9-2.5	2.5	02/06/10	50	50	50	50	50	50	50

Table 3
Summary of Soil Analytical Results - PCBs
SMMUSD Malibu Middle and High School
30215 Morning View Drive, Malibu, California
CM011144.0003

Sample Name	Depth (feet)	Sample Date Analyte: Method: Units:	Aroclor-1016 EPA 8082 µg/kg	Aroclor-1221 EPA 8082 µg/kg	Aroclor-1232 EPA 8082 µg/kg	Aroclor-1242 EPA 8082 µg/kg	Aroclor-1248 EPA 8082 µg/kg	Aroclor-1254 EPA 8082 µg/kg	Aroclor-1260 EPA 8082 µg/kg
SS-SO-10-0.5	0.5	02/06/10	50	50	50	50	50	50	50
SS-SO-11-0.5	0.5	02/06/10	50	50	50	50	50	50	50
SS-SO-12-0.5	0.5	02/06/10	50	50	50	50	50	50	50
SS-SO-13-0.5	0.5	02/06/10	50	50	50	50	50	**58.3**	50
SS-SO-14-0.5	0.5	02/06/10	50	50	50	50	50	**67.8**	50
SS-SO-15-2.5	2.5	02/06/10	50	50	50	50	50	50	50
SS-SO-16-0.5	0.5	02/06/10	50	50	50	50	50	50	50
SS-SO-17-0.5	0.5	02/06/10	50	50	50	50	50	50	50
Statistical Analysis									
		Number of Samples:	40	40	40	40	40	40	40
		Number of Detects:	0	0	0	0	0	23	0
		Minimum Concentration:	<50	<50	<50	<50	<50	<50	<50
		Maximum Concentration:	<50	<50	<50	<50	<50	**1420**	<50
		Average Concentration:	50	50	50	50	50	201.14	50
		Standard Deviation:	0	0	0	0	0	289.06	0
		95% UCL:	NA	NA	NA	NA	NA	654.5735	NA
Comparison Criteria									
CHHSLS			89	89	89	89	89	89	89
Is maximum concentration below CHHSL?			YES	YES	YES	YES	YES	NO	YES
Quality Control Samples									
Equipment Blanks (µg/L)									
EQBLK	NA	02/06/10	50	50	50	50	50	50	50
Duplicate Samples									
SS-STRUCTURE-16-0.5'	0.5	11/21/09	<50	<50	<50	<50	<50	**84.5**	<50
DUP-2	0.5	11/21/09	<50	<50	<50	<50	<50	**56.9**	<50
RPD(%)			0%	0%	0%	0%	0%	39%	0%
SS-STRUCTURE-1-0.5'	0.5	11/21/09	<50	<50	<50	<50	<50	<50	<50
DUP-3	0.5	11/21/09	<50	<50	<50	<50	<50	<50	<50
RPD(%)			0%	0%	0%	0%	0%	0%	0%
SS-SO-2-0.5	0.5	02/06/10	<50	<50	<50	<50	<50	**161**	<50
DUP-1-020610	0.5	02/06/10	<50	<50	<50	<50	<50	**79.7**	<50
RPD(%)			0%	0%	0%	0%	0%	68%	0%
SS-SO-11-0.5	0.5	02/06/10	<50	<50	<50	<50	<50	<50	<50
DUP-2-020610	0.5	02/06/10	<50	<50	<50	<50	<50	<50	<50
RPD(%)			0%	0%	0%	0%	0%	0%	0%

Soil samples analyzed by Positive Lab Services, Los Angeles, California

NOTES:

QA/QC: AMH

PCBs = polychlorinated biphenyls
< = not detected above laboratory reporting limit indicated
µg/kg = micrograms per kilograms
RPP = rellative percent difference
95% UCL = 95% upper confidence limit above the mean concentration, calculated using Pro UCL and using 1/2 the detection limit for those concetration reported as non-detections.
NA = not analyzed
CHHSL = California Human Health Screening Level (California Office of Environmental Health Hazard Assessment)
Concentrations in bold typeface and shading were reported above the method detection limit.
Concentrations in *red italic typeface* are slated for removal and as such, are not included in post-removal statistical calculations.

Table 4
Summary of Soil Vapor Analytical Results - VOCs
SMMUSD Malibu Middle and High School
30215 Morning View Drive, Malibu, California
CM011144.0003

Sample ID	Depth (feet)	Date Sampled	1,1,1,2-Tetrachloroethane	1,1,1-Trichloroethane	1,1,2,2-Tetrachloroethane	1,1,2-Trichloroethane	1,1-Dichloroethane	1,1-Dichloroethene	1,1-Difluoroethane (LCC)	1,2-Dichloroethane	Benzene	Carbon tetrachloride	Chloroethane	Chloroform	cis-1,2-Dichloroethene	Dichlorodifluoromethane	Ethylbenzene	Freon 113	m,p-Xylene	Methyl tert-butyl ether	Methylene chloride	o-Xylene	Tetrachloroethene	Toluene	trans-1,2-Dichloroethene	Trichloroethene	Trichlorofluoromethane	Vinyl chloride
		Method:	EPA 8260B	EPA 8260B	EPA 8260B	EPA 8260B	EPA 8260B	EPA 8260B	EPA 8260B	EPA 8260B	EPA 8260B	EPA 8260B	EPA 8260B	EPA 8260B	EPA 8260B	EPA 8260B	EPA 8260B	EPA 8260B	EPA 8260B	EPA 8260B	EPA 8260B	EPA 8260B	EPA 8260B	EPA 8260B	EPA 8260B	EPA 8260B	EPA 8260B	EPA 8260B
		Units:	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L
SV-1-5'	5.0	11/21/09	0.5	0.5	0.5	0.5	0.5	0.5	10	0.1	**0.1**	0.1	0.5	0.1	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.1	<1.0	0.5	0.1	0.5	0.1
SV-1-10'	10.0	11/21/09	0.5	0.5	0.5	0.5	0.5	0.5	10	0.1	0.1	0.1	0.5	0.1	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.1	<1.0	0.5	0.1	0.5	0.1
SV-2-5'	5.0	11/21/09	0.5	0.5	0.5	0.5	0.5	0.5	10	0.1	0.1	0.1	0.5	0.1	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.1	<1.0	0.5	0.1	0.5	0.1
SV-2-10'	10.0	11/21/09	0.5	0.5	0.5	0.5	0.5	0.5	10	0.1	0.1	0.1	0.5	0.1	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.1	**4.3**	0.5	0.1	0.5	0.1
SV-3-5'	5.0	11/21/09	0.5	0.5	0.5	0.5	0.5	0.5	10	0.1	0.1	0.1	0.5	0.1	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.1	<1.0	0.5	0.1	0.5	0.1
SV-3-10'	10.0	11/21/09	0.5	0.5	0.5	0.5	0.5	0.5	10	0.1	0.1	0.1	0.5	0.1	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.1	<1.0	0.5	0.1	0.5	0.1
SV-4-5'	5.0	11/21/09	0.5	0.5	0.5	0.5	0.5	0.5	10	0.1	0.1	0.1	0.5	0.1	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.1	<1.0	0.5	0.1	0.5	0.1
SV-4-10'	10.0	11/21/09	0.5	0.5	0.5	0.5	0.5	0.5	10	0.1	0.1	0.1	0.5	0.1	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.1	<1.0	0.5	0.1	0.5	0.1
SV-5-5'	5.0	11/21/09	0.5	0.5	0.5	0.5	0.5	0.5	10	0.1	0.1	0.1	0.5	0.1	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.1	<1.0	0.5	0.1	0.5	0.1
SV-5-10'	10.0	11/21/09	0.5	0.5	0.5	0.5	0.5	0.5	10	0.1	0.1	0.1	0.5	0.1	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.1	<1.0	0.5	0.1	0.5	0.1
SV-6-5'	5.0	11/21/09	0.5	0.5	0.5	0.5	0.5	0.5	10	0.1	0.1	0.1	0.5	0.1	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.1	<1.0	0.5	0.1	0.5	0.1
SV-6-10'	10.0	11/21/09	0.5	0.5	0.5	0.5	0.5	0.5	10	0.1	0.1	0.1	0.5	0.1	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.1	<1.0	0.5	0.1	0.5	0.1
SV-7-5'	5.0	11/21/09	0.5	0.5	0.5	0.5	0.5	0.5	10	0.1	0.1	0.1	0.5	0.1	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.1	<1.0	0.5	0.1	0.5	0.1
SV-7-10'	10.0	11/21/09	0.5	0.5	0.5	0.5	0.5	0.5	10	0.1	0.1	0.1	0.5	0.1	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.1	<1.0	0.5	0.1	0.5	0.1
SV-8-5'	5.0	11/21/09	0.5	0.5	0.5	0.5	0.5	0.5	10	0.1	0.1	0.1	0.5	0.1	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.1	<1.0	0.5	0.1	0.5	0.1
SV-8-10'	10.0	11/21/09	0.5	0.5	0.5	0.5	0.5	0.5	10	0.1	0.1	0.1	0.5	0.1	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.1	**1.2**	0.5	0.1	0.5	0.1
SV-9-5'	5.0	11/21/09	0.5	0.5	0.5	0.5	0.5	0.5	10	0.1	0.1	0.1	0.5	0.1	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.1	<1.0	0.5	0.1	0.5	0.1
SV-9-10'	10.0	11/21/09	0.5	0.5	0.5	0.5	0.5	0.5	10	0.1	**0.16**	0.1	0.5	0.1	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.1	**1.2**	0.5	0.1	0.5	0.1
SV-10-5'	5.0	11/21/09	0.5	0.5	0.5	0.5	0.5	0.5	10	0.1	0.1	0.1	0.5	0.1	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.1	<1.0	0.5	0.1	0.5	0.1
SV-10-10'	10.0	11/21/09	0.5	0.5	0.5	0.5	0.5	0.5	10	0.1	0.1	0.1	0.5	0.1	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.1	**1.1**	0.5	0.1	0.5	0.1
Statistical Analysis																												
		Number of Samples:	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20
		Number of Detects:	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	4	0	0	0	0
		Minimum Concentration:	0.5	0.5	0.5	0.5	0.5	0.5	10	0.1	0.1	0.1	0.5	0.1	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.1	1	0.5	0.1	0.5	0.1
		Maximum Concentration:	0.5	0.5	0.5	0.5	0.5	0.5	10	0.1	**0.16**	0.1	0.5	0.1	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.1	**4.3**	0.5	0.1	0.5	0.1
		Average Concentration:	0.5	0.5	0.5	0.5	0.5	0.5	10	0.1	0.10	0.1	0.5	0.1	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.1	1.19	0.5	0.1	0.5	0.1
		Standard Deviation:	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.73	0.00	0.00	0.00	0.00
Quality Control Samples																												
Duplicate Samples																												
SV-4-10'	10.0	11/21/09	0.5	0.5	0.5	0.5	0.5	0.5	10	0.1	0.1	0.1	0.5	0.1	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.1	<1.0	0.5	0.1	0.5	0.1
SV-4-10' Dup	10.0	11/21/09	0.5	0.5	0.5	0.5	0.5	0.5	10	0.1	0.1	0.1	0.5	0.1	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.1	<1.0	0.5	0.1	0.5	0.1
RPD(%)			0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%

Soil vapor samples analyzed by H&P Mobile Geochemistry, Signal Hill, California

NOTES:
All samples analyzed for VOCs by EPA Method 8260.
A purge volume test was conducted at sample location SV-1-5 and conducted with 1, 3 and 7 purge volumes. As the results were non-detect for all analytes with 3 and 7 purge volumes, yet benzene was reported at the detection limit at 1 purge volume, 1 purge volume was selected as the purge volume most conservative for site conditions.
< = not detected above laboratory reporting limit indicated
µg/L = micrograms per liter
NA = not analyzed
Concentrations in bold typeface and shading were reported above the method detection limit.

QA/QC: AMH

ARCADIS

Appendix C

Risk Assessment Spreadsheets
from PEA Report

Table 5a
Selection of Compounds of Potential Concern in Soil and Soil Vapor
Malibu Middle and High School
30215 Morning View Drive, Malibu, California
CM011144.0003

	Background Soil Data [1]			Site Soil Data [1]			Comparison Criteria				
Chemical	**Maximum Detected Concentration (mg/kg)**	**Arithmetic Mean Concentration (mg/kg)**	**95% UCL Concentration (mg/kg)**	**Maximum Detected Concentration (mg/kg)**	**Arithmetic Mean Concentration (mg/kg)**	**95% UCL Concentration (mg/kg)**	**Is Site$_{Max}$ ≤ Background$_{Max}$?**	**If not, is Site$_{Avg}$ ≤ Background$_{Max}$?**	**Does statistical evaluation show that site data is indicative of background? ***	**Selected as COPC**	**Rationale for Selection or Exclusion**
Metals											
Antimony	2.5	2.5	--	11.0	3.7	7.7	NO	NO	NO	**No**	Maximum detected concentration < CHHSL
Arsenic	10.6	6.5	10.5	13.7	6.0	8.9	NO	YES	YES	**No**	Naturally occurring
Barium	211.0	126.0	206.3	258.0	147.8	195.6	NO	YES	YES	**No**	Maximum detected concentration < CHHSL
Cadmium	4.8	2.7	5.0	6.2	1.9	3.2	NO	YES	YES	**No**	Naturally occurring
Chromium	57.2	49.7	56.0	83.3	49.8	63.5	NO	YES	YES	**No**	Maximum detected concentration < CHHSL
Cobalt	14.3	7.9	15.5	8.7	5.7	7.2	YES	YES	YES	**No**	Maximum detected concentration < CHHSL
Copper	31.3	26.4	34.0	193.0	47.4	95.4	NO	NO	NO	**No**	Maximum detected concentration < CHHSL
Lead	4.1	2.3	3.8	304.0	21.0	38.2	NO	NO	NO	**Yes**	Detected
Mercury	0.1	0.1	--	0.15	0.1	--	NO	NO	NO	**No**	Maximum detected concentration < CHHSL
Molybdenum	8.4	4.2	11.4	11.1	4.9	8.6	NO	YES	YES	**No**	Maximum detected concentration < CHHSL
Nickel	62.6	51.0	61.3	151.0	62.9	89.4	NO	NO	NO	**No**	Maximum detected concentration < CHHSL
Vanadium	92.8	66.1	90.3	69.1	42.5	55.0	YES	YES	YES	**No**	Maximum detected concentration < CHHSL
Zinc	75.8	58.6	82.2	1,400.0	212.9	438.1	NO	NO	NO	**No**	Maximum detected concentration < CHHSL
Pesticides											
4,4'-DDE	NA	NA	NA	0.361	0.053	0.229	--	--	--	**Yes**	Detected
4,4'-DDT	NA	NA	NA	0.047	0.019	0.024	--	--	--	**Yes**	Detected
alpha-Chlordane	NA	NA	NA	0.683	0.050	0.354	--	--	--	**Yes**	Detected
gamma-Chlordane	NA	NA	NA	0.305	0.028	0.162	--	--	--	**Yes**	Detected
Technical-Chlordane	NA	NA	NA	1.910	0.194	1.052	--	--	--	**Yes**	Maximum detected concentration > CHHSL
PCBs											
Aroclor-1254	NA	NA	NA	1.420	0.201	0.655	--	--	--	**Yes**	Maximum detected concentration > CHHSL
	Background Soil Vapor Data [2]			**Site Soil Vapor Data [2]**			**Comparison Criteria**				
Chemical	**Maximum Detected Concentration (µg/L)**	**Arithmetic Mean Concentration (µg/L)**	**95% UCL Concentration (µg/L)**	**Maximum Detected Concentration (µg/L)**	**Arithmetic Mean Concentration (µg/L)**	**95% UCL Concentration (µg/L)**	**Is Site$_{Max}$ ≤ Background$_{Max}$?**	**If not, is Site$_{Avg}$ ≤ Background$_{Max}$?**	**evaluation show that site data is indicative of background? ***	**Selected as COPC**	**Rationale for Selection or Exclusion**
VOCs											
Benzene	NA	NA	NA	0.16	0.10	--	--	--	--	**Yes**	Maximum detected concentration > CHHSL
Toluene	NA	NA	NA	4.3	1.2	--	--	--	--	**Yes**	Maximum detected concentration > CHHSL

Notes:

[1] Statistical summary of analytical data for soil samples collected at the Malibu Middle and High School Campus November 2009 and February 2010 sampling events. Soil data analyzed by Positive Lab Service, Inc.

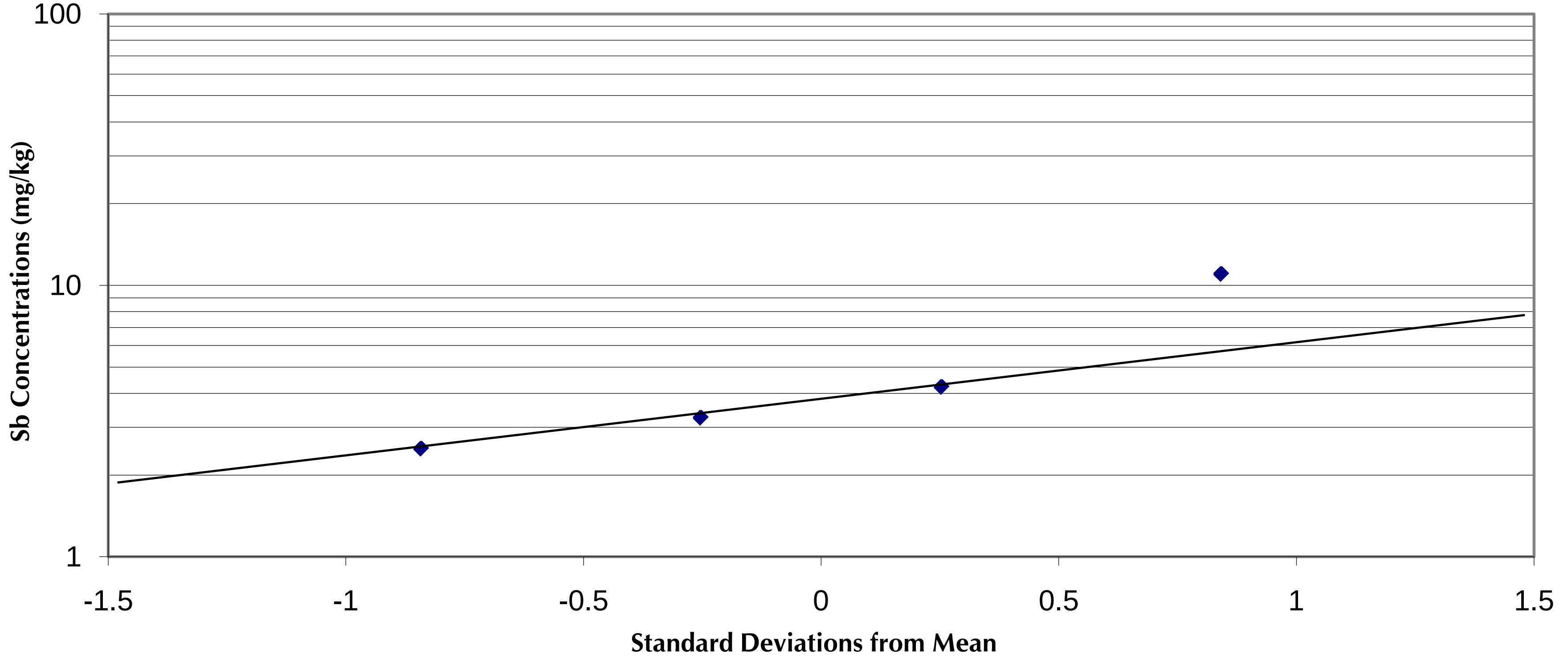
[2] Statistical summary of analytical data for soil vapor samples collected from the Malibu High School campus during the November 2009 sampling event. Soil vapor data collected and analyzed by H&P Mobile Geochemistry Inc.

Highlighted chemicals selected as chemicals for further evaluation.

Abbreviations:

-- = not relevant
µg/L = micrograms per liter
4,4'-DDE = 4,4'-dichlorodiphenyltrichloroethylene
4,4'-DDT = 4,4'-dichlorodiphenyltrichloroethane
95% UCL= 95 percent upper confidence level of arithmetic mean
COPC = chemical of potential concern
CHHSL= California Human Health Screening Level
mg/kg = milligrams per kilogram
NA= not available
PCBs = polychlorinated biphenyls
VOCs = Volatile Organic Compounds

Table 5a-1
Antimony Concentration Statistical Evaluation
Malibu Middle and High School
CM011144.0003



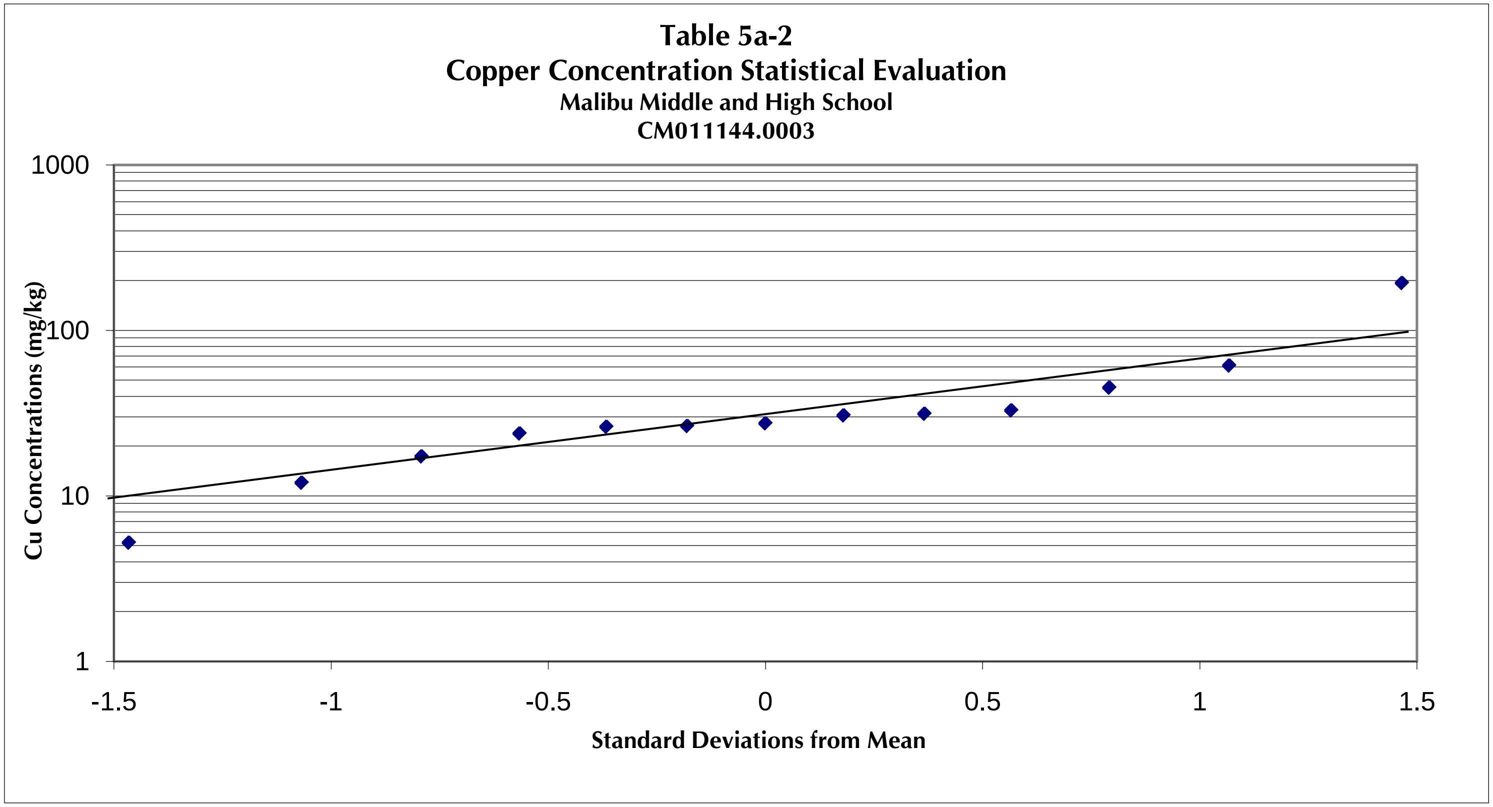


Table 5a-2
Copper Concentration Statistical Evaluation
Malibu Middle and High School
CM011144.0003
1000
100
10
1
-1.5
-1
-0.5
0
0.5
1
1.5
Cu Concentrations (mg/kg)
Standard Deviations from Mean

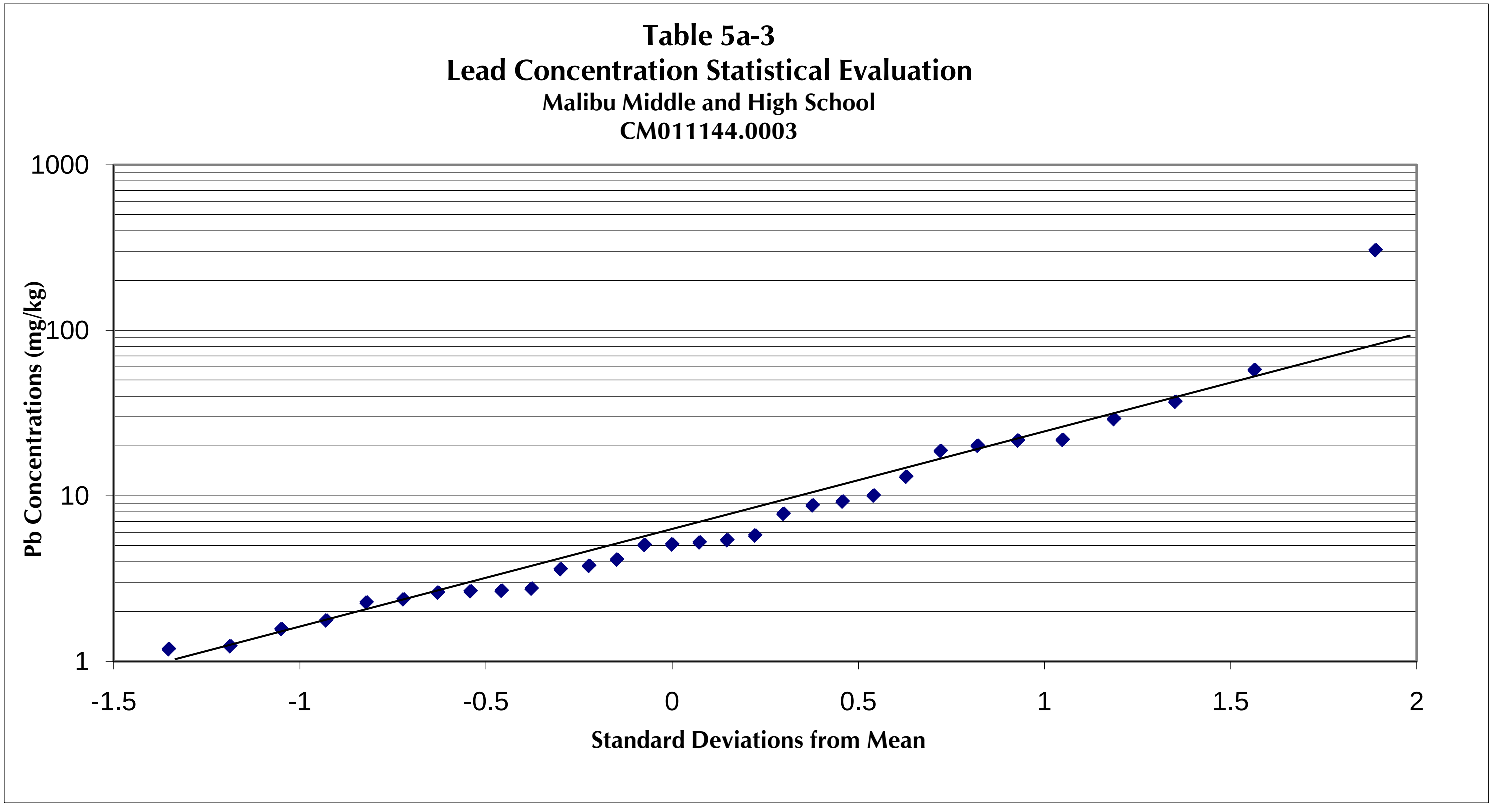


Table 5a-3
Lead Concentration Statistical Evaluation
Malibu Middle and High School
CM011144.0003
1000
100
10
1
-1.5
-1
-0.5
0
0.5
1
1.5
2
Pb Concentrations (mg/kg)
Standard Deviations from Mean

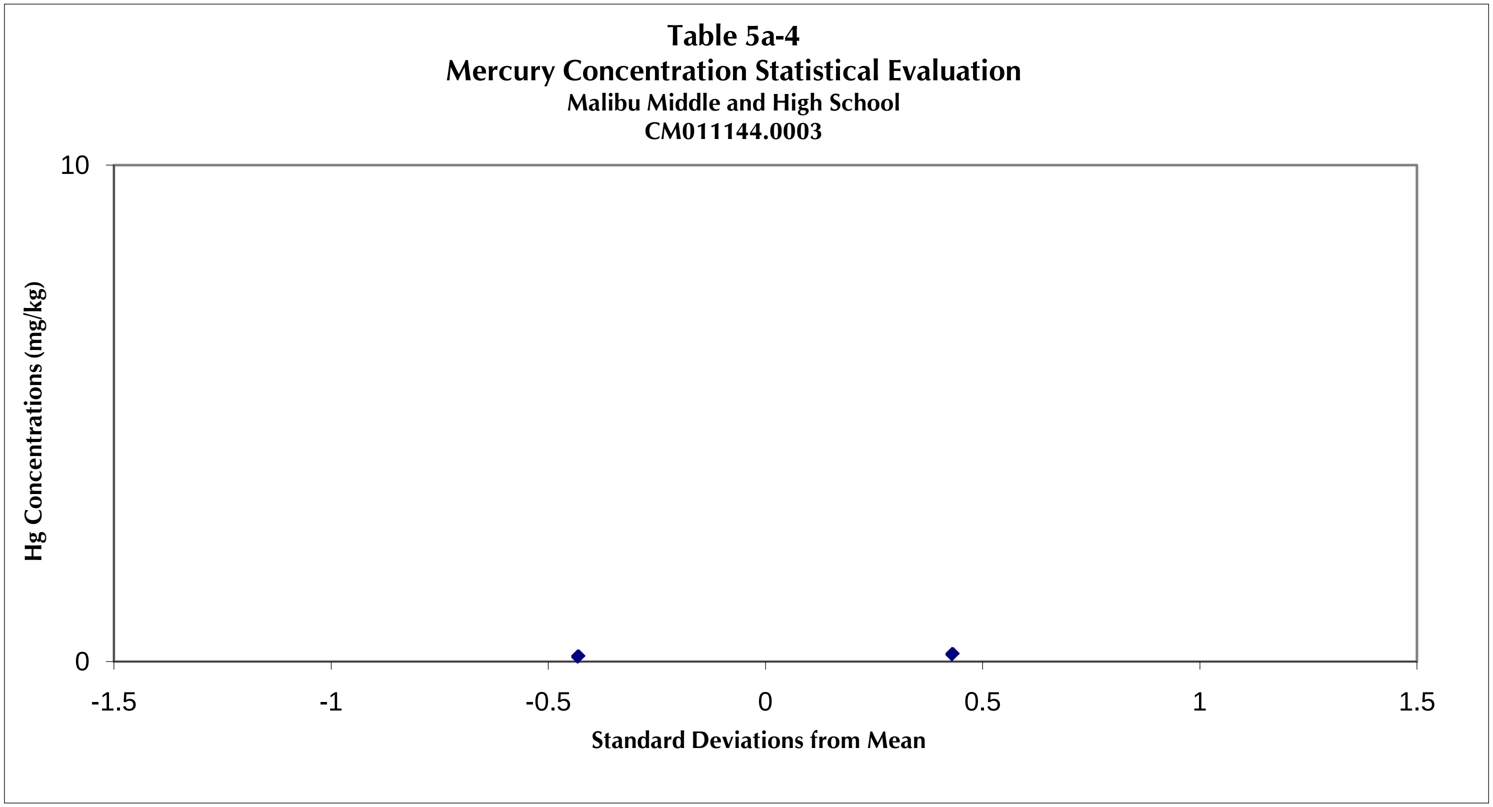


Table 5a-4
Mercury Concentration Statistical Evaluation
Malibu Middle and High School
CM011144.0003
10
0
Hg Concentrations (mg/kg)
-1.5
-1
-0.5
0
0.5
1
1.5
Standard Deviations from Mean

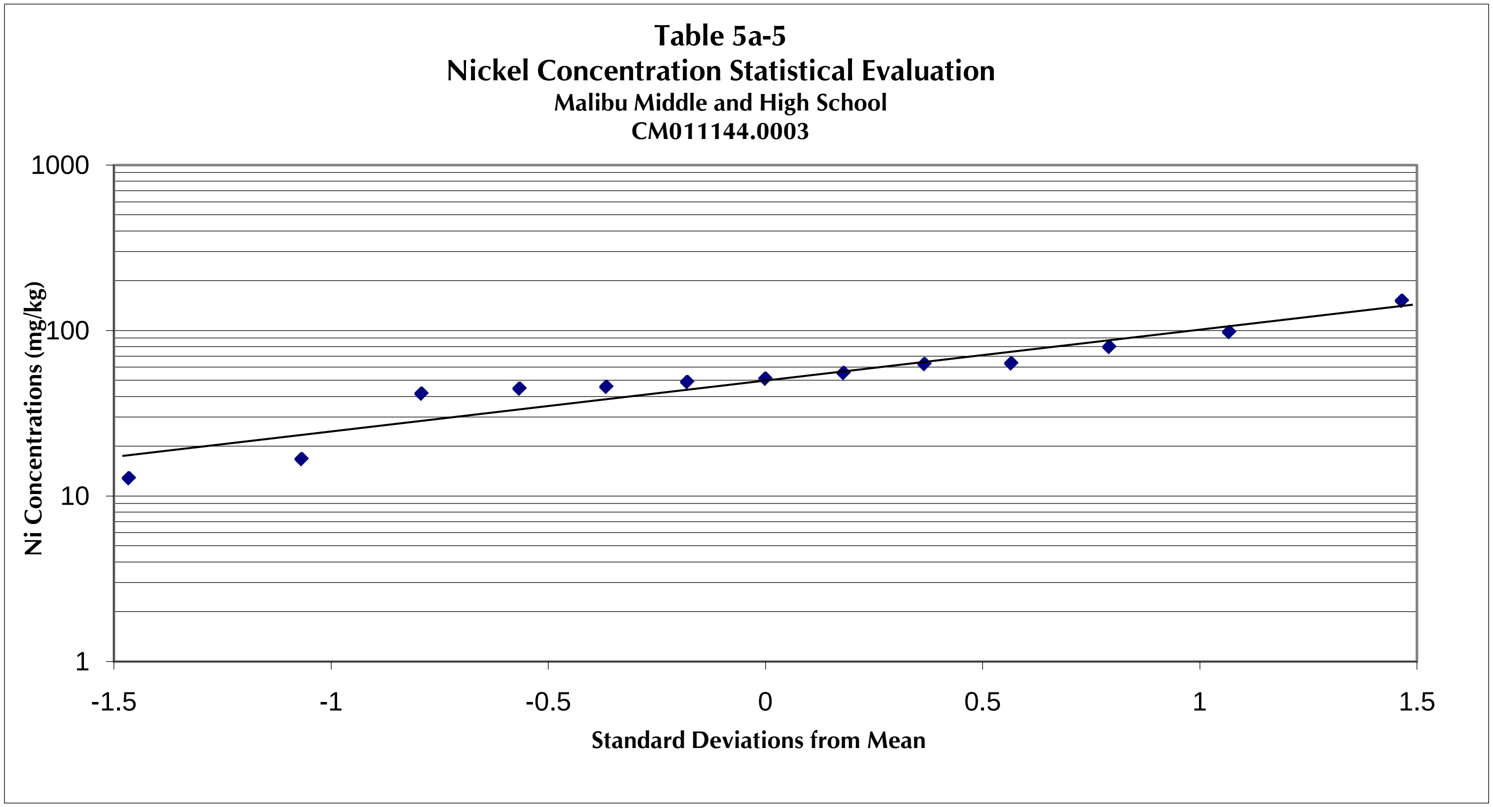


Table 5a-5
Nickel Concentration Statistical Evaluation
Malibu Middle and High School
CM011144.0003
1000
100
10
1
Ni Concentrations (mg/kg)
-1.5
-1
-0.5
0
0.5
1
1.5
Standard Deviations from Mean

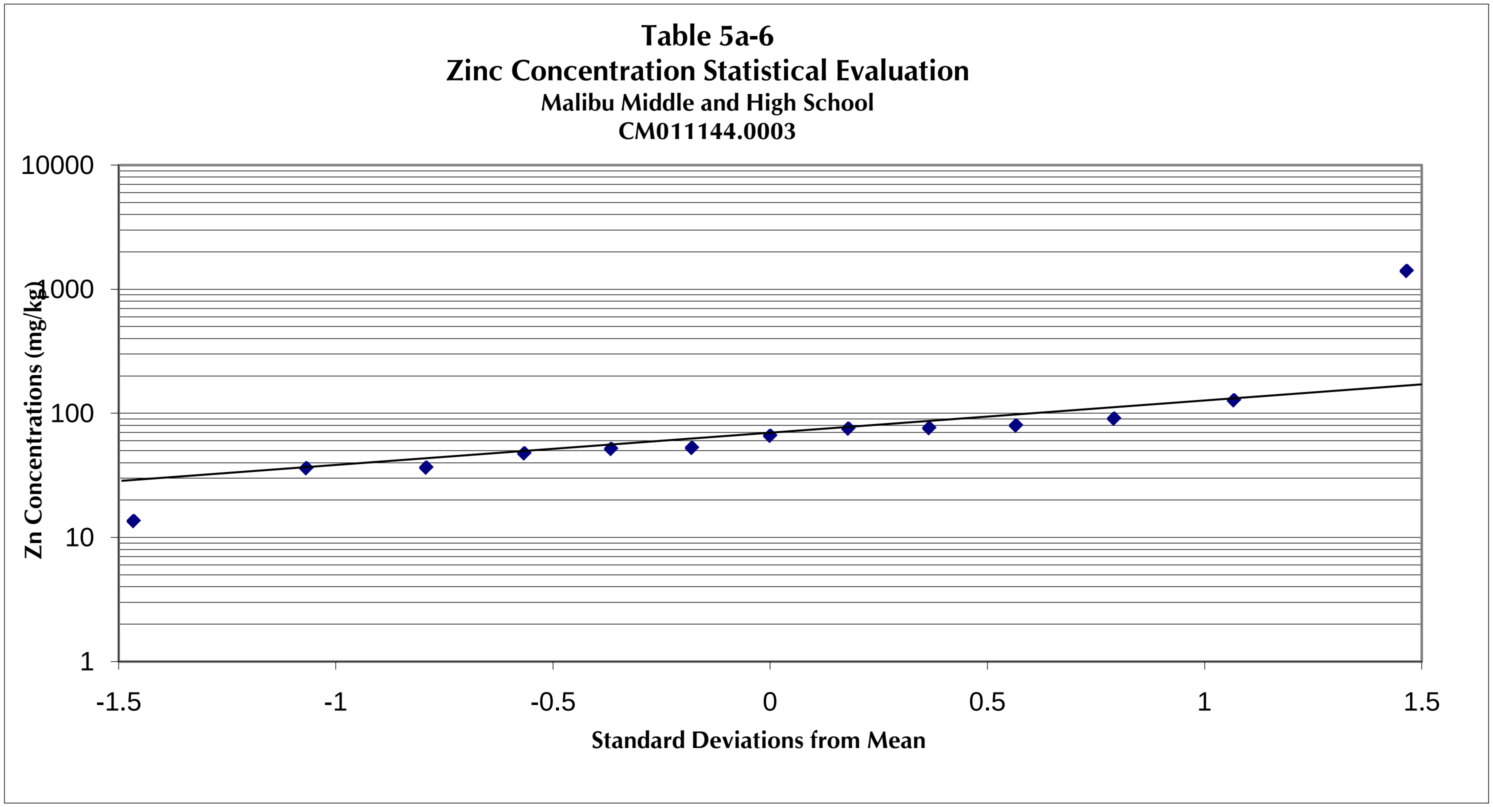


Table 5a-6
Zinc Concentration Statistical Evaluation
Malibu Middle and High School
CM011144.0003
Zn Concentrations (mg/kg)
10000
1000
100
10
1
-1.5
-1
-0.5
0
0.5
1
1.5
Standard Deviations from Mean

Table 6
Chemical Properties for Compounds of Potential Concern
Malibu Middle and High School
30215 Morning View Drive, Malibu, California
CM011144.0003

Chemical	CAS Number	Vapor Pressure (mmHg @ 20-30C)	Solubility (mg/l @ 20-30C)	Henry's Law Constant
Metals				
Lead	7439-92-1	1.77 @ 1000C	insoluble	NA
Pesticides				
4,4'-DDE	72-55-9	6.00E-06	6.50E-02	8.59E-04
4,4'-DDT	50-29-3	1.60E-07	5.50E-03	NA
alpha-Chlordane[1]	12789-03-6	2.90E-05	5.60E-02	1.99E-03
gamma-Chlordane [1]	12789-03-6	2.90E-05	5.60E-02	1.99E-03
Technical-Chlordane [1]	12789-03-6	2.90E-05	5.60E-02	1.99E-03
PCBs				
Aroclor-1254	11097-69-1	7.71E-05	1.20E-02	NA
VOCs				
Benzene	71-43-2	95	1791	2.27E-01
Toluene	108-88-3	28.4	534.8	2.72E-01

Notes:
[1] Technical-chlordane data was applied to alpha and gamma-chlordane

Physical properties are derived from following sources:
Johnson & Ettinger Models: http://www.dtsc.ca.gov/AssessingRisk/JE_Models.cfm
Preliminary Endangerment Assessment (PEA) Guidance Manual:
http://www.dtsc.ca.gov/SiteCleanup/Brownfields/upload/SMP_REP_PEA_appendix.pdf
Hazardous Substances Data Bank (HSDB): http://toxnet.nlm.nih.gov/cgi-bin/sis/htmlgen?HSDB
Toxicological Profile for chlordane: http://www.atsdr.cdc.gov/toxprofiles/tp31.html
Toxicological Profile for PCBs: http://www.atsdr.cdc.gov/toxprofiles/tp17.html

Abbreviations:
4,4'-DDE = 4,4'-dichlorodiphenyltrichloroethylene
4,4'-DDT = 4,4'-dichlorodiphenyltrichloroethane
C= Celsius
mg/l= milligrams per liter
mmHg= millimeters of mercury
NA= not available
PCBs = polychlorinated biphenyls
VOCs = Volatile Organic Compounds

Table 7a

Carcinogenic Toxicity Information for Chemicals of Potential Concern

Malibu Middle and High School

30215 Morning View Drive, Malibu, California

CM011144.0003

Chemical	Oral Cancer Slope Factor (Sfo) $(mg/kg\text{-}day)^{-1}$	Inhalation Cancer Slope Factor (Sfi) $(mg/kg\text{-}day)^{-1}$	Weight-of Evidence Classification	Toxicity Information Reference Source[1]
Metals				
Lead	---	---	---	Cal/EPA
Pesticides				
4-4-DDE	3.4E-01	3.4E-01	B2	Cal/EPA
4,4-DDT	3.4E-01	3.4E-01	B2	Cal/EPA
alpha-Chlordane	1.3E+00	1.2E+00	B2	Cal/EPA
gamma-Chlordane	1.3E+00	1.2E+00	B2	Cal/EPA
Technical Chlordane	1.3E+00	1.2E+00	B2	Cal/EPA
PCBs				
Aroclor-1254	2.00E+00	2.00E+00	B2	Cal/EPA
VOCs				
Benzene	1.00E-01	1.00E-01	A	Cal/EPA
Toluene	--	--	--	Cal/EPA

Notes:

[1] California EPA OEHHA Cancer Potency Values, July 2009

4,4'-DDE = 4,4'-dichlorodiphenyltrichloroethylene

4,4'-DDT = 4,4'-dichlorodiphenyltrichloroethane

PCBs = polychlorinated biphenyls

VOCs = Volatile Organic Compounds

--- = not applicable

Cal/EPA = California Environmental Protection Agency

mg/kg-day = Milligrams per kilogram per day

OEHHA= Office of Environmental Human Hazard Assessment

Weight-of-Evidence Classification:

A - Human carcinogen

B1 - Probable human carcinogen - indicates that limited human data are available

B2 - Probable human carcinogen - indicates sufficient evidence in animals and inadequate or no evidence in humans

C - Possible human carcinogen

D - Not classifiable as to human carcinogenicity

Table 7b
Noncarcinogenic Toxicity Information for Chemicals of Potential Concern
Malibu Middle and High School
30215 Morning View Drive, Malibu, California
CM011144.0003

Chemical	Oral Reference Dose (RfDo) (mg/kg-day)	Inhalation Reference Dose (RfDi) (mg/kg-day)	Primary Target Organ	Toxicity Information Reference Source [1]
Metals				
Lead	---	---	--	--
Pesticides				
4-4-DDE	---	---	---	--
4,4-DDT [2]	5.0E-04	5.0E-04	Liver	IRIS
alpha-Chlordane [3]	5.0E-04	2.0E-04	Liver	IRIS
gamma-Chlordane [3]	5.0E-04	2.0E-04	Liver	IRIS
Technical Chlordane	5.0E-04	2.0E-04	Liver	IRIS
PCBs				
Aroclor-1254 [2]	2.0E-05	2.0E-05	--	RSL
VOCs				
Benzene	4.0E-03	8.6E-03	Immune system	IRIS
Toluene	8.0E-02	1.4E+00	Kidney/nervous system	IRIS

Notes:

[1] U.S. Environmental Protection Agency Integrated Risk Information System (IRIS) database, January 2007: http://www.epa.gov/ncea/iris/ and U.S. Environmental Protection Agency Regional Screening Levels (RSL), December 2009: http://www.epa.gov/region9/superfund/prg/index.html

[2] No RfDi was available; the RfDo was used as surrogate.

[3] Technical chlordane data is applied to alpha and gamma chlordane.

Abbreviations:

--- = Not available
4,4'-DDE = 4,4'-dichlorodiphenyltrichloroethylene
4,4'-DDT = 4,4'-dichlorodiphenyltrichloroethane
mg/kg-day = Milligrams per kilogram per day
PCBs = polychlorinated biphenyls
VOCs = Volatile Organic Compounds

Table 8
Carcinogenic Risk Estimate for Chemicals of Potential Concern
Using Maximum Concentrations of All Site Data
Malibu Middle and High School
30215 Morning View Drive, Malibu, California
CM011144.0003

Chemical	Oral Cancer Slope Factor (Sfo) $(mg/kg\text{-}day)^{-1}$	Inhalation Cancer Slope Factor (Sfi) $(mg/kg\text{-}day)^{-1}$	Dermal Absorption Fraction (ABS) (dimensionless)	Concentration in Soil[1] (Cs) (mg/kg)	Concentration in Air (Ca) (mg/m^3)	RISK for Soil Pathway	RISK for Air Pathway
Pesticides							
4-4-DDE	3.4E-01	3.4E-01	0.05	0.3610	1.8E-08	**3.E-07**	**9.E-10**
4,4-DDT	3.4E-01	3.4E-01	0.05	0.047	2.3E-09	**4.E-08**	**1.E-10**
alpha-Chlordane	1.3E+00	1.2E+00	0.05	0.6830	3.4E-08	**2.E-06**	**6.E-09**
gamma-Chlordane	1.3E+00	1.2E+00	0.05	0.3050	1.5E-08	**1.E-06**	**3.E-09**
Technical Chlordane	1.3E+00	1.2E+00	0.05	1.9100	9.6E-08	**6.E-06**	**2.E-08**
PCBs							
Aroclor-1254	2.0E+00	2.0E+00	0.15	1.420	7.1E-08	**1.E-05**	**2.E-08**
VOCs							
Benzene (max at 5 ft bgs) [2]	--	1.0E-01	0.10	--	7.88E-05	**--**	**1.E-06**
Risk for Pathway						**2.E-05**	**1.E-06**
Overall risk from metals:			--				
Overall risk from pesticides:			1.E-05				
Overall risk from PCBs:			1.E-05				
Overall risk from VOCs:			1.E-06				
TOTAL RISK (across all chemicals and exposure routes)**:**			**2.E-05**				

Notes:

[1] Maximum detected concentration in soil (for non-VOCs) or soil vapor (for VOCs)

[2] The maximum concentration of benzene in soil vapor (0.16 ug/l at a depth of 10 feet bgs with a soil profile of clay loam) was also input into the Johnson and Ettinger soil vapor model to estimate the concentration in the air and the corresponding risk. The resulting air concentration and corresponding risk was slightly lower than that calculated from the maximum benzene concentration at a depth of 5 feet bgs (0.1 µg/l) with a soil profile of clay loam). (Air concentration of 0.16 µg/l benzene at a depth of 10 feet bgs is estimated to be 7.88×10^{-2} $\mu g/m^3$ and the corresponding risk is 1×10^{-6}.)

Risks highlighted in yellow are above a 5 in a 1,000,000 (million) target risk for that analyte for that pathway.

For Soil Pathway (equation shown on Figure 2.3; Cal/EPA 1999):
RISK = $((Cs \times SFo) \times (1.57 \times 10^{-6})) + ((Cs \times SFo) \times (1.87 \times 10^{-5}) \times ABS)$

For Air Pathway (equation shown on Figure 2.4; Cal/EPA 1999):
RISK = $(Ca \times SFi) \times 0.149$
where for non-VOCs (equation shown on Figure 2.8, Cal/EPA 1999):
$Ca = Cs \times (5.0 \times 10^{-8}\ kg/m^3)$

For VOCs, the Johnson and Ettinger model was used (DTSC, last modified 02/04/09)

Abbreviations:

--- = Not applicable
4,4'-DDE = 4,4'-dichlorodiphenyltrichloroethylene
4,4'-DDT = 4,4'-dichlorodiphenyltrichloroethane
PCBs = Polychlorinated biphenyls
VOCs = Volatile organic compounds
bgs= below ground surface
DTSC= Department of Toxic Substances Control
Cal/EPA 1999= California Environmental Protection Agency. 1999. Preliminary Endangerment Assessment Guidance Manual.

mg/kg = Milligrams per kilogram
mg/kg-day = Milligrams per kilogram per day
mg/m^3 = Milligrams per cubic meter
µg/l= micrograms per liter
$\mu g/m^3$= micrograms per cubic meter
kg/m^3= kilograms per cubic meter

QA/QC: AMH

Table 9
Noncarcinogenic Hazard Estimate for Chemicals of Potential Concern
Using Maximum Concentrations of All Site Data
Malibu Middle and High School
30215 Morning View Drive, Malibu, California
CM011144.0003

Chemical	**Oral Reference Dose (RfDo) (mg/kg-day)**	**Inhalation Reference Dose (RfDi) (mg/kg-day)**	**Dermal Absorption Fraction (ABS) (dimensionless)**	**Concentration in Soil[1] (Cs) (mg/kg)**	**Concentration in Air (Ca) (mg/m^3)**	**HAZARD for Soil Pathway**	**HAZARD for Air Pathway**
Pesticides							
4-4-DDE	---	---	--	---	---	**--**	**--**
4,4-DDT	5.0E-04	5.0E-04	0.05	0.0467	2.3E-09	**1.79E-03**	**2.98E-06**
alpha-Chlordane	5.0E-04	2.0E-04	0.05	0.6830	3.4E-08	**2.62E-02**	**1.09E-04**
gamma-Chlordane	5.0E-04	2.0E-04	0.05	0.3050	1.5E-08	**1.17E-02**	**4.87E-05**
Technical Chlordane	5.0E-04	2.0E-04	0.05	1.9100	9.6E-08	**7.33E-02**	**3.05E-04**
PCBs							
Aroclor-1254	2.0E-05	2.0E-05	0.15	1.4200	7.1E-08	**2.27E+00**	**2.27E-03**
VOCs							
Benzene[2]	--	8.6E-03	0.10	--	7.88E-05	**--**	**5.87E-03**
Toluene[3]	---	---	--	---	---	**--**	**--**
Hazard Index for Pathway						**2**	**0.009**
Overall hazard from metals:			--				
Overall hazard from pesticides:			1.14E-01				
Overall risk from PCBs:			2.27E+00				
Overall hazard from VOCs:			5.87E-03				
TOTAL HAZARD (across all chemicals and exposure routes)**:**			**2**				

Notes:

[1] Maximum detected concentration in soil (for non-VOCs) or soil vapor (for VOCs)

[2] The maximum concentration of benzene in soil vapor (0.16 ug/l at a depth of 10 feet bgs with a soil profile of clay loam) was also input into the Johnson and Ettinger soil vapor model to estimate the concentration in the air and the corresponding hazard. The resulting air concentration and corresponding hazard was slightly lower than that calculated from the maximum benzene concentration at a depth of 5 feet bgs (0.1 µg/l) with a soil profile of clay loam). (Air concentration of 0.16 µg/l benzene at a depth of 10 feet bgs is estimated to be 7.88 x 10-2 $\mu g/m^3$ and the corresponding hazard is 5.9×10^{-3}.)

[3] The maximum concentration in soil vapor (4.3 µg/l at a depth of 10 feet bgs with a soil profile of clay loam) was input into the Johnson and Ettinger soil vapor model to estimate the concentration in the air and the corresponding hazard. Toluene was not detected in any samples at the 5 foot bgs depth so no secondary evaluations were necessary to evaluate multiple data points.

Highlighted analytes represent those chemicals contributing a hazard quotient of 1.0 or greater and are therefore considered hazard drivers.

For Soil Pathway (equation shown on Figure 2.3; Cal/EPA 1999):
$HAZARD = ((Cs/RfDo) \times (1.28 \times 10^{-5})) + ((Cs/RfDo) \times (1.28 \times 10^{-4}) \times ABS)$

For Air Pathway (equation shown on Figure 2.4; Cal/EPA 1999):
$HAZARD = (Ca/RfDi) \times 0.639$
where for non-VOCs (equation shown on Figure 2.8, Cal/EPA 1999):
$Ca = Cs \times (5.0 \times 10^{-8}\ kg/m^3)$

For VOCs, the Johnson and Ettinger model was used (DTSC, last modified 02/04/09)

Abbreviations:

--- = Not applicable
4,4'-DDE = 4,4'-dichlorodiphenyltrichloroethylene
4,4'-DDT = 4,4'-dichlorodiphenyltrichloroethane
PCBs = Polychlorinated biphenyls
VOCs = Volatile organic compounds
bgs= below ground surface
DTSC= Department of Toxic Substances Control
Cal/EPA 1999= California Environmental Protection Agency. 1999. Preliminary Endangerment Assessment Guidance Manual.

kg/m^3= kilograms per cubic meter
mg/kg = Milligrams per kilogram
mg/kg-day = Milligrams per kilogram per day
mg/m^3 = Milligrams per cubic meter
µg/l= micrograms per liter
$\mu g/m^3$= micrograms per cubic meter

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Table 10
Carcinogenic Risk Estimate for Chemicals of Potential Concern
Using Maximum Concentrations of Remaining Site Data After Excluding Data Points Proposed for Removal
Malibu Middle and High School
30215 Morning View Drive, Malibu, California
CM011144.0003

Chemical	Oral Cancer Slope Factor (Sfo) $(mg/kg\text{-}day)^{-1}$	Inhalation Cancer Slope Factor (Sfi) $(mg/kg\text{-}day)^{-1}$	Dermal Absorption Fraction (ABS) (dimensionless)	Concentration in Soil[1] (Cs) (mg/kg)	Concentration in Air (Ca) (mg/m^3)	RISK for Soil Pathway	RISK for Air Pathway
Pesticides							
4-4-DDE	3.4E-01	3.4E-01	0.05	0.3610	1.8E-08	**3.E-07**	**9.E-10**
4,4-DDT	3.4E-01	3.4E-01	0.05	0.0467	2.3E-09	**4.E-08**	**1.E-10**
alpha-Chlordane	1.3E+00	1.2E+00	0.05	0.0731	3.7E-09	**2.E-07**	**7.E-10**
gamma-Chlordane	1.3E+00	1.2E+00	0.05	0.0463	2.3E-09	**2.E-07**	**4.E-10**
Technical Chlordane	1.3E+00	1.2E+00	0.05	0.2740	1.4E-08	**9.E-07**	**2.E-09**
PCBs							
Aroclor-1254	2.0E+00	2.0E+00	0.15	0.0678	3.4E-09	**6.E-07**	**1.E-09**
VOCs							
Benzene (max at 5 ft bgs)	--	1.0E-01	0.10	--	7.88E-05	**--**	**1.E-06**
Risk for Pathway						**2.E-06**	**1.E-06**
Overall risk from metals:							
Overall risk from pesticides:			2.E-06				
Overall risk from PCBs:			6.E-07				
Overall risk from VOCs:			1.E-06				
TOTAL RISK (across all chemicals and exposure routes)**:**			**3.E-06**				

Notes:

1 Maximum detected concentration in soil (for non-VOCs) or soil vapor (for VOCs)

2 The maximum concentration of benzene in soil vapor (0.16 µg/l at a depth of 10 feet bgs with a soil profile of clay loam) was also input into the Johnson and Ettinger soil vapor model to estimate the concentration in the air and the corresponding risk. The resulting air concentration and corresponding risk was slightly lower than that calculated from the maximum benzene concentration at a depth of 5 feet bgs (0.1 µg/l) with a soil profile of clay loam). (Air concentration of 0.16 µg/l benzene at a depth of 10 feet bgs is estimated to be 7.88×10^{-2} $\mu g/m^3$ and the corresponding risk is 1×10^{-6}).

Risks highlighted in yellow are above a 5 in a 1,000,000 (million) target risk for that analyte for that pathway.

For Soil Pathway (equation shown on Figure 2.3; Cal/EPA 1999):
RISK = $((Cs \times SFo) \times (1.57 \times 10^{-6})) + ((Cs \times SFo) \times (1.87 \times 10^{-5}) \times ABS)$

For Air Pathway (equation shown on Figure 2.4; Cal/EPA 1999):
RISK = $(Ca \times SFi) \times 0.149$
where for non-VOCs (equation shown on Figure 2.8, Cal/EPA 1999):
$Ca = Cs \times (5.0 \times 10^{-8}\ kg/m^3)$

For VOCs, the Johnson and Ettinger model was used (DTSC, last modified 02/04/09)

Abbreviations:

--- = Not applicable
4,4'-DDE = 4,4'-dichlorodiphenyltrichloroethylene
4,4'-DDT = 4,4'-dichlorodiphenyltrichloroethane
PCBs = Polychlorinated biphenyls
VOCs = Volatile organic compounds
bgs= below ground surface
DTSC= Department of Toxic Substances Control
Cal/EPA 1999= California Environmental Protection Agency. 1999. Preliminary Endangerment Assessment Guidance Manual.

mg/kg = Milligrams per kilogram
mg/kg-day = Milligrams per kilogram per day
mg/m^3 = Milligrams per cubic meter
µg/l= micrograms per liter
$\mu g/m^3$= micrograms per cubic meter
kg/m^3= kilograms per cubic meter

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Table 11
Noncarcinogenic Hazard Estimate for Chemicals of Potential Concern
Using Maximum Concentrations of Remaining Site Data After Excluding Data Points Proposed for Removal
Malibu Middle and High School
30215 Morning View Drive, Malibu, California
CM011144.0003

Chemical	Oral Reference Dose (RfDo) (mg/kg-day)	Inhalation Reference Dose (RfDi) (mg/kg-day)	Dermal Absorption Fraction (ABS) (dimensionless)	Concentration in Soil[1] (Cs) (mg/kg)	Concentration in Air (Ca) (mg/m^3)	HAZARD for Soil Pathway	HAZARD for Air Pathway
Pesticides							
4-4-DDE	---	---	--	---	---	---	---
4,4-DDT	5.0E-04	5.0E-04	0.05	0.0467	2.3E-09	**1.8E-03**	**3.0E-06**
alpha-Chlordane	5.0E-04	2.0E-04	0.05	0.0731	3.7E-09	**2.8E-03**	**1.2E-05**
gamma-Chlordane	5.0E-04	2.0E-04	0.05	0.0463	2.3E-09	**1.8E-03**	**7.4E-06**
Technical Chlordane	5.0E-04	2.0E-04	0.05	0.2740	1.4E-08	**1.1E-02**	**4.4E-05**
PCBs							
Aroclor-1254	2.0E-05	2.0E-05	0.15	0.0678	3.4E-09	**1.1E-01**	**1.1E-04**
VOCs							
Benzene[2]	--	8.6E-03	0.10	--	7.88E-05	--	**5.9E-03**
Toluene[3]	--	--	--	--	--	--	--
Hazard Index for Pathway						**0.1**	**0.01**
Overall hazard from metals:			--				
Overall risk from PCBs:			1.1E-01				
Overall hazard from pesticides:			1.7E-02				
Overall hazard from VOCs:			5.9E-03				
TOTAL HAZARD (across all chemicals and exposure routes)**:**			**0.1**				

Notes:
1 Maximum detected concentration in soil (for non-VOCs) or soil vapor (for VOCs)

2 The maximum concentration of benzene in soil vapor (0.16 µg/l at a depth of 10 feet bgs with a soil profile of clay loam) was also input into the Johnson and Ettinger soil vapor model to estimate the concentration in the air and the corresponding hazard. The resulting air concentration and corresponding hazard was slightly lower than that calculated from the maximum benzene concentration at a depth of 5 feet bgs (0.1 µg/l) with a soil profile of clay loam). (Air concentration of 0.16 µg/l benzene at a depth of 10 feet bgs is estimated to be 7.88 x 10-2 $\mu g/m^3$ and the corresponding hazard is 2.5×10^{-3})

3 The maximum concentration in soil vapor (4.3 µg/l at a depth of 10 feet bgs with a soil profile of clay loam) was input into the Johnson and Ettinger soil vapor model to estimate the concentration in the air and the corresponding hazard. Toluene was not detected in any samples at the 5 foot bgs depth so no secondary evaluations were necessary to evaluate multiple data points.

Highlighted analytes represent those chemicals contributing a hazard quotient of 1.0 or greater and are therefore considered hazard drivers.

For Soil Pathway (equation shown on Figure 2.3; Cal-EPA 1999):
$HAZARD = ((Cs/RfDo) \times (1.28 \times 10^{-5})) + ((Cs/RfDo) \times (1.28 \times 10^{-4}) \times ABS)$

For VOCs, the Johnson and Ettinger model was used [DTSC, last modified 02/04/09)

For Air Pathway (equation shown on Figure 2.4; Cal-EPA 1999):
$HAZARD = (Ca/RfDi) \times 0.639$
where for non-VOCs (equation shown on Figure 2.8, Cal-EPA 1999):
$Ca = Cs \times (5.0 \times 10^{-8}\ kg/m^3)$

Abbreviations:
--- = Not applicable
4,4'-DDE = 4,4'-dichlorodiphenyltrichloroethylene
4,4'-DDT = 4,4'-dichlorodiphenyltrichloroethane
PCBs = Polychlorinated biphenyls
VOCs = Volatile organic compounds
bgs= below ground surface
DTSC= Department of Toxic Substances Control
Cal/EPA 1999= California Environmental Protection Agency. 1999. Preliminary Endangerment Assessment Guidance Manual.

mg/kg = Milligrams per kilogram
mg/kg-day = Milligrams per kilogram per day
mg/m^3 = Milligrams per cubic meter
µg/l= micrograms per liter
$\mu g/m^3$= micrograms per cubic meter
kg/m^3= kilograms per cubic meter

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Table 12
LeadSpread Evaluation
Malibu Middle and High School
30215 Morning View Drive, Malibu, California
CM011144.0003

LEAD RISK ASSESSMENT SPREADSHEET
CALIFORNIA DEPARTMENT OF TOXIC SUBSTANCES CONTROL
USER'S GUIDE to version 7

INPUT

MEDIUM	LEVEL
Lead in Air (ug/m3)	0.028
Lead in Soil/Dust (ug/g)	38.17
Lead in Water (ug/l)	15
% Home-grown Produce	0.07
Respirable Dust (ug/m3)	1.5

OUTPUT

Percentile Estimate of Blood Pb (ug/dl)						PRG-99	PRG-95
	50th	90th	95th	98th	99th	(ug/g)	(ug/g)
BLOOD Pb, ADULT	1.229432	2.245879137	2.657426947	3.229767	3.675395867	676.4058197	1062.969467
BLOOD Pb, CHILD	1.981586	3.619884266	4.283212678	5.205704	5.923964228	146.0237037	247.3845577
BLOOD Pb, PICA CHILD	2.250303	4.110765734	4.86404609	5.911633	6.727294955	93.79193047	158.8966355
BLOOD Pb, OCCUPATIONAL	1.130711	2.06553911	2.444040377	2.970422	3.380268236	3475.232014	5464.165044

EXPOSURE PARAMETERS

	units	adults	children
Days per week	days/wk	7	
Days per week, occupational		5	
Geometric Standard Deviation		1.6	
Blood lead level of concern (ug/dl)		10	
Skin area, residential	cm2	5700	2900
Skin area occupational	cm2	2900	
Soil adherence	ug/cm2	70	200
Dermal uptake constant	(ug/dl)/(ug/day)	0.000096	
Soil ingestion	mg/day	50	100
Soil ingestion, pica	mg/day		200
Ingestion constant	(ug/dl)/(ug/day)	0.04	0.16
Bioavailability	unitless	0.44	
Breathing rate	m3/day	20	6.8
Inhalation constant	(ug/dl)/(ug/day)	0.082	0.192
Water ingestion	l/day	1.4	0.4
Food ingestion	kg/day	1.9	1.1
Lead in market basket	ug/kg	3.07	
Lead in home-grown produce	ug/kg	17.1765	

PATHWAYS

ADULTS			Residential			Occupational		
			Pathway contribution			Pathway contribution		
Pathway			PEF	ug/dl	percent	PEF	ug/dl	percent
Soil Contact			0.000038304	0.001462064	0.001189219	0.00001392	0.000531326	0.000469905
Soil Ingestion			0.00088	0.0335896	0.027321231	0.000628571	0.023992571	0.021219014
Inhalation, bkgrnd				0.04592	0.037350577		0.0328	0.029008297
Inhalation			0.00000246	9.38982E-05	7.63753E-05	1.75714E-06	6.70701E-05	5.93168E-05
Water Ingestion				0.84	0.683242264		0.84	0.74289542
Food Ingestion, bkgrnd				0.2169876	0.176494166		0.23332	0.206348047
Food Ingestion			0.002394	0.09137898	0.074326168			0
CHILDREN			typical			with pica		
			Pathway contribution			Pathway contribution		
Pathway			PEF	ug/dl	percent	PEF	ug/dl	percent
Soil Contact			0.00005568	0.002125306	0.001072528		0.002125306	0.000944453
Soil Ingestion			0.00704	0.2687168	0.135606951	0.01408	0.5374336	0.238827265
Inhalation			1.9584E-06	7.47521E-05	3.77234E-05		7.47521E-05	3.32187E-05
Inhalation, bkgrnd				0.0365568	0.018448256		0.0365568	0.016245282
Water Ingestion				0.96	0.484460491		0.96	0.426609304
Food Ingestion, bkgrnd				0.5024976	0.253583577		0.5024976	0.223302241
Food Ingestion			0.005544	0.21161448	0.106790474		0.21161448	0.094038236

Click here for REFERENCES

Abbreviations:

µg = microgram	dl = deciliter
m3 = cubic meter	cm2 = squared centimeter
g = gram	mg = milligram
l = liter	kg = kilogram

ARCADIS

Appendix D

Health and Safety Plan

Health and Safety Plan
for Removal Action Activities at
Malibu Middle and High School Campus
30215 Morning View Drive
Malibu, California

October 22, 2009
CM011144.0003

Revised April 6, 2010

Prepared for
Santa Monica-Malibu Unified School District
1651 Sixteenth Street
Santa Monica, California 90404-3891

LFR an ARCADIS company

Project Name: SMMUSD-Malibu	**Project Number: CM011144.0003**
Site Name: Malibu Middle and High School	**Site Address: 30215 Morning View Drive**
Completed By: DCB **Date: 10-20-09**	**Reviewed/Updated by: AMH** **Date: 4-6-10**

Briefly describe planned work activities: Oversight of soil excavation and soil sampling. Soil samples will be collected in brass or stainless steel sleeves or laboratory-supplied glass jars and will be placed in an ice-filled cooler for transport to the laboratory.

Site Type: (Check as many as applicable}									
X	Active		Secure		Industrial		Landfill		Service station
	Inactive		Unsecured		Commercial		Well field		Water work
			Uncontrolled		Residential		Railroad		Undeveloped
Other specify: School Campus									

Chemical Hazards		
Check if applicable		**Explain Hazard Control:**
	Flammables	
X	Corrosives: Acids or bases in soil	Wear protective gloves and clothing
	Reactives	
	Toxics	
	Injection of Chemicals:	
X	List Chemicals of Concern: PCBs, Pesticides, Metals, VOCs, acids/bases	Wear protective gloves and clothing; Real-time monitoring and compare results to Action Level table
	List Chemicals to be used by ARCADIS onsite (verify MSDS available):	
Biological Hazards		
Check if applicable		**Explain Hazard Control:**
	Virus	
	Bacteria	
	Fungi	
	Other Parasites	
	Insects and/or Spiders	
	Rodents/Fur Bearing Animal	
	Alligators	
	Venomous Snakes	
	Allergenic Plants	
	Sanitary Waste	
Physical/Other Hazards		
Check if applicable		**Explain Hazard Control:**
X	Noise (>85 dBA)	Ear protection must be worn during heavy noise activities such as drilling or concrete cutting
	Extreme Cold	
	Extreme Heat	
	Ionizing Radiation (alpha, beta, gamma, X-ray, neutron)	
	Non-Ionizing Radiation (radiofrequency, microwave, optical)	
	Extreme Pressure	
	Physical Hazards related to Chemical Hazards (explosion, oxidizer, abrasion, pyrophoric, unstable, water reactive)	
X	Airborne Dust	Use wet methods during concrete coring activities
	Confined Space	
	Permit-Required Confined Space (contact	

	Director of H&S)	
	Electrical Hazard	
	Hazardous Energy (stored energy)	
	Ladder Use	
	Fall Hazard (elevated work level)	
	Falling Objects	
X	Working Surface Slip, Trip or Fall Hazard	Work area will be will be marked; be aware when walking and working around equipment
	Excavation	
X	Moving Parts/Rotating Machinery	Be aware when working near heavy equipment; maintain safe distance away from equipment during operation
	Adequate Work Area Lighting	
	Weather	
	Personal Safety/Security	
	Ergonomic	
	Trailer in Tow	
	Other:	
Tools/Equipment		
Check if applicable		**Explanation/Comments:**
	Scissor Lift or Aerial Lift	
	Special Tools/Equipment	
X	Heavy Equipment Operation	Various: Backhoe, Loader, Bobcat, etc.
	ATV Operation	
	Boat	
X	Fire Extinguisher	Heavy Equipment operators should have fire extinguisher
X	First Aid Kit	First Aid Kit onsite
X	Eye Wash Station or Portable Eye Wash	Portable Eye Wash onsite
X	Real-time Air Monitoring	Aerosol dust monitoring
	Other Specialized Equipment:	
Work Zone/Site Controls		
Check if applicable		**Explanation/Comments:**
	Lighting	
	Weather	
X	Adjacent Structures (condition)	School related buildings
	Terrain	
	Water Bodies	
	Railroad	
	Mining Operation	
X	Pedestrian/Traffic Control	
	Tall Traffic Cones/Flagging	Work zones will be blocked off with traffic cones and caution tape
	Concrete Traffic Barrier	
	Chain-Link Fence	
	Other:	
	Work Zone demarcation	
X	Overhead Utilities	Overhead utilities will be avoided when working excavation locations; be aware when in vicinity; maintain 10 feet clearance with utility lines <50 kV
X	Underground Utilities	Underground Service Alert contacted and private utility locater utilized.
X	Heavy Equipment Operation	Safe excavation practices
	Driving Conditions to/from Site	
X	Operating permits (e.g., excavation, sidewalk closure, traffic control, etc.)	Check w/ City regarding excavation permit
X	Decon Procedure	Truck decon at exit of Site, if necessary; re-usable equipment decon using 3 bucket system
	Other:	

PPE CHECKLIST

R = Equipment required to be present on the site.
O = Optional equipment.
Subcontractors must have the same equipment listed here as a minimum.

Description (Put Specific Material or Type in Box)	Level Of Protection		
	D	C	B
Body			
Coveralls	O		
Chemical Protective Suit	O		
Splash Apron	O		
Rain Suit	O		
Traffic Safety Vest (reflective)	R		
Head			
Hard Hat (if does not create other hazard)	R		
Head Warmer (depends on temperature and weather conditions)	O		
Eyes & Face			
Safety Glasses (incorporate sun protection as necessary)	R		
Goggles (based on hazard)	O		
Splash Guard (based on hazard)	O		
Ears			
Ear Plugs	R		
Ear Muffs	O		
Hands and Arms			
Outer Chemical Resistant Gloves	O		
Inner Chemical Resistant Gloves - nitrile	R for sampling		
Insulated Gloves	O		
Work Gloves*	R		
Foot			
Safety Boots (steel toe)	R		
Safety Boots (steel toe and shank)	O		
Rubber, Chemical Resistant Boots	O		
Rubber Boots	O		
Disposable Boot Covers	O		
Respiratory Protection			
1/2 Mask APR	O		
Full Face APR	O		
Dust Protection	O		
Powered APR	O		
SCBA	O		
Air Line	O		

EMERGENCY CONTACTS

In the event a utility is damaged during the course of site work, contact the utility operator and emergency services. If the damage results in the escape of any flammable, toxic, or corrosive gas or liquid or endangers life, health, or property, the excavator responsible shall **immediately** notify the utility operator and the 911 public safety answering point…and take immediate action to protect the public and property.

Emergency Services (Police/Fire Department/Ambulance):	911
National Response Center:	(800) 424-8802
Poison Control Center:	(800) 876-4766 or (800) 222-1222
CHEMTREC:	(800) 424-9300
WorkCare Injury Management (24/7)	800-455-6155
ARCADIS Health and Safety Manager 2 (Tony Tremblay):	(781) 356-7300
Tony Tremblay Cell Phone:	(617) 908-7058
ARCADIS Administration contact (Leticia Zelaya, Costa Mesa, CA):	(714) 755-7226
ARCADIS Project Manager: Stephanie Gentry	916-786-2132
Cell Phone:	714-334-9750
ARCADIS Costa Mesa office:	714-444-0111
Client Contact (via Parsons – Hunter Gaines) Cell Phone:	310-954-2273
Nearby Hospital:	**805-497-2727**

Los Robles Hospital and Medical Center
215 West Janss Road
Thousand Oaks, California

Directions to Hospital:

A: 30215 Morning View Dr, Malibu, CA 90265-3616

1:	Start out going **SOUTH** on **MORNING VIEW DR** toward **EBBTIDE WAY**.	0.4 mi
2:	Turn **LEFT** onto **PACIFIC COAST HWY/CA-1**.	1.7 mi
3:	Turn **LEFT** onto **KANAN DUME RD/CR-N9**. Continue to follow **CR-N9 N**.	12.4 mi
4:	Merge onto **US-101 N** toward **VENTURA**.	8.1 mi
5:	Take the **LYNN RD** exit, **EXIT 45**.	0.3 mi
6:	Turn **RIGHT** onto **LYNN RD**.	1.7 mi
7:	Turn **RIGHT** onto **W JANSS RD**.	0.2 mi
8:	**215 W JANSS RD**.	0.0 mi

B: 215 W Janss Rd, Thousand Oaks, CA 91360-1847

Total Travel Estimates: 33 minutes / 24.69 miles

A hospital route map is presented in Appendix C.

CONTENTS

TABLE

APPENDICES

1.0 GENERAL

ARCADIS U.S., Inc. (formerly LFR an ARCADIS Company, now fully integrated and known as ARCADIS) has prepared this Health and Safety Plan (HSP) for use during the removal action activities to be conducted at the Malibu Middle and High School campus located at 30215 Morning View Drive, Malibu, California ("the Site"). Activities conducted under ARCADIS' direction at the Site will be in compliance with applicable Occupational Safety and Health Administration (OSHA) regulations, particularly those in Title 8 California Code of Regulations (CCR) 5192, and other applicable federal, state, and local laws, regulations, and statutes. A copy of this HSP will be kept on site during scheduled field activities.

This HSP addresses the potential hazards associated with planned field activities at the Site. It presents the minimum health and safety requirements for establishing and maintaining a safe working environment during the course of work. In the event of conflicting requirements, the procedures or practices that provide the highest degree of personnel protection will be implemented. If work plan specifications change or if site conditions encountered during the course of the work are found to differ substantially from those anticipated, the Director of Health and Safety must be informed immediately upon discovery, and appropriate changes will be made to this HSP.

It is the Project Manager's responsibility to ensure that health and safety procedures are enforced at the Site. Project personnel, including subcontractors, shall receive a copy of this HSP and shall sign the form to indicate acceptance before onsite project activities begin.

ARCADIS' health and safety programs and procedures, including medical monitoring, respiratory protection, injury and illness prevention, hazard communication, and personal protective equipment (PPE), are documented in the ARCADIS Corporate Health and Safety Manual. These health and safety procedures are incorporated herein by reference, and ARCADIS employees will adhere to the procedures specified in the manual.

When specified in contract documents, this HSP may cover the activities of ARCADIS' subcontractors. However, this HSP may not address hazards associated with tasks and equipment that are specialties of the subcontractor (e.g., operation of a drill rig). Subcontractors are responsible for developing, maintaining, and implementing their own health and safety programs, policies, and procedures.

ARCADIS is responsible for the safety of its employees and subcontractors under its control, but assumes no responsibility for the activities of other contractors, or their subcontractors, who may be working concurrently at the general project location. ARCADIS will use a reasonable degree of care when marking potentially hazardous areas within its project work site and restricting access as appropriate. ARCADIS will not be responsible for others outside its control that disregard such marked hazards or restricted access. This HSP has been prepared specifically for this project and is intended to address health and safety issues solely with respect to ARCADIS' work. Therefore, all references to the Site, the work, activities, site personnel, workers, persons, or subcontractors in this HSP are with respect to ARCADIS work only.

2.0 SITE DESCRIPTION AND BACKGROUND

The Site consists of the Malibu Middle and High School campus. The topography of the Site and vicinity slopes gently towards the west-southwest. The Site was undeveloped land until at least 1946. Portions of the Site were used for dry land farming until at least 1952. The Site was improved with a school by 1965.

For the purposes of this HSP (and associated Removal Action Workplan), the Site consists of one area of pesticide-affected soils and multiple areas of soils affected by polychlorinated biphenyls (PCBs) totaling approximately 1,200 cubic yards (yds^3) near and/or within improvement Areas 3 and 9 through 13 (Figure 3 of the Removal Action Workplan [RAW]).

Information on past Site uses and existing Site conditions was presented in the document titled "Phase I Environmental Site Assessment, Malibu Middle and High School Campus, 30215 Morning View Drive, Malibu, California" (Phase I ESA) dated October 1, 2009.

Based on the information presented in the Phase I ESA, a surface soil sampling investigation was conducted to establish whether the recognized environmental conditions (RECs) identified in the Phase I ESA posed a significant threat to human health or the environment at the Site, and to evaluate the potential risk, if any, to human health or the environment. Initial laboratory soil sample analysis indicated the presence of pesticides and PCBs at the Site. PCBs were not originally considered to be an REC, based on the ESA review. Additional soil samples were collected and analyzed to determine the extent of pesticide- and PCB-affected soils. ARCADIS presented the results of the soil investigation and an associated human health risk screening evaluation in the document titled "Preliminary Environmental Assessment Report, Malibu Middle and High School, Campus Improvements Project, 30215 Morning View Drive, Malibu, California," dated June 14, 2010. The human health risk screening evaluation performed by ARCADIS during the Preliminary Environmental Assessment (PEA) indicated that pesticides and PCBs were present in shallow Site soils at concentrations that presented an unacceptable health risk.

A RAW was prepared using data collected during the environmental assessment, and identifies and evaluates viable remedial alternatives for the affected soil and the elimination of exposure pathways. A removal action was selected as the preferred remedy. The details of the proposed removal activity are outlined in the RAW.

Emergency response should be able to respond to the Site within approximately 5 minutes.

3.0 PLANNED SITE ACTIVITIES

Scheduled work will consist of the following activities:

- Underground Service Alert will be contacted at least 48 hours prior to the start of on-site activities. Additionally, a private utility locator will be utilized to clear proposed excavation areas at the Site.
- Various heavy and hand-operated equipment will be utilized to excavate multiple areas of PCB- and pesticide-affected soils.
- Soils will be temporarily stockpiled or directly loaded to dump trucks and transported to an approved off-site disposal facility.
- Soil samples will be collected from the excavation areas by hand and placed in laboratory supplied glass jars. Following collection, cores will be capped, labeled, and placed in ice-filled coolers pending transport to an offsite laboratory.

The proposed removal date is still being determined. Work is anticipated to begin in 2010 and is expected to last less than one month.

4.0 KEY PROJECT PERSONNEL AND RESPONSIBILITIES

Project Manager	Stephanie Gentry
Site Safety Officer (SSO)	Aaron Hook
Health and Safety Manager	Tony Tremblay

The responsibilities of key project personnel are outlined in the following sections.

4.1 Project Manager

The Project Manager has the ultimate responsibility for the health and safety of ARCADIS personnel at the Site. The Project Manager is responsible for:

- ensuring that project personnel review and understand the requirements of this HSP
- keeping the Health and Safety Manager informed of project developments
- keeping onsite personnel, including subcontractors, informed of the expected hazards and appropriate protective measures at the Site
- providing resources necessary for maintaining a safe and healthy work environment for ARCADIS personnel

4.2 Health and Safety Manager

The Health and Safety Manager is responsible for the review, interpretation, and modification of this HSP. Modifications to this HSP that may result in less stringent precautions cannot be undertaken by the Project Manager or SSO without the approval of the Health and Safety Manager. In addition, the Health and Safety Manager has the following responsibilities:

- advising the Project Manager and SSO on matters relating to health and safety on this project
- recommending appropriate safeguards and procedures
- modifying this HSP, when necessary
- approving changes in health and safety procedures employed at the Site

4.3 Site Safety Officer

The SSO is responsible for enforcing the requirements of this HSP once site work begins. The SSO has the authority to immediately correct situations where noncompliance with this HSP is noted and to immediately stop work in cases where an immediate danger to site workers or the environment is perceived. Responsibilities of the SSO also include:

- obtaining and distributing PPE and air monitoring equipment necessary for this project
- limiting access at the Site to authorized personnel
- communicating unusual or unforeseen conditions at the Site to the Project Manager
- supervising and monitoring the safety performance of site personnel to evaluate the effectiveness of health and safety procedures and correct deficiencies
- conducting daily tailgate safety meetings before each day's activities begin
- conducting a site safety inspection prior to the commencement of each day's field activities

4.4 Subcontractor Personnel

Subcontractor personnel are expected to comply with the minimum requirements specified in this HSP. Failure to do so may result in the dismissal of the subcontractor or any of the subcontractor's workers from the job site. Subcontractors may employ health and safety procedures that afford them a greater measure of personal protection than those specified in this plan as long as they do not pose additional hazards to themselves, the environment, or others working in the area.

5.0 HAZARDS OF KNOWN OR EXPECTED CHEMICALS OF CONCERN

Based on the PEA, areas of soil affected by organochlorinated pesticides (OCPs) and PCBs were documented in around the buildings at the Site. Other chemicals of concern may also be present at the Site.

Exposure pathways of concern for chemical compounds that may be present at the Site are inhalation of airborne contaminants, direct skin contact with contaminated materials, and incidental ingestion of affected media. Wearing protective equipment and following decontamination procedures listed in Section 9 can minimize dermal contact and incidental ingestion. To minimize inhalation hazards, dust or vapor control measures will be implemented, where necessary, and action levels will be observed during scheduled activities. Site-specific action levels are presented in Section 10. Chemical descriptions of chemicals of concern, including health effects and exposure limits, are located in Appendix A.

In accordance with the Hazard Communication standard, material safety data sheets (MSDSs) will be maintained onsite for chemical products used by ARCADIS personnel at the Site. In addition, containers will be clearly labeled in English to indicate their contents and appropriate hazard warnings.

5.1 Air Monitoring

Real-time air monitoring devices will be used to analyze airborne contaminant concentrations every 30 minutes in the workers' breathing zones while workers are in the designated Exclusion Zone. If elevated concentrations are indicated, the monitoring frequency will be increased, as appropriate. The equipment will be calibrated daily, and the results will be recorded on ARCADIS' Air Monitoring Form or project log book. The results of air monitoring will be recorded on an ARCADIS Air Monitoring Form or project log book and will be retained in the project files following completion of field activities. A copy of the Air Monitoring Form is located in Appendix B.

On-site worker exposure to airborne contaminants will be monitored during intrusive site activities. Dust monitors will be utilized to measure particulate matter.

VOCs are not anticipated at the Site. If conditions should change and VOCs are identified, a calibrated photoionization detector (PID) with a lamp strength of 10.6 electron volts or flame ionization detector (FID) will be used to monitor changes in exposure to volatile organic compounds (VOCs). Personnel will perform routine monitoring during site operations to evaluate concentrations of VOCs in employee breathing zones. If VOCs are detected above predetermined action levels specified in Section 10, the procedures found in Section 7 of this HSP will be followed.

5.2 Job Safety Analyses

A Job Safety Analysis (JSA) has been completed for each safety critical task. Copies of these JSAs are included in Appendix F. JSAs identify control methods to protect employees and property from hazards. The JSA also lists the type of personal protective equipment (PPE) required for the completion of the project.

6.0 PHYSICAL HAZARDS

The following potential physical hazards may be encountered during scheduled activities at the Site:

- slips, trips, and falls
- heavy equipment
- heat stress
- cold stress
- noise
- electrical sources
- underground and overhead utilities
- materials and equipment handling
- biological hazards
- fire/explosion
- lightning/electrical storms
- traffic
- vehicle operating standards
- work area illumination
- hand tools

6.1 General Safe Work Practices

- Workers will thoroughly clean their hands, faces, and other potentially contaminated areas before smoking, eating, or leaving the Site.
- Respiratory devices may not be worn with beards or long sideburns, or under other conditions that prevent a proper seal.
- Accidents and/or injuries associated with work at the Site will be immediately reported to the SSO. If necessary, an incident report will be initiated by the SSO.
- Periodic safety briefings will be held to discuss current site conditions, field tasks being performed, planned modifications, and work concerns.

- Site conditions may include uneven, unstable, or slippery work surfaces. Substantial care and personal observation is required on the part of each employee to prevent injuries from slips, trips, and falls.
- Workers will maintain good housekeeping practices during field activities to maintain a safe working environment. The work site will be kept free of debris, waste, and trash.
- The “buddy system” will be used whenever appropriate.
- To prevent head injury, American National Standards Institute– (ANSI-) approved hard hats will be worn at all times while the worker is in an area where overhead obstructions or falling objects may be encountered.
- To prevent eye injuries, workers must wear ANSI-approved safety glasses during field activities.
- Site workers will wear other appropriate PPE (in addition to the PPE described above) as required to perform work safely.

6.2 Heavy Equipment

Equipment, including earth-moving equipment, drill rigs, or other heavy machinery, will be operated in compliance with the manufacturer’s instructions, specifications, and limitations, as well as any applicable regulations. The operator shall have received appropriate training to ensure safe operation of any equipment used. The operator is responsible for inspecting the equipment daily to verify that it is functioning properly and safely. Damaged/deteriorated equipment will be removed from the Site or will be repaired prior to use on the Site.

Operation of equipment at the Site for the activities outlined in Section 3 poses potential physical hazards. The following precautions should be observed whenever heavy equipment is in use:

- PPE, including steel-toed boots, safety glasses, and hard hats, must be worn.
- Personnel must be aware of the location and operation of heavy equipment and take precautions to avoid getting in the way of its operation. Workers must never assume that the equipment operator sees them; eye contact and hand signals should be used to inform the operator of intent.
- Traffic safety vests are required for personnel working near mobile heavy equipment or near public/private streets, highways, and interstates.
- Personnel should not walk directly in back of, or to the side of, heavy equipment without the operator’s knowledge.
- Nonessential personnel are not allowed in the work area, and appropriate warning signs will be posted to warn unapproved visitors not to enter the work area(s).

6.3 Heat Stress

Adverse climate conditions, primarily heat, are important considerations in planning and conducting site operations. Heat-related illnesses range from heat fatigue to heat stroke, with heat stroke being the most serious condition. The effects of ambient temperature can cause physical discomfort, loss of efficiency, and personal injury, and can increase the probability of accidents. In particular, protective clothing that decreases the body's ventilation can be an important factor leading to heat-related illnesses.

To reduce the possibility of heat-related illness, workers should drink plenty of fluids and establish a work schedule that will provide sufficient rest periods for cooling down. Personnel shall maintain an adequate supply of non-caffeinated drinking fluids on site for personal hydration. Workers should be aware of signs and symptoms of heat-related illnesses, as well as first aid for these conditions. These are summarized in the following table:

Condition	Signs	Symptoms	Response
Heat Rash or Prickly Heat	Red rash on skin.	Intense itching and inflammation.	Increase fluid intake and observe affected worker.
Heat Cramps	Heavy sweating, lack of muscle coordination.	Muscle spasms, and pain in hands, feet, or abdomen.	Increase fluid uptake and rest periods. Closely observe affected worker for more serious symptoms.
Heat Exhaustion	Heavy sweating; pale, cool, moist skin; lack of coordination; fainting.	Weakness, headache, dizziness, nausea.	Remove worker to a cool, shady area. Administer fluids and allow worker to rest until fully recovered. Increase rest periods and closely observe worker for additional signs of heat exhaustion. If symptoms of heat exhaustion recur, treat as above and release worker from the day's activities after he/she has fully recovered.
Heat Stroke	Red, hot, dry skin; disorientation; unconsciousness	Lack of or reduced perspiration; nausea; dizziness and confusion; strong, rapid pulse.	Immediately contact emergency medical services by dialing 911. Remove the victim to a cool, shady location and observe for signs of shock. Attempt to comfort and cool the victim by administering small amounts of cool water (if conscious), loosening clothing, and placing cool compresses at locations where major arteries occur close to the body's surface (neck, underarms, and groin areas). Carefully follow instructions given by emergency medical services until help arrives.

6.4 Cold Stress

Workers performing activities during winter and spring months may encounter extremely cold temperatures, as well as conditions of snow and ice, making activities in the field difficult. Adequate cold weather gear, especially head and foot wear, is required under these conditions. Workers should be aware of signs and symptoms of hypothermia and frostbite, as well as first aid for these conditions. These are summarized in the following table:

Condition	Signs	Symptoms	Response
Hypothermia	Confusion, slurred speech, slow movement.	Sleepiness, confusion, warm feeling.	Remove subject to warm area, such as truck cab; give warm fluids; warm body core as rapidly as possible; remove outer clothing and wrap torso in blankets with hot water bottle or other heat source. Get medical attention immediately.
Frostbite	Reddish area on skin, frozen skin.	Numbness or lack of feeling on exposed skin.	Place affected extremity in warm, not hot, water, or wrap in warm towels. Get medical attention.

6.5 Noise

Noise may result primarily from the operation of drill rigs and mechanical equipment. The use of heavy equipment may generate noise above the OSHA permissible exposure limit for noise of 90 dBA for an eight-hour time-weighted average. Workers will wear appropriate hearing protection when operating or working near heavy equipment. If loud noise is present or normal conversation becomes difficult, hearing protection in the form of ear plugs, or equivalent, will be required.

6.6 Excavations

A Cal/OSHA Excavation Permit (per 8 CCR 341) will be obtained by the Project Manager prior to the construction of any excavation greater than 5 feet in depth into which an ARCADIS employee is required to descend. **Each** subcontractor whose employees will enter such an excavation is responsible for obtaining a permit from Cal/OSHA for its operations.

A competent person who is capable of identifying existing and predictable hazards in the surroundings, or working conditions that are unsanitary, hazardous, or dangerous to employees, and who has authorization to take prompt corrective measures to eliminate them, will be present during excavation activities.

The atmosphere will be tested in excavations greater than 4 feet in depth where oxygen deficiency or toxic or flammable gases are likely to be present before employees are permitted to enter and begin work. The atmosphere should be ventilated and re-tested until flammable gas concentrations less than 10 percent of the LEL are obtained. Worker entry will not be allowed if the oxygen concentration is less than 19.5 percent.

Workers will not enter excavations greater than 5 feet in depth without appropriate protective systems such as benching, sloping, or shoring. Side slopes will not be steeper than 1½:1 without a written report from a qualified civil or geotechnical engineer. Excavations will be constructed in accordance with the Cal/OSHA Excavation Safety Standard, 8 CCR 1541.

The competent person will inspect excavations daily. If there is evidence that a cave-in or slide is possible, work will cease until the necessary safeguards have been taken. Excavated material will be placed far enough from the edge of the excavation (a minimum of 2 feet) so that it does not fall back into the opening. At the end of each day's activities, open excavations will be clearly marked and secured to prevent nearby workers or unauthorized personnel from entering them. Remote sampling techniques will be the preferred method of sample collection in excavations.

6.7 Electric Shock

Electrical equipment to be used during field activities will be suitably grounded and insulated. Ground fault circuit interrupters (GFCI), or equivalent, will be used with electrical equipment to reduce the potential for electric shock. Electrical equipment shall be inspected before each use. Damaged/deteriorated electrical equipment shall be removed from the Site.

Lockout/tagout procedures in accordance with 8 CCR 3314 will be conducted before activities begin on or near energized or mechanical equipment that may pose a hazard to site personnel. Workers conducting the operation will isolate the piece of equipment, lock/tag the energy source, and verify effectiveness of the isolation. Only employees who perform the lockout/tagout procedure may remove their own tags/locks. Employees will be thoroughly trained before initiating this procedure.

6.8 Underground and Overhead Utilities

Reasonable efforts will be made to identify the location(s) of underground utilities (e.g., pipes, electrical conductors, fuel lines, and water and sewer lines) before soil intrusive work is performed in accordance with local requirements.

The following three actions (lines of evidence) are required for the utility location process:

- Contact the State underground utility notification authority (e.g., USA, Dig Alert, Blue Stake, One Call)
- Obtain a detailed site utility plan drawn to scale, preferably an "as-built" plan

- Conduct a detailed visual site inspection

In the event that one or more of the above lines of evidence cannot be conducted, or if the accuracy of utility location is questionable, a minimum of one additional line of evidence must be used as appropriate or suitable to the conditions. Examples of additional lines of evidence include but are not limited to:

- Private utility locating service
- Research of state, county or municipal utility records and maps including computer drawn maps or geographical information systems (GIS)
- Contact with the utility provider to obtain their utility location records
- Hand augering or digging
- Hydro-knife
- Air-knife
- Radio Frequency Detector (RFD)
- Ground Penetrating Radar (GPR)
- Any other method that may give ample evidence of the presence or location of subgrade utilities

If utilities cannot be located to eliminate any reasonable concern, field personnel will use their Stop Work authority until utility locations can be identified. ARCADIS staff must refer to ARCADIS HS Procedure Number ARCHSFS019 for complete subsurface utility policy information.

CalOSHA Specific Requirements

All Regional Notification Centers as defined by Government Code Section 4216 (j) in the area involved and all known owners of subsurface facilities in the area who are not members of a Notification Center shall be advised of the proposed work at least two working days prior to the start of any digging or excavation work. EXCEPTION: Repair work to subsurface facilities done in response to an emergency as defined in Government Code Section 4216(d).

In accordance with CCR, Title 8, Section 1541 (Excavations), an excavation shall not commence until:

- The excavation area has been marked as specified in Government Code Section 4216.2 by the excavator; and
- The excavator has received a positive response from all known owner/operators of subsurface installations within the boundaries of the proposed project; those responses confirm that the owner/operators have located their installations, and those responses either advise the excavator of those locations or advise the

excavator that the owner/operator does not operate a subsurface installation that would be affected by the proposed excavation.

When the excavation is proposed within 10 feet of a high priority subsurface installation, the excavator shall be notified by the facility owner/operator of the existence of the high priority subsurface installation before the legal excavation start date and time in accordance with Government Code Section 4216.2(a), and an onsite meeting involving the excavator and the subsurface installation owner/operator's representative shall be scheduled by the excavator and the owner/operator at a mutually agreed on time to determine the action or activities required to verify the location of such installations. High priority subsurface installations are high pressure natural gas pipelines with normal operating pressures greater than 415 kPA gauge (60 p.s.i.g), petroleum pipelines, pressurized sewage pipelines, conductors or cables that have a potential to ground of 60,000 volts or more, or hazardous materials pipelines that are potentially hazardous to employees, or the public, if damaged.

Only qualified persons shall perform subsurface installation locating activities, and all such activities shall be performed in accordance with this section and Government Code Sections 4216 through 4216.9. Persons who complete a training program in accordance with the requirements of Section 1509, Injury and Illness Prevention Program (IIPP), that meets the minimum training guidelines and practices of the Common Ground Alliance (CGA) Best Practices, Version 3.0, published March 2006, or the standards of the National Utility Locating Contractors Association (NULCA), Standard 101: Professional Competence Standards for Locating Technicians, 2001, First Edition, which are incorporated by reference, shall be deemed qualified for the purpose of subsurface installation locating activities.

ARCADIS employees who are involved in the excavation operation and exposed to excavation operation hazards shall be trained in the excavator notification and excavation practices required by this section and Government Code Sections 4216 through 4216.9.

When excavation or boring operations approach the approximate location of subsurface installations, the exact location of the installations shall be determined by safe and acceptable means that will prevent damage to the subsurface installation, as provided by Government Code Section 4216.4.

While the excavation is open, subsurface installations shall be protected, supported, or removed as necessary to safeguard employees.

An excavator discovering or causing damages to a subsurface installation shall immediately notify the facility owner/operator or contact the Regional Notification Center to obtain subsurface installation operator contact information immediately after which the excavator shall notify the facility operator. All breaks, leaks, nicks, dents, gouges, grooves, or other damages to an installation's lines, conduits, coatings or cathodic protection shall be reported to the subsurface installation operator. If damage to a high priority subsurface installation results in the escape of any flammable, toxic, or corrosive gas or liquid or endangers life, health or property, the excavator responsible shall immediately notify 911, or if 911 is unavailable, the appropriate emergency response personnel having jurisdiction. The facility owner/operator shall also be contacted.

In areas not evaluated by the underground utility notification authority, and a reasonable potential for underground utilities exists, one or more of the following techniques will be employed to determine the location of subsurface structures:

- contracting the services of a qualified private utility locator
- conducting a survey of the subject area by staff trained in the use of subsurface utility locating equipment
- subsurface testing (i.e., potholing) to the expected depth of probable utilities (not less than 5 feet)

If utilities cannot be located or if unlocated utilities are suspected to be present, subsurface activities (i.e., borings, excavation) should not be conducted prior to confirming the location(s) or absence of underground utilities.

Equipment with articulated upright booms or masts shall not be permitted to pass within 10 feet of an overhead utility line (less than 50 kilovolts [kV]) while the boom is in the upright position. For transmission lines in excess of 50 kV, an additional distance of 4 inches for each 10 kV over 50 kV will be used.

6.9 Biological Hazards

If any biological hazards are identified at the Site, workers in the area will immediately notify the SSO and other site personnel. Natural hazards that may be encountered at the Site are described below.

6.9.1 Sanitary Waste

Some work activities may potentially expose site workers to sanitary waste streams. Whenever possible, personnel should avoid contact with sewage or sewage-affected equipment. A variety of chemicals and microbial pathogens are generally associated with sanitary waste. Persons handling sewage-affected materials will employ Universal Precautions and will wear prescribed PPE (latex in lieu of nitrile gloves). Potentially exposed personnel will be offered the opportunity to receive hepatitis B virus (HBV) vaccinations before the start of activities. Whenever possible, ARCADIS personnel should avoid contact with sewage or sewage-affected equipment.

6.9.2 Venomous Snakes

Every snake should be treated as venomous and avoided. If bitten by a snake, a person should pay attention to the characteristics of the snake, including color and pattern.

Keep bite victim(s) still and calm to slow the spread of venom in case the snake is poisonous. Seek medical attention as soon as possible. The bitten person should be transported immediately to a medical facility, and the snake should be described to the attending physician. If immediate transportation to a medical facility is not possible, the victim should be placed at rest so that the bite is below the level of the heart and the extremity of the bite should be covered with a clean, dry dressing. Do not cut the wound or attempt to suck out the venom.

6.9.3 Insects and Spiders

Nearly all work sites may contain ticks, venomous spiders (e.g., black widow, brown recluse), chiggers, scorpions, and venomous insects. Venomous insects and spiders are generally reclusive, and the greatest potential for exposure arises when personnel are opening containers, structures, buildings, and well casings, or are handling idle equipment and construction material stockpiles. Caution should be taken when opening the casing around monitoring wells. ARCADIS personnel should be aware of ticks and inspect themselves at the end of each workday.

Deer Ticks

Black-legged ticks (deer ticks) and Western black-legged ticks are primarily responsible for transmitting Lyme disease, which, if left unchecked, can lead to serious health problems. According to the Centers for Disease Control, a tick needs to be attached for at least 36 to 48 hours before it can transmit Lyme disease. Once the bacteria enter the bloodstream, victims may experience neck stiffness, chills, headaches, achiness, and fatigue. Most people are cured if Lyme disease is caught in this early stage and treated with antibiotics. One of the classic signs of infection is a bull’s-eye rash that appears at the bite site within a week to a month after the bite. The circular rash can expand to more than 3 inches in diameter. It is important to note that not everyone gets this rash, and it may look like a bruise on those with dark skin. You often can't tell when a tick has bitten you, as deer ticks in the baby or “nymph” stage can be as small as the period at the end of this sentence. Adult deer ticks are less than 1/10 of an inch, or about the size of a small apple seed. Ticks can be difficult to spot on dark clothing because the males are black, and the females are dark red and black.

Therefore, ARCADIS field staff shall comply with the following procedures:

- ARCADIS field personnel must wear long pants, light-colored shirts, and a light-colored hat, at a minimum, unless more extensive PPE is required due to field operations.
- Tuck pant legs into socks or boots.
- The most important measure is for field staff to check each other whenever they might have been in tick-infested areas. Their favorite hiding places include the scalp and ankles.

- Do not try to pry a tick from your skin by using an irritating agent such as nail polish or a hot match. Ticks should always be removed with fine-point tweezers. Disinfect the bite area with alcohol.
- If an employee is bitten by a deer tick, consult with an ARCADIS Human Resources representative to coordinate consultation and/or visit with a health care provider. Persons should promptly seek medical attention if they develop any signs and symptoms of early Lyme disease, ehrlichiosis, or babesiosis.

Spiders

Black widow and brown recluse spiders, both venomous, may be present in and around structures or vegetation. Spider bites from these species can cause swelling and intense pain and, in some instances, have caused death. Personnel who are bitten by black widow or brown recluse spiders should wash the bite area with soap and water, apply cool compresses to the area, elevate the area on a pillow, and call the nearest poison control center. The poison control center will monitor the condition and advise if medical attention is needed.

Mosquitoes

Mosquitoes are bothersome and may carry disease. They are attracted by heat, sweat, body odor, and carbon dioxide. Only the female mosquito bites. Site personnel should wear protective clothing and insect repellent containing 30 percent DEET. Insect repellent should be reapplied at least every 4 hours or as instructed by product label.

Chiggers

Common chiggers are the larva of a type of mite found in tall grass and weeds. Chiggers attach themselves to tender skin areas to feed. The bites cause intense itching and small reddish welts. Because chiggers are so small, they are hard to avoid. Most persons cannot see them without a magnifying glass and so the bites may be the only indication that the bugs have infested a certain area.

Several commercially available repellents are effective against chigger infestations. These repellents usually contain one or more of the following compounds: permethrin, diethyl toluamide, dimethyl phthalate, dimethyl carbate, ethyl hexanediol, and benzyl benzoate. Most repellents are also effective against mosquitoes and other insects. They are formulated as liquids, aerosol sprays, solid sticks, and ointments. Repellents should be used in accordance with manufacturer instructions.

If exposure to chiggers is thought to have occurred or is evident (itching and small, reddish bumps), take a hot bath or shower as soon as possible and wash with soapy water to remove chiggers, especially in areas where clothes fit closely. Temporary relief of itching may be achieved with nonprescription local anesthetics available at most drug stores. Apply antiseptic to welts to avoid secondary infections. Infested clothing should be washed in hot soapy water prior to wearing them again.

Venomous Insects

Venomous insects include wasps, bees, hornets, fire ants, and red ants. Nests should not be allowed to form near structures and areas where personnel will continue to have a need for access. If bitten, personnel should wash the bite area with soap and water, apply a cool compress to the area, elevate the area on a pillow, and make a paste of baking soda and water for itching.

Each year, many workers are stung by insects while on the job. For most, these stings mean pain and discomfort generally lasting only a few hours. Symptoms may include redness, swelling, and itching at the site of the sting. However, some people are allergic to insect stings. This means that their immune systems overreact to the venom injected by a stinging insect. Severe or allergic reactions to bites or stings should be referred to a physician for appropriate care.

After the first sting, the allergic person's body produces an allergic substance called Immunoglobulin E (IgE) antibody, which reacts with the insect venom. If the worker is stung again by an insect of the same or similar species, the insect venom interacts with the IgE antibody produced in response to the earlier sting. This triggers the release of histamine and other chemicals that cause allergic symptoms.

Symptoms of Insect Bite

Signs and symptoms of an insect bite result from the injection of venom or other substances into the skin. The venom triggers an allergic (immune) reaction. The severity of the reaction depends on the victim's sensitivity to the insect venom or substance. Most reactions are mild, causing little more than an annoying itching or stinging sensation and mild swelling that disappears within a day or so. A delayed reaction may cause fever, painful joints, hives, and swollen glands. A worker can experience both immediate and delayed reactions from the same bite or sting.

Emergency Care for Victims with Mild Reactions

- Move to a safe area to avoid more insect stings.
- Scrape or brush off the stinger with a straight-edged object, such as a credit card or the back of a knife. Do not try to pull out the stinger with tweezers or with the fingers; doing so may release more venom.
- Wash the area carefully with soap and water. Do this two to three times a day until the skin is healed.
- Swab the site with disinfectant.
- To reduce pain and swelling, apply ice or a cold pack.
- Apply 0.5 percent or 1 percent hydrocortisone cream, calamine lotion or a baking soda paste to the bite or sting several times a day until the symptoms subside. Consult with a physician before using any medication.

- If necessary, consult with a physician regarding the use of an antihistamine containing diphenhydramine or chlorpheniramine maleate.

Symptoms of Severe Reactions

For a small number of people with severe venom allergy, stings may be life-threatening. This severe allergic reaction to insect stings is called anaphylaxis. It can involve many body organs and may develop rapidly. Symptoms of anaphylaxis may include itching and hives over large areas of the body, swelling in the throat or tongue, difficulty breathing, dizziness, stomach cramps, nausea, or diarrhea.

In severe cases, a rapid fall in blood pressure may result in shock and loss of consciousness. Anaphylaxis is a medical emergency and may be fatal. If a worker experiences any of these symptoms after an insect sting, obtain emergency medical treatment immediately. After the symptoms are treated in the emergency room, the workers may need to obtain a referral to an allergist/immunologist to learn about treatment options.

Emergency Care for Victims with Severe Reactions

Severe reactions may progress rapidly. Dial 911 or call for emergency medical assistance if the worker experiences any of the following signs or symptoms:

- difficulty breathing
- swelling of the lips or throat
- faintness
- confusion
- rapid heartbeat
- hives
- nausea, stomach cramps, and vomiting

A sting anywhere in the mouth warrants immediate medical attention. That's because stings in the mucous membranes of the mouth can quickly cause severe swelling that may block the airway.

While Waiting for Emergency Transportation

- Have the person lie down.
- Watch for and treat signs of shock.
- If the person is unconscious and breathing, lay the person on his or her side to allow drainage from the mouth.
- If there is no pulse, trained personnel should begin cardiopulmonary resuscitation (CPR).

- Check to see if the person is carrying an allergy kit containing injectable epinephrine and follow instructions on the kit.

Remember that injectable epinephrine is rescue medication only, and the workers must still have someone take them to an emergency room immediately if they are stung. Additional medical treatment may be necessary. Workers with severe allergies may want to consider wearing a special bracelet or necklace that identifies the wearer as having severe allergies and supplies other important medical information.

Identifying Stinging Insects

Most sting reactions are caused by five types of insects: yellow jackets, honeybees, paper wasps, hornets and fire ants. Therefore, to avoid these insects it is important to learn what they look like and where they live. Bites from mosquitoes, ticks, biting-flies and some spiders can cause reactions, but these are generally milder.

Yellow jackets are black with yellow markings, and are found in various climates. Their nests, which are made of a papier-mâché material, are usually located underground but can sometimes be found in the walls of frame buildings, cracks in masonry, or woodpiles.

Honeybees have a rounded, “fuzzy” bodies with dark-brown coloring and yellow markings. Upon stinging, the honeybee usually leaves its barbed stinger in its victim and the bee dies as a result. Do not try to pull out the stinger because this may release more venom. Honeybees are nonaggressive and will only sting when provoked. However, Africanized honeybees, or so-called “killer bees” found in the southwestern United States and South and Central America, are more aggressive and may sting in swarms. Domesticated honeybees live in man-made hives, while wild honeybees live in colonies or “honeycombs” in hollow trees or cavities of buildings. Africanized honeybees may nest in holes in house frames, between fence posts, in old tires or holes in the ground, or other partially protected sites.

Paper wasps’ slender, elongated bodies are black, brown, or red with yellow markings. Their nests also are made of a paper-like material that forms a circular comb of cells that opens downward. The nests are often located under eaves, behind shutters, or in shrubs or woodpiles.

Hornets are black or brown with white, orange, or yellow markings, and are usually larger than yellow jackets. Their nests are gray or brown, football-shaped, and made of a paper material similar to that of yellow jackets’ nests. Hornets’ nests are usually found high above ground on branches of trees, in shrubbery, on gables, or in tree hollows.

Fire ants are reddish-brown to black stinging insects related to bees and wasps. They build nests of dirt in the ground that may be quite tall (18 inches) in certain kinds of soil. Fire ants may attack with little warning: after firmly grasping the victim’s skin with its jaws, the fire ant arches its back as it inserts its rear stinger into the skin. It then pivots at the head and may inflict multiple stings in a circular pattern. Fire ant venom often causes an immediate burning sensation.

Preventing Stings

Stay out of the “territory” of the stinging insects’ nests. These insects are most likely to sting if their homes are disturbed, so it may be necessary to have hives and nests around the workplace destroyed. In some instances this activity can be dangerous. ARCADIS will consult with property owner/client regarding the need to hire a trained exterminator as the situation warrants.

If ARCADIS employees encounter any flying stinging insects, they should remain calm and quiet, and move slowly away from them. Many stinging insects are foraging for food, so do not smell like a flower; avoid brightly colored clothing and perfume when outdoors. Because the smell of food attracts insects, be careful when cooking, eating, or drinking sweet drinks like soda or juice outdoors. Keep food covered until eaten. Wear closed-toe shoes outdoors. Also, avoid loose-fitting garments that can trap insects between material and skin.

6.9.4 Rodents and Fur-Bearing Animals

Fur-bearing animals. Animals may potentially carry the rabies virus or ticks that may transmit Lyme disease to humans. Avoid contact. Do not attempt to feed or touch.

Dead and live animals can spread diseases such as Rat Bite Fever and Rabies.

- Avoid contact with wild or stray animals.
- Avoid contact with rats or rat-contaminated buildings. If you cannot avoid contact, wear protective gloves, protective clothing, and respirator and wash your hands regularly.
- Request that the client/property owner contract to have dead animals removed as soon as possible.
- If bitten/scratched, get medical attention immediately.

6.9.5 Allergenic Plants and Plant Physical Hazards

There may be allergenic plants on the site property. Direct physical contact with these plants may produce significant allergic responses. The degree of allergic response depends on the individual’s sensitivity and the extent to which they were exposed to the irritant. Types of reactions vary from nothing to characteristic red skin rash with raised lumps to more serious systemic reactions.

The best defense in dealing with these plants is preventing the direct physical contact that can lead to allergic reaction. This can be accomplished through the use of a skin barrier. Effective barriers include clothing (which should be handled carefully when laundering) and/or barrier cream.

The irritants can also be transported in smoke if these plants are burned. Irritants can also be released into the air when these plants are ground up as happens in mowing or mulching. These exposures may affect the respiratory tract as well as the skin.

Some large tropical fruit bearing trees such as coconut palms and breadfruit trees have heavy and potentially dangerous fruits that have the potential to cause property damage or injury if they fall. Workers should inspect the trees at each jobsite to ensure that fruits are not present and avoid areas that may be in the path of falling fruit. Do not park vehicles or other equipment under fruit trees and wear a hard hat to protect the head from falling fruit.

6.10 Materials and Equipment Handling Procedures

The movement and handling of equipment and materials on the Site pose a risk to workers in the form of muscle strains and minor injuries. These injuries can be avoided by using safe handling practices, proper lifting techniques, and proper personal safety equipment such as steel-toed boots and sturdy work gloves. Where practical, mechanical devices will be used to assist in the movement of equipment and materials. Workers will not attempt to move heavy objects by themselves without using appropriate mechanical aids, such as drum dollies or hydraulic lift gates.

6.11 Fire/Explosion

Site workers should have an increased awareness concerning fire and explosion hazards whenever working with or near flammable materials, especially when performing any activity that may generate sparks, flame, or other source of ignition. Intrinsically safe equipment is required when working in or near environments with the potential for an explosive atmosphere. The SSO will verify facility requirements for a “hot work” permit before activities that may serve as a source of ignition are conducted.

Flammable materials will be kept away from sources of ignition. In the event of fire, work will cease, the area will be evacuated, and the local fire response team will be notified immediately. Only trained, experienced fire fighters should attempt to extinguish substantial fires at the Site. Site personnel should not attempt to fight fires, unless properly trained and equipped to do so. A fully charged ABC dry chemical fire extinguisher will be readily available for use during all scheduled activities at the Site.

6.12 Lightning/Electrical Storms

Lightning can be unpredictable and may strike many miles in front of, or behind, a thunderstorm. Workers will therefore cease field operations at the **first** sign of a thunderstorm and suspend activities until at least 30 minutes after the last observed occurrence of lightning or thunder. For purposes of this HSP, signs of a thunderstorm will include any visible lightning or audible thunder.

In the event of a thunderstorm, workers will take the following actions:

- Get inside a permanent building structure (not a shed or canopy) or fully enclosed metal vehicle (not a convertible or camper shell) with the windows fully up.
- Stay away from tall isolated objects, such as trees, drill rigs, telephone poles, or flag poles.
- Avoid large open areas, such as fields or parking lots, where a person is the relatively highest object.
- Stay away from lakes, ponds, railroad tracks, fences, and other objects that could transmit current from a distant lightning strike.

6.13 Traffic

Vehicular traffic presents opportunities for serious injury to persons or property. Traffic may consist of street traffic or motor vehicles operated by facility employees or visitors to the Site. Workers and other pedestrians are clearly at risk during periods of heavy traffic. Risk from motor vehicle operations may be minimized by good operating practices and alertness, and care on the part of workers and pedestrians.

Site personnel will wear high-visibility safety vests whenever activities are conducted in areas of heavy traffic. Work vehicles will be arranged to be used as a barrier between site workers and nearby traffic. If required by local ordinances or site location, a traffic control plan will be developed and implemented.

6.14 Vehicle Operating Standards

- Drivers will carry their Driver's License at all times when operating a motor vehicle on company business. They will also ensure that proof of insurance is with the vehicle prior to beginning any journey on public roads.
- Drivers shall comply with all motor vehicle regulations including speed limits for the state in which they are operating a vehicle.
- Drivers will operate the vehicle in a safe manner and in accordance with the existing road, weather and traffic conditions.
- It is strictly forbidden to drive under the influence of alcohol or drugs.
- All vehicle drivers and passengers shall wear safety belts and drivers will not put the vehicle in motion before they assure that each person is wearing a seat belt.
- Cargo is only to be carried within the passenger compartment of a vehicle when segregated and restrained from interfering with passengers and the driver should emergency vehicle maneuvers be required (e.g., harsh braking, crash, etc).

- All goods transported on flat bed trucks and in pick-ups must be securely fastened to prevent them becoming a hazard in emergency situations.
- Hands-free cellular telephone use by the driver of a motor vehicle is permitted while the vehicle is in motion ONLY IF permitted by state or local laws. For clients that do not allow cellular telephone use by the driver when working on their projects or where prohibited by state or local laws, cellular telephones may be left on while driving to alert drivers of an incoming call, however, calls must not be answered. Drivers shall stop their vehicle in a safe location off the road and away from traffic to retrieve messages and return calls.
- Text messaging (viewing or sending of messages) is not permitted by the driver of a motor vehicle while the vehicle is in motion.
- Drivers will only transport passengers who are associated with company business. Passengers shall never be transported in the rear of a pick up truck.
- Whenever possible, all vehicles will be parked so that their first move is forward when leaving a parking space.

6.15 Work Area Illumination

Scheduled work is anticipated to be conducted during daylight hours. If site activities are to occur during non-traditional hours (i.e., night-time), an addendum to this HSP will be prepared to specify auxiliary lighting requirements as outlined in the HAZWOPER standard.

6.16 Hand Tools

Appropriate personal protective equipment (e.g., safety goggles, gloves, etc.), must be worn due to hazards that may be encountered while using portable power tools and hand tools.

When hand-augering within 5 feet of an underground electrical line and there is a likelihood that an electrical line could be contacted, a wood- or fiberglass-handled tool or tool with insulated handle must be used. The tool used must be clean and dry, as even a wood- or fiberglass-handled tool will conduct electricity if the handle is wet or dirty. If contact with live electrical component is a possibility, use of voltage-rated gloves is also recommended.

In the workplace, floors must be kept as clean and dry as possible to prevent accidental slips with or around dangerous hand tools.

Around flammable substances, sparks produced by iron and steel hand tools can be a dangerous ignition source. Where this hazard exists, spark-resistant tools made from brass, plastic, aluminum, or wood will provide for safety.

Power tools must be equipped with a constant-pressure switch or control that shuts off the power when pressure is released.

Employees will not be issued or allowed to use defective or unsafe tools.

Impact tools must be kept free of mushroomed heads. The wooden handles of tools shall be kept tight in the tool and free of splinters. Tools with cracked wooden handles must be taken out of service until a new handle is provided.

Electrical, air or any type of hand tool will not be used if safety equipment such as shields, tool rests, hoods and/or guards have been removed or otherwise rendered inoperative.

Employees using tools under conditions that expose them to the hazards of flying objects or harmful dusts are provided with and must use proper personal protective equipment (may include, but is not limited to, safety glasses, gloves and hearing protection).

All electrically powered tools shall be properly grounded. Tools, cords and outlets using 110-volt electrical power shall be protected by ground fault circuit interrupters.

Portable grinders should be provided with hood-type guards with side enclosures that cover the spindle and at least 50% of the wheel. All wheels should be inspected regularly for signs of fracture.

Bench grinders shall be equipped with deflector shields and side covers guards. Tool rests shall have a maximum clearance of 1/8 inch from the wheel.

Hoses supplying pneumatic tools shall have couplings secured to prevent accidental disconnection.

Air-supply lines should be protected from damage, inspected regularly and maintained in good condition.

Pneumatic power tools with hoses exceeding ½-inch inside diameter shall have a safety device at the source of supply or branch line to reduce pressure in case of hose failure.

Refer to Section 22 (Hand and Power Tools) of the ARCADIS Corporate Health & Safety Program for additional information.

7.0 PERSONAL PROTECTIVE EQUIPMENT

The purpose of PPE is to protect employees from hazards and potential hazards they are likely to encounter during site activities. The amount and type of PPE used will be based on the nature of the hazard encountered or anticipated. Respiratory protection will be utilized when an airborne hazard has been identified using real-time air monitoring devices, or as a precautionary measure in areas designated by the Director of Health and Safety or SSO.

Dermal protection, primarily in the form of chemical-resistant gloves and coveralls, will be worn whenever contact with chemically affected materials (e.g., soil, groundwater, sludge) is anticipated, without regard to the level of respiratory protection required.

ARCADIS personnel will be provided with appropriate personal safety equipment and protective clothing. The SSO is to inform each worker about necessary protection and must provide proper training in the use of the safety equipment. The required PPE to be worn is described below.

A detailed list of PPE for the project is also located in the Site Safety Briefing Form.

7.1 Conditions Requiring Level D Protection

In general, site activities will commence in Level D PPE unless otherwise specified, or if the SSO determines on site that a higher level of PPE is required. Air monitoring of employee breathing zones will be routinely conducted using real-time air monitoring devices to determine if upgrading more protective PPE is necessary. Level D PPE will be permitted as long as air monitoring data indicate that airborne concentrations of chemicals of concern are maintained below the site-specific action levels defined in Section 10.

It is important to note that dermal protection is required whenever contact with chemically affected soils or groundwater is anticipated. The following equipment is specified as the minimum PPE required to conduct activities at the Site:

- work shirt and long pants
- ANSI-approved steel-toed boots or safety shoes
- ANSI-approved safety glasses
- ANSI-approved hard hat

Other personal protection readily available for use, if necessary, includes the following:

- outer nitrile gloves and inner nitrile surgical gloves when direct contact with chemically affected soils or groundwater is anticipated (nitrile surgical gloves may be used for collecting or classifying samples as long as they are removed and disposed of immediately after each sampling event)
- chemical-resistant clothing (e.g., Tyvek or polycoated Tyvek coveralls) when contact with chemically affected soils or groundwater is anticipated
- apron

- safety shield
- safety goggles
- safety shoes/boots with protective overboots or knee-high polyvinyl chloride (PVC) polyblend boots when direct contact with chemically affected soils is anticipated
- hearing protection
- sturdy work gloves

7.2 Conditions Requiring Level C Protection

If air monitoring indicates that the site-specific action levels defined in Section 10 are exceeded, workers in the affected area(s) will upgrade PPE to Level C. In addition to the protective equipment specified for Level D, Level C also includes the following:

- National Institute for Occupational Safety and Health– (NIOSH-) approved half-face or full-face air-purifying respirator (APR) equipped with filter cartridges as specified in Section 10 (Note: Safety glasses are not required when wearing a full-face APR.)
- chemical-resistant clothing (e.g., Tyvek, polycoated Tyvek, or Saranex coveralls) when contact with chemically affected soils or groundwater is anticipated
- outer nitrile gloves and inner nitrile surgical gloves when direct contact with chemically affected soils or groundwater is anticipated (nitrile surgical gloves may be used for collecting or classifying samples as long as they are removed and disposed of immediately after each sampling event)
- safety shoes/boots with protective overboots or knee-high PVC polyblend boots when direct contact with chemically affected soils is anticipated

Respirators will be stored in clean containers (i.e., self-sealing bag) when not in use. Respirator cartridges will be replaced in accordance with the following change-out schedule.

Type of Cartridge	Cartridge Change-out Schedule
Particulate (i.e., High Efficiency Particulate Air)	At least weekly or whenever the employee detects an increase in breathing resistance. This will occur as the filter becomes loaded with particulate matter.
Sorbent (i.e., organic vapor)	At the end of each day’s use or sooner, if the respirator manufacturer change-out schedule software program dictates otherwise. The Director of Health & Safety must be consulted regarding gas/vapor cartridge change-out schedule.

Personnel who wear APRs must be trained in their use, must have successfully passed a qualitative respiratory fit test in accordance with 8 CCR 5144 within the last 12 months, and must have medical clearance for APR use.

7.3 Conditions Requiring Stoppage of Work

If air monitoring indicates that the site-specific action levels defined in Section 10 are exceeded, activities must cease, and personnel must evacuate the Exclusion Zone (see Section 9). The Project Manager and Director of Health and Safety will be contacted immediately.

8.0 SAFETY PROCEDURES AND SITE REQUIREMENTS

A daily morning briefing to cover safety procedures and contingency plans in the event of an emergency is to be included with a discussion of the day's activities. These daily meetings will be recorded on ARCADIS Daily Tailgate Safety Meeting Forms. A debriefing to cover the activities is to be held upon completion of the work. A copy of the Daily Tailgate Safety Meeting Form is included in Appendix B.

The SSO will conduct a safety inspection of the work site before each day's activities begin, to verify compliance with the requirements of the HSP. Results of the first day's inspection will be documented on an ARCADIS Site Safety Checklist. A copy of the checklist is included in Appendix B.

Minimum emergency equipment maintained on site will include a fully charged 20-pound ABC dry chemical fire extinguisher, an adequately stocked first aid kit, and an emergency eyewash station (when corrosive chemicals are present).

8.1 Training Requirements

Site personnel, including subcontractors and visitors conducting work in controlled areas of the Site, must have completed the appropriate training as required by 8 CCR 5192. Further site-specific training will be conducted by the SSO prior to the initiation of project activities. This training will include, but will not necessarily be limited to, emergency procedures, site control, personnel responsibilities, and the provisions of this HSP.

General site workers (such as equipment operators, general laborers, and supervisory personnel) engaged in hazardous substance removal or other activities that could expose them to hazardous substances must have successfully completed an initial 40-hour Hazardous Waste Operations and Emergency Response (HAZWOPER) training course. In addition, each employee must have attended an eight-hour annual HAZWOPER refresher training course within the past 12 months if their initial 40-hour HAZWOPER training course was completed more than 12 months prior.

8.2 Medical Surveillance Requirements

Site personnel, including subcontractors and site visitors, who will or may work in an area designated as an exclusion zone must have fulfilled the appropriate medical monitoring requirements in accordance with 8 CCR 5192(f). Each individual entering an exclusion zone must have completed an annual surveillance examination and/or an initial baseline examination within the last 12 months.

9.0 SITE CONTROL MEASURES

Procedures must be followed to maintain site control so that persons who may be unaware of site conditions are not exposed to hazards. The work area will be barricaded by tape, warning signs, or other appropriate means. Pertinent equipment or machinery will be secured and stored safely.

Access inside the specified work area will be limited to authorized personnel. Only ARCADIS employees and designated ARCADIS subcontracted personnel, as well as designated employees of the client, will be admitted to the work site. Personnel entering the work area are required to sign the signature page of this HSP, indicating they have read and accepted the health and safety practices outlined in this plan.

9.1 Establishing Work Zones

In some instances it may be necessary to define established work zones: an Exclusion Zone, a Contamination Reduction Zone, and a Support Zone. Work zones may be established based on the extent of anticipated contamination, projected work activities, and the presence or absence of non-project personnel. The physical dimensions and applicability of work zones will be determined for each area based on the nature of job activity and hazards present. Within these zones, prescribed operations will occur using appropriate PPE. Movement between zones will be controlled at checkpoints.

Considerable judgment is needed to maintain a safe working area for each zone, balanced against practical work considerations. Physical and topographical barriers may constrain ideal locations. Field measurements combined with climatic conditions may, in part, determine the control zone distances. Even when work is performed in an area that does not require the use of chemical-resistant clothing, work zone procedures may still be necessary to limit the movement of personnel and retain adequate site control.

Personnel entering the designated Exclusion Zone should exit at the same location. There must be an alternate exit established for emergency situations. In all instances, worker safety will take precedence over decontamination procedures. If decontamination of personnel is necessary, exiting the Site will include the decontamination procedures described below.

9.2 Decontamination Procedures

Despite protective procedures, personnel may come in contact with potentially hazardous compounds while performing work tasks. If so, decontamination needs to take place using an Alconox or TSP wash, followed by a rinse with clean water. Standard decontamination procedures for levels C and D are as follows:

- equipment drop
- boot cover and outer glove wash and rinse
- boot cover and outer glove removal
- suit wash and rinse
- suit removal
- safety boot wash and rinse
- inner glove wash and rinse
- respirator removal
- inner glove removal
- field wash of hands and face

Workers should employ only applicable steps in accordance with level of PPE worn and extent of contamination present. The SSO shall maintain adequate quantities of clean water to be used for personal decontamination (i.e., field wash of hands and face) whenever a suitable washing facility is not located in the immediate vicinity of the work area. Disposable items will be disposed of in an appropriate container. Wash and rinse water generated from decontamination activities will be handled and disposed of properly. Non-disposable items may need to be sanitized before reuse. Each site worker is responsible for the maintenance, decontamination, and sanitizing of his/her own PPE.

Used equipment may be decontaminated as follows:

- An Alconox or TSP and water solution will be used to wash the equipment.
- The equipment will then be rinsed with clean water.

Each person must follow these procedures to reduce the potential for transferring chemically affected materials off site.

When hazardous waste cleanup or removal operations commence on a site and the duration of the work will require six months or greater time to complete, showers and change rooms for all employees exposed to hazardous substances and health hazards involved in hazardous waste clean-up or removal operations must be provided.

9.3 Sanitation at Temporary Workplaces

9.3.1 Potable Water

An adequate supply of potable water must be provided on the site. Portable containers used to dispense drinking water shall be capable of being tightly closed, and equipped with a tap. Water shall not be dipped from containers. Any container used to distribute drinking water shall be clearly marked as to the nature of its contents and not used for any other purpose. Where single service cups (to be used but once) are supplied, both a sanitary container for the unused cups and a receptacle for disposing of the used cups shall be provided.

Potable water will be available at the Site.

9.3.2 Toilet Facilities

Under temporary field conditions, ARCADIS' SSO will make provisions so that not less than one toilet facility is available. Use of a nearby toilet facility is an acceptable arrangement for mobile crews having transportation readily available.

Toilet facilities will be available at the Site.

9.4 Buddy System

There will be no activities conducted onsite without sufficient backup personnel to permit operation of a buddy system. The buddy system is a method of organizing employees into work groups, in such a manner that each employee of the work group is designated to be observed by at least one other employee in the work group. Both employees shall be in visible or verbal communication with each other at all times and shall be equipped with the personal protective equipment required to assist the buddy in case of an emergency. At a minimum, two persons must be present at the site at all times.

9.5 Site Communication Plan

Successful communication between field teams and contact with personnel in the support zone is essential. Visual, voice or radio communications must be maintained at all times.

One or more of the following communications systems will be available during activities at the Site:

- Two-way radio (if two person crews become separated) or a cellular telephone in the support zone

- compressed air horn
- hand signals

Signal	Definition
Hands clutching throat	Out of air/cannot breath
Hands on top of head	Need assistance
Thumbs up	OK/I am alright/I understand
Thumbs down	No/ negative
Hands waving upright	Send backup support
Grip partners wrist	Exit area immediately

9.6 Site Security

Site security is necessary to prevent unintentional exposure of unauthorized or unprotected people. Good site security can also prevent theft and avoid interference with site activities. Specific security measures will be determined by site conditions and will be coordinated with the Client.

The SSO will approve all visitors to the work site. Visitors must sign off that they have read and understand the HSP, must have a valid reason to visit the site, must have the appropriate PPE, must have appropriate medical surveillance, must have the proper level of hazardous waste site training, and must be accompanied by trained site personnel.

The SSO will also ensure that the exclusion zone is properly marked, fenced or otherwise barricaded and that these areas are secured at the end of the workday.

9.7 Fire Prevention

There will be no smoking or other sources of combustion in any area where flammable or combustible liquids are used or stored. Combustible or flammable construction materials will be properly stored with liquids kept in UL-approved safety cans.

Any welding or cutting will be isolated from combustible or flammable materials. Daily cutting or welding will be stopped one-half hour before the end of the shift and a fire watch will be posted for one-half hour after the welding or cutting has stopped.

10.0 ACTION LEVELS

The following action levels were developed for exposure monitoring with real-time air monitoring instruments as specified in Section 5. Air monitoring data will determine the required respiratory protection levels at the Site during scheduled intrusive activities. The action levels are based on sustained readings indicated by the instrument(s). Air monitoring will be performed and recorded at up to 30-minute intervals.

If elevated concentrations are indicated, the monitoring frequency will be increased, as appropriate. If sustained measurements are observed during this time, the following actions will be instituted, and the Project Manager and Director of Health and Safety will be notified. For purposes of this HSP, sustained readings are defined as the average airborne concentration maintained for a period of one (1) minute.

Activity	Action Level	Level of Respiratory Protection
Soil and soil-gas sampling	< 5 ppm above background	Level D: No respiratory protection required.
	5 to 25 ppm	Level C: Half- or full-face APR fitted with organic vapor filter cartridges. The Director of Health & Safety must be consulted regarding gas/vapor cartridge change-out schedule.
	> 25 ppm	Cease operations and evacuate work area. Contact Director of Health and Safety and Project Manager immediately.

11.0 CONTINGENCY PROCEDURES

In the event of an emergency, site personnel will signal distress with three blasts of a horn (a vehicle horn will be sufficient), or other predetermined signal. Communication signals, such as hand signals, must be established where communication equipment is not feasible or in areas of loud noise.

It is the SSO's duty to evaluate the seriousness of the situation and to notify appropriate authorities. Section 12 of this plan contains emergency telephone numbers as well as directions to the hospital. Nearby telephone access must be identified and available to communicate with local authorities. If a nearby telephone is not available, a cellular telephone will be maintained on site during work activities.

Personnel should contact local emergency services in the event of an emergency (see Section 12). After emergency services are notified, the Project Manager and Director of Health and Safety will be notified of the situation as soon as possible. If personal injury, property damage, or equipment damage occurs, the Project Manager and ARCADIS Corporate Administration will be contacted as soon as practicable. An Incident Report form will be completed within 24 hours by the SSO, or other designated person. A copy of the ARCADIS Incident Report form is included in Appendix B.

11.1 Injury/Illness

If an exposure or injury occurs, work will be temporarily halted until an assessment can be made of whether it is safe to continue work. The SSO, in consultation with the Director of Health and Safety, will make the decision regarding the safety of continuing work. The SSO will conduct an investigation to determine the cause of the incident and steps to be taken to prevent recurrence.

In the event of an injury, the extent and nature of the victim's injuries will be assessed and first aid will be rendered as appropriate. If necessary, the individual may be transported to the nearby medical center. The mode of transportation and the eventual destination will be based on the nature and extent of the injury. A hospital route map is presented in Appendix C.

In the event of a life-threatening emergency, the injured person will be given immediate first aid and emergency medical services will be contacted by dialing the telephone number listed in Section 12. The individual rendering first aid will follow directions given by emergency medical personnel via telephone and will wear appropriate PPE to prevent direct contact with potential blood-borne pathogens. When working in areas where medical services are not readily available, a person trained in first aid/CPR techniques will be present during field activities.

For those ARCADIS staff that are working at a remote location in which emergency medical service is not in near proximity to the work site, someone working at the site (may or may not be ARCADIS staff) must have First Aid/CPR training. OSHA's interpretation of emergency medical care "in near proximity" to the project work site is defined as follows:

- In areas where accidents resulting in suffocation, severe bleeding, or other life threatening or permanently disabling injury or illness can be expected, a **3- to 4-minute** response time, from time of injury to time of administering first aid, is required.
- In other circumstances, i.e., where a life-threatening or permanently disabling injury is an unlikely outcome of an accident, a longer response time such as **15 minutes** is acceptable

11.2 Fire

In the event of fire, personnel should contact the local fire department immediately by dialing 911. When representatives of the fire department arrive, the SSO, or designated representative, will advise the commanding officer of the location, nature, and identification of hazardous materials on site. Only trained, experienced fire fighters should attempt to extinguish substantial fires at the Site. Site personnel should not attempt to fight fires, unless it is safe to do so, and they are properly trained and appropriately equipped to do so.

Smoking is not permitted in controlled areas (i.e., exclusion or contamination reduction zones), near flammable or combustible materials, or in areas designated by the facility as non-smoking areas.

11.3 Underground Utilities

In the event that an underground conduit is damaged during excavation or drilling, mechanized equipment will immediately be shut off until the nature of the piping can be determined. Depending on the nature of the broken conduit (e.g., natural gas, water, or electricity), the appropriate local utility will be contacted If the damage results in the escape of any flammable, toxic, or corrosive gas or liquid or endangers life, health, or property, the excavator responsible shall **immediately** notify the utility operator and the 911 public safety answering point…and take immediate action to protect the public and property.

Contact ARCADIS Project Manager and client contact as soon as practical.

11.4 Evacuation

The SSO will designate evacuation routes and refuge areas to be used in the event of an emergency. Site personnel will stay upwind from vapors or smoke and upgradient from spills. If workers are in an Exclusion or Contamination Reduction Zone at the start of an emergency, they should exit through the established decontamination areas whenever possible. If evacuation cannot be done through an established decontamination area, site personnel will go to the nearest safe location and remove contaminated clothing there or, if possible, leave it near the Exclusion Zone. Personnel will assemble at the predetermined refuge following evacuation and decontamination. The SSO, or designated representative, will count and identify site personnel to verify that all have been evacuated safely.

11.5 Hazardous Material Spill

All personnel responding to spills must have appropriate training and wear PPE appropriate for the situation. If a hazardous material spill occurs, properly trained and equipped site personnel should locate the source of the spill and determine the hazard to the health and safety of site workers and the public. Attempt to stop or reduce the flow if it can be done without risk to personnel. Isolate the spill area and do not allow entry by unauthorized personnel. De-energize sources of ignition within 100 feet of the spill, including vehicle engines. Should a spill be of the nature or extent that it cannot be safely contained, or poses an imminent threat to human health or the environment, an emergency cleanup contractor will be called out as soon as possible. Spill containment measures listed below are examples of responses to spills.

- Right or rotate containers to stop the flow of liquids. This step may be accomplished as soon as the spill or leak occurs, providing it is safe to do so.
- Sorbent pads, booms, or adjacent soil may be used to dike or berm materials, subject to flow, and to solidify liquids.
- Sorbent pads, soil, or booms, if used, shall be placed in appropriate containers after use, pending disposal.
- Contaminated tools and equipment shall be collected for subsequent cleaning or disposal.

11.6 Buried Drums or Tanks

Leaks from buried drums or tanks shall be handled in the following manner:

If during the excavation of soil, an unanticipated buried drum (s) or tank are uncovered, work should stop immediately and workers should evacuate area.

The SSO will be notified at once about the discovery of the buried drums. The SSO will notify the Project Manager. The SSO will then survey the area to determine number of and damage to any drums. Level C Protection (minimum protection allowed) will be worn to survey the area. The SSO will use a PID, an FID or similar, to determine if there are any airborne hydrocarbons. Specific analysis shall be performed with calorimetric tubes if suspect chemicals are identified. Samples of the material will be collected and analyzed as directed by the Environmental Professional (e.g., LSP, LEP) of record for the Site.

The area will be taped off as an exclusion zone until the drums are removed by the Emergency Response personnel and the SSO deems the area safe to resume excavation.

If there is leakage or leakage potential from the drums, an Emergency Response team will be called immediately. The emergency responder will stop the leak and remove the drum(s) from the ground and place it in an overpack and store within an appropriate secondary containment structure at the Site.

Areas of suspected buried tanks or drums shall be restricted to Emergency Responder personnel working on excavation activities. Workers in the area shall don proper PPE before continuing excavation. The SSO will monitor other areas on site with the PID, FID or similar to determine if work can continue in those areas.

All contaminated soil will be excavated, properly stockpiled or drummed nd disposed of with other hazardous materials.

If undocumented, buried tank(s) are encountered during excavation, stop work at once and notify the SSO. The SSO will notify the Project Manager. The SSO will survey the area.

Refer to the HAZWOPER standard for specific requirements on opening, sampling, handling, shipping and transporting drums or containers.

12.0 ARCADIS APPROVALS

This HSP has been prepared for the following project:

Malibu Middle and High School
30215 Morning View Drive
Malibu, California

ARCADIS Project Number: CM011144.0003

This HSP has been reviewed and approved by the following ARCADIS personnel:

April 6, 2010

Aaron Hook — Date
Site Safety Officer

April 6, 2010

Martin Hamann — Date
Project Manager

October 22, 2009

Anthony Tremblay, CIAQP — Date
Corporate Director of Health and Safety

SIGNATURE PAGE

The following signatures indicate that this Health and Safety Plan (HSP) has been read and accepted by ARCADIS personnel as well as subcontractors and their personnel.

NAME	COMPANY	SIGNATURE	DATE

Important notice to subcontractor(s):

This HSP has been prepared solely for the use of ARCADIS personnel. It is supplied to you for informational purposes only and may not be relied upon for protection of your employees. The Subcontractor is responsible for providing, at its cost, all personal protective clothing and equipment required for its employees to perform their work in a safe manner and in compliance with all applicable state and federal OSHA regulations. Subcontractor is responsible for ensuring that such equipment is in good condition and is properly inspected and maintained. Subcontractor must, at a minimum, use the equipment and follow the procedures described in this HSP. Failure to do so may result in immediate termination of Subcontractor's services. This does not relieve Subcontractor of the responsibility to provide equipment and institute procedures affording a greater degree of protection than those specified in this HSP should Subcontractor determine such measures are necessary to protect the health and welfare of its employees, second-tier subcontractors, or others under its control or direction.

APPENDIX A

Chemical Descriptions

CHEMICAL DESCRIPTIONS

The following chemical descriptions are to be used for chemicals that may be present at the Site. Each chemical description includes physical and odor recognition characteristics, the health effects associated with exposure, and exposure limits expressed as an 8-hour time-weighted average (TWA). Provided are federal Occupational Safety and Health Administration (OSHA) permissible exposure limits (PELs; located in 29 CFR 1910.1000); California OSHA (Cal/OSHA) PELs (located in 8 CCR 5155); and the American Conference of Governmental Industrial Hygienists (ACGIH) threshold limit values (TLVs). Short-term exposure limits (STELs) are short-term concentrations that must not be exceeded over a specified period of time (generally 15 minutes). Ceiling concentrations are limits that must not be exceeded during any part of the workday. These are expressed in parts per million (ppm), milligrams per cubic meter (mg/m^3), or fibers per cubic centimeter (f/cc), as appropriate.

Odor thresholds can not be used as the primary indicator for changing gas and vapor cartridges as a result of the OSHA standard, 29 CFR 1910.134. The program administrator and designated representative(s), using objective data and information, must establish chemical cartridge change schedules if a gas or vapor cartridge does not have an end-of-service life indicator. Odor thresholds can be a useful secondary or backup indicator for cartridge change-out. The primary references for odor threshold information were VOCBASE and an American Industrial Hygiene publication. The method of defining and determining odor thresholds varies widely; therefore, caution must be used in relying upon odor threshold as a warning of potentially hazardous exposure.

For sites outside California, Cal/OSHA PELs are included as an additional reference.

POLYCHLORINATED BIPHENYLS (PCBs)

PCBs are a series of technical mixtures consisting of many isomers and compounds that vary from mobile oil liquids to white crystalline solids and hard non-crystalline resins. Technical products vary in composition, in the degree of chlorination, and possibly according to batch. Generally, they are moderately toxic by ingestion, and some are poisons by other routes. Most are suspect human carcinogens and experimental tumorigens, and exhibit experimental reproductive effects. They have two distinct actions on the body: a skin effect (chloracne) and a toxic action on the liver. The higher the chlorine content, the more toxic the PCBs tend to be.

- The OSHA PEL is listed as 0.5 mg/m^3 for 54% chlorine content (as a PCB) and 1.0 mg/m^3 for 42% chlorine content (as a PCB).
- The Cal/OSHA PEL is listed as 0.5 mg/m^3 for 54% chlorine content (as a PCB) and 1.0 mg/m^3 for 42% chlorine content (as a PCB).

- The TLV is listed as 0.5 mg/m^3 for 54% chlorine content (as a PCB) and 1.0 mg/m^3 for 42% chlorine content (as a PCB).

Note: Published exposure limits designate a skin notation indicating that dermal contact can contribute to the overall exposure.

WARNING: This chemical is known to the State of California to cause cancer.

WARNING: This chemical is known to the State of California to cause birth defects, developmental toxicity, and/or reproductive harm.

AROCLOR

Aroclor (containing variable amounts of chlorine) is a polychlorinated biphenyl (PCB) used in heat transfer fluids, hydraulic fluids, lubricants, and insecticides. It is a confirmed carcinogen with experimental carcinogenic and neoplastigenic data. It is moderately toxic by ingestion and intraperitoneal routes. It also exhibits experimental teratogenic and reproductive effects. When heated to decomposition, it emits toxic fumes of chlorine.

- The OSHA PEL is listed as 0.5 mg/m^3 for 54% chlorine content (as a PCB) and 1.0 mg/m^3 for 42% chlorine content (as a PCB).
- The Cal/OSHA PEL is listed as 0.5 mg/m^3 for 54% chlorine content (as a PCB) and 1.0 mg/m^3 for 42% chlorine content (as a PCB).
- The TLV is listed as 0.5 mg/m^3 for 54% chlorine content (as a PCB) and 1.0 mg/m^3 for 42% chlorine content (as a PCB).

Note: Published exposure limits designate a skin notation indicating that dermal contact can contribute to the overall exposure.

WARNING: This chemical is known to the State of California to cause cancer.

ALDRIN

Aldrin is a light to dark brown crystal with a mild chemical odor. Short-term exposure to aldrin can cause hyperirritability, headaches, dizziness, nausea, vomiting, blood in the urine, tremors, convulsions, and coma.

- The OSHA PEL is listed as 0.25 mg/m^3.
- The Cal/OSHA PEL is listed as 0.25 mg/m^3.
- The TLV is listed as 0.05 mg/m^3 measured as inhalable fraction and vapor.

Note: Published exposure limits designate a skin notation indicating that dermal contact can contribute to the overall exposure.

WARNING: This chemical is known to the State of California to cause cancer.

ALUMINUM

Aluminum is a malleable, white metal or a shiny gray foil. Aluminum powder is white to gray in color. It is mined from bauxite for use in construction, electrical wiring and conductors, electronics, paints, and medicines.

Aluminum can affect humans when breathed in. Contact can irritate the skin and eyes. Exposure to aluminum can cause “metal fume fever,” a flu-like illness with symptoms of metallic taste in the mouth, headache, fever and chills, aches, chest tightness, and cough. The symptoms may be delayed for several hours after exposure and usually last for a day or two. Exposure to fine dust can cause scarring of the lungs (pulmonary fibrosis) with symptoms of cough and shortness of breath.

Aluminum powder is a flammable solid and a dangerous fire hazard.

- The OSHA PEL is listed as 15 mg/m^3 for total dust and 5 mg/m^3 for respirable dust averaged over an 8-hour workshift.
- The Cal/OSHA PEL is listed as 10 mg/m^3 for total dust and 5 mg/m^3 for respirable dust.
- The TLV is listed as 10 mg/m^3 for total dust. A Notice of Intended Change outlines 1 mg/m^3 as the respirable dust level.

ANTIMONY

Antimony is a silvery-gray, lustrous metal. It is a moderate fire and explosion hazard in the forms of dust and vapor when exposed to heat and flame. Antimony can react violently with acids, halogens and oxidants. Short-term exposure to antimony can cause gastrointestinal pain, cough, loss of appetite, itching, skin eruptions, and irritation of the eyes, nose, and throat.

- The OSHA PEL is listed as 0.5 mg/m^3.
- The Cal/OSHA PEL is listed as 0.5 mg/m^3.
- The TLV is listed as 0.5 mg/m^3.

WARNING: Antimony oxide is known to the State of California to cause cancer.

AROCLOR

Aroclor (containing variable amounts of chlorine) is a polychlorinated biphenyl (PCB) used in heat transfer fluids, hydraulic fluids, lubricants, and insecticides. It is a confirmed carcinogen with experimental carcinogenic and neoplastigenic data. It is moderately toxic by ingestion and intraperitoneal routes. It also exhibits experimental teratogenic and reproductive effects. When heated to decomposition, it emits toxic fumes of chlorine.

- The OSHA PEL is listed as 0.5 mg/m^3 for 54% chlorine content (as a PCB) and 1.0 mg/m^3 for 42% chlorine content (as a PCB).
- The Cal/OSHA PEL is listed as 0.5 mg/m^3 for 54% chlorine content (as a PCB) and 1.0 mg/m^3 for 42% chlorine content (as a PCB).
- The TLV is listed as 0.5 mg/m^3 for 54% chlorine content (as a PCB) and 1.0 mg/m^3 for 42% chlorine content (as a PCB).

Note: Published exposure limits designate a skin notation indicating that dermal contact can contribute to the overall exposure.

WARNING: This chemical is known to the State of California to cause cancer.

ARSENIC

Metallic arsenic is most commonly a gray, brittle, crystalline solid. It can also be in a black or yellow amorphous form. Arsenic is also commonly found in its volatile white trioxide form. Arsenic is used in several insecticides, herbicides, defoliants, desiccants, and rodenticides and appears in a variety of forms. It is also used in tanning, pigment production, glass manufacturing, wood preservation, and anti-fouling coatings. Arsenic is classified as a known carcinogen.

Short-term exposure to arsenic can cause marked irritation of the stomach and intestines with nausea, vomiting, and diarrhea. In severe cases the vomiting and stools are bloody and the exposed individual goes into collapse and shock with weak, rapid pulse, cold sweats, coma, and death. Inorganic arsenicals are more toxic than organic arsenicals, and the trivalent form is more toxic than the pentavalent form. Acute arsenic poisoning usually results from ingestion exposures. Blood cell changes, blood vessel damage, and impaired nerve function can also result from chronic arsenic ingestion. Other effects include skin changes, irritation of the throat, and increased risk of cancer of the liver, bladder, kidney, and lung.

- The OSHA PEL is listed as 0.01 mg/m^3 for inorganic forms of arsenic and 0.5 mg/m^3 for organic forms. Refer to 29 CFR 1910.1018 for additional information on inorganic forms of arsenic.

- The Cal/OSHA PEL is listed as 0.01 mg/m^3 for inorganic forms of arsenic and 0.2 mg/m^3 for organic forms. Refer to Section 5214 for additional information on inorganic forms of arsenic.
- The TLV is listed as 0.01 mg/m^3 for arsenic and inorganic arsenic compounds.

WARNING: This chemical is known to the State of California to cause cancer.

WARNING: This chemical is known to the State of California to cause birth defects, developmental toxicity, and/or reproductive harm.

BARIUM

Barium is a silvery-white metal found in nature. It occurs combined with other chemicals such as sulfur or carbon or oxygen. These combinations are called compounds. Barium compounds can also be produced by industry.

Barium compounds are used by the oil and gas industries to make drilling muds. They are also used to make paint, bricks, tiles, glass, and rubber.

Barium compounds that dissolve well in water may cause harmful health effects in people. Ingesting high levels of barium compounds that dissolve well in water over the short term has resulted in difficulties in breathing, increased blood pressure, changes in heart rhythm, stomach irritation, brain swelling, muscle weakness and damage to the liver, kidney, heart and spleen.

- The OSHA PEL is listed as 0.5 mg/m^3.
- The Cal/OSHA PEL is listed as 0.5 mg/m^3 for barium and soluble compounds (as Ba).

The TLV is listed as 0.5 mg/m^3 for barium and soluble compounds (as Ba).

BENZENE

Benzene is a clear, volatile liquid. It is colorless, highly flammable, and toxic, with a characteristic odor. It is a severe eye and moderate skin irritant. Human effects by inhalation and ingestion include euphoria, changes in sleep and motor activity, nausea and vomiting, other blood effects, dermatitis, and fever. In industry, inhalation is the primary route of chronic benzene poisoning. If the liquid is aspirated into the lung it may cause pulmonary edema. Poisoning by skin contact has also been reported. Exposure to high concentrations (3,000 ppm) may result in acute poisoning, which is characterized by the narcotic action of benzene on the central nervous system. Chronic poisoning occurs most commonly through inhalation and dermal absorption. Benzene is a known human carcinogen that can cause leukemia.

The odor threshold is 8.65 ppm to 61 ppm. Odor threshold CANNOT be used as a warning of potentially hazardous exposures.

- The OSHA PEL is listed as 1 ppm. Refer to 29 CFR 1910.1028 for additional information.
- The Cal/OSHA PEL is listed as 1 ppm. Refer to Section 5218 for additional information.
- The TLV is listed as 0.5 ppm.

Note: Published exposure limits designate a skin notation indicating that dermal contact can contribute to the overall exposure.

WARNING: This chemical is known to the State of California to cause cancer.

WARNING: This chemical is known to the State of California to cause birth defects, developmental toxicity, and/or reproductive harm.

BENZOIC ACID

Benzoic acid is poison by the subcutaneous route and is moderately toxic by ingestion. Human systemic effects by inhalation include dyspnea and allergic dermatitis. It is a severe eye and human skin irritant.

No OSHA PEL, Cal/OSHA PEL, or TLV is listed for benzoic acid.

BERYLLIUM

Beryllium is a confirmed carcinogen with experimental carcinogenic, neoplastigenic, and teratogenic data. Human systemic effects by inhalation include lung fibrosis, dyspnea, and weight loss.

- The OSHA PEL is listed as 0.002 mg/m^3.
- The Cal/OSHA PEL is listed as 0.0002 mg/m^3.
- The TLV is listed as 0.002 mg/m^3. A value of 0.00005 mg/m^3 (as Inhalable Particulate Mass) is proposed.

WARNING: This chemical is known to the State of California to cause cancer.

CADMIUM

Cadmium dust is an odorless gray powder. Short-term exposure to cadmium dust can cause irritation of the nose and throat, cough, chest pain, sweating, chills, shortness of breath, and weakness. Inhalation of cadmium compounds has been shown to cause lung cancer in humans. Fatal concentrations may be breathed without sufficient discomfort to warn a worker to leave the area. Ingestion of cadmium dust may cause nausea, vomiting, diarrhea, and abdominal cramps.

- The OSHA PEL is listed as 0.005 mg/m^3. Refer to 29 CFR 1910.1027 for additional information.
- The Cal/OSHA PEL is listed as 0.005 mg/m^3. Refer to Sections 1532 and 5207 for additional information.
- The TLV is listed as 0.01 mg/m^3 for dust (total) and 0.002 mg/m^3 for the respirable dust fraction.

WARNING: This chemical is known to the State of California to cause cancer.

WARNING: This chemical is known to the State of California to cause birth defects, developmental toxicity, and/or reproductive harm.

CARBON TETRACHLORIDE

Carbon tetrachloride is a confirmed carcinogen with experimental carcinogenic, neoplastigenic, and tumorigenic data. It is a human poison by ingestion and is mildly toxic by inhalation. Human systemic effects by ingestion and inhalation include nausea or vomiting, pupillary constriction, coma, anti-psychotic effects, tremors, somnolence, anorexia, and respiratory and gastrointestinal system effects. It is an eye and skin irritant that also damages liver, kidneys, and lungs.

The odor threshold is 40.7 ppm. Odor threshold CANNOT be used as a warning of potentially hazardous exposures.

- The OSHA PEL is listed as 10 ppm.
- The Cal/OSHA PEL is listed as 2 ppm.
- The TLV is listed as 5 ppm.

Note: Published exposure limits designate a skin notation indicating that dermal contact can contribute to the overall exposure.

WARNING: This chemical is known to the State of California to cause cancer.

CHLORDANE

Chlordane is a colorless to amber, odorless, viscous liquid. It is a confirmed carcinogen and is a poison to humans by ingestion and possibly other routes. It is moderately toxic by skin contact. Human systemic effects by ingestion or skin contact include tremors, convulsions, excitement, loss of muscle coordination, and gastritis. When heated to decomposition, chlordane emits toxic fumes of hydrogen chloride.

- The OSHA PEL is listed as 0.5 mg/m^3.
- The Cal/OSHA PEL is listed as 0.5 mg/m^3.
- The TLV is listed as 0.5 mg/m^3.

Note: Published exposure limits designate a skin notation indicating that dermal contact can contribute to the overall exposure.

WARNING: This chemical is known to the State of California to cause cancer.

CHLOROETHANE

Chloroethane (also known as ethyl chloride) is a flammable gas with an ether-like odor and a burning taste. The liquid form of chloroethane is mildly irritating to skin, eyes, and mucous membranes. Frostbite can occur because of rapid liquid evaporation. Exposure to chloroethane may produce headache, dizziness, incoordination, stomach cramps, and eventual loss of consciousness. In high concentrations, it is a respiratory tract irritant, and death from cardiac arrest has been recorded. Renal damage may also occur.

The odor threshold for chloroethane is 4.07 ppm. Caution should be used in relying on odor alone as a warning of potentially hazardous exposures.

- The OSHA PEL is listed as 1,000 ppm.
- The Cal/OSHA PEL is listed as 100 ppm.
- The TLV is listed as 100 ppm.

Note: Published exposure limits designate a skin notation indicating that dermal contact can contribute to the overall exposure.

WARNING: This chemical is known to the State of California to cause cancer.

CHLOROFORM

Chloroform is a confirmed carcinogen with experimental carcinogenic, teratogenic, neoplastigenic, and tumorigenic data. It is a human poison by ingestion and inhalation. Human systemic effects by inhalation include hallucinations and distorted perceptions, nausea, vomiting and other unspecified gastrointestinal effects. Inhalation of the concentrated vapor causes dilation of the pupils with reduced reaction to light. In the initial stages there is a feeling of warmth of the face and body, then an irritation of the mucous membranes and skin, followed by excitation, loss of reflexes, and unconsciousness. Prolonged inhalation will bring on paralysis accompanied by cardiac respiratory failure and finally death.

The odor threshold is 11.7 ppm. Odor threshold CANNOT be used as a warning of potentially hazardous exposures.

- The OSHA Ceiling Limit is listed as 50 ppm.
- The Cal/OSHA PEL is listed as 2 ppm.
- The TLV is listed as 10 ppm.

WARNING: This chemical is known to the State of California to cause cancer.

CHROMIUM

Chromium is a greenish-blue, odorless solid. Chromic acid and its salts have a corrosive action on the skin and mucous membranes. The lesions are confined to the exposed parts, affecting chiefly the skin of the hands and forearms and the mucous membranes of the nasal septum. Chromate salts are human and experimental carcinogens of the lungs, nasal cavity, and paranasal sinus, and are also experimental carcinogens of the stomach and larynx. Hexavalent compounds are more toxic than trivalent. Exposure to chromium has been associated with lung changes in workers exposed to chromium alloys. Chromium dust exposure may cause minor lung changes.

- The OSHA PEL is listed as 0.005 mg/m^3 for hexavalent chromium (Cr [VI]); 0.5 mg/m^3 for Cr (II and III) compounds; and 1.0 mg/m^3 for chromium as a metal. Refer to 29 CFR 1910.1026, 29 CFR 1926.1126 for additional information.
- The Cal/OSHA PEL is listed as 0.005 mg/m^3 for hexavalent chromium (Cr [VI]) compounds and 0.5 mg/m^3 for other forms. Refer to Sections 1532.2, 5206, and 8359 for additional information.
- The TLV is listed as 0.01 mg/m^3 for insoluble Cr (VI) compounds, 0.05 mg/m^3 for soluble Cr (VI) compounds, and 0.5 mg/m^3 for metal and Cr III compounds.

WARNING: Chromium (hexavalent compounds) are known to the State of California to cause cancer.

COPPER

In its elemental form, copper is a common metal with a distinct reddish color. Human systemic effects by ingestion include nausea and vomiting. In animals, inhalation of copper dust has caused hemolysis of the red blood cells, deposition of hemofuscin in the liver and pancreas, and injury to the lung cells. Short-term exposure to copper dust can cause a feeling of illness similar to the common cold with sensations of chills and stuffiness of the head. Small copper particles may enter the eye and cause irritation, discoloration, and damage.

- The OSHA PEL is listed as 0.1 mg/m^3 for copper as a fume, and 1.0 mg/m^3 for dust.
- The Cal/OSHA PEL is listed as 0.1 mg/m^3 for copper as a fume, and 1.0 mg/m^3 for dust.

The TLV is listed as 0.2 mg/m^3 for copper as a fume, and 1.0 mg/m^3 for dusts and mists.

DIBUTYL PHTHALATE

Dibutyl phthalate (also known as di-n-butyl phthalate) is a colorless to pale yellow, oily liquid with a slight aromatic odor and is mildly toxic by ingestion. It exhibits experimental teratogenic and reproductive effects. Human systemic effects by ingestion include hallucinations, distorted perceptions, nausea, vomiting, and kidney, ureter, and bladder changes. It is combustible when exposed to heat or flame, and can react with oxidizing materials. When heated to decomposition, it emits acrid smoke and fumes.

- The OSHA PEL is listed as 5 mg/m^3.
- The Cal/OSHA PEL is listed as 5 mg/m^3.

The TLV is listed as 5 mg/m^3.

1,2-DICHLOROBENZENE (1,2-DCB)

1,2-DCB (also known as o-dichlorobenzene) is a poison by ingestion and is moderately toxic by inhalation. It is an eye, skin, and mucous membrane irritant, and causes liver and kidney injury. It is an experimental teratogen and suspected carcinogen exhibiting experimental reproductive effects. It is flammable when exposed to heat or flame and can react vigorously with oxidizing materials.

The odor threshold is 0.072 ppm. Caution should be used in relying on odor alone as a warning of potentially hazardous exposures.

- The OSHA PEL is listed as 50 ppm as a ceiling limit.

- The Cal/OSHA PEL is listed as 25 ppm.
- The TLV is listed as 25 ppm.

Note: Published exposure limits designate a skin notation indicating that dermal contact can contribute to the overall exposure.

1,3-DICHLOROBENZENE (1,3-DCB)

Limited toxicological information is available for 1,3-DCB (also known as m-dichlorobenzene). It is identified as a poison and mutation data are reported. It is reported in the Environmental Protection Agency Toxic Substances Control Act Inventory and Community Right-To-Know List. When heated to decomposition, it emits toxic fumes of chlorine.

- No OSHA PEL, Cal/OSHA PEL, or TLV is listed for 1,3-dichlorobenzene.

1,4-DICHLOROBENZENE (1,4-DCB)

1,4-DCB (also known as p-dichlorobenzene) is a confirmed carcinogen and an experimental teratogen. It is moderately toxic to humans by ingestion. Human systemic effects by ingestion include unspecified changes in the eyes, lungs, thorax, and respiration. It is also an eye irritant. It is flammable when exposed to heat or flame and can react vigorously with oxidizing materials.

The odor threshold is 0.048 ppm. Caution should be used in relying on odor alone as a warning of potentially hazardous exposures.

- The OSHA PEL is listed as 75 ppm.
- The Cal/OSHA PEL is listed as 10 ppm.
- The TLV is listed as 10 ppm.

WARNING: This chemical is known to the State of California to cause cancer.

DICHLORODIFLUOROMETHANE

Synonym and trade names include Difluorodichloromethane; Fluorocarbon 12; Freon® 12; Genetron® 12; Halon® 122; Propellant 12; and Refrigerant 12. It is a colorless gas with an ether-like odor at extremely high concentrations. Exposure routes include inhalation and skin and/or eye contact (liquid). Exposure symptoms include dizziness, tremor, asphyxia, unconsciousness, cardiac arrhythmias, cardiac arrest; liquid: frostbite. Target organs include the cardiovascular system and peripheral nervous system. The chemical is incompatible with chemically active metals such as sodium, potassium, calcium, powdered aluminum, zinc, and magnesium.

- The OSHA PEL is listed as 1,000 ppm.
- The Cal/OSHA PEL is listed as 1,000 ppm.
- The TLV is listed as 1,000 ppm.

DICHLORODIPHENYLTRICHLOROETHANE (DDT)

DDT is a confirmed carcinogen with experimental carcinogenic, neoplastigenic, tumorigenic, and teratogenic data. It is an insecticide and is a human poison by ingestion. It is an experimental poison by skin contact and subcutaneous routes. Human systemic effects include anesthesia, convulsions, headache, cardiac arrhythmia, nausea, vomiting, sweating, and pulmonary changes. When heated to decomposition, it emits very toxic fumes of chlorine.

- The OSHA PEL is listed as 1 mg/m^3.
- The Cal/OSHA PEL is listed as 1 mg/m^3.
- The TLV is listed as 1 mg/m^3.

Note: Published exposure limits designate a skin notation indicating that dermal contact can contribute to the overall exposure.

WARNING: This chemical is known to the State of California to cause cancer.

WARNING: This chemical is known to the State of California to cause birth defects, developmental toxicity, and/or reproductive harm.

1,1-DICHLOROETHENYLIDENE BIS 4-CHLOROBENZENE (4,4-DDE)

4,4-DDE (also known as dichlorodiphenyl-dichloroethylene) is a suspected carcinogen with experimental carcinogenic, reproductive, and neoplastigenic data. It is an insecticide and is a poison by ingestion. When heated to decomposition, it emits very toxic fumes of chlorine.

No OSHA PEL, Cal/OSHA PEL, or TLV is listed for 4,4-DDE.

WARNING: This chemical is known to the State of California to cause cancer.

DIELDRIN

Dieldrin is a light brown crystal with a mild chemical odor. Short-term exposure to dieldrin can cause hyperirritability, headaches, dizziness, nausea, vomiting, blood in the urine, tremors, convulsions, and coma.

- The OSHA PEL is listed as 0.25 mg/m^3.
- The Cal/OSHA PEL is listed as 0.25 mg/m^3.
- The TLV is listed as 0.25 mg/m^3.

Note: Published exposure limits designate a skin notation indicating that dermal contact can contribute to the overall exposure.

WARNING: This chemical is known to the State of California to cause cancer.

2,4-DIMETHYLPHENOL

2,4-Dimethylphenol is a white, crystalline solid that is slightly soluble in water and is soluble in most organic solvents and in caustic soda solutions. It is toxic by ingestion and skin absorption. Breathing 2,4-dimethylphenol can irritate the nose, throat, and lungs, causing coughing, wheezing, and/or shortness of breath. High exposure can cause headache, nausea, weakness, and fainting. It is used in disinfectants, solvents, pharmaceuticals, insecticides, and herbicides, and as a plasticizer, additive, and wetting agent. It is present in petroleum and coal tar. It should be recognized that 2,4-dimethylphenol can be absorbed through the skin, thereby increasing the exposure.

- No OSHA PEL, Cal/OSHA PEL, or PEL is listed for 2,4-dimethylphenol.

ENDOSULFAN

Endosulfan is a highly toxic organochlorine pesticide that does not accumulate significantly in human tissue. It is a questionable carcinogen with experimental tumorigenic and neoplastigenic data. It is a poison by ingestion, inhalation, and skin contact. Endosulfan is a central nervous system stimulant producing convulsions. When heated to decomposition, it emits toxic fumes of chlorine and sulfur oxide.

- The OSHA PEL of 0.1 mg/m^3 has been vacated.
- The Cal/OSHA PEL is listed as 0.1 mg/m^3.
- The TLV is listed as 0.1 mg/m^3.

Note: Published exposure limits designate a skin notation indicating that dermal contact can contribute to the overall exposure.

ENDRIN

Endrin is a colorless to tan solid with a mild chemical odor. Exposure to endrin may cause sudden convulsions that may occur from 30 minutes to 10 hours after exposure. Headaches, dizziness, drowsiness, weakness, and loss of appetite may occur two to four weeks after exposure.

- The OSHA PEL is listed as 0.1 mg/m^3.
- The Cal/OSHA PEL is listed as 0.1 mg/m^3.
- The TLV is listed as 0.1 mg/m^3.

Note: Published exposure limits designate a skin notation indicating that dermal contact can contribute to the overall exposure.

WARNING: This chemical is known to the State of California to cause birth defects, developmental toxicity, and/or reproductive harm.

ETHYLBENZENE

Ethylbenzene is a clear, colorless liquid. It is mildly toxic by inhalation and skin contact. Inhalation can cause eye, sleep, and pulmonary changes. It is an eye and skin irritant at levels as low as 0.1% (1,000 ppm) of the vapor in air. At higher concentrations, it is extremely irritating at first, then can cause dizziness, irritation of the nose and throat, and a sense of constriction in the chest. Exposure to high concentrations of ethylbenzene vapor may result in irritation of the skin and mucous membranes, dizziness, irritation of the nose and throat, and a sense of constriction of the chest.

The odor threshold is 2.3 ppm. Caution should be used in relying on odor alone as a warning of potentially hazardous exposures.

- The OSHA PEL is listed as 100 ppm.
- The Cal/OSHA PEL is listed as 100 ppm.
- The TLV is listed as 100 ppm.

- **WARNING: This chemical is known to the State of California to cause cancer.**

HEPTACHLOR

Heptachlor is a light tan, waxy solid with an odor similar to that of camphor. Exposure to heptachlor has produced tremors, convulsions, and liver damage in animals. Heptachlor is toxic by dermal absorption; it is easily absorbed through intact skin.

- The OSHA PEL is listed as 0.5 mg/m^3.
- The Cal/OSHA PEL is listed as 0.05 mg/m^3.
- The TLV is listed as 0.05 mg/m^3.

Note: Published exposure limits designate a skin notation indicating that dermal contact can contribute to the overall exposure.

WARNING: This chemical is known to the State of California to cause cancer.

WARNING: This chemical is known to the State of California to cause birth defects, developmental toxicity, and/or reproductive harm.

HEXACHLOROBENZENE

Hexachlorobenzene (also known as benzene hexachloride isomers or HCB) is a toxic organochlorine pesticide that is persistent in the environment and accumulates in mammalian tissues. It is a confirmed carcinogen with experimental tumorigenic and neoplastigenic data by ingestion and skin contact. It is a poison by ingestion and inhalation. Human systemic effects by inhalation include headache, nausea, vomiting, and fever. Hexachlorobenzene is more toxic than DDT or dieldrin. When heated to decomposition, it emits very toxic fumes of chlorine, hydrogen chloride, and phosgene.

The odor threshold is 0.463 ppm. Odor threshold cannot be used as a warning of potentially hazardous exposures.

- No OSHA PEL or is listed for hexachlorobenzene.
- The Cal/OSHA PEL is listed as 0.002 mg/m^3.
- The TLV is listed as 0.002 mg/m^3.

Note: Published exposure limits designate a skin notation indicating that dermal contact can contribute to the overall exposure.

WARNING: This chemical is known to the State of California to cause cancer.

WARNING: This chemical is known to the State of California to cause birth defects, developmental toxicity, and/or reproductive harm.

LEAD

Lead (inorganic) is a bluish-white, silver, or gray odorless solid. Short-term exposure to lead can cause decreased appetite, insomnia, headache, muscle and joint pain, colic, and constipation. Considerable data exist on the effects of lead exposure in humans. It is a poison by ingestion and a suspected human carcinogen of the lungs and kidneys. There are data to suggest that lead is a mutagen and can cause reproductive effects. Human systemic effects by ingestion and inhalation (the two routes of absorption) include loss of appetite, anemia, malaise, insomnia, headache, irritability, muscle and joint pains, tremors, flaccid paralysis without anesthesia, hallucinations and distorted perceptions, muscle weakness, gastritis, and liver changes. Recent experimental evidence suggests that blood levels of lead below 10 micrograms per deciliter (μg/dl) can have the effect of diminishing the IQ scores of children.

- The OSHA PEL is listed as 0.05 mg/m^3. Refer to 29 CFR 1910.1025 for additional information.
- The Cal/OSHA PEL is listed as 0.05 mg/m^3. Refer to Section 5198 for additional information.
- The TLV is listed as 0.05 mg/m^3.

WARNING: This chemical is known to the State of California to cause cancer.

WARNING: This chemical is known to the State of California to cause birth defects, developmental toxicity, and/or reproductive harm.

LINDANE (BENZENE HEXACHLORIDE - GAMMA ISOMER)

Lindane is a colorless solid with a musty odor (pure material is odorless). Exposure to lindane may cause vomiting, restlessness, muscle spasms, convulsions, respiratory failure, severe breathing difficulties that may be delayed in onset, headaches, irritation of the eyes, nose, and throat, and skin rash. Lindane is moderately toxic by dermal absorption.

- The OSHA PEL is listed as 0.5 mg/m^3.
- The Cal/OSHA PEL is listed as 0.5 mg/m^3.
- The TLV is listed as 0.5 mg/m^3.

Note: Published exposure limits designate a skin notation indicating that dermal contact can contribute to the overall exposure.

WARNING: This chemical is known to the State of California to cause cancer.

MANGANESE

Manganese (Mn) is a lustrous, brittle, silvery solid. Exposure routes include inhalation and ingestion. Symptoms of exposure include Manganism; asthenia, insomnia, mental confusion; metal fume fever: dry throat, cough, chest tightness, dyspnea (breathing difficulty), rales, flu-like fever; low-back pain; vomiting; malaise (vague feeling of discomfort); lassitude (weakness, exhaustion); kidney damage. Target organs are the respiratory system, central nervous system, blood, and kidneys.

- The OSHA Ceiling Limit is listed as 5 mg/m^3.
- The Cal/OSHA PEL is listed as 0.2 mg/m^3 for Manganese and compounds, as Mn and Mn fume.
- The TLV is listed as 0.2 mg/m^3 for inorganic compounds, as Mn and Mn fume.

METHYLENE CHLORIDE

Methylene chloride (also known as dichloromethane) is a colorless liquid with a chloroform-like odor. It is an experimental carcinogen and tumorigen. Human systemic effects upon inhalation include altered sleep time, convulsions, euphoria, and change in cardiac rate. It is an eye and severe skin irritant. Data suggest it may be a mutagen in humans. Methylene chloride also exhibits the unique effect of elevating the blood carboxyhemoglobin levels, similar to the effect of exposure to carbon monoxide (CO). In fact, evidence suggests that methylene chloride can convert to CO in the body. Ingestion of methylene chloride can lead to systemic effects such as light headedness and numbness of the limbs. Inhalation of methylene chloride shows symptoms such as fatigue or weakness and sleepiness.

The odor threshold is 0.912 ppm. Caution should be used in relying on odor alone as a warning of potentially hazardous exposures.

- The OSHA PEL is listed as 25 ppm. Refer to 29 CFR 1910.1052 for additional information.
- The Cal/OSHA PEL is listed as 5 ppm. Refer to Section 5202 for additional information.
- The TLV is listed as 50 ppm.

WARNING: This chemical is known to the State of California to cause cancer.

2-METHYLNAPHTHALENE

2-Methylnaphthalene, also called beta methylnaphthalene (CASRN 91-57-6), is a polycyclic aromatic hydrocarbon (PAH), consisting of two-fused aromatic rings with a methyl group attached on one of the rings at the number two carbon. It is a solid-like naphthalene. The taste and odor of 2-methylnaphthalene have not been described. 2-methylnaphthalene is used to make other chemicals such as dyes and resins and is a natural component of crude oil and coal. 2-Methylnaphthalene is also used to make vitamin K. 2-Methylnaphthalene is also present in cigarette smoke, wood smoke, tar, asphalt, and at some hazardous waste sites. 2-Methylnaphthalene can enter the human body if a person breathes air that contains these chemicals, smokes, eats mothballs, or drinks water that is contaminated with this chemical, or if it touches the skin. This chemical is most likely to enter the body through the air breathed into the lungs.

No data are available regarding the potential toxicity of 2-methylnaphthalene in exposed humans via the oral route. However, the available animal data indicate that the lung is a sensitive target organ. The critical effect observed in mice following chronic oral exposure to 2-methylnaphthalene (Murata et al. 1997) and chronic dermal exposure to methylnaphthalene mixtures (Emi and Konishi 1985; Murata et al. 1992) was pulmonary alveolar proteinosis. This effect was characterized by accumulation of foamy cells, cholesterol crystals, and proteinaceous materials rich in lipids in the lumen of the pulmonary alveoli (Murata et al. 1997). Since the effect is similar to a disorder of unknown etiology that has been observed in humans, it is anticipated that humans exposed to 2- methylnaphthalene may develop pulmonary alveolar proteinosis.

In humans, pulmonary alveolar proteinosis is characterized by symptoms such as dyspnea and cough with possible decreased pulmonary function, identified by decreased functional lung volume and reduced diffusing capacity. It has not been associated with airflow obstruction (Lee et al. 1997; Mazzone et al. 2001; Wang et al. 1997). Cases of pulmonary alveolar proteinosis in humans have not been directly associated with exposure to 2-methylnaphthalene.

The effects of prechronic or chronic inhalation exposure to 2-methylnaphthalene have not been studied in humans or animals. No suitable toxicokinetic models are available to extrapolate between routes of exposure. Since chronic exposure to 2-methylnaphthalene by oral and dermal routes targets the lung causing pulmonary alveolar proteinosis, it is plausible that similar adverse effects may be seen after chronic inhalation exposure to 2-methylnaphthalene. However, no conclusions can be drawn from the current data regarding potential exposure-response relationships for chronic inhalation exposure. Under the Draft Revised Guidelines for Carcinogen Risk Assessment (U.S. EPA 1999), the available data for 2-methylnaphthalene are inadequate to assess human carcinogenic potential.

No occupational exposure limits have been established for 2-methylnaphthalene. This does not mean that this substance is not harmful. Safe work practices should always be followed.

MOLYBDENUM

Molybdenum is a lustrous, silver-white metal or black-gray powder. Molybdenum is a poison by intratracheal, subcutaneous, and intraperitoneal routes. Symptoms of acute poisoning include severe gastrointestinal irritation with diarrhea. Inhalation of molybdenum dust from alloys or carbides can cause “hard-metal lung disease.” It is rapidly excreted by the body and is found in animal tissue, although its precise function is unknown.

- The OSHA PEL is listed as 5 mg/m^3 for soluble compounds (as Mo) and 15 mg/m^3 for insoluble compounds (as Particulate not Otherwise Specified).
- The Cal/OSHA PEL is listed as 0.5 mg/m^3 for soluble compounds (as Mo) and 10 mg/m^3 for insoluble compounds (as Total Mo) and 3 mg/m^3 for insoluble compounds (as respirable Mo).

The TLV is listed as 0.5 mg/m^3 (respirable) for soluble compounds (as Mo) and for insoluble compounds it is listed as 10 mg/m^3 (inhalable Mo) and 3 mg/m^3 (respirable fraction).

NAPHTHALENE

Naphthalene is a colorless to brown solid with an odor of mothballs. Poisoning may occur by inhalation, ingestion, or skin absorption. Naphthalene can cause nausea, headache, fever, anemia, liver damage, vomiting, convulsions, and coma. It is an experimental teratogen and a questionable carcinogen.

Naphthalene is flammable when exposed to heat or flame and reacts with oxidizing materials. It is explosive in the form of vapor or dust when exposed to heat or flame. When heated to decomposition, it emits acrid smoke and irritating fumes.

- The OSHA PEL is listed as 10 ppm.
- The Cal/OSHA PEL is listed as 10 ppm.
- The TLV is listed as 10 ppm.

Note: Published exposure limits designate a skin notation indicating that dermal contact can contribute to the overall exposure.

WARNING: This chemical is known to the State of California to cause cancer.

NICKEL

Nickel is a silvery gray, metallic, odorless metal. It is a confirmed carcinogen with experimental carcinogenic, neoplastigenic, tumorigenic, and teratogenic data. Nickel is a poison by ingestion, subcutaneous, and intravenous routes. Hypersensitivity to nickel is common and can cause allergic contact dermatitis, pulmonary asthma, and conjunctivitis. Exposure to nickel can cause pneumonitis. Nickel and its compounds have also been reported to cause cancer of the lungs and sinuses. Nickel itself is not very toxic if swallowed.

- The OSHA PEL is listed as 1.0 mg/m^3 for elemental, insoluble, and soluble compounds, as Ni.

- The Cal/OSHA PEL is listed as 1.0 mg/m^3 for metal and insoluble compounds (as Ni), and 0.1 mg/m^3 for soluble compounds.
- The TLV is listed as 1.5 mg/m^3 for elemental compounds, 0.2 mg/m^3 for insoluble compounds (inhalable fraction), and 0.1 mg/m^3 for soluble inorganic compounds (inhalable fraction, as Ni and nickel subsulfide).

WARNING: This chemical is known to the State of California to cause cancer.

NITROBENZENE

Yellow, oily liquid with a pungent odor like paste shoe polish. (Note: A solid below 42 °F.) Exposure routes include inhalation, skin absorption, ingestion, skin, and/or eye contact. Symptoms include irritation to eyes and skin; anoxia; dermatitis; anemia; methemoglobinemia; in animals: liver, kidney damage; testicular effects. Target organs include the eyes, skin, blood, liver, kidneys, cardiovascular system, and reproductive system.

The odor threshold is less than 0.044 ppm. The range of accepted odor threshold values is quite broad. Caution should be used in relying on odor alone as a warning of potentially hazardous exposures.

- The OSHA PEL is listed as 1 ppm.
- The Cal/OSHA PEL is listed as 1 ppm.
- The TLV is listed as 1 ppm.

Note: Published exposure limits designate a skin notation indicating that dermal contact can contribute to the overall exposure.

WARNING: This chemical is known to the State of California to cause cancer.

PENTACHLOROPHENOL (PCP)

PCP is a colorless to white, sand-like solid. It has a pungent odor when hot and is used in making pesticides and fungicides, and as a wood preservative. PCP is a suspected human carcinogen with experimental data. It is a human poison by ingestion and is a skin irritant on contact. PCP is an experimental teratogen with other experimental reproductive effects. Acute poisoning is marked by sweating, weakness, changes in respiration, high fever, chest pain, and urinary output. PCP also causes dermatitis, convulsions, and collapse.

- The OSHA PEL is listed as 0.5 mg/m^3.
- The Cal/OSHA PEL is listed as 0.5 mg/m^3.

- The TLV is listed as 0.5 mg/m^3.

Note: Published exposure limits designate a skin notation indicating that dermal contact can contribute to the overall exposure.

WARNING: This chemical is known to the State of California to cause cancer.

PHENANTHRENE

Phenanthrene is a white, crystalline polynuclear aromatic hydrocarbon. It is moderately toxic by ingestion. It is used in the manufacture of dyes, explosives, and drugs, and in biological research. Phenanthrene can affect humans when breathed in and may be absorbed through the skin. Contact can irritate the skin and eyes. If skin contaminated with Phenanthrene is exposed to sunlight, a rash or skin burn may occur, sometimes with blisters. Breathing phenanthrene can irritate the nose and throat. Phenanthrene may cause a skin allergy. If allergy develops, very low future exposure can cause itching and a skin rash.

- The OSHA PEL is listed as 0.2 mg/m^3 (as coal tar pitch volatiles).
- The Cal/OSHA PEL is listed as 0.2 mg/m^3 (coal tar pitch volatiles, benzene- or cyclohexane-soluble fraction).
- The TLV is listed as 0.2 mg/m^3 (coal tar pitch volatiles, as benzene-soluble aerosol).

PHENOL

Phenol is a human poison by ingestion, is moderately toxic by skin contact, and is a severe eye and skin irritant. It exhibits experimental carcinogenic and neoplastigenic characteristics and is an experimental teratogen. Absorption of phenolic solutions through the skin can cause death by exposure of as little as 64 square inches of skin. Lesser exposures can cause damage to the kidneys, liver, pancreas, and spleen, and edema of the lungs. Ingestion can cause corrosion of the lips, mouth, throat, esophagus, and stomach. Chronic exposures can cause death from liver and kidney damage. Dermatitis resulting from phenol or phenol-containing products is fairly common in industry. Phenol is combustible when exposed to heat, flame or oxidizers, and emits acrid smoke and irritating fumes when heated to decomposition.

The odor threshold is 0.011 ppm. Caution should be used in relying on odor alone as a warning of potentially hazardous exposures.

- The OSHA PEL is listed as 5 ppm.
- The Cal/OSHA PEL is listed as 5 ppm.
- The TLV is listed as 5 ppm.

- Note: Published exposure limits designate a skin notation indicating that dermal contact can contribute to the overall exposure.

POLYCHLORINATED BIPHENYLS (PCBs)

PCBs are a series of technical mixtures consisting of many isomers and compounds that vary from mobile oil liquids to white crystalline solids and hard non-crystalline resins. Technical products vary in composition, in the degree of chlorination, and possibly according to batch. Generally, they are moderately toxic by ingestion, and some are poisons by other routes. Most are suspect human carcinogens and experimental tumorigens, and exhibit experimental reproductive effects. They have two distinct actions on the body: a skin effect (chloracne) and a toxic action on the liver. The higher the chlorine content, the more toxic the PCBs tend to be.

- The OSHA PEL is listed as 0.5 mg/m^3 for 54% chlorine content (as a PCB) and 1.0 mg/m^3 for 42% chlorine content (as a PCB).
- The Cal/OSHA PEL is listed as 0.5 mg/m^3 for 54% chlorine content (as a PCB) and 1.0 mg/m^3 for 42% chlorine content (as a PCB).
- The TLV is listed as 0.5 mg/m^3 for 54% chlorine content (as a PCB) and 1.0 mg/m^3 for 42% chlorine content (as a PCB).

Note: Published exposure limits designate a skin notation indicating that dermal contact can contribute to the overall exposure.

WARNING: This chemical is known to the State of California to cause cancer.

WARNING: This chemical is known to the State of California to cause birth defects, developmental toxicity, and/or reproductive harm.

PYRENE

Pyrene is a colorless or white solid. Pyrene is moderately toxic by ingestion and poisonous by inhalation. It is listed as one of the coal tar pitch volatiles. Exposure to pyrene may cause skin irritation.

- The OSHA PEL is listed as 0.2 mg/m^3 (as coal tar pitch volatiles).
- The Cal/OSHA PEL is listed as 0.2 mg/m^3 (as coal tar pitch volatiles, benzene- or cyclohexane-soluble fraction).
- The TLV is listed as 0.2 mg/m^3 (coal tar pitch volatiles, as benzene-soluble aerosol).

1,1,2,2-TETRACHLOROETHANE (1,1,2,2-TCA)

1,1,2,2-TCA is a colorless liquid with a chloroform-like odor. Initial symptoms resulting from vapor exposure are lacrimation, salivation, and irritation of the eyes, nose and throat. Continued exposure to high concentration results in restlessness, dizziness, nausea, vomiting, and narcosis. Due to its low volatility, narcosis is less severe and much less common in industrial poisoning than other chlorinated hydrocarbons.

It is a suspected carcinogen and is a poison by inhalation and ingestion. 1,1,2,2-TCA is considered the most toxic of the common chlorinated hydrocarbons. The toxic action is chiefly on the liver, where it produces acute yellow atrophy and cirrhosis. Fatty degeneration of the kidneys and heart, hemorrhage into the lungs, and edema of the brain have also been found in fatal exposure cases.

The odor threshold is reportedly 0.21 ppm to 7.3 ppm. Odor threshold CANNOT be used as warning of potentially hazardous exposure.

- The OSHA PEL is listed as 5 ppm.
- The Cal/OSHA PEL is listed as 1 ppm.
- The TLV is listed as 1 ppm.

Note: Published exposure limits designate a skin notation indicating that dermal contact can contribute to the overall exposure.

WARNING: This chemical is known to the State of California to cause cancer.

TETRACHLOROETHYLENE (PCE)

PCE (also known as perchloroethylene) is a colorless liquid with an ether-like odor. Short-term exposure to PCE may cause headaches, nausea, drowsiness, dizziness, incoordination, unconsciousness, irritation of the eyes, nose, and throat, and flushing of the face and neck. In addition, it may cause liver damage with such findings as yellow jaundice and dark urine. Liver damage may become evident several weeks after exposure. Skin contact may create a dry, scaly, itchy dermatitis. PCE is classified by the U.S. Environmental Protection Agency as a Group B2 probable human carcinogen.

The odor threshold is reportedly 4.7 ppm to 6.17 ppm. Caution should be used in relying on odor alone as a warning of potentially hazardous exposures.

- The OSHA PEL is listed as 100 ppm.
- The Cal/OSHA PEL is listed as 25 ppm.
- The TLV is listed as 25 ppm.

TOLUENE

Toluene is a colorless liquid with a benzol-like odor. Toluene can affect humans when breathed in and by passing through the skin. Toluene should be handled as a TERATOGEN—WITH EXTREME CAUTION. It may damage the developing fetus. Contact can irritate the skin and eyes. Breathing toluene can irritate the nose and throat causing coughing and wheezing. Exposure to toluene can affect the nervous system, causing trouble concentrating, headaches, and slowed reflexes. Higher levels can cause humans to feel dizzy, lightheaded, and to lose consciousness. Death may occur. Prolonged contact can cause drying of the skin and a skin rash. Repeated toluene exposure may cause liver, kidney, and brain damage. Toluene is a FLAMMABLE LIQUID and a FIRE HAZARD.

The odor threshold is 0.16 ppm. Caution should be used in relying on odor alone as a warning of potentially hazardous exposures.

- The OSHA PEL is listed as 200 ppm.
- The Cal/OSHA PEL is listed as 50 ppm.
- The TLV is listed as 20 ppm.

Note: Published exposure limits designate a skin notation indicating that dermal contact can contribute to the overall exposure.

WARNING: This chemical is known to the State of California to cause birth defects, developmental toxicity, and/or reproductive harm.

WARNING: This chemical is known to the State of California to cause cancer.

TOXAPHENE (CHLORINATED CAMPHENE)

Toxaphene, also called chlorinated camphene, is a waxy, amber-colored solid with a mild, turpentine-like odor. Toxaphene can affect humans when breathed in and by passing through the skin. Toxaphene should be handled as a CARCINOGEN and a TERATOGEN--WITH EXTREME CAUTION. Contact can irritate the skin and eyes. Breathing toxaphene can irritate the nose and throat. Breathing toxaphene can irritate the lungs, causing coughing and/or shortness of breath. Higher exposures can cause a buildup of fluid in the lungs (pulmonary edema), a medical emergency, with severe shortness of breath. High exposure can affect the nervous system, causing tremors, weakness, dizziness, increased saliva, nausea, vomiting, and convulsions. High or repeated exposures may cause kidney and liver damage. Low blood count (aplastic anemia) is an uncommon but serious reaction to toxaphene. Skin irritation may result from skin contact; moderately toxic through dermal absorption.

- The OSHA PEL is listed as 0.5 mg/m^3.

- The Cal/OSHA PEL is listed as 0.5 mg/m^3.
- The TLV is listed as 0.5 mg/m^3.

Note: Published exposure limits designate a skin notation indicating that dermal contact can contribute to the overall exposure.

WARNING: This chemical is known to the State of California to cause cancer.

1,2,4-TRICHLOROBENZENE (1,2,4-TCB)

1,2,4-Trichlorobenzene (1,2,4-TCB) is a poison by ingestion and is a skin irritant. It is an experimental teratogen, exhibiting experimental reproductive effects. Breathing trichlorobenzenes can irritate the nose, throat, and lungs, causing coughing, wheezing, and/or shortness of breath. Trichlorobenzenes may damage the liver and can affect the kidneys. High or repeated exposure can damage the blood cells, causing anemia. It is combustible when exposed to heat or flame and can react vigorously with oxidizing materials.

The odor threshold is 2.91 ppm. Caution should be used in relying on odor alone as a warning of potentially hazardous exposures.

- No OSHA PEL is listed for 1,2,4-trichlorobenzene.
- The Cal/OSHA PEL is listed as 5 ppm (as a ceiling limit).
- The TLV is listed as 5 ppm (as a ceiling limit).

1,1,1-TRICHLOROETHANE (1,1,1-TCA)

1,1,1-TCA (also known as methyl chloroform) is a colorless liquid with a mild odor, like chloroform. It is moderately toxic by inhalation and skin contact. It is a skin irritant and can cause central nervous system effects such as hallucinations or distorted perceptions, motor activity changes, irritability, and aggression. Gastrointestinal changes such as diarrhea, nausea, or vomiting have also been reported from 1,1,1-TCA exposure at high concentrations. Short-term exposure to 1,1,1-TCA vapor may cause headaches, dizziness, drowsiness, unconsciousness, irregular heart beat, and death. 1,1,1-TCA liquid splashed in the eye causes irritation.

Prolonged inhalation at high concentrations may affect the central nervous system and, if massively inhaled, may cause cardiac arrest. Exposure to vapors may cause mild eye irritation, and prolonged skin contact may produce irritation and dermatitis. Brief exposure to high concentrations of vapor may cause a slight loss of coordination because of its anesthetic properties.

The odor threshold is 22.4 ppm. Caution should be used in relying on odor alone as a warning of potentially hazardous exposures.

- The OSHA PEL is listed as 350 ppm.
- The Cal/OSHA PEL is listed as 350 ppm.
- The TLV is listed as 350 ppm.

1,1,2-TRICHLOROETHANE (1,1,2-TCA)

1,1,2-Trichloroethane (1,1,2-TCA) is a colorless liquid with a sweet odor, like chloroform. Short-term exposure to 1,1,2-TCA may cause irritation of the eyes, skin, throat, and nose, drowsiness, incoordination, unconsciousness, and death. It may also damage the liver and kidneys.

Odor threshold unknown.

- The OSHA PEL is listed as 10 ppm.
- The Cal/OSHA PEL is listed as 10 ppm.
- The TLV is listed as 10 ppm.

Note: Published exposure limits designate a skin notation indicating that dermal contact can contribute to the overall exposure.

- **WARNING: This chemical is known to the State of California to cause cancer.**

TRICHLOROETHYLENE (TCE)

Trichloroethylene (TCE) is a clear, colorless liquid with a characteristic chloroform odor. It is a mildly toxic VOC that is also an experimental carcinogen, tumorigen, and teratogen. It can cause eye effects, hallucinations, and distorted perceptions when inhaled. TCE is an eye and severe skin irritant. Exposure to vapors may cause eye, nose, and throat irritation. Prolonged inhalation of moderate concentrations of vapor may cause headaches and drowsiness. Inhalation of high concentrations may cause narcosis and anesthesia. Severe, acute exposure can result in cardiac failure. Significant chronic exposure may damage the liver and other organs. Prolonged repeated skin contact with the liquid may cause irritation and dermatitis. TCE may cause a skin allergy. If allergy develops, very low future exposure can cause itching and a skin rash. Repeated exposure can cause memory loss, headache, and depression. TCE may damage the liver and kidneys.

The odor threshold is 1.36 ppm. Caution should be used in relying on odor alone as a warning of potentially hazardous exposures.

- The OSHA PEL is listed as 100 ppm.
- The Cal/OSHA PEL is listed as 25 ppm.
- The TLV is listed as 10 ppm.
- **WARNING: This chemical is known to the State of California to cause cancer.**

TRICHLOROFLUOROMETHANE

Synonym and trade names include Fluorotrichloromethane; Freon® 11; Monofluorotrichloromethane; Refrigerant 11; and Trichloromonofluoromethane. Colorless to water-white, nearly odorless liquid or gas (above 75 °F). Exposure routes include inhalation, ingestion, skin, and/or eye contact. Symptoms include incoordination, tremor; dermatitis; cardiac arrhythmias, cardiac arrest; asphyxia; liquid: frostbite. Target organs include the skin, respiratory system, and cardiovascular system. The chemical is incompatible with chemically active metals such as sodium, potassium, calcium, powdered aluminum, zinc, magnesium, and lithium shavings; granular barium.

The odor threshold is 16.3 ppm. The range of accepted odor threshold values is quite broad. Caution should be used in relying on odor alone as a warning of potentially hazardous exposures.

- The OSHA PEL is listed as 1,000 ppm.
- The Cal/OSHA Ceiling Limit is listed as 1,000 ppm.
- The TLV-Ceiling Limit is listed as 1,000 ppm.

TRICHLOROFLUOROMETHANE

Synonym and trade names include Fluorotrichloromethane; Freon® 11; Monofluorotrichloromethane; Refrigerant 11; and Trichloromonofluoromethane. Colorless to water-white, nearly odorless liquid or gas (above 75 °F). Exposure routes include inhalation, ingestion, skin, and/or eye contact. Symptoms include incoordination, tremor; dermatitis; cardiac arrhythmias, cardiac arrest; asphyxia; liquid: frostbite. Target organs include the skin, respiratory system, and cardiovascular system. The chemical is incompatible with chemically active metals such as sodium, potassium, calcium, powdered aluminum, zinc, magnesium, and lithium shavings; granular barium.

The odor threshold is 16.3 ppm. The range of accepted odor threshold values is quite broad. Caution should be used in relying on odor alone as a warning of potentially hazardous exposures.

- The OSHA PEL is listed as 1,000 ppm.

- The Cal/OSHA Ceiling Limit is listed as 1,000 ppm.
- The TLV-Ceiling Limit is listed as 1,000 ppm.

SELENIUM

Selenium is a metal commonly found in rocks and soil. In the environment, selenium is not often found in the pure form. Much of the selenium in rocks is combined with sulfide minerals or with silver, copper, lead, and nickel minerals. Selenium and oxygen combine to form several compounds.

People exposed to very high levels of selenium have reported dizziness, fatigue, irritation, collection of fluid in the lungs and severe bronchitis. Upon contact with skin, selenium compounds have caused rashes, swelling, and pain.

- The OSHA PEL is listed as 0.2 mg/m^3 for selenium compounds, as Se.
- The Cal/OSHA PEL is listed as 0.2 mg/m^3 for selenium compounds, as Se.
- The TLV is listed as 0.2 mg/m^3 for selenium compounds and Se as metal.

SILVER

Silver is a white, metallic solid with no odor. Human systemic effects by ingestion of silver include argyrosis (skin effects). It is a questionable carcinogen with experimental tumorigenic data. It is flammable in the form of dust when exposed to flame or by chemical reaction to strong acids. Exposure to silver can cause discoloration of blue-gray darkening of the eyes, nose, throat, and skin.

- The OSHA PEL is listed as 0.01 mg/m^3 for metal and soluble compounds.
- The Cal/OSHA PEL is listed as 0.01 mg/m^3 for metal and soluble compounds.
- The TLV is listed as 0.1 mg/m^3 for metal, and 0.01 mg/m^3 for soluble compounds.

SODIUM

Sodium is a soft, silvery-white solid. It is used as a laboratory reagent, in organic synthesis, and in the manufacture of sodium compounds. Sodium can affect humans when breathed in. Contact can severely irritate and burn the skin and eyes with possible eye damage. Sodium can irritate the nose and throat. Breathing sodium can irritate the lungs causing coughing and/or shortness of breath. Higher exposures can cause a build-up of fluid in the lungs (pulmonary edema), a medical emergency, with severe shortness of breath. Exposure to sodium can cause vomiting, diarrhea, and stomach pain. Sodium is a flammable and reactive chemical and a fire and explosion hazard.

Wear protective work clothing. Wash thoroughly immediately after exposure to sodium.

No occupational exposure limits have been established for sodium. This does not mean that this substance is not harmful. Safe work practices should always be followed.

THALLIUM

Thallium in solid form exists as thallium sulfate, thallium acetate, and thallium nitrate, all of which are colorless, odorless solids. Soluble thallium compounds are very toxic and cause cumulative intoxication. Many deaths have resulted from swallowing these compounds. Swallowing soluble thallium compounds can cause nausea, vomiting, diarrhea, abdominal pain, and bleeding from the gut. These symptoms are followed by drooping of the eyelids, crossed eyes, weakness, numbness, tingling of the arms and legs, trembling, and pain and tightness of the chest. Hair may fall out after two to three weeks. Severe intoxication may result in prostration, rapid heartbeat, convulsions, and psychosis. Recovery may be complete, but permanent effects such as staggering, visual difficulties, trembling, and mental abnormalities have been reported, and liver and kidney damage have occurred.

- The OSHA PEL is listed as 0.1 mg/m^3 for soluble compounds.
- The Cal/OSHA PEL is listed as 0.1 mg/m^3 for soluble compounds.
- The TLV is listed as 0.1 mg/m^3 for elemental and soluble compounds.

Note: Published exposure limits designate a skin notation indicating that dermal contact can contribute to the overall exposure.

TIN

Tin is a gray, crystalline metallic element. Elemental tin and inorganic tin compounds have low toxicity and are poorly absorbed when ingested. It is a questionable carcinogen with experimental tumorigenic data by implant route.

- The OSHA PEL is listed as 2 mg/m^3 for metal and inorganic compounds (except stannane [SnH_4]) and 0.1 mg/m^3 for organic compounds.
- The Cal/OSHA PEL is listed as 2 mg/m^3 for oxides and inorganic compounds (except SnH_4), and 0.1 mg/m^3 for organic compounds.
- The TLV is listed as 2 mg/m^3 for metal, oxides and inorganic compounds (except SnH_4), and 0.1 mg/m^3 for organic compounds.

Note: Published exposure limits designate a skin notation (for organic forms) indicating that dermal contact can contribute to the overall exposure.

VANADIUM

Vanadium is a gray or white, shiny powder or solid metal. It is used to make steel alloys, other vanadium compounds, X-ray equipment, sulfuric acid, and synthetic rubber.

Vanadium can affect humans when breathed in. Contact can irritate the skin and eyes. Breathing vanadium can irritate the nose, throat, and lungs, causing coughing, wheezing, and/or shortness of breath. High exposure to vanadium can cause nausea, vomiting, abdominal pain, and greenish discoloration of the tongue. Exposure to vanadium can cause headache, tremors, and dizziness. Vanadium may cause an asthma-like allergy. Future exposure can cause asthma attacks with shortness of breath, wheezing, cough, and/or chest tightness. Vanadium may damage the kidneys. Repeated high exposure may cause anemia.

No occupational exposure limits have been established for vanadium and inorganic compounds. This does not mean that this substance is not harmful. Safe work practices should always be followed.

VINYL CHLORIDE

Vinyl chloride is a colorless gas with a sweet odor. It is a known human carcinogen which causes liver and blood tumors. It is a poison by inhalation. It is also a severe skin and eye irritant and can cause skin burns by rapid evaporation and consequent freezing. Chronic exposure has also shown liver injury. Short-term exposure to vinyl chloride can cause dizziness, light-headedness, nausea, dullness of visual and auditory responses, drowsiness, and unconsciousness. Irritation of the skin and eyes can also occur. Skin contact with the liquid can cause frostbite. Vinyl chloride is a HIGHLY FLAMMABLE and REACTIVE chemical and a DANGEROUS FIRE and EXPLOSION HAZARD. Vinyl chloride is classified by the U.S. Environmental Protection Agency as a Group A human carcinogen.

The odor threshold is 0.253 ppm. Caution should be used in relying on odor alone as a warning of potentially hazardous exposures.

- The OSHA PEL is listed as 1 ppm. Refer to 29 CFR 1910.1017 for additional information.
- The Cal/OSHA PEL is listed as 1 ppm. Refer to Section 5210 for additional information.
- The TLV is listed as 1 ppm.

Note: Published exposure limits designate a skin notation indicating that dermal contact can contribute to the overall exposure.

WARNING: This chemical is known to the State of California to cause cancer.

XYLENE

Xylene is a clear, colorless liquid with a strong odor. Xylene is used as solvents, in making drugs, dyes, insecticides, lacquers, and enamels, and in gasoline for airplanes. It exhibits the general chlorinated hydrocarbon central nervous system effects, olfactory (smell) changes, eye irritation, and pulmonary changes. It is a severe skin irritant. There are three isomers: ortho, meta, and para. Exposure to high concentrations of xylene vapor may result in eye and skin irritation. Eye irritation may occur at concentrations of about 200 ppm. Xylenes may damage the developing fetus. Breathing Xylenes can irritate the nose and throat. Xylenes can cause headache, nausea, and vomiting. High levels can cause dizziness, lightheadedness, loss of consciousness, and even death. Prolonged contact with Xylenes can cause dryness and cracking of the skin. Repeated exposure to Xylenes can cause poor memory and concentration. Xylenes can damage the liver and kidneys. Xylenes are flammable liquids and fire hazards.

The odor threshold ranges from 0.324 ppm to 0.851 ppm for the o-, m-, and p-isomers. Caution should be used in relying on odor alone as a warning of potentially hazardous exposures.

- The OSHA PEL is listed as 100 ppm.
- The Cal/OSHA PEL is listed as 100 ppm.
- The TLV is listed as 100 ppm.

ZINC

Zinc is a bluish-white, lustrous metallic element, and zinc oxide is a white fume. Short-term exposure to zinc oxide fume can cause a flu-like illness called metal fume fever. Symptoms of metal fume fever include headache, fever, chills, muscle ache, nausea, vomiting, weakness, and tiredness. Pure zinc powder, dust, and fume is relatively non-toxic to humans by inhalation. However, the inhalation of zinc oxides may cause a sweet taste, throat dryness, cough, weakness, generalized aches, chills, nausea, and vomiting. Zinc is flammable in the form of dust when exposed to heat or flame and may ignite spontaneously in air when dry. It is explosive in the form of dust when reacted with acids.

Zinc (7440-66-6) does not have an OSHA PEL, Cal/OSHA PEL or TLV.

- The OSHA PEL is listed as 15 mg/m^3 for total zinc oxide dust, and 5 mg/m^3 for respirable zinc oxide. The OSHA PEL is listed as 1 mg/m^3 for zinc chloride fume.
- The Cal/OSHA PEL is listed as 10 mg/m^3 for total zinc oxide dust, 5 mg/m^3 for respirable zinc oxide dust and zinc oxide fume, and 1 mg/m^3 for zinc chloride fume.

The TLV is listed as 2 mg/m^3 for respirable zinc oxide, 0.01 mg/m^3 for zinc chromates (as Cr), and 1 mg/m^3 for zinc chloride fume.

APPENDIX B

ARCADIS Forms

LFR an ARCADIS company

AIR MONITORING FORM

page ______ of ______

Date ____________________ *ARCADIS Project No.* ____________________

Project Name ____________________ *Type of Activities* ____________________

Type of PID/FID ____________________ *Serial No.* ____________________

Initial Calibration Reading ____________________ *End-of-Use Calibration Check* ____________________

Calibration Standard/Concentration ____________________

Mini-RAM Serial No. ____________________ *Zeroed in Z-Bag?* ☐ Yes ☐ No

Time	Activity/Location	PID/FID (ppm)	Mini-RAM (mg/m^3)

Name (print) ____________________ *Signature* ____________________

PRE-PLANNING SUBSURFACE INVESTIGATION SAFETY CHECKLIST

Client:	ARCADIS Project #:	Drilling Company:
Client Address:	Site Address:	Drilling Co Address:
Client Contact:	Site Contact:	Drilling Co. Contact:
Client Tel #:	Contact tel #:	Drilling Co. tel #:
Underground Service Alert Tel #:	Underground Service Alert Ticket #:	
Underground Service Alert Clearance Date & Time:	Underground Service Alert Expiration date:	
Utilities marked by Underground Service Alert		
Other Agencies contacted (i.e., local water, sewer):		
Underground Utility Locator (If GPR, verify subcontractor will provide scan records):		

	YES	NO	N/A
Has property owner/operator been consulted regarding location of drill/excavation points?	☐	☐	☐
Has excavation/subsurface investigation area has been marked?	☐	☐	☐
Have secondary fall-back locations been marked at Site?	☐	☐	☐
Positive response from all known owner/operators of subsurface installations received?	☐	☐	☐
Have you addressed underground utility issue? (USA Alert, Town dept., Private Utility locator)	☐	☐	☐
Have you requested "As-Built" plans from Site Owner/Management?	☐	☐	☐
Have you conducted a Site Inspection to identify subsurface utility indicators?	☐	☐	☐
Have site utilities or AST/UST location been identified on site?	☐	☐	☐
Natural gas, oil, steam	☐	☐	☐
Communication	☐	☐	☐
Sewer/Septic System (on or off site)	☐	☐	☐
Water (public or private)	☐	☐	☐
Electricity	☐	☐	☐
AST or UST (describe:)	☐	☐	☐
Other (steam, sprinkler, etc.)	☐	☐	☐
Have you marked where utilities enter building on site plan?	☐	☐	☐

		YES	NO	N/A
Reasonable efforts will be made to identify the location(s) of underground utilities (e.g., pipes, electrical conductors, fuel lines, and water and sewer lines) before soil intrusive work is performed in accordance with local requirements. The following three actions (lines of evidence) are required for the utility location process (If one or more is not available, see below):	Contact the State underground utility notification authority (e.g., USA, Dig Alert, Blue Stake, One Call).	☐	☐	☐
	Obtain a detailed site utility plan drawn to scale, preferably an "as-built" plan	☐	☐	☐
	Conduct a detailed visual site inspection	☐	☐	☐
In the event that one or more of the above lines of evidence cannot be conducted, or if the accuracy of utility location is questionable, a minimum of one additional line of evidence must be used as appropriate or suitable to the conditions. Examples of additional lines of evidence include but are not limited to:	Private utility locating service	☐	☐	☐
	Research of state, county or municipal utility records and maps including computer drawn maps or geographical information systems (GIS)	☐	☐	☐
	Contact with the utility provider to obtain their utility location records	☐	☐	☐
	Hand augering or digging	☐	☐	☐
	Hydro-knife	☐	☐	☐
	Air-knife	☐	☐	☐
	Radio Frequency Detector (RFD)	☐	☐	☐
	Ground Penetrating Radar (GPR)	☐	☐	☐
	Any other method that may give ample evidence of the presence or location of subgrade utilities	☐	☐	☐

Note: For any "No" responses, please review and address prior to conducting any subsurface investigation or excavation activities

PRE-PLANNING SUBSURFACE INVESTIGATION SAFETY CHECKLIST

	YES	NO	N/A
Have special site requirements been identified and addressed?	☐	☐	☐
Notifications	☐	☐	☐
Permits	☐	☐	☐
Police Detail	☐	☐	☐
Transportation Dept. Detail	☐	☐	☐
Traffic Management Plan required? (e.g., State/Count Highway Dept, Local, etc.)	☐	☐	☐
Height limitations been addressed?	☐	☐	☐
Other ( )	☐	☐	☐
Have you addressed Site building(s) impact issues (occupant access, excavation engineering, etc.)?	☐	☐	☐
Has HSP been developed and reviewed?	☐	☐	☐
Has HSP, Site Plan, directions to Site and Scope of Work been submitted to Subcontractor(s)?	☐	☐	☐
Has Subcontractor made provisions for its own site-specific HSP?	☐	☐	☐
Have you addressed special PPE or work restriction requirements?	☐	☐	☐

*Explain here:*____

*Comments:*____

Completed By: ____________________ *Signature:* ________________________ *Date:*____________________

Note: For any "No" responses, please review and address prior to conducting any subsurface investigation or excavation activities

LFR an ARCADIS company

SITE SAFETY CHECKLIST

Project Name: ______________________ *ARCADIS Project No.* ______________________

Project Activities: ____

	YES	NO	N/A
HSP Review/Meeting			
Written Health and Safety Plan (HSP) is on site	☐	☐	☐
Addenda to the HSP are documented on site	☐	☐	☐
Information in the HSP matches conditions and activities at the site	☐	☐	☐
HSP has been read and signed by all site personnel, including visitors	☐	☐	☐
Daily tailgate safety meetings have been held and documented	☐	☐	☐
Emergency Procedures			
Established emergency communication procedure (cell phone, nearest pay phone)	☐	☐	☐
Emergency and first aid equipment is on site as described in the HSP	☐	☐	☐
Accessible phone is readily available for emergency use	☐	☐	☐
Tools/Equipment			
Air monitoring equipment has been calibrated daily	☐	☐	☐
Drinking water is readily available	☐	☐	☐
Tools and equipment are in good working order	☐	☐	☐
Extension cords are grounded and protected from water and vehicle traffic	☐	☐	☐
Personal Protective Equipment/Medical			
Site personnel have appropriate training and medical clearance	☐	☐	☐
Decontamination procedures are followed and match the requirements of the HSP	☐	☐	☐
Decontamination stations (including hand/face wash) are set up and used	☐	☐	☐
Personal protective equipment used matches HSP requirements	☐	☐	☐
Hearing protection used where appropriate	☐	☐	☐
Respirators are properly cleaned and stored	☐	☐	☐
Work Zone			
Site zones are set up and observed where appropriate (EZ, CRZ, and SZ)	☐	☐	☐
Air monitoring is performed and documented as described in the HSP	☐	☐	☐
Access to the work area is limited to authorized personnel	☐	☐	☐
Traffic control measures have been implemented (barricades/traffic cones)	☐	☐	☐
Overhead utilities do not present a hazard to field equipment/personnel	☐	☐	☐
Trenches and excavations are in compliance with federal, state, and local safety requirements before worker entry	☐	☐	☐
Spoils are placed no closer than 2 feet from the edge of an excavation	☐	☐	☐
Proper drum and material handling techniques are used	☐	☐	☐
Drums and waste containers are labeled appropriately	☐	☐	☐

Note: For any "No" responses, please review and address prior to conducting any subsurface investigation or excavation activities

LFR an ARCADIS company

SITE SAFETY CHECKLIST

Subsurface Investigation		YES	NO	N/A
Have you reviewed the Pre-Planning Subsurface Investigation Safety Checklist?		☐	☐	☐
Have Utilities been marked out:	*Pink: temporary survey marking*	☐	☐	☐
	Yellow: natural gas, oil, steam	☐	☐	☐
	Orange: communication	☐	☐	☐
	Green: sewer	☐	☐	☐
*If not, **DO NOT** Drill or Excavate.*	*Blue: water*	☐	☐	☐
Contact the Project Manager	*Red: electric*	☐	☐	☐
and DigSafe	*White: proposed boring locations*	☐	☐	☐
Have you photographed site marking prior to subsurface investigation?		☐	☐	☐
Traffic control measures have been implemented (barricades/traffic cones)		☐	☐	☐
Overhead utilities do not present a hazard to field equipment/personnel (Must be 10 feet away from overhead utility lines (<50 kilovolts [kV]. Add 4 inches more distance for each 10 kV over 50 kV)		☐	☐	☐
Has drilling subcontractor verified that drill rig is safe to operate? (cable/rope, kill switches, gauges/levers, and safety devices are operational & in good condition)		☐	☐	☐
Does Subcontractor have enough supplies to complete anticipated activities?		☐	☐	☐
If in remote area, is someone on ARCADIS staff or drilling staff CPR/First Aid trained?		☐	☐	☐
If not, have emergency medical service arrangements been made?		☐	☐	☐
Recommended distance guidelines for field activities				
Is planned subsurface work at least 30 inches away from marked subsurface utility?		☐	☐	☐

(If not, an additional line of evidence must be used. Refer to current ARCADIS Utility Locate Policy ARCHSFS019)

Notes (All "no" answers must be addressed and corrected immediately. Note additional health and safety observations here):

____

____

____

____

____

____

____

____

____

Completed By: ____________________ *Signature:* ________________________ *Date:* ____________________

LFR an ARCADIS company

DAILY TAILGATE SAFETY MEETING FORM

Date __________ *Time* ____________ ____________ *ARCADIS Project No.* ______________________

Project Name ______________________________ *Specific Location* ______________________

Type of Work ____

Chemicals Present ____

SAFETY TOPICS DISCUSSED

Protective Clothing/Equipment ____

____

Hazards of Chemicals Present ____

____

Physical Hazards ____

____

Special Hazards ____

____

Other Topics ____

____

ATTENDEES

Name (please print)	***Signature***

Completed By: ______________________ *Signature:* ______________________ *Date:* ______________

ARCADIS

Incident / Near-Miss Investigation Process

Employee/Witness Report Form (Form A)

Employee Reporting Requirements (see Form B, Section B1 for definitions of Level of Incident). The involved employee or subcontractor reports the incident, completes this form and provides to ARCADIS Supervisor ASAP but no later than the following timelines: **Level 1**: By the next business day (*Can also be reported via the Near Miss Reporting Hotline: 866-242-4304*); **Level 2**: Within the same business day; **Level 3:** Immediately, but no later than 2 hours. Other ARCADIS employees who witness the incident, as well as non-ARCADIS witnesses may also be asked to complete this form. If more space is necessary for any section, please use a separate sheet and attach.

Supervisor Reporting Requirements, see Form B, Section B2.

Date of Incident:	Time of Event/Exposure:	Office:
Date First Reported:	To whom reported:	

Project Information

Project Name:	Project #
Project Location:	Project Manager

Employee

Employees Full Name: ☐ M ☐ F	Employee Number:
Time Employee began work:	Contact Number:
Employment Status: ☐ Regular ☐ Part Time	How long in present job?
Business Practice:	

Personnel immediately involved in or witness to incident

Name	Employer	Role at Site

Description of Incident / Near Miss: (Describe what happened and how it happened.) ☐ **Near Miss** ☐ **Incident**

Where did the incident / near miss occur? (number, street, city, state, zip):

Employee's specific activity before and at the time of the incident / near miss (Provided by employee/witness):

Equipment, materials, or chemicals the employee was using when the incident / near miss occurred:

Injury or Illness or Near-Miss Information: ☐ **N/A** **Was WorkCare Called:** ☐ **No** ☐ **Yes**

Was treatment was given away from the injury site: ☐ No ☐ Yes, if yes:

Name of Facility or Physician:	Address:
Treated in Emergency/Urgent Care Room: ☐ No ☐ Yes	Overnight Hospitalization: ☐ No ☐ Yes,
To whom reported:	Other workers injured / made ill in this event? ☐ Yes ☐ No
Fatality: ☐ Yes ☐ No	Describe the specific injury or illness:

Motor Vehicle Accident (MVA) ☐ **N/A**

Company Vehicle? ☐ Yes ☐ No	Leased/Rented Vehicle? ☐ Yes ☐ No	Personal Vehicle? ☐ Yes ☐ No
Seat Belt Worn? ☐Yes ☐No ☐NA	Lease/Rental Company:	
Anyone else injured? ☐ Yes ☐ No	Cell Phone in use at time of accident ☐ Yes ☐ No	

Signatures

Form Completed By (print/sign):	Date:
Employee Involved (print/sign):	Date:

ARCADIS

Incident / Near-Miss Investigation Process
Investigation Report Form *(Form B)*

Section B1 – Levels of Incidents Definitions:

Level 1: First Aid, "less significant" near miss, and asset damage (includes MVAs)
Level 2: Professional Medical Advice or Treatment (Includes incidents in which WorkCare is called)
Level 3: Overnight hospitalization, fatality, or "significant near miss"

Section B2 – Levels of Incidents and Supervisor Reporting Requirements:

Supervisor reports to the Regional H&S Manager and client (as required) ASAP but no later than outlined below:
Level 1 – No later than the end of the same business day in which the incident was reported
Level 2 – By the end of the same business day in which the incident was reported
Level 3 – Immediately, but no later than 2 hours from the initial report

Section B3 – Investigation Team Members/Signed Initials

Name	Job Title	Date

Section B4 – Investigation Team Decription of Incident

Incident Level Determination (Final determination made by Investigative Team) Level 1 ☐ Level 2 ☐ Level 3 ☐

Estimated Cost of Incident (including labor and expenses): $

Section B5 – Additional Motor Vehicle (MVA) Accident Information ☐ N/A

Vehicle Towed?	☐ Yes ☐ No	Other Vehicle Towed?	☐ Yes ☐ No	# Vehicles Towed:		# of Injuries:

Section B6 – Spill ☐ N/A

Material Spilled:	Quantity:	Source:
Agency Notifications:		

Section B7 – Third Party Incidents ☐ N/A

Name of Owner:		Address:	Telephone:
Description of Damage/Injury:			
Witness Name:		Address:	Telephone:
Witness Name:		Address:	Telephone:

#	Section B8 – Contributing Factors: Conclusion (Describe in Detail Why Incident / Near Miss Occurred)
1	
2	
3	
4	
5	

Incident / Near-Miss Investigation Process
Investigation Report Form *(Form B)*

Section B9 – Root Cause(s) Analysis (RCA)-the Causative Factors

Personal Factors:

1. Lack of skill or knowledge (Worker does not understand task procedures or acceptable practices and/or have proficiency in task).
2. Doing the job according to procedures or acceptable practices takes more time/effort.
3. Short-cutting procedures or acceptable practices are positively reinforced or tolerated.
4. In past, did not follow procedures or acceptable practices and no incident occurred (injury, product quality incident, equipment damage, regulatory assessment or production delay).

Job Factors:

5. Lack of or inadequate procedures (changing procedures across organization outside of supervisor, workers control).
6. Inadequate communication of expectations regarding procedures or acceptable practices.
7. Inadequate tools or equipment (available, operable & safely maintained; proper task & workplace design).

External Factors:

8. An uncontrollable factor cause or contribute to the incident or questionable work activity or condition.

Section B10 – Root Cause(s) Analysis (RCA)-the Preventative Actions

#	RCA #	Solution(s): How to Prevent Incident / Near Miss From Reoccurring	Person Responsible	Due Date	Closure Date
1					
2					
3					
4					
5					

Section B11 – Results of Solution Verification and Validation

Reviewed By

Name/Initials	Job Title	Date

Additional Comments:

Page ___ of ___

LFR **FLASH REPORT**

INSTRUCTIONS

Within 2 hours of notification of an Incident, Supervisor/Manager must e-mail a brief Flash Report detailing Incident to Ops Mgr, Regional Mgr, Dir of H&S, and Corp Admin; and, Client Director and Project Manager, as applicable.

From: ______________________ Date: ______________________

Org: ______________________

Date of Incident: ______________________

Location of Incident: ______________________

Project No.: ______________________

Client: ______________________

LFR Staff involved: ______________________

Subcontractor(s) and type of service providing: ______________________

Summary of Incident: ______________________

APPENDIX C

Hospital Route Map


MAPQUEST.
0
3200 m
9600 ft
Lewis Rd
E Olsen Rd
101
23
Newbury Park
Thousand Oaks
Oak Park
West Hills
Calabasas
Westlake Village
101
Agoura
Agoura Hills
Calabasas Highlands
Kanan Rd
Cornell
Las Virgenes Rd
Point Mugu State Park
Monte Nido
Kanan Dume Rd
Pacific Coast Hwy
Pacific Coast Hwy
Kanan Dume Rd
Malibu
© 2009 MapQuest Inc.
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APPENDIX D

Site Diagram


PROJECT SCOPE
1 New Parking
2 Interim Housing
3 New I.T. Room
4 New Ramp & Stairs
5 Secure Perimeter
6 Relocated Equestrian Trail
7 Storm Water Management System
8 Fill Site
9 New Administration/Library/ Classroom Building
10 Renovated Classroom Building
11 New Student Drop-Off
12 Middle School Quad
13 High School Quad
14 Trac Circle & Modied Parking
15 Modi ed Sta /Visitor Parking
16 Secondary Treatment System
17 New Bleachers
18 New Field Lights
19 New Tennis Courts
20 New Arti cial Turf
Merritt Drive
Morning View Drive
N
0 100 500
0 300 feet
HMC
2009.06.09
Malibu Middle and High School
Campus Improvements Project
Approx. Aea of Construction: 1,007,300 SF (23.1 Ares)

APPENDIX E

HSP Addendum Log

LFR an ARCADIS company

Addendum Page

This form should be completed for new tasks associated with the project. The project manager and/or task manager should review the initial project hazard analysis with the new task information. JSAs should be developed for any new tasks and attached as well.

Review the addendum with all site staff, including subcontractors, during the daily tailgate briefing, and complete the tailgate briefing form as required. Attach a copy of the addendum to all copies of the HASP including the site copy, and log in the Addendum Log Table on the next page.

Addendum Number:	________________	Project Number:	________________
Date of Changed Conditions:	________________	Date of Addendum:	________________

Description of Change that Results in Modifications to HASP:

Signed:	________________ Project Manager	Signed:	________________ Site Safety Officer
Signed:	________________ H&S Plan Writer	Signed:	________________ H&S Plan Reviewer

Addendum Log Table

Addendums are to be added to every copy of the HASP, and logged on Table E-1 to verify that all copies of the HASP are current:

Table E-1 Addendum Log Table

Addendum Number	Date of Addendum	Reason for Addendum	Person Completing Addendum
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			

Make additional copies of this form as necessary.

APPENDIX F

Job Safety Analysis

ARCADIS

JOB SAFETY ANALYSIS

SECTION 1			
JSA Type: Field Work	JSA #	New ✖ Revised	Date: April 6, 2010
Work Type: Environmental - Excavation	Work Activity: Oversight of Soil Excavation and Soil Sampling		

SECTION 2					
Development Team	**Position/Title**	**Date**	**Reviewed By**	**Position/Title**	**Date**
Dana Brodie	Staff Geologist	3-19-09	Tony Tremblay	Director H&S	3-20-09
			Aaron Hook	Staff Scientist	4-6-10

SECTION 3			
Job Steps	**Potential Hazard(s)**	**Critical Action(s)**	**H&S Policy, HASP and/or JSA Reference**
Evaluate work area and utility clearance	Overhead and underground utilities	Follow the ARCADIS Utility Location H&S Procedure (including contacting USA and contracting with a private utility locator), and complete the Underground/Overhead Utility Checklist. Use Site contacts to assist with utility location, if available.	ARCHSFS019
Gather necessary PPE and appropriate equipment (air monitoring, applicable logs, sampling equipment, etc.), mobilize to the Site	Lifting hazards and back strain. Not brining necessary PPE for the task. Traffic hazards and accidents, automotive trouble and breakdowns	Use proper lifting techniques, request assistance when lifting heavy equipment. Use defensive driving or Smith Driving techniques when driving to and from the Site.	
Driving vehicle on site	Potential vehicular damage due to debris on site. Potential pedestrians or obstructions. Driving near heavy equipment or excavation	Be aware of surroundings. Park vehicle in a safe place. Ensure safe clearance from heavy equipment or excavation (>10 feet from any extendable limit of equipment and/or excavation). Avoid parking where transportation trucks are loading or where soil will be stockpiled. Place safety cone at front and rear of vehicle to reinforce vehicle walk-around prior to moving	
Start up excavation equipment	Malfunctioning or damaged equipment	Require the subcontractor to conduct a safety inspection of all heavy equipment prior to use each day. Review pertinent operating information with the subcontractor (i.e. hand signals, site traffic flow, equipment kill switches, etc.)	

Excavation of soils	Stockpiled soil, staged construction materials, housekeeping of tools and equipment. Open excavation. Movement of heavy equipment. Dust.	Wear appropriate PPE. Use caution where walking to avoid slips, trips, or falls. Maintain work area to minimize clutter near the excavation including placing excavated material several feet away from the edge of the excavation. Maintain a 3 foot distance from the edge of the excavation. Excavations should not be entered unless it has been certified as safe by a competent person. Implement and heed proper safety barriers (barricades, cones, caution tape). Conduct excavation inspections daily and after significant weather events. Maintain a safe distance from excavation equipment. No personnel are permitted to stand underneath suspended loads. Perform air monitoring per HASP. Ensure equipment operators are aware of overhead/underground utilities. Ensure all stockpiled soil is properly confined. Avoid walking in areas where hazardous materials are present. Control dusts using wetting methods or other approved engineering control.	
Traffic control for transportation trucks or equipment operators	Excavators and transportation truck drivers operating in a congested area	Inform drivers and operators of the appropriate entrances for the Site. Limit speed. Use traffic cones and signs as needed to direct traffic during excavation or loading activities.	
Stockpile and confirmation soil sampling	Contact with potentially hazardous material. Sampling in excavation.	Use appropriate PPE (gloves, etc.). Certify that the excavation is safe before entering. Use ladders as necessary to enter the excavation.	
Backfilling and compaction of excavation areas	Heavy equipment and trucks delivering backfill material. Slips and falls on uneven or wet surfaces. Dust from backfilling.	Maintain a safe distance from excavation during backfilling and compaction activities. Wear appropriate PPE. Control dusts through wetting or other approved engineering control. Perform air monitoring per HASP.	

SECTION 4

Personal Protective Equipment (PPE):

X Hard hat	X Hearing protection	X Gloves:
		☐ Coveralls:
X Safety glasses / goggles	☐ Face shield	X Other: Traffic rated safety vest
X Steel-toed boots	☐ Leather gloves	

Required and/or Recommended Equipment and Supplies:

First aid kit
HASP
Eyewash bottle
Fire extinguisher
Cell phone
Daily Excavation Checklist
Drums
Camera
Coolers, sample bottles, and ice
Sampling device (hand auger or trowel)
Rain gear
Sunscreen
Cones and caution tape

JOB SAFETY ANALYSIS

SECTION 1			
JSA Type: Field Work	JSA #	X New ☐ Revised	Date: 10-21-09
Work Type: Environmental – Soil and Soil Vapor Sampling	Work Activity: Soil and soil vapor sampling using direct push drilling rig		

SECTION 2					
Development Team	**Position/Title**	**Date**	**Reviewed By**	**Position/Title**	**Date**
Dana Brodie	Staff Geologist	10-21-09			

SECTION 3			
Job Steps	**Potential Hazard(s)**	**Critical Action(s)**	**H&S Policy, HASP and/or JSA Reference**
Evaluate work area and utility clearance	Overhead and underground utilities	Follow the ARCADIS Utility Location H&S Procedure (including contacting USA and contracting with a private utility locator), and complete the Underground/Overhead Utility Checklist. Use Site contacts to assist with utility location, if available.	ARCHSFS019
Gather necessary PPE and appropriate equipment (air monitoring, applicable logs, sampling equipment, etc.), mobilize to the Site	Lifting hazards and back strain. Not brining necessary PPE for the task. Traffic hazards and accidents, automotive trouble and breakdowns	Use proper lifting techniques, request assistance when lifting heavy equipment. Use defensive driving or Smith Driving techniques when driving to and from the Site.	
Start up drilling equipment	Malfunctioning or damaged equipment	Wear appropriate PPE (safety gloves, hard hat, safety glasses, ear plugs, etc.) Require the subcontractor to conduct a safety inspection of all heavy equipment/drill rig prior to use each day. Review pertinent operating information with the subcontractor (i.e. hand signals, site traffic flow, equipment kill switches, etc.)	
Direct push for soil-gas implant installation and soil sampling	Contact with potentially hazardous material. Moving parts and heavy equipment. Noise. May be in active area of school. Hand tools	Wear appropriate PPE (gloves, ear plugs, hard hat, safety glasses, etc.). Use caution where walking to avoid slips, trips, or falls. Maintain work area to minimize clutter near the borings. Implement and heed proper safety barriers (barricades, cones, caution tape). Maintain a safe distance from drilling equipment. Ensure equipment operators are aware of overhead/underground utilities. Be aware of activities in vicinity, including moving vehicles, school activities, or students/faculty. Use caution when using hand tools.	

Soil-gas sample collection and removal of implant	May be in active area of school.	Wear appropriate PPE. Be aware of surrounding activities prior to soil-gas collection. If in an active area, have someone watch for moving vehicles or students/faculty near boring location while sampling.	
Backfilling and surface patching of borings	May be in active area of school. Lifting hazards and back strain.	Wear appropriate PPE. Be aware of activity in vicinity, including moving vehicles and students/faculty.	

SECTION 4		
Personal Protective Equipment (PPE):		
X Hard hat	X Hearing protection	X Gloves:
		☐ Coveralls:
X Safety glasses / goggles	☐ Face shield	X Other: Traffic rated safety vest
	☐ Leather gloves	
X Steel-toed boots		

Required and/or Recommended Equipment and Supplies:

First aid kit

HASP

Eyewash bottle

Fire extinguisher

Cell phone

Daily Excavation Checklist

Drums

Camera

Coolers, sample bottles, and ice

Sampling device (hand auger or trowel)

Rain gear/Sunscreen

Cones and caution tape

APPENDIX G

Hazardous Materials Shipment Form

LFR an ARCADIS company

Hazardous Materials Transportation Form

	Vehicle (place X in box)	Type (pick-up, car, box truck, etc.)
Personal		
Rental		
ARCADIS owned/leased		
Government owned		
Trailer		

Materials Transported	Quantity	Storage/Transport Container

List Trained Drivers:

____

____

Hazardous Materials Shipment Form

Material Description and Proper Shipping Name (per DOT or IATA)	Shipment Quantity	DOT Hazard Classification	Shipment Method (air/ground)

List Shipper (i.e., who we are offering the shipment to):

List Trained Employee(s):

ARCADIS

Appendix E

Quality Assurance Project Plan

Quality Assurance Project Plan
for Removal Action Work Plan
Malibu Middle and High School
Campus Improvements Project
30215 Morning View Drive
Malibu, California

August 5, 2010
CM011144.0003

Prepared for
Santa Monica-Malibu Unified School District
1651 Sixteenth Street
Santa Monica, California 90404-3891

Prepared by
ARCADIS U.S., Inc.
3150 Bristol Street, Suite 250
Costa Mesa, California 92626

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APPENDICES

ACRONYMS AND ABBREVIATIONS

μg/kg	micrograms per kilogram, approximately equivalent to parts per billion
μg/l	micrograms per liter, approximately equivalent to parts per billion
CL	Control Limits
COC	Compound of Concern
cy	cubic yards
PLS	Positive Lab Service
CLP	Contract Laboratory Program
DHS	California Department of Health Services
DQOs	data-quality objectives
DTSC	California Environmental Protection Agency, Department of Toxic Substances Control
ELAP	Environmental Laboratory Accreditation Program
EOA	Environmental Oversight Agreement
HSP	Health and Safety Plan
IDL	instrument detection limit
LCL	lower control limits
LFR	LFR an Arcadis Company
LWL	lower warning limits
MDL	method detection limit
mg/kg	milligrams per kilogram, approximately equivalent to parts per million
mg/l	milligrams per liter, approximately equivalent to parts per million
mg/m^3	milligrams per cubic meter
mini-RAM	miniature real-time aerosol monitor
NFA	No Further Action
OCP	organochlorine pesticide
PCG	Preliminary Cleanup Goal
PQL	practical quantitation limit
QA	Quality Assurance
QA/QC	Quality Assurance/Quality Control
QAPP	Quality Assurance Project Plan
QC	Quality Control
RAW	Removal Action Work Plan
RPD	relative percent differences
SMMUSD	Santa Monica Malibu Unified School District

SOP	standard operating procedures
SPR	spike percent recovery
SQL	sample quantitation limit
U.S. EPA	United States Environmental Protection Agency
UCL	upper control limits
UWL	upper warning limits

CERTIFICATION

ARCADIS U.S., Inc. has prepared this Quality Assurance Project Plan (QAPP) on behalf of the Santa Monica Malibu Unified School District in a manner consistent with the level of care and skill ordinarily exercised by professional geologists and environmental scientists. This QAPP was prepared under the technical direction of the undersigned California Professional Geologist.

August 5, 2010

Stephanie M. Gentry
Senior Toxicologist

Date

August 5, 2010

Martin E. Hamann, P.G., C.HG, REAII
Principal Hydrogeologist
California Professional Geologist (5482)

Date

REGISTERED GEOLOGIST
MARTIN E. HAMANN
No. 203
CERTIFIED HYDROGEOLOGIST
STATE OF CALIFORNIA

* A professional geologist's certification of conditions comprises a declaration of his or her professional judgment. It does not constitute a warranty or guarantee, expressed or implied, nor does it relieve any other party of its responsibility to abide by contract documents, applicable codes, standards, regulations, and ordinances.

1.0 INTRODUCTION

This Quality Assurance Project Plan (QAPP) has been prepared by ARCADIS U.S., Inc. (formerly LFR an ARCADIS Company, now fully integrated and known as ARCADIS) on behalf of the Santa Monica Malibu Unified School District (SMMUSD or “the District”) for the proposed Removal Action Work Plan (RAW) for the Malibu Middle and High School Campus Improvements project located at 30215 Morning View Drive in Malibu, California (“the Site”; Figure 1).

The purpose of the QAPP is to describe the quality assurance (QA) and quality control (QC) methods that will be employed during the removal action at the Site as described in the RAW prepared by ARCADIS.

Implementation of the RAW includes excavation and off site disposal of approximately 1,200 in-place cubic yards (cy) of soil affected with, alpha-chlordane, gamma-chlordane, technical-chlordane (pesticides) and polychlorinated biphenyls (PCBs). This affected soil will be excavated for off-site disposal during the removal action at the Site as described in the RAW. This work is anticipated to take up to 20 working days to complete.

1.1 Site Description

Malibu Middle and High School is located 30215 Morning View Drive, Malibu, California. The overall project area for environmental assessment activities included 20 proposed improvement areas within the boundaries of the Malibu Middle and High School campus. The following areas within the campus were defined as areas of concern due to the presence of RECs within or adjacent to their boundaries:

- Areas 9, 10, 11, and 12 consist of (or are adjacent to) existing structures referred to as Buildings A, B, and E (REC #1).

- Areas 3 and 13 are currently developed as an open quad area for students (REC #1 and REC #2).

- Areas 14 and 15 consist of vehicle parking areas (REC #2 and REC #3).

- Septic system 1 collects wastewater from the buildings that contain the woodshop and photography laboratory and drains to the seepage pits (1-1, 1-2, 2-1, and 2-2) located in Area 15 (GeoConcepts 2009; REC #3).

- Septic system 3 collects wastewater from Building D where the chemistry laboratories and chemical storeroom are located. This septic system drains to a set of six seepage pits (3-1 thru 3-6) located adjacent to Area 9 (GeoConcepts ; REC #3).

For the purposes of the RAW, the Site consists of one area of pesticide-affected soils near and 8 areas of PCB-affected soils totaling approximately 1,200 cubic yards (yds3) near and, or within improvement Areas 3, 9-13.

A detailed site history, historical soil sampling plan, analytical result summary, compounds of concern (COC), and conclusions and recommendations associated with previous site activities can be found in ARCADIS's (formerly LFR an Arcadis Company) Phase I Environmental Site Assessment (ESA; LFR 2009a), Preliminary Environmental Assessment Workplan (PEA Workplan; LFR 2009c), and Preliminary Environmental Assessment Report (PEA; ARCADIS 2010).

1.2 Background

Consistent with CDE requirements for school site expansion and modernization projects, a Phase I ESA (LFR 2009a), a PEA Workplan (LFR 2009c), and PEA (ARCADIS 2010) were conducted for the Site. The purpose of the Phase I ESA was to establish whether a release or threatened release of hazardous substances posing a threat to human health or the environment exists at the Site. The purpose of the PEA Workplan was to develop a soil sampling plan to define the extent of the affected soil. The PEA sampling locations are shown on Figure 6 of the PEA.

The PEA results indicated that soil quality at the Site has been affected by on-site releases of pesticides and PCBs.

Accordingly, a RAW has been developed to mitigate human health and environmental risks and hazards; its scope of work includes excavation, transport, and disposal of affected soil at off-site facilities, collecting and analyzing waste characterization samples, and collecting and analyzing confirmation samples. The areas of the proposed removal action include areas detailed in Section 3.1 of the RAW. The Site boundaries are shown on Figures 3a and 3b of the RAW.

1.3 Purpose and Objectives

The purpose of the QAPP is to identify the methods to be employed to establish technical accuracy, precision, and validity of data generated at the Site. This QAPP details procedures to be used during implementation of the RAW to provide for the collection of representative data and appropriate completion of the remedial activities at the Site; it can be divided into two broad components: QA and QC.

The QA program is designed to ensure that data precision, accuracy, completeness, comparability, and representatives meet defined data-quality objectives (DQOs). Quality control is the routine application of procedures for achieving prescribed performance standards (in monitoring and measurement) during project planning, field activities, sample analysis, sample and data handling, and data evaluation and interpretation.

The principal rationale for conducting the confirmation sampling associated with the RAW is to demonstrate that the COCs have been removed from the Site and to make the Site suitable for school site expansion. The data collected will be further used to assess the relative threat associated with residual levels of hazardous substances in the soil following the soil removal (if any). The confirmation sampling program has been designed to include sufficient data through adequate numbers of samples, a comprehensive analytical program, and proper quality control procedures. The procedures presented in this QAPP will establish the quality of the data used for this purpose.

Decisions will be based on data obtained from the sampling and analysis program. It is intended that data collected through implementation of this QAPP will satisfy local, state, and federal data quality requirements. These data may be used to characterize the nature and extent of residual concentrations of contaminants that remain following excavation, support additional risk assessment that may be needed, and support the No Further Action (NFA) determination that is required for additional school development.

However, if the evaluation indicates unacceptable risk of exposure, then the data can be used by SMMUSD for consideration of further action.

1.4 Informational Sources

This QAPP has been prepared using information from the following United States Environmental Protection Agency (U.S. EPA) documents:

- Methods for Chemical Analyses of Water and Waste, EPA 600/4-79-020, revised November 1986
- Interim Guidelines and Specifications for Preparing Quality-Assurance Project Plans, QAMS-005/80, January 1986
- Guidance for Preparation of Combined Work/Quality-Assurance Project Plans for Environmental Monitoring, OWRS QA-1, May 1984
- Laboratory Data Validation Functional Guidelines for Evaluating Organic Analyses, February 1988 (Draft)
- Laboratory Data Validation Functional Guidelines for Evaluating Inorganic Analyses, July 1988 (Draft)
- Data-Quality Objectives for Remedial Response Activities, EPA 540/G-87/003A, March 1987
- Test Methods for Evaluating Solid Waste, EPA SW-846, Third Edition, November 1986
- Laboratory Documentation Requirements for Data Validation, EPA 9QA-07-90, 1990

- Test Methods for Evaluating Solid Waste, Physical/Chemical Methods, SW-846, Third Edition, 1996
- U.S. EPA Guidance for Quality Assurance Project Plans, EPA QA/G-5, 1998
- Guidance for the Data Quality Objectives Process, EPA QA/G-4, 2000
- U.S. EPA Requirements for Quality Assurance Project Plans, EPA QA/R-5, 2001
- Contract Laboratory Program National Functional Guidelines for Inorganic Data Review, EPA 540/R-01/008, 2002

2.0 PROJECT ORGANIZATION AND RESPONSIBILITY

Responsibilities of the key ARCADIS personnel working on the project are as follows:

Project Director: Mr. Martin Hamann, P.G., C.HG, REAII, Principal Hydrogeologist. Oversees project implementation and progress. Provides technical and managerial advice to the project manager.

Project Manager: Ms. Stephanie Gentry, Senior Toxicologist. Schedules tasks and manages technical aspects of the project. Ensures that the Health and Safety Plan (HSP) for the project is implemented. Reports to the project director.

QA/QC Officer: Mr. Aaron Hook, Staff Scientist. Assists in design, monitors project, and evaluates the project's QA/QC program. Makes recommendations to the project director and project manager on QA/QC issues.

Corporate Health and Safety Officer: Mr. Tony Tremblay. Assists in review of HSP and advises on site-specific health and safety procedures.

California Department of Health Services (DHS)-Certified Subcontractor Laboratory: Positive Lab Service (PLS) or other qualified laboratory. Analyzes environmental media samples using appropriate methods. An equivalent laboratory may be substituted for this facility based on availability and costs of the analyses. The laboratory's project manager will report to ARCADIS's project manager on all aspects of the sample analyses. In addition, ARCADIS's project manager will be advised of any matters related to data quality during the course of the RAW implementation. The analytical laboratory will comply with the QA and QC procedures outlined in the laboratory's QA Plan and the approved U.S. EPA methods of analyses.

The quality of the laboratory data will be such that the data can be evaluated using the process defined in the *Risk Assessment Guidance for Superfund* (U.S. EPA 1989) and *Laboratory Data Validation Functional Guidelines* (U.S. EPA 1994a and 1994b). Using this process will allow data quality to be evaluated for the potential uses noted in Section 3.1.2.

3.0 QA/QC OBJECTIVES

The QA objective is to evaluate the appropriateness of data generated during the project (i.e., precision, accuracy, completeness, comparability, and representatives). Before data appropriateness can be evaluated, the potential uses of the data and corresponding analytical method levels must be identified. This is accomplished by defining DQOs, as discussed below.

The QC objective is to evaluate the quality of data collected before they are included in reports or used in evaluations or analyses. Before data quality can be evaluated, QC procedures, including data reduction, validation, and acceptance criteria, must be defined and followed for field and laboratory activities.

3.1 Data Quality Objectives

DQOs have been specified for each data collection activity, and the work will be conducted and documented so that the data collected are of sufficient quality for their intended use (U.S. EPA 1998). DQOs specify the data type, quality, quantity, and uses needed to make decisions, and are the basis for designing data collection activities. The DQOs have been used to design the data collection activities. The DQOs for this project are discussed in the following sections.

3.1.1 Data Quality Objective Process

The project DQOs developed specifically for the planned sampling and analysis program have been established based on U.S. EPA's seven-step DQO process (U.S. EPA 2000). ARCADIS's project manager will evaluate the project DQOs to establish if the quantitative and qualitative needs of the sampling and analysis program have been met. The project definition associated with each step of the DQO process can be summarized as follows.

State the Problem: Based on the PEA (ARCADIS 2010) the following impacts to the Site were identified:

- The results of the soil investigation revealed pesticides above acceptable concentrations a single area located in improvement Area 10. The source of pesticides in this area is not known; however, the initial soil sample was collected adjacent to a tree stump that may have been treated with pesticides.
- The results of the soil investigation revealed PCBs above acceptable concentrations. The source of PCBs in this area is not known, as no transformers or other activities potentially associated with PCBs are known to have been associated with this area. Three potential origins include the use of PCB-contaminated import material, potential use of PCB-containing paint on nearby structures (as some historic paints are reported to have contained PCBs), or potential historic use of PCB-containing caulking/sealing materials on nearby

structures (as caulking/sealing materials have been reported to have historically contained PCBs); however, all of these potential sources are speculative. Fill materials are a questionable source, as one might expect a more even distribution of PCBs in the subsurface materials and possibly existence in the quad area, although the results of testing to date identify the PCBs, where present, in near proximity to buildings. Building materials are also a questionable source, and it is noted that not all soil samples collected in the vicinity of and/or adjacent to buildings contained detectable concentrations of PCBs. Building materials have not been tested for the presence of PCBs.

According to the Agency for Toxic Substance and Disease Registry (ATSDR), PCBs were historically used both for nominally closed applications (e.g., capacitors and transformers, heat transfer, hydraulic fluids) and in open-ended applications (e.g., flame retardants, inks, adhesives, microencapsulation of dyes for carbonless duplicating paper, paints, pesticide extenders, plasticizers, slide-mounting mediums for microscopes, surface coatings, wire insulators, metal coatings). Pesticide extenders are not believed to be a source of PCBs at this Site, as pesticides were not detected in the primary location where the PCBs were encountered. To reiterate, the source of the PCBs has not been identified.

The RAW describes procedures for removal of the affected soil. A confirmation sampling program has been designed to demonstrate that the affected soil has been removed, and the Site is suitable for redevelopment and expansion as a school facility.

Identify the Decision: The data obtained from the confirmation sampling and analysis activities will be used to demonstrate that affected soil has been removed from the Site. The residual concentrations of COCs in soil will meet the Preliminary Cleanup Goals (PCGs) that have been established based on the development and modernization of the Site as a school campus.

Identify Inputs to the Decision: Inputs to the decision will include results of analytical testing of surface and subsurface soil from selected locations on the Site. These samples will be tested for COCs identified at the Site.

Define the Remediation Boundaries: The boundaries of the excavations are shown on Figures 3a and 3b of the RAW. Based on the PEA results, detected concentrations of COCs above the PCGs were found in the following areas:

- The lateral extents of pesticide-affected soil are defined by analytical results from soil sample locations SS-S0-18, SS-SO-19 and SS-SO-20. The pesticide-affected soil was found to be confined to an area approximately 20 feet long by 10 feet wide.
- The vertical extent of pesticide-affected soil appears to be limited to the upper 3 feet based on pesticide concentration in soil sample SS-STRUCTURE-7-2.0'

- Soils with PCB concentrations above 89 μg/kg were identified at multiple boring locations at depths of approximately 0.5 and 2.0 ft bgs. ARCADIS delineated approximately 8 areas of PCB-affected soil as shown in Figure 3a.

- The vertical extent of PCB-affected soil appears to be limited to the upper 1 to 2 ft, based on the PCB concentrations in the soil samples collected from the Site.

The excavation floors and sidewalls will be sampled to document the vertical and lateral extents of residual concentrations of COCs.

Develop a Decision Rule: Decisions will be based upon laboratory results for COCs. If no detectable concentrations of COCs are reported based on valid analytical data, then a decision will be made that the Site is fully characterized and remediated with respect to the COCs and no further sampling will be required as part of this RAW. If COCs are detected in the samples tested, then the data will be compiled for use in evaluating the completion of the soil removal. The results of the data evaluation may be used by SMMUSD to satisfy a conclusion of NFA or to support the implementation of additional soil removal.

Specify Limits on Decision Error: The results of analytical testing will be subjected to data evaluation or validation as specified in Section 3.1.4. Data are considered valid if the specified limits on precision, accuracy, representativeness, comparability and completeness are achieved. Positive COC results will be considered in evaluating the need for additional sampling of site soil, and assessing the necessity for reducing risks posed by the potentially affected soil.

Optimize the Design: The field sampling program has been designed to provide the type and quantity of data needed to satisfy each of the aforementioned objectives. The quality of the data will be assessed through the procedures further described in this QAPP.

3.1.2 U.S. EPA Analytical Method Levels

U.S. EPA has identified five levels of analytical methods, whose use depends on the DQOs identified for a project. The levels are defined as follows:

Level I: Field Testing. Level I methods include the use of handheld instruments. Data QA/QC includes proper calibration of instruments and appropriate data interpretation.

Level II: Tentative Identification of Compounds. Under Level II, compound identification is presented as a range. This level usually includes screening by a mobile laboratory, with variable data QA/QC, depending on the report format.

Level III: Organic and Inorganic Analysis Using U.S. EPA Procedures. Level III methods involve the use of U.S. EPA procedures generally taken from *Test Methods for Evaluating Solid Waste* and other recognized laboratory method manuals, except those that include the U.S. EPA Contract Laboratory Program (CLP). Level III results have quantitation limits similar to those obtained from CLP analyses; under Level III, data QA/QC can be performed to provide data of the same quality as Levels IV and V.

Level IV: Hazardous Substance List Analyses. This level covers organic and inorganic analyses for compounds on the Hazardous Substance List, as defined by the U.S. EPA CLP Statement of Work, which is issued periodically and detailed in each contract-year's description of routine analytical services. These analyses are conducted exclusively by U.S. EPA CLP laboratories, which are under (sub)contract to the federal government or its contractor. Data QA/QC is rigorous; raw data are generally validated by a data-validation contractor.

Level V: Nonconventional Parameters. Level V methods identify nonconventional parameters using analyses that are developed or modified for the particular parameter(s) being analyzed. Significant lead time is generally needed, and data QA/QC is method specific.

3.1.3 Identification of Data Uses and Definition of Project DQOs

In defining DQOs, general factors to be considered include all potential uses of the data (e.g., site characterization, health risk assessment, engineering and design, remediation, monitoring); cost limitations; the schedule of the project; and overall levels of concern (health risk assessment-based criteria) for the project.

The DQOs for this project are (1) to generate field data (for use in sample screening and health and safety monitoring) and laboratory data (for use in site characterization and monitoring of remedial activities) of a quality appropriate for the data's use; and (2) to evaluate the quality of the data. The quality of the field data, which will be generated using portable instruments that must be calibrated following the procedures described in Section 6.0, must be sufficient to allow proper evaluation of the results.

3.1.4 Analytical Method Levels to Be Used During the Project

On the basis of the DQOs and known site conditions (from previously generated data), Level I and Level III analytical methods have been selected for this project. Level I methods will be implemented in the field for sample screening and for health and safety reasons. They include the use of a miniature real-time aerosol monitor.

Level III methods will be applied to all soil and water samples submitted to PLS for analysis, so that after the data have been reviewed and validated, they will be suitable for use in site characterization and monitoring during remedial-action implementation. Level III analyses will be conducted by PLS under subcontract to ARCADIS. The level of QA/QC and associated documentation will comply with the requirements of DHS' Environmental Laboratory Accreditation Program (ELAP). QA/QC procedures and requirements in addition to the ELAP requirements are detailed in this QAPP. Sample quantitation limit goals (Appendix A), if achieved, will provide results sufficient for use in a health risk assessment and for other potential uses identified. The methods chosen for soil analyses (Section 7.0) are the best available technologies that meet the QA/QC requirements of this project.

3.2 Data Acceptance Criteria

In addition to being evaluated against the sample quantitation limit goals outlined in Section 7.0, laboratory data generated during the project will be evaluated for precision, accuracy, completeness, comparability, and representativeness. Precision and accuracy are the primary parameters used in evaluating the quality of the data. Data evaluation will be conducted in accordance with the guidance entitled *Laboratory Data Validation Functional Guidelines* (U.S. EPA 1994a and 1994b). Appendix A presents initial QA objectives to be used in evaluating laboratory and field QC samples.

3.2.1 Precision and Accuracy Criteria

Precision criteria allow evaluation of the reproducibility of measurements under a given set of conditions. They quantitatively measure the variability of a group of measurements. Data precision is measured by calculating relative percent differences (RPDs; see Section 11.0) of the analytical results for field and laboratory splits.

Accuracy criteria allow evaluation of the bias in a measurement system. Evaluation of data accuracy includes a quantitative measure of the bias by calculating spike percent recovery (SPR; see Section 11.0). Blank results will also be evaluated, as described in Section 11.0.

Because the precision and accuracy of any data obtained will depend on the type of measurement and the type of medium sampled (solid, liquid, or vapor), the data acceptance criteria for precision and accuracy should be site- and measurement-specific. Initially, laboratory data acceptance criteria for precision and accuracy will be based on control limits used by PLS (Appendix A).

If deemed necessary, site-specific data acceptance criteria will be developed after sufficient data are collected to perform valid statistical calculations to determine project data-based acceptance criteria. The results of the precision and accuracy evaluation of the initial data will be used to assess the appropriateness of the initial data acceptance criteria. When the data-pool size has reached at least 25 QC points, acceptance criteria will be derived from historical QC data collected by ARCADIS at the Site and from new QC data as they become available. Data acceptance criteria will not be re-evaluated after the data-pool size has exceeded 30 QC points.

Other acceptance criteria may be defined for duplicate samples containing compounds at very low concentrations because of the inherent variability of results near the detection limit. The inherent variability in lithology and geology, including the geochemistry of most geologic media, will be taken into consideration in developing data acceptance criteria. An upper warning limit of two standard deviations above the mean and an upper control limit of three standard deviations above the mean will be applied throughout the analysis. Appendix B summarizes PLS's calibration and QC procedures.

If laboratory data precision and accuracy do not meet the data acceptance criteria, the reason will be noted in ARCADIS's project report. Corrective action to be taken if precision and accuracy data acceptance criteria are not met may include additional sampling and/or reanalysis.

3.2.2 Completeness, Comparability, and Representativeness Criteria

Data completeness will be evaluated using the following calculation: the number of valid data generated divided by the number of valid data planned, expressed as a percentage. Although 100 percent data completeness is theoretically ideal, 80 percent data completeness is generally associated with Level III, IV, and V analyses (U.S. EPA 1987) and accounts for unforeseen incidents associated with the data collection. Consequently, the data completeness goal for this project is 80 percent. Deviations from specifications in this QAPP will be detailed in the project report.

To ensure that the data collected are comparable to both previous and subsequent data, standardized procedures will be followed during field sampling, laboratory analysis, and data evaluation. Whenever procedures change from one sampling round to another, or within a sampling episode, historical data will be compared to recent data before data are validated and reduced.

To obtain representative data, strict technical and management procedures (as detailed below) will be followed, including careful planning of sample collection procedures and analytical methodologies. These procedures will be audited as described in Section 10.0.

4.0 FIELD ACTIVITIES

This section describes routine procedures designed to ensure quality data acquisition, the collection of representative samples, and minimal sample contamination. To allow comparison of data from different data collection events, soil results will be reported in the units of milligrams per kilogram (mg/kg) and water results (equipment and field blanks) will be reported in units of milligrams per liter (mg/l) or micrograms per liter (μg/l). Sampling locations will be consistently indicated on site maps, and all lithologic descriptions will be in accordance with the Unified Soil Classification System.

4.1 Excavation of Affected Soil and Confirmation Sampling

Conventional construction equipment such as backhoes and/graders will be used for excavation of affected soil. Additionally, some excavation will require removal with smaller hand tools. The equipment will be operated by a person with a current Hazardous Waste Operations certificate. Excavation of soil will continue until visual observations, analytical results, and/or photoionization detector readings indicate that the affected soil has been removed from the area. The excavated soil will be loaded directly into trucks or temporarily stockpiled on the Site and disposed of appropriately. Affected soil temporarily stockpiled will be placed on plastic sheeting and covered with plastic sheeting while on the Site.

After removal of the affected soil is completed, confirmation soil samples will be collected from the sidewalls and/or floor of the excavations to confirm that residual concentrations of COCs are less than the PCGs established in the RAW.

The confirmation soil samples will be collected in 2-inch-diameter brass or stainless steel liners or 4-oz glass jars using hand-sampling equipment or hand-pressure.

Excavated soil will be profiled for disposal by hand-driving a brass or stainless steel tube or a 4-oz glass jar into randomly selected portions of the excavated soil. The soil will then be transported to the appropriate disposal facility selected by SMMUSD.

4.2 Decontamination

Equipment used during this project that might come into contact with contaminated materials will be properly decontaminated before and after each use. Generally, equipment will be cleaned with high-pressure hot water (steam cleaning) and/or washed with a laboratory-grade detergent (such as Alconox™) and rinsed with deionized or distilled water.

A washdown area will be constructed on the Site to decontaminate equipment. The washdown area will be constructed by laying plastic sheeting, sealing seams, and berming edges to contain wash water. A thin layer of sand will be placed under the sheeting, if necessary, to reduce the potential for tears from equipment tires. Trucks will not be entering areas with affected soil; therefore, truck decontamination is not anticipated. Equipment will be brushed off, washed with water or detergent, scrubbed, and rinsed, as necessary, to reduce cross-contaminating previously excavated areas. The excavation strategy will facilitate the possibility of the equipment to not enter previously excavated areas and still be able to excavate affected soils. Mitigation of potential track-in and track-out soil will be in conformance with the local regulatory agency (if applicable and necessary).

5.0 SAMPLE CONTAINMENT, LOGGING, HANDLING, AND CUSTODY

5.1 Sample Containers, Preservation, and Holding Times

The appropriate containers, preservation methods, and holding times for the following analyses that may be conducted during this project are listed in Appendix A:

- Metals (including lead) using EPA Method 6010B
- OCPs using EPA Method 8081A
- PCBs using EPA Method 8082
- VOCs using EPA Method 8260B (for waste characterization)
- TPH using EPA Method 8015M (for waste characterization)

Water sample containers, if used, that have been pre-preserved by the laboratory must be labeled as such. Containers will not be reused.

Soil and water[1] samples will be placed in coolers and chilled to approximately 4°C. Regular ice used in the coolers will be sealed in a plastic bag other than the one in which it was purchased. Reusable "blue ice" packets may also be used.

Any sample analyzed after the recommended holding time has been exceeded will be appropriately flagged in data summary tables (see Section 11.0). These data can be used for quantitative purposes only with appropriate disclosure and qualification.

5.2 Documentation and Sample Custody

Sample custody and documentation procedures link each reported datum with its associated sample. Documentation and custody procedures cover field, office, and laboratory activities. Chain-of-custody forms, which are central to these procedures, will travel with all samples and their associated data throughout the tracking process.

Field documentation consists of sample labels, sampling information forms, a field activities logbook, and chain-of-custody forms. These documents will be completed using indelible ink. Any corrections to a document will be made by drawing a line through the error and entering the correct value, without obliterating the original entry. Anyone correcting an original document will initial and date all changes. Field documentation is described in detail below.

[1] i.e., equipment blanks

5.2.1 Sample Labels

Sample labels will be completed and attached to the sample container for every sample collected. Labels are made of a waterproof material backed with a water-resistant adhesive. Labels will be filled out using waterproof ink and will include (at least) the sample name, the sampling date and time, the sampling location, the sampler's name, and the analyses to be conducted.

5.2.2 Field Activities Logbook

A field activities logbook will be used to record daily field activities. Each logbook entry will include the following, as necessary, for each activity undertaken:

- name of person making entry
- date and time of entry
- location of activity
- equipment calibration status
- personnel present at the Site
- sampling and measurement methods
- total number of samples collected
- sample numbers
- laboratory to perform analysis
- field observations and comments

5.2.3 Chain-of-Custody Forms

Chain-of-custody forms will be prepared for groups of samples collected at a given location on a given day. Each chain-of-custody form will be prepared in triplicate. Two of the three copies will accompany each shipment of samples to the laboratory. One copy is kept in ARCADIS's QA/QC file, and the pink copy is kept in the project file. The chain-of-custody forms identify the personnel involved in sample transfer and accompany the samples from the time of collection until received by the laboratory. Information entered on the chain-of-custody forms consists of the following:

- project name and number
- field activities logbook number
- chain-of-custody serial number
- project location
- sample numbers
- sampler's/recorder's signature
- date and time of collection
- number of containers
- sample type
- analyses requested
- inclusive dates of possession
- name of person receiving the sample
- laboratory sample number
- date and time of receipt of sample
- address of laboratory
- miscellaneous remarks

Samples will be shipped so that no more than 24 hours elapse from the time of shipment to the time the laboratory receives the samples. The method of shipment may be hand delivery by field personnel, laboratory courier, or commercial shipping services (such as United Parcel Service or Federal Express). The method of sample shipment will be noted on the chain-of-custody form. Strict chain-of-custody procedures will be maintained during sample handling.

The condition of the samples upon arrival at the laboratory will be documented on the chain-of-custody forms or similar forms. A copy of the completed chain-of-custody forms and other pertinent forms will be provided by the laboratory along with the analytical results.

5.2.4 Office Documentation

Samples will be tracked and data archived at ARCADIS's Costa Mesa office. ARCADIS's QA/QC Officer will be responsible for ensuring that documentation is in order and that all results are obtained for the analyses requested on the chain-of-custody form and that sample identifications on the laboratory reports match those on the chain-of-custody form. The project file will be used in data tracking and documentation, as discussed below.

The project file is the common location for all information required in data evaluation and report preparation. It contains documents including work plans, sampling plans, assessment reports, correspondence, field activities logbooks, chain-of-custody forms, and sampling information forms. The file is organized for easy retrieval and long-term storage of information (two years or more). The ARCADIS project manager will direct the maintenance of the project file.

5.2.5 Laboratory Custody

The laboratory will designate a sample custodian who will accept custody of the shipped samples and check that the information on the sample labels matches that on the chain-of-custody form. The custodian will then enter the appropriate data into the laboratory's sample tracking system. The custodian will use the sample number on the sample label or will assign a unique laboratory number to each sample. As a record of sample receipt, the analytical laboratory will return a copy of the chain-of-custody form, with the assigned laboratory numbers, to the sampler. The custodian will then transfer the sample(s) to the proper analyst(s) or store the sample(s) under refrigeration until they are analyzed.

Laboratory personnel are responsible for the care and custody of samples from the time they are received until the sample is exhausted or disposed. Disposal of unused samples must comply with applicable local, state, and federal environmental regulations. Data sheets and laboratory records will be retained as permanent documentation.

The laboratory will immediately notify ARCADIS's project manager if conditions or problems are identified which require immediate resolution. Such conditions include container breakage, missing, or improper chain-of-custody forms, exceeding holding times, missing or illegible sample labeling, or temperature excursions.

5.3 Sample Packaging and Transport

Each soil and groundwater sample will be packaged and transported according to the following procedure:

- Attach completed label to each sample.
- Properly seal and package sample containers (package samples so the potential for shipping damage is minimized).
- Complete chain-of-custody forms.
- Seal the top two copies of the chain-of-custody form inside a reclosable plastic bag.
- Seal the shipping container with several strips of strapping tape.
- Arrange for appropriate shipment to the analytical laboratory.

Samples will be transported to the laboratory by ARCADIS or by courier pickup, following the chain-of-custody and documentation protocols outlined above.

6.0 EQUIPMENT MAINTENANCE AND CALIBRATION

Field personnel will follow the protocols described below to ensure that equipment is in good working condition and that field measurements made by different individuals or at different times are consistent and reproducible.

6.1 Maintenance

Equipment operation will be routinely checked and maintained to minimize breakdowns in the field, and nonfunctional equipment will be removed from service.

6.2 Field Calibration

Calibration of field instruments is necessary to ensure that they are operating correctly and are adjusted so that they yield accurate measurements. Adjustments made to field equipment are recorded in each instrument-dedicated logbook that is kept with the instrument.

6.2.1 Groundwater-Level Measurement Equipment

Groundwater is not anticipated to be sampled during implementation of this RAW.

6.2.2 Miniature Real-time Aerosol Monitor

A miniature real-time aerosol monitor (mini-RAM) may be used to monitor total dusts generated during site work. Background dust levels may be established by monitoring dust levels at the Site for several days during the two weeks prior to implementation of this RAW. Background dust levels may be documented at air monitoring stations established at approximately 100 foot intervals along the Site's perimeters if applicable.

If dust in excess of background levels (greater than 0.25 milligrams per cubic meter [mg/m^3] above background levels) is observed for a sustained period of time (greater than 5 minutes), appropriate dust suppression measures (e.g., spraying soil with water) may be undertaken. A total dust action level of 0.25 mg/m^3 above background levels would be conservative for the various COCs detected on the Site that would be likely to adhere to windblown dust and protective of the on-site workers and members of the surrounding community.

6.3 Laboratory Calibration

Maintenance and calibration of laboratory instruments is required to ensure that the analytical system is operating correctly and functioning at the proper sensitivity to meet established detection limits. Calibration and repair records are maintained by the analytical laboratory.

The standard operating procedures (SOPs) for analyses to be conducted as part of this project are contained in U.S. EPA (1986). Each instrument will be calibrated with standard solutions appropriate for the type of instrument and the linear range established for the analytical method used.

7.0 LABORATORY ANALYSIS

7.1 Methods

The analytical laboratory will perform chemical analyses using the methods identified Appendix A. Confirmation soil samples will be collected from the excavation sidewalls and floor as described in the RAW and analyzed for COCs using appropriate U.S. EPA methods and laboratory reporting limits (see Section 5.1).

7.2 QA/QC Procedures

The laboratory will follow its own internal QA/QC procedures during routine operations and will base its analytical QA/QC on EPA Method manuals and its own specific QA/QC procedures, which should include (as a minimum), method blanks, method calibration standards, and method or matrix spike recoveries.

Sample holding times for various analyses to be conducted can be found in Appendix A. Samples will be analyzed at the laboratory within specific holding times; the laboratory may not analyze any sample that has exceeded its holding time without permission of ARCADIS.

Calculations for reporting chemical concentrations will be performed by the laboratory according to the procedures specified for each referenced method of analysis. Calculations conducted by the analytical laboratory in converting raw data to reported results will be readily available for inspection. The accuracy and correctness of any data reported by the laboratory will be checked by senior laboratory personnel before the laboratory reports its results.

7.3 Quantitation Limits

There are four commonly used detection or quantitation limits: instrument detection limit (IDL), method detection limit (MDL), sample quantitation limit (SQL), and practical quantitation limit (PQL).

IDL: The minimum amount of an analyte that can be identified using an individual instrument. The laboratory usually determines the IDL by calculating the standard deviation of the results of seven replicate spike sample analyses performed using a single instrument and multiplying by 3.

MDL: The minimum amount of an analyte that can be identified using a specific method. The laboratory usually determines the MDL by calculating the standard deviation of the results of seven replicate spike sample analyses and multiplying by 3, using reagent water as a sample. The MDL is an ideal detection limit when there is no background laboratory contamination and the sample to be analyzed is a clean sample free of matrix effects. When MDLs are defined within a particular method, they are established using reagent water as a sample. Also known as the method quantitation limit, this limit is not sample-specific and does not vary with any sample preparation or dilutions required for each sample analyzed. The MDL is the IDL plus adjustments for typical sample preparation techniques.

SQL: The minimum amount of an analyte that can be identified using a specific method and instrument, taking into account sample dilutions required for the method as well as for matrix effects or high compound concentrations, and the IDL and MDL information. The laboratory may elevate the SQL because of known method problems, such as blank contamination, or on the basis of the laboratory's experience with the method. The SQL is the most common "detection limit" or "reporting limit" referred to in laboratory reports.

PQL: The minimum amount of an analyte that can be reliably identified within specified limits of precision and accuracy during routine laboratory operations. The PQL is defined in U.S. EPA (1986). PQLs represent goals for each analytical laboratory and are generally higher than a laboratory's expected sample quantitation limits.

Sample results will be reported using SQLs because they represent the actual sample detection limits, taking into account matrix effects and sample dilutions rather than arbitrarily reporting the sample detection limits on the basis of the analysis of reagent water. Expected sample quantitation limits, assuming no dilutions, are presented in Appendix A.

8.0 DATA REDUCTION AND VALIDATION

All data collected during the project will be reduced and validated before being included in reports. Copies of laboratory reports will be stored in the project file.

8.1 Reduction

Data reduction will be conducted as follows. If laboratory data are received in electronic form, they will be transferred into a spreadsheet database program. When data are not received from the laboratory in electronic form, ARCADIS personnel will enter the data into a computer database or spreadsheet program manually, and other ARCADIS personnel will check that the data have been entered correctly. Data for relevant compounds reported at concentrations above sample quantitation limits will be presented in summary tables. The tables may also contain the following information: laboratory name; sample number; laboratory number; sampling date; field measurement; and QC analytical data.

8.2 Field Data Validation

ARCADIS personnel will validate any data obtained from field measurements before the data are included in any reports or used in any calculations. Field data will be validated by checking procedures used in the field and comparing current measurements with historical data. To allow comparison of data from different sampling episodes, results must be reported in the same units. The units to be used for the various parameters are identified below.

- **Dust Concentrations:** Field measurements collected for health and safety purposes using a mini-RAM to monitor exposure to total dust will be reported in mg/m^3.

8.3 Laboratory Analytical Data Validation

ARCADIS's QA/QC officer or a designee will validate analytical data before the summary tables have been created and before the data are included in any reports or used in any calculations. Validation of laboratory analytical data involves specific procedures for evaluating and/or calculating data precision, accuracy, and completeness; those procedures are described in detail in Section 11.

Calculations performed by the laboratory in converting raw data to reported results will be readily available for inspection. The accuracy of all analytical results must be checked by senior laboratory personnel before the laboratory reports the results.

If suspect laboratory performance is evident, either in precision or accuracy evaluations or in detectable chemical concentrations in trip blank samples, the ARCADIS QA/QC officer will notify the laboratory and the laboratory will take appropriate corrective action, such as reanalyzing samples or conducting a detailed review of spectra or chromatograms. The ARCADIS QA/QC officer also will make recommendations to the ARCADIS project manager on any additional action ARCADIS should take, such as resampling or modification of the sampling or analytical protocol. The ARCADIS project manager will then take appropriate action.

9.0 QC CHECK SAMPLES

Field and laboratory QC check samples will be analyzed as required by regulatory agencies and will consist of introducing various control samples into the sample analysis stream, to help evaluate the accuracy and precision of analytical results.

9.1 Field

The types of QC check samples that may be used for this project are field blanks, equipment blanks, trip blanks, and field duplicates. Each field blank and duplicate QC sample will be assigned a unique number so that the laboratory will not know which samples are field blanks or duplicates. Trip blanks will be identified as such and will undergo the QC checks described below. Field blank and duplicate QC samples will be identified in the field activities logbook according to type.

9.1.1 Field Blanks

Field blanks will be collected by pouring laboratory-supplied, organic-free, deionized water directly into appropriate sample containers once per field day. Their purpose is to evaluate the presence of chemicals for which environmental samples are being analyzed in the water used for equipment decontamination. The field blank samples will be stored and processed in the same manner as the other samples.

Additional field blanks may be collected at the sampler’s discretion. The sampler, after consultation with the ARCADIS project manager, hydrogeological analyst, or QA/QC officer, may instruct the laboratory either to analyze such additional samples or to hold them for possible analysis later, pending initial results. If initial results for a sample collected at the time a field blank was collected indicate that a sample contains unexplainable concentrations of constituents, the field blank sample will be analyzed.

9.1.2 Equipment Blanks

Equipment rinsate blanks (equipment blanks) will be collected immediately before samples are collected by pouring laboratory-supplied, organic-free, deionized water into the bailer or other sample collection device, and then into the appropriate sample containers. At least one equipment blank will be collected for each analytical method during each sampling episode.

Additional equipment blanks may be collected at the sampler's discretion. The sampler, after consultation with the ARCADIS project manager, hydrogeological analyst, or QA/QC officer, may instruct the laboratory either to analyze such additional samples or to hold them for possible analysis later, pending initial results. If initial results for a sample collected at the time an equipment blank was collected indicate that a sample contains unexplainable concentrations of constituents, the equipment blank sample will be analyzed.

9.1.3 Trip Blanks

Trip blanks are prepared by the laboratory using organic-free, deionized water supplied in appropriate pre-filled sample containers. One trip blank will be included with each shipment of groundwater samples. Trip blanks will be analyzed for VOCs only. The trip blank is analyzed as a check for possible contamination of the sample bottles and/or the organic-free deionized water used for field blanks. ARCADIS does not anticipate the need for trip blanks because VOCs are not considered COCs for this project.

9.1.4 Field Duplicates

A minimum of 1 field duplicate sample per analysis method per every 10 field samples (at least 10 percent of the number of samples) will be collected and analyzed.

9.2 Laboratory

The types of samples that may be used for laboratory QC are blanks, duplicates, and spikes. The laboratory will also report information on surrogate-compound recoveries (where applicable for the method) and dates of analysis. In addition, the laboratory will record (but not necessarily report) information on second-column confirmation of positive detections for organics analyses (where applicable), internal standards (where applicable), recording of compliance with limits associated with daily calibration checks, control charts or equivalents for method-specific spikes and surrogate spikes, and instrument initial calibration and tuning (where applicable).

9.2.1 Blanks

Blanks are indicators of possible sample contamination. Samples can be contaminated during and after field sampling. Often this results from container contamination before or during field sampling. After field sampling, samples may be contaminated during transport and storage prior to analysis and during laboratory chemical analysis. To isolate the stage at which sample contamination may have occurred, two types of blank samples may be analyzed, namely trip blanks and laboratory-reagent blanks (method/reagent and matrix blanks). In the blank analysis, reagent or method blanks will be samples of laboratory deionized and distilled water.

9.2.2 Duplicates

Laboratory duplicates are samples used to estimate data precision as affected by laboratory sources of variation. To measure precision, the laboratory will analyze matrix spikes in duplicate.

9.2.3 Spikes

Spike sample results allow the accuracy of the analytical methodologies to be assessed. For this project, matrix spikes, matrix-spike duplicates, method spikes, and method-spike duplicates will be analyzed by the laboratory. Matrix spikes and matrix-spike duplicates are samples spiked with a predetermined quantity of selected target compounds for each matrix type (i.e., soil or groundwater from the Site). Following analysis, percent recovery of the spikes and the RPD of the two spikes are calculated. Method spikes and method-spike duplicates are samples prepared using laboratory reagent water and adding a predetermined quantity of selected target compounds. Following analysis, percent recovery of the spikes and the RPD of the two spikes are calculated.

In addition, surrogates (compounds similar in composition and structure to the compounds of interest but which are not normally found in the environment) will be added, as applicable, to samples to allow for evaluation of matrix effects or preparatory effects on each sample.

9.2.4 Sample Ratios

Reagent blanks and method blanks will be analyzed at a ratio of one per 20 samples or for every batch of samples per matrix analyzed, whichever is more frequent. Matrix spikes will be analyzed at a ratio of 1 per 10 samples (or batch of samples, whichever is more frequent) per analysis or a set of duplicate matrix spikes per 20 samples (or batch of samples, whichever is more frequent) per analysis. Where applicable, surrogates and internal standards will be added to each sample.

10.0 AUDIT PROCEDURES

Internal and external QA/QC audits will be performed and documented in the project file, as necessary.

11.0 DATA VALIDATION PROCEDURES

This section describes procedures for validating analytical data, including diagnostic procedures for identifying possible sources of error and appropriate corrective action.

ARCADIS's QA/QC officer or their designated representative will evaluate analytical data for samples using quantitative tests, qualitative assessment, and professional judgment to ensure that the data reported by the laboratory are representative of actual field conditions. Analytical results first will be checked for completeness, using the criteria described in Section 8.0, including the analytical method sensitivity (reported sample quantitation limit). If the laboratory's rationale for elevated sample quantitation limits is not appropriate, corrective action will be implemented. Blanks, duplicates, and spikes (QC samples) then will be evaluated for contamination, data precision, and data accuracy, respectively.

The completion of all analyses requested on the chain-of-custody form will be verified by tracking the status of each sample being analyzed. Tracking will be maintained until all samples have been analyzed and the results have been reported by the analytical laboratory and received by ARCADIS's QA/QC officer. Analytical data will be reduced and compiled into summary tables as described in Section 8.0.

11.1 Data Acceptance Criteria and Evaluation Procedures for Control Samples

QC sample data will be comprehensively evaluated for contamination, accuracy, and precision, as discussed below. Analytical results for both field and laboratory QC samples will be evaluated for the extent to which they represent actual field conditions. Simple statistical parameters and qualitative indicators will be used in validating data. Appendix A presents initial QA objectives to be used in evaluating laboratory and field QC samples.

Field and laboratory blank samples will be used to determine if and where any field samples may have been contaminated and the significance of any such contamination. Duplicate samples will be used to assess the precision of the analytical procedure.

11.2 Blanks

Field and laboratory blank data will be evaluated for those samples with which the blanks are associated. Any compound detected in any of the field or laboratory blank samples will also be checked for in trip blanks which were shipped with the same field blanks, or which were analyzed using the same equipment and on the same day(s) as the laboratory blanks were analyzed. The maximum detectable concentration of each compound of any associated blank will be used in the evaluation of the data.

If the blank contains detectable concentrations of common laboratory contaminants (methylene chloride, acetone, toluene, and bis[2-ethylhexyl]phthalate), the sample results will only be considered positive detections if the concentrations exceed 10 times the maximum amount detected in any blank. If the concentration of the common laboratory contaminant in the sample is less than 10 times the maximum amount detected in the blanks, the sample result will be tabulated as not detected, with the detection limit adjusted to the original laboratory reported sample result.

The "not detected" result will be flagged as "suspect" in the summary tables. The summary tables ARCADIS prepares from laboratory data will include flags or qualifiers, but laboratory data reports will not be flagged or qualified except according to the laboratory's standard reporting practice. Laboratory data reports will be included in the quarterly or investigation reports.

If the blank contains detectable concentrations of chemicals that are not considered common laboratory contaminants, then the analytes will only be considered detected if the concentrations exceed 5 times the maximum amount detected in any blank. If the sample concentration of the contaminant is less than 5 times the maximum amount detected in the blanks, the sample result will be tabulated as not detected, with the detection limit adjusted to the original laboratory reported sample result.

The "not detected" result will be flagged as "suspect" in the summary tables. Under no circumstances will any sample result be deleted from the summary tables for blank-related problems. Corrective action for blank contamination may include reanalysis of samples, re-sampling, review of raw data (including chromatograms), and/or an audit of the analytical lab and/or field activities by the ARCADIS project manager and/or the ARCADIS QA/QC officer.

11.3 Duplicates and Spikes

Spike results (including results for method spikes and surrogate spikes) will be evaluated for accuracy and expressed in terms of SPR for each compound. The SPR is the difference in concentration between the total measured concentration in the spike sample and the original concentration in the sample, divided by the actual spike concentration added to the sample. The SPR will be computed on a compound-by-compound basis for spiked sample data.

Duplicate results will be statistically evaluated for data precision, using the RPD values computed from the data reported. RPD is the difference in measured concentrations between either field duplicates or laboratory splits, divided by their average measured concentration, expressed as a percentage.

Corrective action for SPR or RPD values that exceed the limits detailed below may include reanalysis of samples, re-sampling, review of raw data (including chromatograms), and/or an audit of the analytical lab and/or field activities by the ARCADIS project manager and/or the ARCADIS QA/QC officer.

One of the following statistical testing and acceptance criteria will be selected and applied:

1. Preselected upper warning and control limits (UWLs and UCLs) and lower warning and control limits (lower warning limits [LWLs] and lower control limits [LCLs]) will be used to assess soil or groundwater data when historical QC data for the site under investigation are insufficient. The warning limits are cautionary indicators that results should be closely evaluated prior to data validation. QC data that exceed control limits may indicate poor data quality. These preselected UCLs for laboratory QC samples are based on those currently used by ARCADIS. For duplicate results expressed as RPDs, the only applicable limits are the UWL and UCL. Other acceptance criteria may be used when compounds are detected near the reporting limit.

2. The UWL, UCL, LWL, and LCL may be computed from the historical QC duplicate and spike data after collection of adequate quantities of QC data (at least 25 QC data points). The control limits (CLs) are ideally at the 95 percent confidence interval for a one-tailed normal distribution for duplicate results expressed as RPD and for a two-tailed normal distribution for spike results expressed as SPR. The CL value for half of a bell-shaped curve is 2.77 of the standard deviation or standard error, depending on the applicable parameter. It will, however, be approximated as three times the standard deviation for statistical testing. The warning limit is two-thirds of the UCL, hence twice the standard deviation.

3. Other tests for statistical significance, such as Student's t-test, F-test, or chi-test, will be selected and applied, as appropriate.

12.0 CORRECTIVE ACTION

If data evaluation brings questionable data to light, corrective action may be necessary. Criteria for determining when corrective action is necessary and the procedure for implementing corrective action are discussed in Section 10.0. Corrective action may include analyzing an additional blank or duplicate sample, if available; rechecking laboratory calculations and chromatograms; re-sampling; modifying the sampling and/or analytical protocol; or other measures. The ARCADIS QA/QC officer will make recommendations for corrective action to the ARCADIS project manager, who will decide what action, if any, to take.

13.0 QA REPORTING

The results of QA/QC audits will be included in reports as described in Section 10.

14.0 REFERENCES

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APPENDIX A-1

Analytical Method Information

APPENDIX A-2

Analytical Methods, Container Types, and Preservatives

Appendix A-2
Analytical Methods, Container Types, and Preservatives

Analysis	Matrix	Analytical Method	Container (water)[1]	Preservative (water)[2]
Organochlorine Pesticides	Water Soil	EPA 8081A	1 L - amber glass --	None --
Polychlorinated Biphenyls	Water Soil	EPA 8082	1 L - amber glass --	None --
Metals	Water Soil	EPA 6010/7000	1 L - poly --	HNO_3 --
Diesel and Motor Oil[3]	Water Soil	EPA 8015 mod	1 L - amber glass --	None --
Gasoline[4]	Water Soil	EPA 8015 mod	3 x 40mL VOA --	HCl --
Volatile Organics Compounds	Water Soil	EPA 8260B	3 x 40mL VOA --	HCL --

Notes:

1.) Soil samples should be collected in laboratory supplied glass jars (no preservatives).

2.) Samples should be kept at 4^{0}C from time of collection until analysis.

3.) Total petroleum hydrocarbons quantified as diesel and motor oil.

4.) Total petroleum hydrocarbons as gasoline

EPA = U.S. Environmental Protection Agency

m = months   mod = modified

d = days   HCl = hydrochloric acid

(m)L = (milli)liters HNO_3 = nitric acid

APPENDIX B

Analytical Laboratory Calibration and QC Procedures

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Appendix F

Transportation Plan

ARCADIS
Infrastructure, environment, buildings

Imagine the result

Santa Monica-Malibu Unified School District

Transportation Plan for Removal Action Work Plan

Malibu Middle and High School
Campus Improvements Project,
30215 Morning View Drive, Malibu, California

August 5, 2010

ARCADIS

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Transportation Plan for Removal Action Work Plan

Malibu Middle and High School Campus Improvements Project, 30215 Morning View Drive, Malibu, California

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Santa Monica-Malibu Unified School District

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Our Ref.:
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Date:
August 5, 2010

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Table

1. Introduction

This Transportation Plan describes how soil removed during the implementation of the Removal Action Workplan (RAW) at the Malibu Middle and High School located at 30215 Morning View Drive, Malibu, California ("the Site") will be managed during transportation to the selected offsite disposal facility(ies). The Transportation Plan was prepared to comply with the May 1994 Interim Final Guidance for Preparation of Transportation Plans at Hazardous Substance Release Sites prepared by the California Environmental Protection Agency (CalEPA), Department of Toxic Substances Control (DTSC).

2. Background

2.1 Location, History, Regulatory Status of the Site

The primary contaminants of concern (COCs) for the Site are organochlorine pesticides (OCPs) and polychlorinated biphenyls (PCBs). Environmental assessment activities performed by ARCADIS U.S., Inc. (formerly LFR an ARCADIS Company) have focused on 20 proposed improvement areas located within the boundaries of the Malibu Middle and High School campus. For the purposes of the RAW, the Site consists of one area of pesticide-affected soils and eight areas of PCB-affected soils totaling approximately 16,200 square feet (ft^2) near or within campus improvement Areas 3 and 9 through 13.

2.2 Description of Removal/Remedial Actions

Elevated levels of pesticides and PCBs were detected in site soils. Based on the soil volume calculations, approximately 1,200 cubic yards (cy) of affected soils are proposed for removal. Soil removal will be accomplished by use of earthmoving equipment (backhoes, bobcats, articulated loaders, etc.) which will place the excavated material into stockpiles in an onsite staging area. Soils will be segregated based on the area from which they were excavated (e.g., center of affected area or perimeter of affected area).

Stockpiles will not reach a height greater than the surrounding fence lines.

2.3 Site Map

A Vicinity Map and a Site Plan are provided as Figures 1 and 2, respectively, of the RAW.

3. Purpose and Objective

The purpose of this Transportation Plan is to minimize potential health, safety, and environmental risks resulting from the transportation of material and/or equipment during the proposed remedial action.

The purpose of the proposed action at the Site focuses on the removal and disposal of soils affected with COCs, to reduce the threat to human health and to provide a permanent solution that reduces the toxicity, mobility, and volume of contaminated soil. Remedial action objectives (RAOs) have been established that are protective of human health and the environment and reduce the potential for exposure to COCs in shallow soil encountered at the Site. These RAOs are presented in the RAW.

The remedial goals developed and adopted for affected media at the Site will be responsive to these RAOs. The primary remedial goal for the Site is performance-based and focuses on restoring the soil to normal conditions with regard to COCs detected in shallow soil.

The goal of this removal action is to excavate and remove all affected soil from the Site, and to have it treated and/or disposed of offsite. Upon completion, a Completion Report will be prepared that will document that post removal conditions do not pose a significant risk to future students, staff, and faculty at the Site.

4. Characteristics of Waste/Material To Be Transported

4.1 Description of Waste To Be Transported

The waste to be transported is pesticide- and PCB-affected soils. It is a dry-to-moist soil. The source is of the pesticide-affected soils is thought to be historic pesticide application; the source of PCB contaminants is unknown. The nature of the contaminants is that they are bound into the soil matrix. The volume of soil to be removed is approximately 1,200 cy.

4.2 Determination of Whether the Waste Is Hazardous

Based on the analytical results for pesticides and PCBs conducted during the Preliminary Environmental Assessment (PEA) investigation (ARCADIS 2010), the soils will likely be classified as non-hazardous waste.

The exact soil waste classification will be determined once soil has been excavated and stockpile samples have been analyzed. Each stockpile will be sampled separately and classified for waste disposal separately. Due to the waste profiling sample requirements, the soil will be submitted for analyses of known COCs (i.e., PCBs and pesticides) as well as total petroleum hydrocarbons (TPH), Title 22 metals, and volatile organic compounds (VOCs). As such, the excavated soil samples will first be analyzed for organochlorine pesticides, PCBs, VOCs, TPH, and Title 22 metals at a ratio of 1 sample per 200 cy. Based on PCB analytical results for soil samples collected to date (< 50 parts per million [ppm]), the PCB-affected soils are not considered hazardous. Analytical results for the stockpile samples will dictate if Soluble Threshold Limit Concentration (STLC) or Toxicity Characteristic Leaching Procedure (TCLP) analyses are required for the stockpile.

A description of STLC and TCLP criteria and a flow chart outlining the conditions under which each analysis will be performed are provided below.

4.2.1 Pesticides

STLC analysis should be obtained if TTLC results are above the following individual pesticide criteria:

- dichlorodiphenyltrichloroethane (DDT), dichlorodiphenyldichloroethylene (DDE), and cichlorodiphenyldichloroethane (DDD) (total)[1] – 1.0 milligrams per kilogram (mg/kg)

- alpha and gamma chlordane (total) – 2.5 mg/kg.

Soils are considered California-hazardous wastes if STLC results are at or above the following individual STLC criteria:

- DDT, DDE, DDD (total) – 0.1 milligrams per liter (mg/L)

- alpha and gamma chlordane (total) – 0.25 mg/L

- TCLP is used to determine if a waste is considered a RCRA hazardous waste. Individual TCLP criteria are not available for Aldrin, DDT, DDE, DDD, alpha and gamma chlordane, and dieldrin.

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[1] Although they are not COCs, criteria for DDT, DDE, and DDD are included herein as DDE and DDT were detected in the PEA investigation and as such may be detected in the stockpile samples. Both pesticides were detected in the PEA investigation at concentrations below regulatory risk thresholds and did not contribute appreciably to the overall risk to the site receptor.

4.2.2 PCBs

TTLC and STLC criteria are not applicable for PCBs as they are evaluated as a potential hazardous waste based on different criteria. See Section 4.3 for details.

4.3 Applicable Regulations

Under the Toxic Substance Control Act (TSCA), the U.S. Environmental Protection Agency (USEPA) has specific rules governing PCB-contaminated soils. If the release occurred prior to 1979, and soil concentrations are below 50 ppm PCBs (the limit at which it is considered a hazardous waste), soil is not regulated under TSCA. If the release occurred after 1979 and concentrations in site soils are all below 50 ppm, it is not regulated under TSCA as long as the original source material also did not contain 50 ppm PCBs or greater. As neither the source or release date for the Site are known, and since PCB concentrations in all samples collected from the Site to date have been below 50 ppm, TSCA has been determined to not be applicable to this Site.

Pesticide- and PCB-affected soils removed from the Site will be handled and disposed of appropriately in accordance with final waste profiling results. (Based on analytical results for soil samples collected during the PEA, it is anticipated that the material will be transported as non-hazardous waste.)

If future waste profiling testing indicates that the soil is considered something other than non-hazardous (i.e., RCRA non-hazardous or RCRA hazardous), the excavated soils will be managed appropriately. As the hazardous waste generator, the Santa Monica-Malibu Unified School District (SMMUSD) has an EPA ID number that will be used for manifesting the waste. Compliance with DTSC requirements for hazardous waste transportation and disposal is required for hazardous waste. The hazardous waste will be transported by a registered hazardous waste hauler under a uniform hazardous waste manifest. Land ban requirements will be followed as necessary.

Since pesticides and PCBs are chemicals known to the State of California to cause cancer as well as reproductive toxicity, a proper Proposition 65 notification will be posted, if necessary.

5. Destination of Waste/Material

While the actual waste hauler will require approval by SMMUSD, American Integrated Services (AIS) may be the transporter, and, if selected, will transport an in-place volume of approximately 1,200 cy of soil to appropriate Class I, Class II, or Class III disposal facilities located in Kettleman Hills, Buttonwillow, or Adelanto, California. It is expected that the waste soils will mostly likely be treated as non-hazardous. The final selection of the disposal facility will be made after receipt of analytical data in compliance with existing regulations and under the direction of the SMMUSD.

6. Transportation Mode

If approved by SMMUSD, the waste will be transported by AIS using end dump tractor-trailers with a 24 ton maximum capacity. (AIS has provided pricing information and for the purposes of this report is assumed to be the contractor; however, it is noted that the contractor has not been selected and if someone other than AIS is chosen, qualification information will need to be updated.) It is anticipated that approximately 75 trips will be necessary to remove approximately 1,200 cy (approximately 1,800 tons) of soil from the Site. Trailers with plastic liners will be utilized for wet non-hazardous soil and all hazardous soil (if applicable). All trailers will be covered with tight-fitting tarp-style covers prior to leaving the Site.

6.1 Transporter Qualifications

AIS is registered with the USEPA (EPA ID# CAR000148338). All vehicles utilized for waste transport will be properly registered, operated, and placarded in compliance with local, state, and federal requirements. The vehicles will be equipped with dust covers and other required equipment to prevent releases of material.

AIS will submit proof of valid hauler registration if waste material to be transported is a non-RCRA hazardous waste.

7. Route

7.1 Primary Routes

The following routes to three potential landfills were selected, as they are the most direct and avoid residential areas and hazardous road conditions. None of the roadways selected for transport are listed with the California Highway Patrol as prohibited for the hauling of hazardous waste. Additionally, local ordinances or road maintenance activities do not restrict the designated routes.

- Class I and II – Waste Management, Inc. Adelanto, California: Trucks loaded with soil will exit the Site via Morning View Drive and go south towards Pacific Coast Highway. Trucks will turn east (left) onto Pacific Coast Highway towards Interstate 10 (I-10). Trucks will proceed east on I-10, north on I-405, and north on I-5 to the Kettleman Hills, California Landfill. The estimated roundtrip time from the Site to the facility is 3.25 hours, with the possibility of an additional 1 hour for rush-hour traffic.

- Class III (non-hazardous) – TPS: Trucks loaded with soil will exit the Site via Morning View Drive and go south towards Pacific Coast Highway. Trucks will turn east (left) onto Pacific Coast Highway towards I-10. Trucks will proceed east on I-10, north on I-15, and north on US 395 to the Adelanto, California, Landfill. The estimated roundtrip time from the Site to the facility is 1 hour 45 minutes, with the possibility of an additional 2.25 hours for rush-hour traffic.

The specific route to the disposal facility will not be known until the disposal contractor has been selected and stockpile samples have been analyzed to characterize the waste material.

7.2 Secondary Routes

Given the distances between the Site and the proposed soil disposal sites, there are numerous secondary routes that are possible. If one of the primary routes is not passable, the most direct secondary route (based on evaluating a map) will be selected. Prior to using the secondary route, the hauler will ensure that none of the secondary roadways selected for transport are listed with the California Highway Patrol as prohibited for the hauling of California hazardous waste. Additionally, local ordinances or road maintenance activities do not restrict the designated routes.

7.3 Scheduling

Approximately 30 trips per day are anticipated. Approximately 15 vehicles per day will be required for this job, with each vehicle making 2 trips each. It is anticipated that work will occur between the hours of 7:00 a.m. and 6:00 p.m. Every reasonable effort will be made to avoid heavy truck traffic during peak traffic hours.

7.4 Emergency Services Notification List

The following is a list of emergency services organizations that may be notified prior to commencement of any hazardous waste substance transporting:

- fire department
- ambulance service
- law enforcement agency
- transportation authority.

8. Traffic Control and Loading Procedures

8.1 Traffic Control

Existing traffic patterns at various times of day will be examined so that the operation will not impact traffic conditions more than necessary. It is anticipated that work will occur between the hours of 7:00 a.m. and 6:00 p.m. Every effort will be made to avoid heavy truck traffic during peak traffic hours. **A flagman or gatekeeper will be utilized to ensure safe entry/exit to and from the overall Site.**

8.2 Loading Procedures

Excavated soils will be loaded using a backhoe, an articulated front-end loader, or similar piece of equipment onto end-dump tractor-trailers. Dust generation will be minimized by spraying loads with water during dumping as necessary, slowly dumping each bucket load, and minimizing dumping height. Trailers with plastic liners will be utilized for wet non-hazardous soil and all hazardous soil. All trailers will be covered with tight-fitting tarp-style covers prior to leaving the Site.

Inspection of all trucks will be performed prior to departure to ensure proper loading, covering/sealing, decontamination, placarding, and manifesting. Inspection and documentation of each load will include date, time, vehicle type, driver's license number, vehicle license number, and signature of the inspector. **A representative of the selected general contractor will be responsible for inspecting all trucks.**

A washdown area will be constructed within the excavation or adjacent to the stockpile area to decontaminate trucks if required. The washdown area will be constructed by laying plastic sheeting, then sealing seams and berming edges to contain wash water. A thin layer of sand will be placed under the sheeting, if necessary, to reduce the potential for tears from vehicle tires. All trucks entering the impacted excavation will be decontaminated and inspected before leaving the Site. Vehicles requiring decontamination will drive onto the washdown area for cleaning and then drive off after decontamination is completed. Trucks will be brushed off, washed with water, or detergent scrubbed and rinsed as necessary.

Equipment in the excavation area or adjacent to the stockpile area will be decontaminated prior to leaving the Site using a method selected by the general contractor. This method may involve washing down the equipment or dusting equipment off. Waste generated from washdown activities will be temporarily stored onsite. Washdown area waste will be sampled and characterized for waste disposal.

9. Record Keeping

The following information will be recorded and tracked for each load of impacted soil transported offsite:

- date, time
- weight/volume of waste/material
- trucking company and driver
- vehicle identification
- manifest number associated with each load.

The following transportation documents must be carried with the driver when transporting the waste/material:

- bill of lading identifying the shipment
- generator’s name and address
- if necessary, hazardous waste manifest and analytical results representing the load
- map and complete instructions describing the route to be traveled
- special instructions including emergency procedures and contacts for the transporter
- **The name of the accepting facility, when determined, will be added to the list.**

10. Health and Safety

All contractors will be responsible for operating in accordance with the most current Occupational Safety and Health Administration (OSHA) regulations including 29 Code of Federal Regulations (CFR) 1910.120, Hazardous Waste Operations and Emergency Response, and 29 CFR 1926, Construction Industry Standards, as well as other applicable federal, state, and local laws and regulations. A site-specific Health and Safety Plan (HSP) is included as Appendix D to the RAW.

11. Contingency Plan

Prior to the start of soil transport operations, the transportation contractor will contact an Emergency Response Contractor (ERC) to establish communication regarding the transportation of any hazardous material from the site to the disposal facilities. The ERC will be provided with a copy of the Transportation Plan. The transportation contractor will work with the ERC to establish appropriate responses to transportation emergencies. The transportation company personnel will be briefed on procedures for contacting either the transportation contractor or the ERC in the event of a spill or incident during soil transport. The ERC will handle all emergency spill response measures, including the cleanup and disposal of any spilled material.

The ERC will be determined after the bidding process.

The following sections outline the individual responsibilities of the parties expected to be involved in this project.

11.1 Emergency Response Contractor Responsibilities

The following matters shall be the responsibility of the ERC selected for the project:

- Upon notification that a spill has occurred, the ERC will call the reporting party to obtain complete details regarding the incident. Enough information must be obtained to develop initial response actions.

- Communication with the scene will be established.

- In the event of an emergency, the ERC will respond to the scene as soon as possible after gathering information to gauge an appropriate response to the spill.

11.2 Transportation Contractor Responsibilities

Adherence to the following conditions shall be the responsibility of the transporter firm contracted for the project:

- The contractor used to transport soil from the Site will be permitted by the USEPA.
- All Department of Transportation (DOT) safety regulations will be strictly followed. These include use of qualified drivers, written and road tests of drivers, medical evaluation, hours of service limitation, equipment standards and inspections, and operating procedures.
- The contractor will possess an EPA Transporter Identification Number.
- The contractor will maintain public liability and property damage insurance in an amount specified by the SMMUSD.
- The contractor will be provided a copy of the HSP for the project and is expected to adhere to the conditions of the HSP. The contractor will advise its drivers regarding the characteristics of the material being hauled and corrective measures that must be taken in the event of an accident or exposure.
- The transportation contractor’s vehicles, including trucks and trailers, must be equipped and maintained in accordance with the Federal Motor Carrier Safety Regulations (49 CFR Parts 393 and 396). These regulations specify minimum standards for equipment, including brakes, tires, lights, suspension, steering, emergency equipment, and maintenance. Trucks will be equipped with radios.

11.3 Driver Responsibilities

In the event of an emergency, a driver’s responsibilities are as follows:

- Park the unit in the most secure area available, away from homes, traffic, or businesses.
- Never abandon the truck or disconnect the trailer unless told to do so by the proper authorities or there is immediate danger which could affect the cargo.

- Set out flares or reflectors.
- Warn all persons to keep away (minimum distance 500 feet; actual distance to be determined by the DOT emergency response guidebook).
- Protect manifest, paperwork, instruction materials, and equipment for later use.
- Notify the Emergency Contact listed on the manifest, the driver's dispatcher, or supervisor, providing the following:
  - proper shipping name, hazard class, and ID number of materials
  - exact Location
  - quantity of material spilled
  - location and distance to any surface water
  - nature and extent of any injuries or property damage
  - weather conditions
  - a telephone number where communications with the scene can be established
  - an estimate of what response and cleanup will be needed.
- Stay at the scene until relieved by an ERC.
- If the nature of the spill allows the driver, using appropriate PPE, to safely take action, he may attempt to dike the area, place a plastic liner down to collect the material or otherwise respond to the emergency. The driver is not to attempt to enter a closed unit or handle waste materials without qualified assistance.

11.4 Jobsite Contractor Responsibilities

The project general contractor overseeing the soil removal project will be responsible for assuring that the Transportation Plan prepared for the project is followed. The project general contractor will act as a liaison between the Site and the transporter. The project general contractor will oversee the proper preparation of manifests to comply with applicable federal, state, and DOT regulations.

Soil Transportation Route Notification List of Emergency Service Organizations

Name	Telephone Number
Emergency Services	911
County of Los Angeles Fire Department (Station #71)	310.457.2578
Los Angeles County Sheriff's Department	323.526.5541
Department of Transportation	949.936.3400
California Highway Patrol	949.559.7800
U.S. National Response Center	800.424.8802

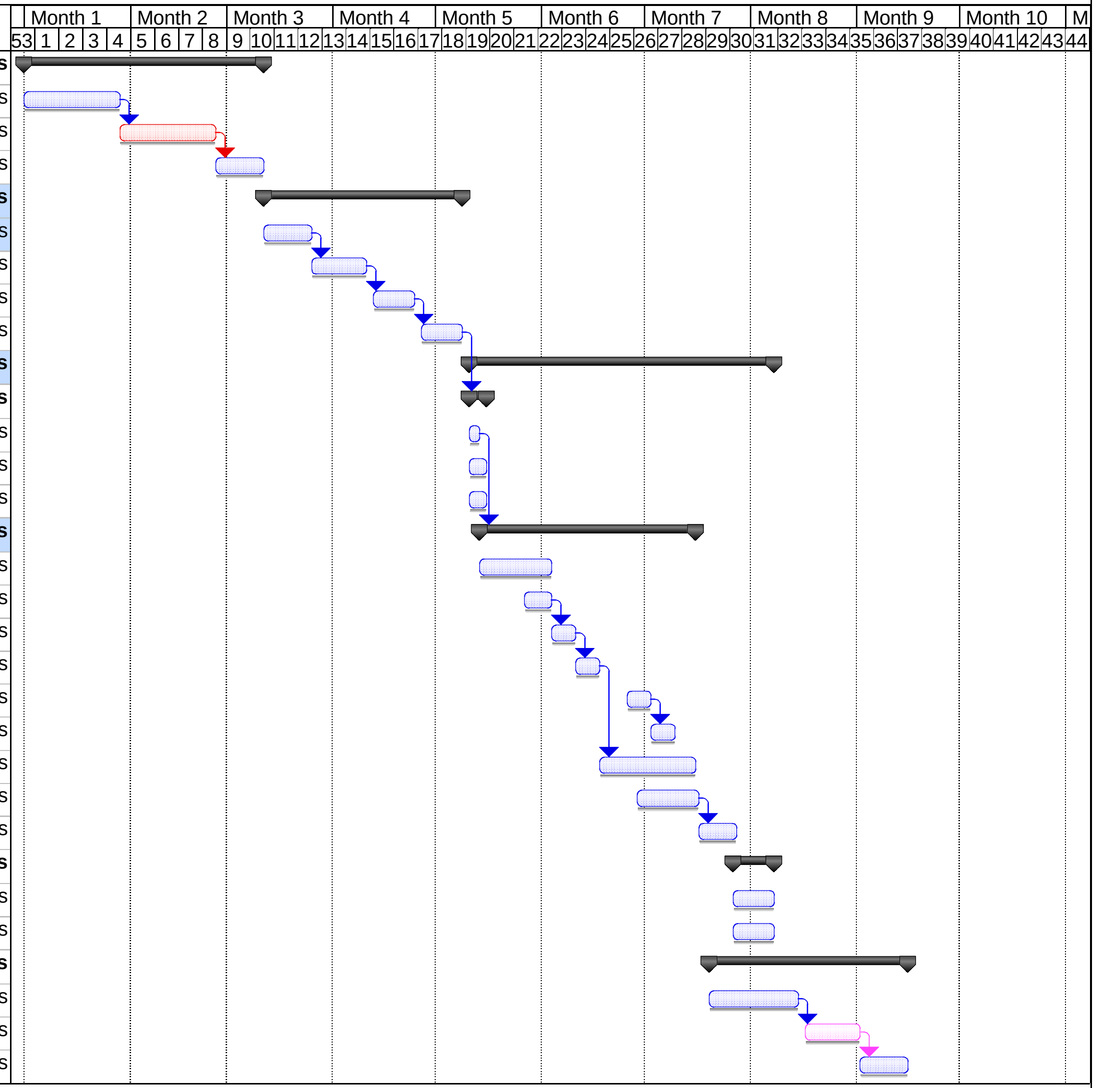
ARCADIS

Appendix G

Detailed Project Schedule

Santa Monica-Malibu Unified School District
Malibu Middle and High School
Malibu, California
RAW Schedule

ID	Task Name	Duration
1	**PREPARE REMEDIAL ACTION WORKPLAN (RAW)**	**50 days**
2	LFR PREPARE/SUBMIT DRAFT RAW	20 days
3	RAW is Part of MND; MND out for Review and Comment	20 days
4	LFR FINALIZE DRAFT RAW	10 days
5	**RAW CONTRACTOR SELECTION (once project ready to proceed)**	**42 days**
6	PREPARE BID DOCUMENTS	10 days
7	BID WALK/REMOVAL CONTRACTOR RFP PROCESS	12 days
8	SELECT AND SECURE REMOVAL CONTRACTOR	10 days
9	PREPARE RAW ADDENDUM WITH CONTRACTOR SPECIFIC INFORMATION	10 days
10	**RAW IMPLEMENTATION**	**65 days**
11	**SCHEDULE AND MOBILIZE FOR REMOVAL ACTIVITY**	**5 days**
12	Identify Underground Utilities	3 days
13	Set Up Stockpile Staging Areas, Loading Area, Decontamination Area	5 days
14	Mobilize, Kickoff Meeting, Set Perimeter Fence/ Air Sampling Stations	5 days
15	**IMPLEMENT RAW**	**45 days**
16	Excavate Soil and Stockpile	15 days
17	Collect Waste Profile Samples (stockpiles)	6 days
18	Laboratory Analysis of Waste Profile Samples	5 days
19	Review Waste Profile Results/Discuss with Disposal Company	5 days
20	Collect Confirmation Samples	5 days
21	Laboratory Analysis of Confirmation Samples	5 days
22	Off Haul Stockpiled Soil (not continuous)	20 days
23	CONTINGENCY REMOVAL FOR SOILS ABOVE PCGs (if necessary)	14 days
24	RECEIPT OF FINAL CONFIRMATION SAMPLING RESULTS	7 days
25	**DEMOBILIZATION**	**10 days**
26	Remove Perimeter Fencing and Demobilization	10 days
27	Return Equipment	10 days
28	**COMPLETION REPORT**	**42 days**
29	PREPARE COMPLETION REPORT	20 days
30	DISTRICT REVIEW/COMMENT	12 days
31	RESPOND TO COMMENTS/FINALIZE REPORT	10 days



Appendix H

DTSC Guidance/Advisories

"Interim Guidance, Evaluation of School Sites with Potential Soil Contamination as a Result of Lead from Lead Based Paint, Organochlorine Pesticides from Termiticides, and Polychlorinated Biphenyls from Electrical Transformers" (DTSC 2006)

Information Advisory on Clean Imported Fill Material (DTSC 2001)

Linda S. Adams
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INTERIM GUIDANCE
EVALUATION OF SCHOOL SITES WITH POTENTIAL SOIL CONTAMINATION AS A RESULT OF LEAD FROM LEAD-BASED PAINT, ORGANOCHLORINE PESTICIDES FROM TERMITICIDES, AND POLYCHLORINATED BIPHENYLS FROM ELECTRICAL TRANSFORMERS

Revised 06/09/06 **(non-substantive revisions made 09/12/06)**

This document is issued as Interim Guidance subject to review and revision as necessary. It should not be considered enforceable or regulatory in nature, and does not have the force or effect of law or regulation. Mention of trade names or commercial products does not constitute endorsement by DTSC.

Guidance Contents

FIGURES

TABLES

1.0 PURPOSE

This guidance is intended to provide a uniform and streamlined approach to initially evaluate proposed school sites where lead from lead-based paint, organochlorine pesticides (OCPs) from termiticide application, and polychlorinated biphenyls (PCBs) from electrical transformers are potential sources of soil contamination. This guidance is not a substitute for professional judgment, supported by technical justification and rationale, of qualified environmental professionals. The purpose is to evaluate the potential soil contamination by lead, OCPs, and PCBs and determine if these levels pose a threat to human health.

This guidance is only intended for evaluating sites for potential human health concerns associated with direct exposure of humans to contaminants in soil through incidental soil ingestion, dermal contact, and inhalation of dust in outdoor air. The screening values contained herein do not consider impact to groundwater or address ecological concerns. If site information indicates that other exposure pathways may be complete or the environment (non-human biota or habitats) may be impacted, a more detailed evaluation should be conducted in consultation with DTSC in a Preliminary Environmental Assessment (PEA). If a school district is unclear or has questions regarding exposure pathways for the site or whether the site can be adequately addressed by this guidance, DTSC should be consulted.

If DTSC determines that results of sampling described in this guidance indicate that a contaminant may pose a risk to human health or the environment, DTSC may require additional characterization of the nature and extent of contamination in a PEA or Supplemental Site Investigation (SSI) (Ed. Code, § 17213.1, subsecs. (a)(4)(A) and (a)(10)).

This guidance supersedes the *Interim Guidance for Evaluating Lead-Based Paint and Asbestos-Containing Materials at Proposed School Sites* (DTSC 2001). The school district is responsible for complying with federal, state, and local requirements for mitigation, management, or removal of asbestos-containing material (ACM). Although DTSC will no longer provide guidance for specifically for ACM found in buildings and structures, DTSC will continue providing guidance for naturally-occurring asbestos.

2.0 BACKGROUND

Education Code sections 17210, 17210.1, 17213.1, and 17213.2, specify a comprehensive environmental review process under DTSC oversight for proposed new or expanding schools. Consistent with the Education Code, DTSC utilizes a three-step process for environmental review of school sites (1) Phase I Environmental Site Assessment (Phase I), (2) PEA, and (3) additional investigation and, if necessary, response action. The role of DTSC is to ensure protection of children, staff, community, and the environment from the potential harmful effects of exposure to hazardous materials.

To expedite the environmental review process and allow school districts to focus resources where they are most needed, regulations for Phase Is became effective on February 10, 2003 (Cal. Code Regs., tit. 22, div. 4.5, ch. 51.5, commencing with § 69100, as amended). The regulations enable school districts to submit limited soil sampling data for specific contaminants at a site in a Phase I or Phase I Addendum.

3.0 USE OF GUIDANCE

This guidance provides recommended sampling strategies, sample analyses, and health screening criteria for lead, OCPs, and PCBs. The information in this guidance may be used for investigations conducted as part of the environmental review process for school sites.

The Phase I regulations (Cal. Code Regs., tit. 22, div. 4.5, ch. 51.5, commencing with § 69100, as amended) should be consulted to determine whether sampling results may be submitted in a Phase I or Phase I Addendum. If sampling results are included in a Phase I or Phase I Addendum, submittal of a work plan for DTSC review and approval is not necessary if the strategies described herein are followed. However, if a school district prefers, DTSC is available to help develop a site-specific sampling strategy using this guidance before sampling at a site.

DTSC should be consulted for sites not addressed by this guidance or with deviations from the strategies described herein. If a school district is unclear or has questions as to whether their site can be adequately addressed by this guidance, DTSC should be consulted. Based on specific characteristics of a site, DTSC may recommend submittal of a work plan prior to conducting sampling activities. If evaluation of lead, OCPs, or PCBs from specific sources, as described, is conducted as part of a PEA or SSI, the strategies herein may be incorporated into an associated work plan.

In general, all potential contaminants associated with a site should be evaluated at the same time. When pre- and post-demolition strategies are presented, sampling should be conducted prior to demolition or renovation of structures (pre-demolition) since activities that disturb soil may spread contamination, if present. However, post-demolition sampling strategies are provided if circumstances beyond the control of the school district make pre-demolition sampling impractical. A consistent sampling strategy (either pre- or post-demolition) should be used for the entire site, even if it consists of multiple parcels. DTSC understands that sampling may become cost prohibitive for sites consisting of multiple parcels and is available to discuss adjustment to the number of sampling locations and samples recommended herein for such sites.

Screening values presented in the guidance are for initial assessment only and should not be construed as a required removal or remedial levels. If a response action is required for a school site, removal or remedial levels will be evaluated and approved by DTSC through a removal action work plan or remedial action plan.

4.0 LEAD FROM LEAD-BASED PAINT

Lead can impair the nervous system, affecting hearing, vision, and muscle control. Lead is also toxic to the kidneys, blood, and heart. Exposure of children to lead may cause irreversible learning deficits, mental retardation, and delayed neurological and physical development (ATSDR 1999).

In response to the potential harmful effects from lead, the United States Consumer Product Safety Commission (U.S. CPSC) banned the application of paint containing more than 0.06 percent (600 parts per million) lead by weight on residential structures in 1978 (DHS 1998, CDC 1991, U.S. CPSC 2005, and U.S. EPA 2004b). However, surplus lead-based paint was still used for more than a decade later and lead-containing paint (paint with a detectable amount of lead) is still available for industrial, military, and marine usage (DHS 1998 and CDC 1991).

Considering the U.S. CPSC action, California Code of Regulations, title 17, section 35043 defines presumed lead-based paint as "paint or surface coating affixed to a component in or on a structure, excluding paint or surface coating affixed to a component in or on a residential dwelling constructed on or after January 1, 1979, or a school constructed on or after January 1, 1993."

Based on this information, structures with paint or surface coatings, with the exception of residential structures constructed on or after January 1, 1979 or schools constructed on or after January 1, 1993, may have surfaces coated with lead-based paint. As a result, any commercial or industrial structures, regardless of construction date, may have surfaces coated with lead-based paint.

Abatement, mitigation, and management of lead-based paint on building surfaces are currently regulated by several federal, state, and local agencies. However, evaluation of potential lead contamination in soil is part of the environmental review process for school sites under DTSC oversight (Ed. Code, § 17213.1). Weathering, scraping, chipping, and abrasion may cause lead to be released to and accumulated in soil around these structures. If the site historically included or currently includes structures with potential lead-based paint, soil sampling for lead in soil should be conducted. A decision tree to evaluate whether lead in soil from lead-based paint may be a concern is provided in Figure 1. If a lead inspection was performed, it may be submitted for DTSC to evaluate in conjunction with site-specific information to determine if lead in soil may be a concern.

4.1 Soil Sampling

A decision tree to select the appropriate sampling strategy for sampling for lead in soil from lead-based paint is provided in Figure 2, and details for pre- and post-demolition sampling strategies are provided in the following sections. The pre-demolition sampling strategy may also be used to evaluate existing structures with potential lead-based paint that will remain on site and be incorporated into the school.

FIGURE 1
Determining If Lead in Soil is a Concern

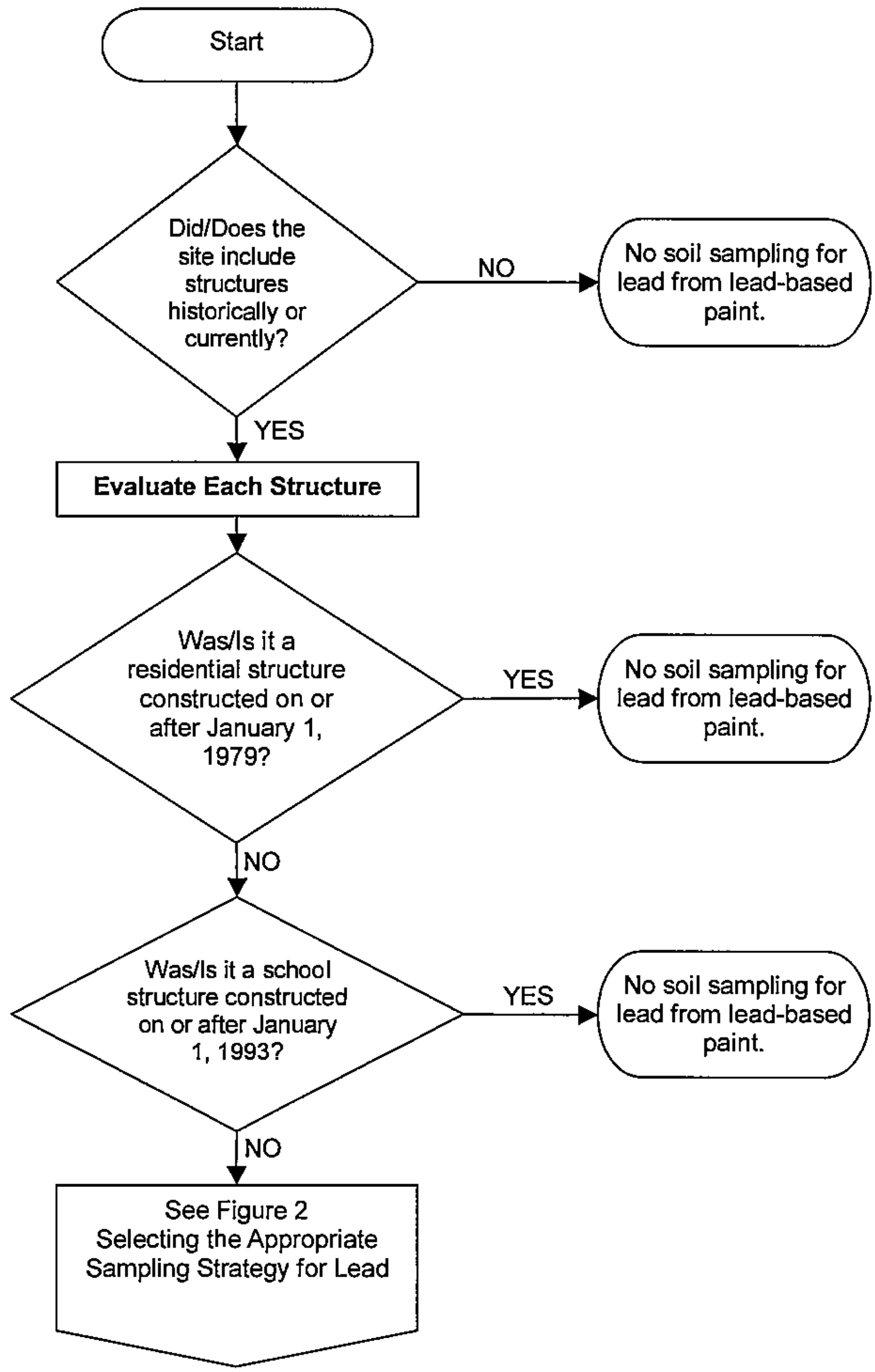
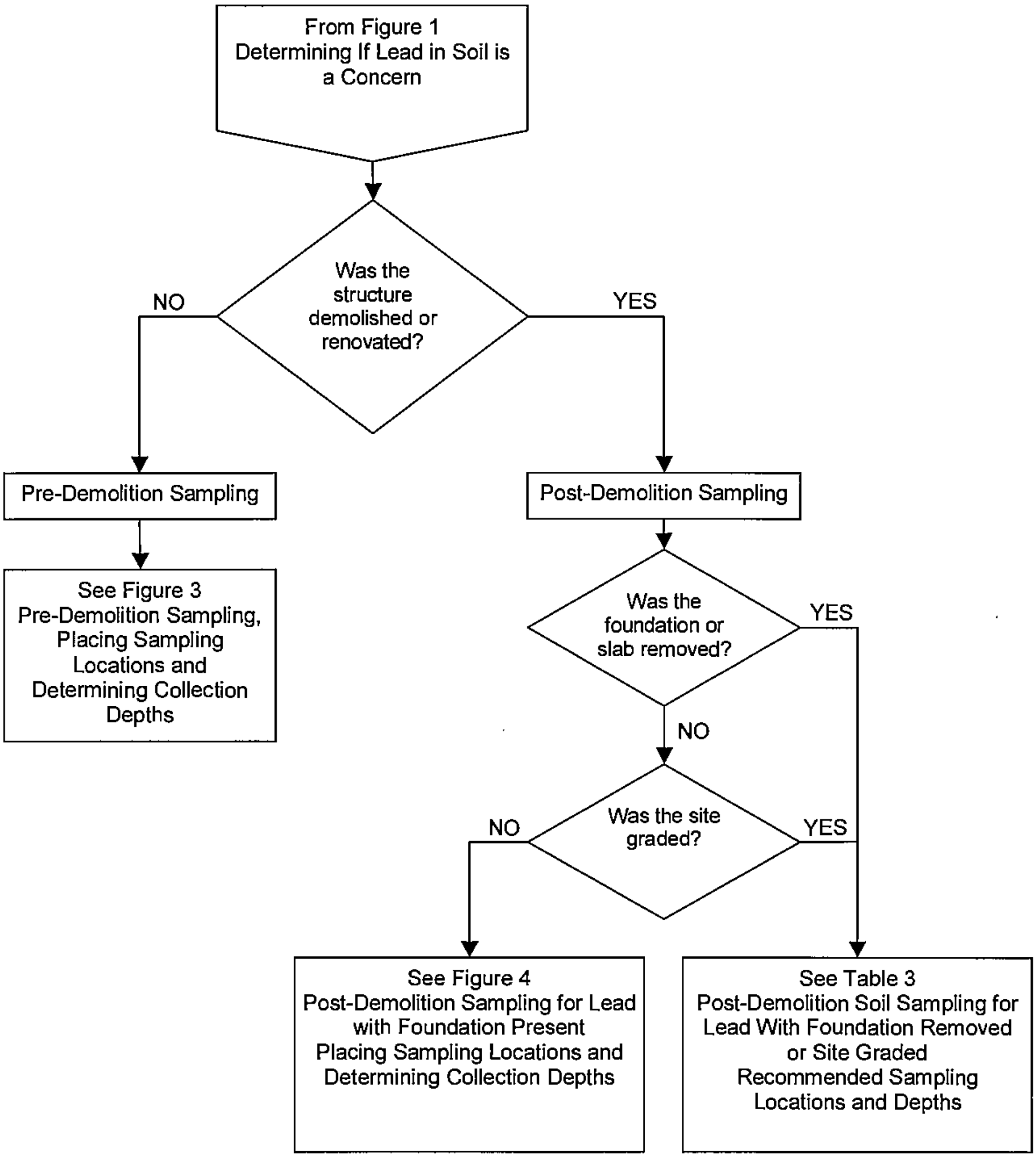


FIGURE 2
Selecting the Appropriate Sampling Strategy for Lead



4.1.1 PRE-DEMOLITION SAMPLING

A visual inspection of the site is useful to determine the presence, location, and extent of deteriorated paint. Any observations should be used to focus soil sampling around structure perimeters in areas with the highest potential for lead deposits.

The recommended number of sampling locations may vary depending on the type and number of structures, and conditions found. Table 1 provides a recommended minimum number of sampling locations for pre-demolition sampling. In general, more samples are recommended as the surface area of the structure increases.

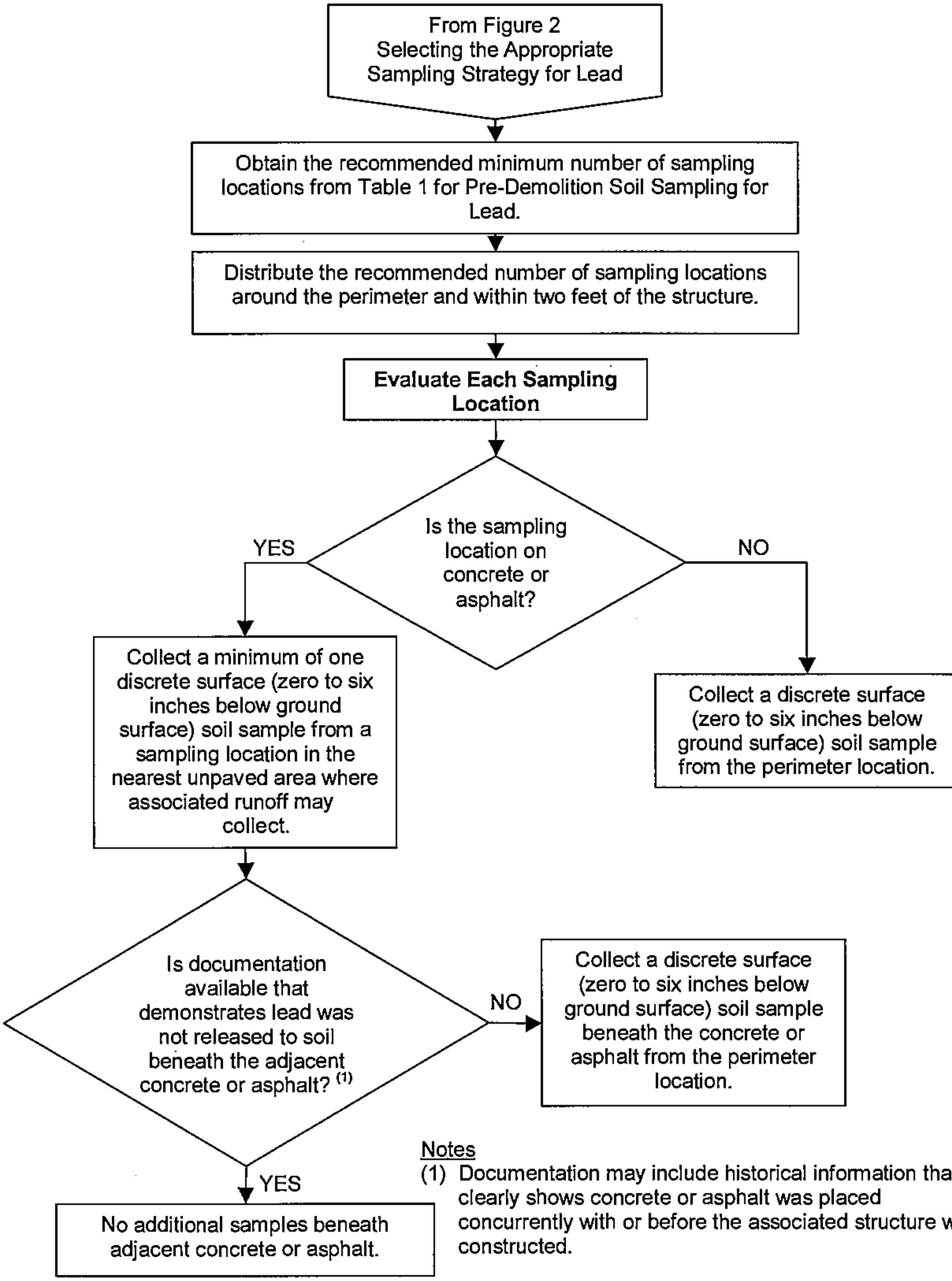
Sampling locations should be distributed around the perimeter within two feet of the structure. If concrete or asphalt borders the structure, sampling locations should be placed in the nearest unpaved areas where associated runoff may collect. Additional sampling locations may be used to evaluate potential releases of lead beneath adjacent concrete or asphalt placed after the structure was constructed. Discrete surface (zero to six inches below ground surface) soil samples should be collected from each sampling location. A decision tree is provided in Figure 3 for sampling location placement and sample collection depths.

TABLE 1
Pre-Demolition Soil Sampling for Lead
Recommended Minimum Number of Sampling Locations

Structure Type	Recommended Minimum Number of Sampling Locations (1)
Single-family housing, multi-family housing (up to and including four units), or detached carports/garages	Four locations for each structure.
Out buildings (shed or similar small structures)	Two locations for each structure.
Multi-family housing (more than four units), commercial structures, or barns	Six locations for each structure.

Notes
(1) Additional sampling locations may be used to evaluate potential releases of lead beneath adjacent concrete or asphalt placed after the structure was constructed. Refer to Figure 3 – Pre-Demolition Sampling, Placing Sampling Locations and Determining Collection Depths.

FIGURE 3
Pre-Demolition Sampling
Placing Sampling Locations and Determining Collection Depths



Notes
(1) Documentation may include historical information that clearly shows concrete or asphalt was placed concurrently with or before the associated structure was constructed.

4.1.2 POST-DEMOLITION SAMPLING

Two post-demolition (structure has been demolished or renovated) sampling strategies are provided for conditions that may be encountered on a site:

- Foundation Present (Section 4.1.2.1)
    - Foundation present and site not graded.
- Foundation Removed or Site Graded (Section 4.1.2.2)
    - Foundation present and site graded.
    - Foundation removed and site not graded.
    - Foundation removed and site graded.

Demolition or renovation activities may result in spreading of contamination resulting from removal of associated debris. To evaluate this possibility, samples at the extent soil disturbed by debris removal, inside the footprint of the former structure, and/or at depth are incorporated into the sampling strategies, as appropriate. The following sections detail sampling strategies for each condition.

4.1.2.1 Foundation Present

If the structure foundation or slab is present and the site has not been graded, a visual inspection of the site may be useful to help focus soil sampling around the structure foundation to sample areas with the highest potential for lead deposits.

The recommended number of sampling locations may vary depending on the type and number of structures, and conditions found. Table 2 provides a recommended minimum number of sampling locations for post-demolition sampling when the structure foundation is present. In general, more samples are recommended as the surface area of the structure increases.

Two sets of sampling locations should be distributed around the perimeter, one set within two feet of the structure foundation and the second corresponding set at the extent of soil disturbed by debris removal. Each of the sampling locations in the second set should be placed in line with one location in the first set. If concrete or asphalt borders the structure foundation, sampling locations should be placed in the nearest unpaved areas where associated runoff may collect. If soil is exposed within the footprint of the former structure, interior sampling locations should be distributed inside the footprint. Additional sampling locations may be used to evaluate potential release of lead beneath adjacent concrete or asphalt placed after the structure was constructed. Discrete surface (zero to six inches below ground surface) soil samples should be collected from each sampling location. A decision tree is provided in Figure 4 for placement of sampling locations and sample collection depths.

TABLE 2
Post-Demolition Soil Sampling for Lead with Foundation Present
Recommended Minimum Number of Sampling Locations

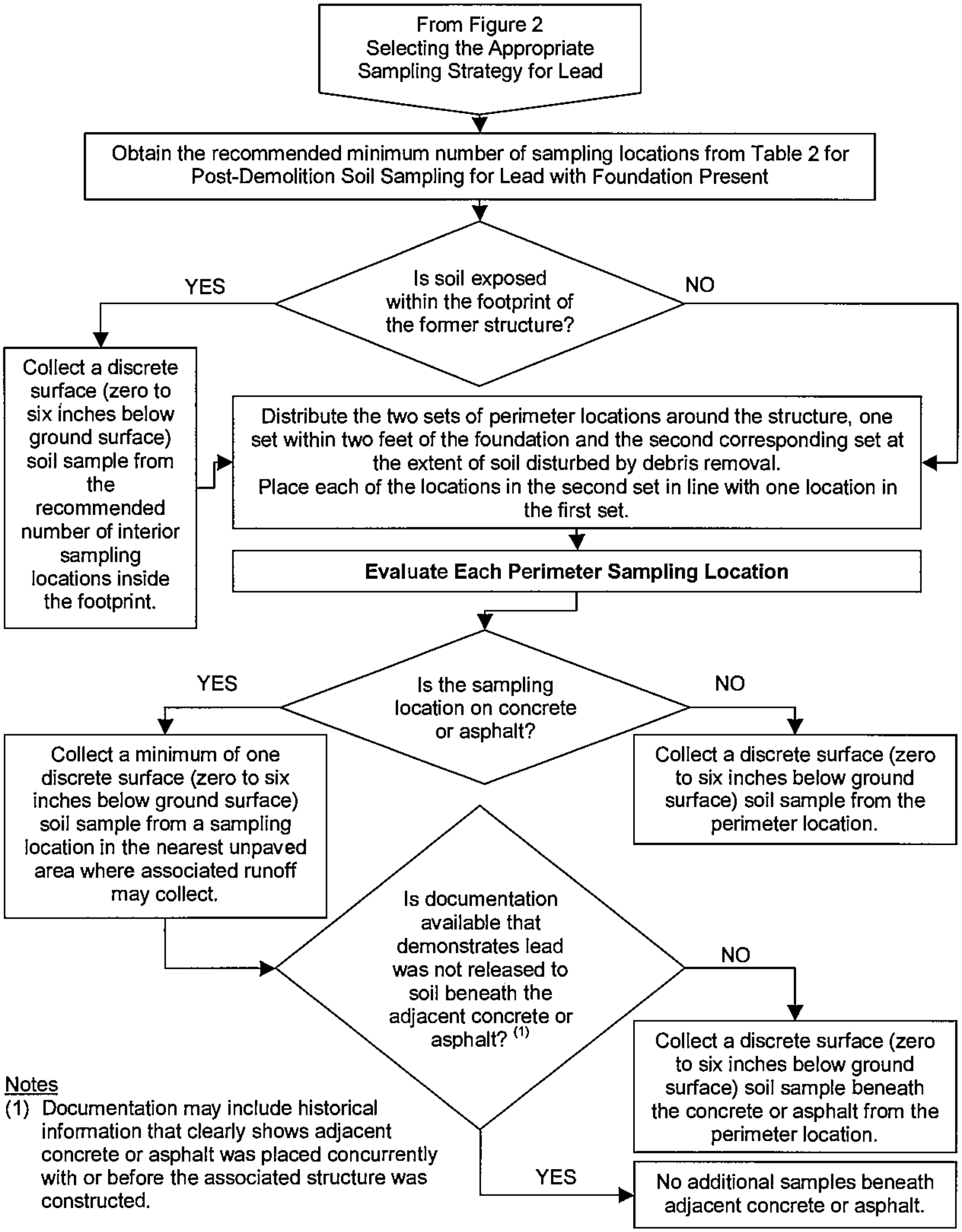
Structure Type	Recommended Minimum Number of Sampling Locations [1]
Single-family housing, multi-family housing (up to and including four units), or detached carports/garages	For each structure, two sets of four perimeter locations: • First set within two feet of the structure foundation. • Second set at the extent of soil disturbed by debris removal[2]. If soil is exposed within the footprint of the former structure, two interior locations distributed inside the footprint.
Out buildings (shed or similar small structures)	For each structure, two sets of two perimeter locations: • First set within two feet of the structure foundation. • Second set at the extent of soil disturbed by debris removal[2]. If soil is exposed within the footprint of the former structure, one interior location inside the footprint.
Multi-family housing (more than four units), commercial structures, or barns	For each structure, two sets of six perimeter locations: • First set within two feet of the structure foundation. • Second set at the extent of soil disturbed by debris removal[2]. If soil is exposed within the footprint of the former structure, four interior locations distributed inside the footprint.

Notes

(1) Additional sampling locations may be used to evaluate potential release of lead beneath adjacent concrete or asphalt placed after the structure was constructed. Refer to Figure 4 – Post-Demolition Sampling for Lead with Foundation Present, Placing Sampling Locations and Determining Collection Depths.

(2) Place each sampling location in the second set in line with one location in the first set.

FIGURE 4
Post-Demolition Sampling for Lead with Foundation Present
Placing Sampling Locations and Determining Collection Depths



Notes
(1) Documentation may include historical information that clearly shows adjacent concrete or asphalt was placed concurrently with or before the associated structure was constructed.

4.1.2.2 *Foundation Removed or Site Graded*

If the structure foundation or slab was removed or the surrounding soil was graded, the following procedure should be used to collect samples from the site:

1. Determine the number of recommended sampling locations for each structure historically or currently present on site based on type (See Table 3).
2. Add up the number of recommended sampling locations for each structure to obtain the total number of sampling locations for the site.
1. Overlay a grid onto the site. The number of grid cells should correspond to the total number of sampling locations for the site. Place one sampling location at the center of each grid cell. For sites with distinct use areas, such as agriculture with a residential structure, the grid should be place over the area associated with the structure(s) and soil disturbed by demolition activities based on review of historical information.
2. Collect discrete surface (zero to six inches below ground surface) and subsurface (two to three feet below ground surface) soil samples from each sampling location.

The recommended number of sampling locations may vary depending on the type and number of structures, and conditions found. Table 3 provides recommended sampling locations and depths for post-demolition sampling when the structure foundation has been removed. In general, more samples are recommended as the surface area of the structure increases.

TABLE 3
Post-Demolition Soil Sampling for Lead
with Foundation Removed or Site Graded
Recommended Sampling Locations and Depths

Step 1: Determine the recommended number of sampling locations for each historic or current structure on site.	
Structure Type	**Recommended Number of Sampling Locations**
Single-family housing, multi-family housing (up to and including four units), or detached carports/garages	Six locations for each structure.
Out buildings (shed or similar small structures)	Four locations for each structure.
Multi-family housing (more than four units), commercial structure, or barns	Eight locations for each structure.
Step 2: Add up the number of sampling locations for each structure to obtain the total number of sampling locations for the site.	
Step 3: Overlay a grid onto the site. The number of grid cells should correspond to the total number of sampling locations for the site. Place one sampling location at the center of each grid cell. For sites with distinct use areas, such as agriculture with a residential structure, the grid should be placed over the area associated with the structure(s) based on review of historical information.	
Step 4: Collect discrete surface (1) and subsurface (2) samples from each sampling location.	

Notes
(1) Surface samples should be collected from zero to six inches below ground surface.
(2) Subsurface samples should be collected from two to three feet below ground surface.

4.2 Sample Analysis

Samples for lead in soil may be analyzed using field and/or laboratory methods. For analysis, subsamples of surface samples (zero to six inches below ground surface) should consist of the uppermost soil from the core (closest to ground surface). To assist the laboratory, the surface, or top of core, should be labeled in the field. Suggested analytical methods and quantitation limits for lead in soil are provided below.

It is advisable for soil samples to be analyzed pursuant to California Code of Regulations, title 22, section 69103, subsection (a)(2), which references United States Environmental Protection Agency (U.S. EPA) test methods available in "Test Methods for Evaluating Solid Waste, Physical/Chemical Methods," EPA Publication SW-846 Third Edition, November 1986 (SW-846), as amended.

Preparation and analytical methods used should result in reporting the total lead concentration in the sample being analyzed. Quantitation limits for lead should be less than the reference concentration (e.g. screening value) used for comparison. Suggested quantitation limits are based on consideration of the applicable reference concentration and represent the level routinely achievable by the DTSC Environmental

Chemistry Laboratory. Suggested methods and quantitation limits for lead analysis are listed in Table 4.

TABLE 4
Methods and Quantitation Limits for Lead Analysis

Analyte	CASRN	Media	Analytical Method	Quantitation Limit (mg/kg or ppm)
Lead	7439-92-1	Soil	LABORATORY U.S. EPA Method 6010, 6020, or 7000 (AA only, not GFAA)	50
			FIELD U.S. EPA Method 6200 (1)	50

Abbreviations

AA atomic absorption
CASRN chemical abstracts registry number
GFAA graphite furnace atomic absorption
mg/kg milligrams per kilogram
ppm parts per million
U.S. EPA United States Environmental Protection Agency

Notes

(1) On-site field analyses for lead in soil may be conducted using portable x-ray fluorescence (XRF) in accordance with U.S. EPA Method 6200 and supplemental guidelines described in Section 4.2.

On-site field analyses for lead in soil may be conducted using portable x-ray fluorescence (XRF) in accordance with U.S. EPA Method 6200 and the following supplemental guidelines.

- In-situ XRF analyses (i.e. readings taken directly off the soil) of lead in soil are not acceptable for this initial assessment.
- Training and Licensing
  - XRF operators should possess a Radioactive Materials License issued by the California Department of Health Services.
  - XRF operators should be trained to operate the specific piece of equipment used.
- Sample Preparation
  - As long as the samples are well homogenized, use of a No. 60 (250 μm) as described in U.S. EPA Method 6200 (U.S. EPA 1998a and 1998b), Section 11.6, sieve is optional. A No. 10 (2.0 mm) sieve may be used to remove large debris and obtain a total soil sample that includes both coarse and fine fractions (rather than just the fine fraction that passes through a No. 60 (250 μm) sieve).
  - Consistent with U.S. EPA Method 6200 (U.S. EPA 1998a and 1998b), Sections 7.2.2 and 11.5, microwave drying is not recommended; however, other methods and times may be used to dry the sample. Moisture content above 20 percent may interfere with analysis, since moisture

alters the soil matrix for which the field-portable XRF has been calibrated. The effect of moisture on XRF results is site-specific. Accordingly, samples should be sufficiently dried to obtain an acceptable correlation coefficient as described in the bulleted item for confirmatory samples below.
    - Grinding of the sample as described in U.S. EPA Method 6200 (U.S. EPA 1998a and 1998b), Section 11.6, is optional and may not be necessary as long as the sample is sieved properly.
- Instrument Calibration
    - Initial and continuing calibration should be conducted in accordance with manufacturer's instructions for soil samples and a standard soil sample containing lead concentration near the screening value of 255 milligrams of lead per kilogram of soil (mg/kg) should be measured and documented. The development and use of the screening value for lead is presented in Section 4.3.
- Confirmatory Samples
    - A confirmatory sample should be a split sample from the well homogenized sample material. Confirmatory samples for 10 percent of the samples (but not less than five) should be forwarded for laboratory analysis. Consistent with U.S. EPA Method 6200 (U.S. EPA 1998a and 1998b), confirmatory samples should be selected from the lower, middle, and upper range measured using XRF. Samples with XRF results near the screening value of 255 mg/kg should also be included.
    - Consistent with U.S. EPA Method 6200, XRF results and laboratory analytical results for associated confirmatory samples should be evaluated with a least squares linear regression analysis (U.S. EPA 1998a and 1998b). The correlation coefficient (r^2) for the results should be 0.8 or greater for the XRF data to be considered valid for initial evaluation of lead in soil at the site (U.S. EPA 1995a).

4.3 Data Interpretation and Assessment

After verifying and validating the analytical data as specified in Section 7.0, detected concentrations of lead in soil from lead-based paint should be compared to the screening value to determine if further investigation is required. The screening value for lead in soil from lead-based paint at proposed school sites is 255 milligrams per kilogram (mg/kg or parts per million, ppm). The value is derived using the DTSC Lead Risk Assessment Spreadsheet, LeadSpread 7 (DTSC 1999), and represents the soil concentration that is predicted to result in a 99th percentile estimate of blood lead equal to 10 micrograms of lead per deciliter of blood (µg/dL) for a child. The threshold blood lead value of 10 µg/dL is the level of concern identified by the United States Department of Health and Human Services, Centers for Disease Control and Prevention (CDC). The value is subject to change and revision when the DTSC Lead Risk Assessment Spreadsheet is updated or other information is made available.

The following input values were used in the worksheet to obtain the screening value:

- Lead in air: Default value of 0.028 micrograms per cubic meter (μg/m^3) based on ambient air lead concentration data from the California Air Resources Board.
- Lead in water: Default value of 15 micrograms per liter (μg/L) based on the California Maximum Contaminant Level.
- Home-grown produce: Zero percent since this pathway is not considered a potential exposure pathway for school sites.
- Respirable dust: Default value of 1.5 μg/m^3 based on Table 3 in Appendix D of the U.S. EPA *Soil Screening Guidance: Technical Background Document* (U.S. EPA 1996b).

The maximum concentration of lead detected on the proposed school site should be compared to the screening value. Generally, sites with lead concentrations detected below the screening value will require no further action and those with lead concentrations detected at or above the screening value will require additional evaluation, investigation, or response action. However, these are general guidelines and DTSC will make a determination, such as additional evaluation for sites with lead concentrations approaching the screening value, based on site-specific information.

5.0 ORGANOCHLORINE PESTICIDES FROM TERMITICIDE APPLICATION

Organochlorine pesticides (OCPs) were commonly used as insecticides for termite control around structures. These OCPs included chlordane, lindane, heptachlor and aldrin, which readily converts to dieldrin in the environment.

OCPs were applied surficially to soil surrounding foundations and injected into the soil in an effort to isolate wood structures from termite nests (Ebeling 1975). Additionally, more recent federal requirements suggest that termite activity is generally limited to the upper four feet of soil (U.S. EPA 1996a). Historically, the following methods were used to apply OCPs for termite control:

- Pre-construction: Soil drenched with termiticides prior to construction of concrete slab foundations.
- Trenching: Trenches, approximately 12 inches deep, excavated around a structure near the foundation and filled with termiticide to saturate the soil to approximately 12 inches beneath the trench bottom.
- Spot treatment: Termiticide pumped into holes drilled into concrete foundations and surrounding soil in infested areas.
- Bait: Termiticide in food pellets placed underground.
- Homeowner: Termiticides applied surficially in and around structures.

Chlordane was used in the United States from 1948 until 1988, when it was banned by U.S. EPA. Because of evidence of human exposure and accumulation in body fat, as well as persistence in the environment and effects on wildlife, U.S. EPA prohibited the use of chlordane in 1988 to control termites around homes and structures. It is estimated that chlordane was applied to over 30 million homes in the United States, often at concentrations far higher than those recommended by the manufacturer because of homeowner application (Kilburn and Thornton 1995). Chlordane is listed as one of the twelve persistent organic pollutants by U.S. EPA based on its resistance to chemical and biological degradation. When applied to soil around structures, chlordane adsorbs to organic matter and clay particles and slowly volatilizes into the atmosphere. The other OCPs which were also used as termiticides have also been banned by the U.S. EPA.

Chlordane is considered a Class B2 carcinogen by U.S. EPA (U.S. EPA 1997, 2002a), and is listed as a carcinogen by the State of California (OEHHA 2005). Chronic exposure of people to chlordane may also result in adverse effects on the nervous, respiratory, and cardiovascular systems, as well as the liver, blood, and lung. The other OCPs used as termiticides are also considered by both U.S. EPA and the State of California to be possible carcinogens.

Widespread application of chlordane and other OCPs is known to have occurred around structures in various regions (Colorado, Florida, Louisiana, Massachusetts, New Jersey, and Texas) throughout the United States. However, due to the lack of data on pesticide residues at residential properties in California and the prevalence of termites throughout the state (Ebeling 1975 and UC 2001), DTSC conducted an investigation of three proposed school sites with residential structures to evaluate the presence and prevalence of chlordane and other OCPs as a result of termiticide application. The results of this study are presented in the report, *Residential Pesticide Study, Final Report* (DTSC 2006).

The study focused on three proposed school sites with multiple housing units on each site in three Southern California counties (Los Angeles, San Bernardino, and San Diego). Risk-screening evaluation results indicated an unacceptable excess cancer risk for a residential, unrestricted land use scenario at all three sites, primarily associated with chlordane and dieldrin in surface soil. Approximately 50 percent of chlordane and dieldrin detections had an associated risk greater than one in a million ($>1x10^{-6}$), and approximately 20 percent of chlordane and dieldrin detections had an associated risk greater than one in 100,000 ($>1x10^{-5}$).

In addition to the three school sites included in the study, DTSC investigated OCPs from terimiticide application at residential properties proposed for school sites in various counties throughout California, including Alameda, Contra Costa, Fresno, Kern, Los Angeles, Merced, Riverside, San Diego, San Joaquin, Santa Cruz, and Stanislaus. Of a total of 23 sites (including three sites from the study), further investigation and/or removal actions were conducted for OCPs from termiticide application at approximately 70 percent of the sites evaluated (DTSC 2006).

The results of this study indicate that it is likely that significant concentrations of OCP residues may exist around structures with wood components built prior to January 1, 1989 and should be evaluated at school sites.

5.1 Soil Sampling

A decision tree to determine whether OCPs in soil from temiticide application may be a concern and the appropriate strategy is provided in Figure 5 and details for pre- and post-demolition sampling strategies are provided in the following sections. The pre-demolition sampling strategy may also be followed to evaluate existing wooden structures, constructed prior to January 1, 1989, that will remain on site and be incorporated into the school.

Locations and depths of soil samples to be collected for OCPs may coincide with those to be collected for lead. If this occurs, the same soil samples analyzed for lead may be analyzed for OCPs.

5.1.1 PRE-DEMOLITION SAMPLING

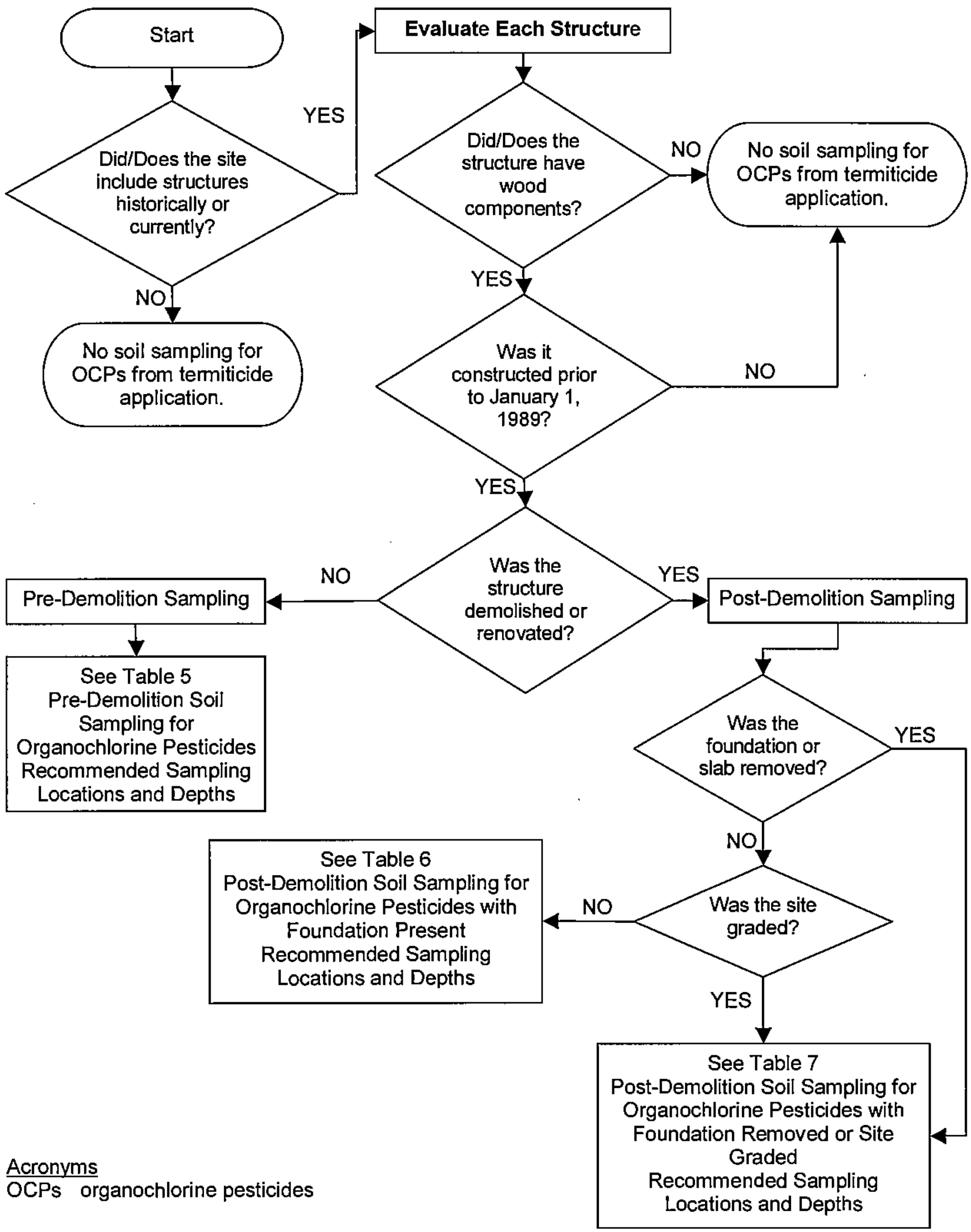
Soil sampling should be focused in areas with the highest potential for OCPs from termiticide application. The recommended number of sampling locations may vary depending on the type and number of structures, and conditions found. Table 5 provides recommended sampling locations, depths, and compositing guidelines for pre-demolition sampling. In general, more samples are recommended as the surface area of the structure increases.

Sampling locations should be distributed around the perimeter within two feet of the structure. Discrete surface (zero to six inches below ground surface) and subsurface (two to three feet below ground surface) soil samples should be collected from these perimeter locations. If concrete or asphalt borders the structure, samples should be collected beneath these paved areas. Termiticide was generally applied immediately adjacent to foundations, and in some cases, may have been injected around the foundation. DTSC is available to discuss collection of samples beneath existing paved areas if the integrity of a structure will be affected.

Additional sampling locations should be placed beneath a raised floors and/or porches, if present. Only discrete surface (zero to six inches below ground surface) soil samples should be collected from these interior locations.

The same type of sample (perimeter or interior) collected from a single structure at the same depth may be composited and analyzed instead of analyzing each discrete sample separately. A maximum of four discrete samples may be composited and analyzed. Guidelines for compositing samples are provided in Section 5.2.

FIGURE 5
Determining If Organochlorine Pesticides in Soil are a Concern and Selecting the Appropriate Sampling Strategy



Acronyms
OCPs organochlorine pesticides

TABLE 5
Pre-Demolition Soil Sampling for Organochlorine Pesticides
Recommended Sampling Locations and Depths

Structure Type	Recommended Locations and Depths
Single-family housing, multi-family housing (up to and including four units), or detached carports/garages	For each structure, collect discrete surface [(1)] and subsurface [(2)] soil samples from four perimeter locations within two feet of the structure, near the foundation, and beneath paved areas, if present. • Four discrete surface samples can be composited for analysis. • Four discrete subsurface samples can be composited for analysis. For each structure, collect discrete surface [(1)] soil samples from four interior locations placed beneath raised floors and/or porches, if present. • Four discrete surface samples may be composited for analysis.
Out buildings (shed or similar small structures)	For each structure, collect discrete surface [(1)] and subsurface [(2)] soil samples from two perimeter locations within two feet of the structure, near the foundation, and beneath paved areas, if present. • Both discrete surface samples can be composited for analysis. • Both discrete subsurface samples can be composited for analysis. For each structure, collect discrete surface [(1)] soil samples from two interior locations placed beneath raised floors and/or porches, if present. • Both discrete surface samples may be composited for analysis.
Multi-family housing (more than four units), commercial structures, or barns	For each structure, collect discrete surface [(1)] and subsurface [(2)] soil samples from six perimeter locations within two feet of the structure, near the foundation, and beneath paved areas, if present. • Three discrete surface samples can be composited for analysis. • Three discrete subsurface samples can be composited for analysis. For each structure, collect discrete surface [(1)] soil samples from six interior locations placed beneath raised floors and/or porches, if present. • Three discrete surface samples may be composited for analysis.

Notes
(1) Surface samples should be collected from zero to six inches below ground surface.
(2) Subsurface samples should be collected from two to three feet below ground surface.

5.1.2 POST-DEMOLITION SAMPLING

Two post-demolition (structure has been demolished or renovated) sampling strategies are provided for conditions that may be encountered on a site:

- Foundation Present (Section 4.1.2.1)
    - Foundation present and site not graded.
- Foundation Removed or Site Graded (Section 4.1.2.2)
    - Foundation present and site graded.
    - Foundation removed and site not graded.
    - Foundation removed and site graded.

Demolition or renovation activities may result in spreading of contamination resulting from removal of associated debris. To evaluate this possibility, samples at the extent soil disturbed by debris removal are incorporated into the sampling strategies, as appropriate. The following sections detail sampling strategies for each condition.

5.1.2.1 Foundation Present

Soil sampling should be focused in areas with the highest potential for OCPs from termiticide application. The recommended number of sampling locations may vary depending on the type and number of structures, and conditions found. Table 6 provides recommended sampling locations, depths, and compositing guidelines for post-demolition sampling when the structure foundation is present. In general, more samples are recommended as the surface area of the structure increases.

Two sets of sampling locations should be distributed around the perimeter, one set within two feet of the structure foundation and the second corresponding set at the extent of soil disturbed by debris removal. Each of the sampling locations in the second set should be placed in line with one location in the first set. If soil is exposed within the footprint of the former structure, interior sampling locations should be distributed inside the footprint. Discrete surface (zero to six inches below ground surface) and subsurface (two to three feet below ground surface) soil samples should be collected from these perimeter and interior locations. If concrete or asphalt borders the structure, samples should be collected beneath these paved areas. Termiticide was generally applied immediately adjacent to foundations, and in some cases, may have been injected around the foundation. DTSC is available to discuss collection of samples beneath existing paved areas if the integrity of a structure will be affected.

The same type of sample (first set of perimeter, second set of perimeter, or interior) collected from a single structure at the same depth may be composited and analyzed instead of analyzing each discrete sample separately. A maximum of four discrete samples may be composited for analysis. Guidelines for compositing samples are provided in Section 5.2.

TABLE 6
Post-Demolition Soil Sampling for Organochlorine Pesticides with Foundation Present
Recommended Sampling Locations and Depths

Structure Type	Recommended Sampling Locations and Depths
Single-family housing, multi-family housing (up to and including four units), or detached carports/garages	For each structure, collect discrete surface (1) and subsurface (2) soil samples from the following locations: • First set of four perimeter locations within two feet of the structure foundation. - Four discrete surface samples may be composited for analysis. - Four discrete subsurface samples may be composited for analysis. • Second set of four perimeter locations at the extent of soil disturbed by debris removal (3). - Four discrete surface samples may be composited for analysis. - Four discrete subsurface samples may be composited for analysis. • If soil is exposed within the footprint of the former structure, two interior locations distributed inside the footprint. - Two discrete surface samples may be composited for analysis. - Two discrete subsurface samples may be composited for analysis.
Out buildings (shed or similar small structures)	For each structure, collect discrete surface (1) and subsurface (2) soil samples from the following locations: • First set of two perimeter locations within two feet of the structure foundation. - Both discrete surface samples may be composited for analysis. - Both discrete subsurface samples may be composited for analysis. • Second set of two perimeter locations at the extent of soil disturbed by debris removal (3). - Both discrete surface samples may be composited for analysis. - Both discrete subsurface samples may be composited for analysis. • If soil is exposed within the footprint of the former structure, one interior location should be placed inside the footprint.
Multi-family housing (more than four units), commercial structures, or barns	For each structure, collect discrete surface (1) and subsurface (2) soil samples from the following locations: • First set of six perimeter locations within two feet of the structure foundation. - Three discrete surface samples may be composited for analysis. - Three discrete subsurface samples may be composited for analysis. • Second set of six perimeter locations at the extent of soil disturbed by debris removal (3). - Three discrete surface samples may be composited for analysis. - Three discrete subsurface samples may be composited for analysis. • If soil is exposed within the footprint of the former structure, four interior locations distributed inside the footprint. - Four discrete surface samples may be composited for analysis. - Four discrete subsurface samples may be composited for analysis.

Notes
(1) Surface samples should be collected from zero to six inches below ground surface.
(2) Subsurface samples should be collected from two to three feet below ground surface.
(3) Place each sampling location in the second set in line with one location in the first set.

5.1.2.2 *Foundation Removed or Site Graded*

If the structure foundation or slab was removed or the surrounding soil was graded, the following procedure should be used to collect samples from the site:

1. Determine the number of recommended sampling locations for each structure historically or currently present on site based on type (See Table 7).
2. Add up the number of recommended sampling locations for each structure to obtain the total number of sampling locations for the site.
3. Overlay a grid onto the site. The number of grid cells should correspond to the total number of sampling locations for the site. Place one sampling location at the center of each grid cell. For sites with distinct use areas, such as agriculture with a residential structure, the grid should be place over the area associated with the structure(s) and soil disturbed by demolition activities based on review of historical information.
4. Collect discrete surface (zero to six inches below ground surface) and subsurface (two to three feet below ground surface) soil samples from each location.
5. As an option, up to four adjacent discrete samples from the same depth can be composited and analyzed.

Adjacent samples collected from the same depth may be composited and analyzed instead of analyzing each discrete sample separately. A maximum of four discrete samples may be composited for analysis. Guidelines for compositing samples are provided in Section 5.2.

The recommended number of sampling locations may vary depending on the type and number of structures, and conditions found. Table 7 provides recommended sampling locations and depths for post-demolition sampling when the structure foundation has been removed. In general, more samples are recommended as the surface area of the structure increases.

TABLE 7
Post-Demolition Soil Sampling for Organochlorine Pesticides with Foundation Removed or Site Graded
Recommended Sampling Locations and Depths

Step 1: Determine the recommended number of sampling locations for each historic or current structure on site.	
Structure Type	**Recommended Number of Sampling Locations**
Single-family housing, multi-family housing (up to and including four units), or detached carports/garages	Six locations for each structure.
Out buildings (shed or similar small structures)	Four locations for each structure.
Multi-family housing (more than four units), commercial structures, or barns	Eight locations for each structure.
Step 2: Add up the number of sampling locations for each structure to obtain the total number of sampling locations for the site.	
Step 3: Overlay a grid onto the site. The number of grid cells should correspond to the total number of sampling locations for the site. Place one sampling location at the center of each grid cell. For sites with distinct use areas, such as agriculture with a residential structure, the grid should be placed over the area associated with the structure(s) based on review of historical information.	
Step 4: Collect discrete surface [(1)] and subsurface [(2)] samples from each sampling location.	
Step 5: (Optional) Up to four adjacent discrete samples from the same depth can be composited for analysis.	

Notes
(1) Surface samples should be collected from zero to six inches below ground surface.
(2) Subsurface samples should be collected from two three feet below ground surface.

5.2 Sample Compositing

A maximum of four discrete samples may be composited for analysis of OCPs around structures for the initial assessment in order to expedite the process and reduce associated analytical costs. However, compositing may increase labor and equipment costs due the additional time and equipment needed to prepare the composited samples. The following compositing guidelines are provided for each sampling strategy:

- Pre-demolition sampling – Discrete samples of the same type (perimeter or interior), collected from the same structure, at the same depth may be composited.
- Post-demolition sampling when the structure foundation is present – Discrete samples of the same type (first set of perimeter, second set of perimeter, or interior), collected from the same structure, at the same depth may be composited.

- Post-demolition sampling when the structure foundation is not present or site is graded – Discrete samples from adjacent locations, collected from the same depth, may be composited.

For compositing, discrete samples should be individually collected, homogenized, and split. A portion of the homogenized discrete sample should be preserved and archived in case additional analysis is necessary based on analytical results of the composited samples. Aliquots of equal amounts of soil from each homogenized discrete sample should be placed into a clean container, such as a bowl, and thoroughly homogenized. The resulting composited sample can be submitted for analysis.

To ensure the integrity of the samples and usability of the resulting data, it is recommended that sample handling and preservation follow SW-846 and subsequent amendments. Samples should be analyzed within the specified holding time. Soil samples collected in 250 milliliter (mL) wide-mouth glass containers with polytetrafluoroethylene (PTFE)-lined lids may be cooled to 4 Celsius (°C). Samples should be extracted within 14 days of collection, and extracts should be analyzed within 40 days following extraction (U.S. EPA 2000).

Adjustments to the screening values have been made to accommodate composited samples and are discussed in Section 5.4. The individual discrete samples should be analyzed when the results of a composited sample meets or exceeds the screening value.

5.3 Sample Analysis

It is advisable for soil samples to be analyzed using U.S. EPA test methods available in SW-846 (U.S. EPA 1986) and subsequent amendments, such as U.S. EPA Method 8081 or an equivalent method capable of attaining the quantitation limits listed in Table 8.

Quantitation limits for OCPs should be less than the reference concentration (e.g. screening value) use for comparison. Recommended quantitation limits for laboratory analysis of OCPs are listed in Table 8. These represent the lowest quantitation limits that can be routinely achieved by the DTSC Environmental Chemistry Laboratory.

TABLE 8
Quantitation Limits for Organochlorine Pesticides Analysis

Analyte	CASRN	Quantitation Limit (µg/kg or ppb)
Aldrin	309-00-2	5
gamma-BHC (Lindane)	58-89-9	5
alpha-Chlordane	5103-71-9	5
gamma-Chlordane	5103-74-2	5
Chlordane (not otherwise specified)	57-74-9	50
4,4'-DDD	72-54-8	5
4,4'-DDE	72-55-9	5
4,4'-DDT	50-29-3	5
Dieldrin	60-57-1	5
Heptachlor	76-44-8	5

Abbreviations and Acronyms

BHC	hexachlorocyclohexane, HCH
CASRN	chemical abstracts registry number
4,4'-DDD	p,p'-Dichlorodiphenyldichloroethane
4,4'-DDE	p,p'-Dichlorodiphenyldichloroethylene
4,4'-DDT	p,p'-Dichlorodiphenyltrichloroethane
µg/kg	micrograms per kilogram
ppb	parts per billion
U.S. EPA	United States Environmental Protection Agency

5.4 Data Interpretation and Assessment

After verifying and validating the analytical data as specified in Section 7.0, the detected concentrations of OCPs from termiticide application in soil should be compared to respective screening values to determine if further investigation is required. The screening values for OCPs are from the California Human Health Screening Levels (CHHSLs; Cal/EPA 2005) for soil for residential land use. CHHSLs are risk-based screening concentrations developed by the California Environmental Protection Agency (Cal/EPA) and are subject to change and revision as updated toxicological information is made available. An abbreviated list of CHHSLs for the most common OCPs used to control termites is provided in Table 9. Adjustments (screening value divided by the number of discrete samples in a composited sample) to the screening values for composited samples are also included in Table 9 (U.S. EPA 1995b).

The maximum concentration of each OCP detected on the proposed school site should be compared to the respective screening value. Generally, sites with OCP concentrations detected below the screening value will require no further action and those with OCP concentrations at or above the respective screening value will require additional evaluation, investigation, or a response action. However, these are general guidelines and DTSC will make a determination based on site-specific information, such as additional evaluation for sites with concentrations of OCPs approaching the screening value.

TABLE 9
Soil Screening Values for Organochlorine Pesticides for Discrete and Composited Samples

Analyte	Discrete Sample Screening Value (µg/kg or ppb) [(1)]	Composited Sample Screening Value (µg/kg or ppb)		
	Composite Ratio (Composite:Discrete)	**1:2**	**1:3**	**1:4**
Aldrin	33	16	10	5
gamma-BHC (Lindane)	500	250	160	125
Chlordane (all forms)	430	215	140	105
4,4'-DDD	2,300	1,150	760	575
4,4'-DDE	1,600	800	530	400
4,4'-DDT	1,600	800	530	400
Dieldrin	35	16	10	5
Heptachlor	130	60	40	20

<u>Abbreviations and Acronyms</u>

BHC	hexachlorocyclohexane, HCH
CASRN	chemical abstracts registry number
4,4'-DDD	p,p'-Dichlorodiphenyldichloroethane
4,4'-DDE	p,p'-Dichlorodiphenyldichloroethylene
4,4'-DDT	p,p'-Dichlorodiphenyltrichloroethane
µg/kg	micrograms per kilogram
ppb	parts per billion

<u>Notes</u>

(1) California Human Health Screening Levels for soil for residential land use (Cal/EPA 2005).

(2) Screening values for composited samples are decreased in proportion to the number of discrete samples that makeup the composite sample in an effort to ensure hot spots are not missed (i.e. 100 percent of the measure concentration in a composited sample is from only one of the associated discrete samples).

6.0 POLYCHLORINATED BIPHENYLS FROM ELECTRICAL TRANSFORMERS

Polychlorinated biphenyls (PCBs) are man-made chemicals commonly used in the past as coolants and lubricants. PCBs are found as a clear to yellow, heavy oily liquid or waxy solid. PCBs were frequently used as insulation in electrical equipment because of their stablility, low water solubility, high boiling point, low flammability, and low electrical conductivity (ATSDR 2001, DTSC 2003, and U.S. EPA 2004a). PCBs were produced in the United States from approximately 1929 to 1977. Production of PCBs was banned in the United States by the Toxic Substances Control Act (TSCA) in 1978 due to evidence of accumulation in the environment and link to harmful health effects (DTSC 2003). U.S. EPA considers PCBs to be probable human carcinogens (U.S. EPA 2004c) and they are listed as carcinogens by the State of California (OEHHA 2005). PCBs may have serious effects on the immune, reproductive, nervous, and endocrine systems (U.S. EPA 2004c).

Prior to 1978, PCBs were often used in the manufacture of transformers and capacitors, and leaks or releases from transformers producing contaminated areas have been documented. The age of the transformer does not necessarily indicate the presence or absence of impacts to soil from PCBs, as releases of PCBs from a previous transformer may have occurred before its replacement. Once released to the environment, PCBs bind to soil particles and are very persistent.

Soil sampling is not necessary for transformers installed for the first time on or after January 1, 1979. Soil sampling should be conducted for any historical (removed or replaced by a newer transformer) or current transformers installed before January 1, 1979.

6.1 Soil Sampling

Since PCBs in soil generally do not migrate significantly, soil sampling should be focused around the base of each pole- or pad-mounted electrical transformer. Surface (zero to six inches below ground surface) and subsurface (two to three feet below ground surface) soil samples should be collected in the area with the highest potential for a release from the transformer. If a historical pad-mounted transformer, installed before January 1, 1979, was replaced by a newer transformer, samples should be collected beneath the replacement pad to evaluate potential releases from the historical transformer. Table 10 provides recommended sampling locations and depths.

TABLE 10
Recommended Soil Sampling Locations and Depths for Polychlorinated Biphenyls

Transformer Type	Sampling Locations	Sample Depths
Pole-mounted	One location within close proximity of the base of the pole or in areas of visible staining.	For each sampling location: • One discrete surface (1) soil sample. • One discrete subsurface (2) soil sample.
Pad-mounted	Two locations within close proximity of the transformer or in areas of visible staining.	For each sampling location: • One discrete surface (1) soil sample. • One discrete subsurface (2) soil sample.

Notes
(1) Surface samples should be collected from zero to six inches below ground surface.
(2) Subsurface samples should be collected from two to three feet below ground surface.

6.2 Sample Analysis

Initially surface samples may be analyzed for PCBs and subsurface samples may be preserved and archived. To ensure the integrity of the samples and usability of the resulting data, it is recommended that sample handling and preservation follow SW-846 and subsequent amendments. Samples collected in 250 mL wide-mouth glass containers with PTFE-lined lids may be cooled to 4°C with no specified holding time (U.S. EPA 2000). However, U.S. EPA Method 8082 recommends refrigerating extracts in the dark and analyzing with 40 days of extraction (U.S. EPA 2000). If PCBs are detected in surface samples, subsurface samples should be analyzed.

It is advisable for soil samples to be analyzed pursuant to California Code of Regulations, title 22, section 69103, subsection (a)(2), which references U.S. EPA test methods available in SW-846 (U.S. EPA 1986) and subsequent amendments, such as U.S. EPA Method 8082 or an equivalent method capable of attaining the quantitation limits listed in Table 11.

Quantitation limits for PCBs should be less than the reference concentration (e.g. screening value) use for comparison. Suggested methods and quantitation limits for laboratory analysis of PCBs are listed in Table 11. These represent the lowest quantitation limits that can be routinely achieved by the DTSC Environmental Chemistry Laboratory.

TABLE 11
Quantitation Limits for Polychlorinated Biphenyls Analysis

Analyte	CASRN	Quantitation Limit (mg/kg or ppm)
Aroclor-1016	12674-11-2	0.300
Aroclor-1221	11104-28-2	0.300
Aroclor-1232	11141-16-5	0.300
Aroclor-1248	12672-29-6	0.300
Aroclor-1254	11097-69-1	0.300
Aroclor-1260	11096-82-5	0.300

Abbreviations and Acronyms
CASRN chemical abstracts registry number
mg/kg milligrams per kilogram
ppm parts per million
U.S. EPA United States Environmental Protection Agency

6.3 Data Interpretation and Assessment

After verifying and validating the analytical data as specified in Section 7.0, the detected concentrations of PCBs (reported in concentrations of Aroclors) from electrical transformers in soil should be compared to the screening value to determine if further investigation is required. The soil screening value for PCBs from electrical transformers at proposed school sites is 0.300 mg/kg or ppm. This value corresponds to an approximate incremental cancer risk of 3.4×10^{-6}. Note that the CHHSL (Cal/EPA 2005) for PCBs in soil for residential land use is 0.089 mg/kg or ppm. However, this value cannot be routinely quantified through laboratory analysis.

The maximum concentration of each Aroclor detected on the proposed school site should be compared to the screening value. Unless sites have PCB concentrations detected above the screening value, no further action is required.

7.0 QUALITY ASSURANCE/QUALITY CONTROL

Site evaluation for lead, OCPs, and PCBs from specific sources described herein should include quality assurance/quality control (QA/QC) measures as part of sampling and analytical procedures. The purpose of these measures is to produce data of a known quality. The following QA/QC measures are recommended for cases in which limited number of samples are collected over a relatively short period of time.

- QA/QC samples
- Laboratory report
- Data validation memorandum

At a minimum, the QA/QC samples are listed in Table 12 should be used. These should be supplemented by additional laboratory QA/QC samples analyzed as part of standard laboratory practice.

TABLE 12
Quality Assurance/Quality Control Samples

Sample Type	Purpose	Preparation	Frequency
Field QA/QC Samples			
Collocated samples	Determine local variability of the soil and contamination at the site.	Collected within 0.5 to 3 feet of a field sample.	At least 10 percent of samples collected per event should be either collocated samples or field replicates. Minimum of one per matrix.
Field replicates (also known as field duplicates)	Assess error associated with sample heterogeneity, sample methodology and analytical procedures.	Split sample of a homogenized field sample.	
Equipment blanks (also known as rinsate blanks)	Assess cross-contamination resulting from improper decontamination procedures.	Run analyte-free water over decontaminated reusable sampling equipment to test for residual contamination.	One equipment blank per matrix per day, not to exceed one blank per 10 samples.
Field blanks	Evaluate contamination error associated with sampling methodology and laboratory procedures	Prepared in the field using clean sand or soil.	Minimum of one field blank sample per matrix per day if disposable sampling equipment is used and equipment blanks are not collected.
Temperature blank	Check the temperature of samples upon receipt at the laboratory.	40 milliliter VOA vial labeled, "temperature blank" in each cooler.	One per cooler.
Laboratory QA/QC Samples			
Matrix Spike (MS) and Matrix Spike Duplicate (MSD) Samples	Used to check sample matrix interferences.	Field samples spiked in the laboratory with a known concentration of a target analyte to verify percent recoveries.	Minimum of one MS/MSD pair per 14 days or one per 20 samples (including blanks and duplicates), whichever is greater.

(DTSC 1994, U.S. EPA 2004d and 1995a)

A laboratory report should include the following information:

1. Environmental laboratory identification and verification that the laboratory is certified under the State of California Environmental Laboratory Accreditation Program (ELAP) or the National Environmental Laboratory Accreditation Program (NELAP) in the appropriate field of testing.
2. Case narrative signed by the laboratory manager, director, or designee that includes the following information:
   a. Client identification, project name, and site identification
   b. Sample designation
   c. Sample matrix

d. Analytical method and analytes
e. Dates of sample collection, preservation, preparation, extraction, and analysis
f. Reporting units and quantitation limits
g. Dilution factors
h. Report page numbering system
i. Holding times met or exceeded
j. Description of problems
k. Discussion of QA/QC criteria outside of acceptance limits and adverse impacts to sample integrity or data quality
l. Discussion of sample handling.

3. Chain of custody forms
4. Holding times
5. Sample preservation
6. Field samples
7. Field QA/QC samples (e.g. collocated samples, field blanks, field replicates, rinsate blanks, as applicable)
8. Laboratory QA/QC samples (e.g. method blanks, laboratory control samples, matrix spike and matrix spike duplicate samples)
9. Surrogate spike recoveries (applicable for organic analyses only)
10. Summary of environmental results
11. Compound identification and quantification
12. Observations regarding any occurrences which may adversely affect sample integrity or data quality
13. Detailed description of all variances encountered during analysis, possible reasons, and corrective actions.

A data validation memorandum should be prepared by a qualified professional, such as a project manager, project QA/QC manager, or third-party QA/QC specialist. In addition to providing an evaluation of the information provided in the laboratory report, the memorandum should evaluate completeness of the laboratory report.

A data report for on-site field analysis for lead in soil using a portable XRF should include the following items:

1. XRF operator identification and verification that the operator has a Radioactive Materials License issued by the California Department of Health Services and training to operate the specific piece of equipment used.
2. Case narrative signed by the certified XRF operator performing the analyses that includes:
   a. Client identification, project name, and site identification
   b. Sample designation
   c. Sample matrix
   d. Analytical method and analytes
   e. Dates of sample collection, preparation, and analysis
   f. Reporting units and quantitation limits
   g. Report page numbering system
   h. Description of problems

i. Discussion of deviations from the recommended method and supplemental guidelines provided herein
j. Discussion of QA/QC criteria outside of acceptance limits and adverse impacts to sample integrity or data quality
k. Discussion of sample preparation and handling.
3. Chain of custody forms or field log sheets indicating sample collection dates and times.
4. Initial and continuing calibration.
5. Field samples
6. Field QA/QC samples (e.g. collocated samples, field blanks, field replicates, rinsate blanks, as applicable)
7. Compound identification and quantification.
8. Associated raw data

A data validation memorandum should be prepared by a qualified professional, such as a project manager, project QA/QC manager, or third-party QA/QC specialist. In addition to providing an evaluation of the information provided in the XRF data report, the memorandum should evaluate completeness of the report and correlation with associated laboratory analysis of confirmatory samples, and should include the following:

- Presentation and evaluation of laboratory analytical results for confirmatory samples.
  - Consistent with U.S. EPA Method 6200, XRF results and laboratory analytical results for associated confirmatory samples should be evaluated with a least squares linear regression analysis (U.S. EPA 1998a and 1998b). The correlation coefficient (r^2) for the results should be 0.8 or greater for the XRF data to be used considered valid for this initial assessment of the site (U.S. EPA 1995a).
- Determination regarding the validity of XRF for initial evaluation of lead.

8.0 PRESENTATION OF DATA

Sampling results and supporting information should be presented in a document such as a Phase I, Phase I Addendum, PEA, or SSI. The information included in the document should:

- Identify the recognized environmental concerns (lead-based paint, termiticides, or electrical transformers) being addressed and the related source of information.
- If DTSC provided a previous determination for the site, provide the date of the determination letter and include a copy of the letter in the appendix.
- Describe the results of visual inspections used to focus soil sampling.
- Describe the sampling approach.
- Identify sampling locations, depths, designation, and rationale.
- Describe the sample collection methods.
  - Sampling methods: Identify the standard operation method and step-by-step procedures of how each sample was collected, including equipment field quality controls.

  - Sample containers and preservation: Identify the types of containers and preservatives used for the different analyses and provide the pre-cleaning method used for the containers.
  - Sample packaging and shipment: Describe the methods for packaging, labeling, marking and shipping the samples.
  - Sample documentation: Describe the label and provide an example. Describe the unique number system used to positively identify each sample without distinguishing the QA/QC samples from other samples. Discuss the field documentation used and include field logs, photographs, and QC checklist or logs, and chain-of-custody forms in an appendix.
- Describe the sample preparation methods used to homogenize, split, and composite samples.
- Describe the QA/QC samples collected.
- List the analyses performed on each sample or group of samples, associated quantitation limits and holding times.
- Describe the field activities conducted in sufficient detail to demonstrate compliance with applicable requirements and to permit reconstruction by another environmental assessor.
  - Decontamination: Describe equipment decontamination procedures.
  - Field conditions: Include a qualitative summary of soil conditions with appropriate description of lithologic changes or evidence of fill material within a designated area. Discuss field variances from the guidance.
  - Health and Safety: Describe any health and safety procedures followed in the field, including safety equipment, personal protective equipment, level of protection, health and safety meetings, hazards encountered, and any instrument readings recorded. If XRF was used for lead analysis, include the qualifications of the operator, standard operating procedures, notes and compliance with radioactive safety requirements.
  - Waste management: Describe the management and disposition of wastes generated during the investigation, including soil cuttings, personal protective equipment, decontamination water, etc. Justification for the management and disposition of wastes should also be provided and should be consistent with the U.S. EPA Guide to Management of Investigation-Derived Wastes (IDW; U.S. EPA 1992).
- Discuss the analytical results.
- Evaluate the overall QA/QC used to ensure that sampling, field and laboratory chain-of custody, laboratory analyses, field and laboratory data measurements, and reporting activities provide data quality consistent with the intended use. As part of the project QA/QC evaluation, data validation should be performed for all submitted samples. Data quality should be defined by data quality indicators (accuracy, precision, method reporting limits, completeness, representativeness, and comparability). A summary of data validation should be included.
- Interpret the data and compare to screening values.
- Provide conclusions and recommendations based on comparison of sampling results to the provided health screening criteria.

- Include references to identify published referenced sources relied upon during the evaluation. Each referenced source shall be adequately annotated to facilitate retrieval by another party.
- Appendices should include site photographs, field logs, XRF data reports, analytical laboratory data reports, chain-of-custody documentation, and IDW disposal documentation, such as uniform hazardous waste manifests or bill of lading for non-hazardous waste.
- Figures
    - Site Vicinity Map – This map should include a north arrow, be to scale, and show the general location of the site relative to its surrounding area, including major highways, surface water bodies, land use, sensitive populations, and critical habitats.
    - Site Plan – This plan should include a north arrow, be to scale, and be of sufficient detail to show significant site features, including site boundaries, land use, paved areas, structures, drainage patters, current uses of the site, areas of known or suspected environmental conditions.
    - Sampling Locations with Analytical Results – This figure should show the samples collected and the associated analytical results overlaid onto the Site Plan. The figure should clearly show the sampling locations relative to the areas of recognized environmental conditions. The sampling locations, depths, matrices, analytes, detected concentrations, quantitation limit for non-detect concentrations, and concentration units should be clearly presented.
- Tables
    - Summary of analytical results, including analytical method, sampling locations, depths, matrix, detected concentrations, quantitation limit for non-detect concentrations, units, and comparison to screening values.

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Information Advisory
Clean Imported Fill Material

October 2001

DEPARTMENT OF TOXIC SUBSTANCES CONTROL

It is DTSC's mission to restore, protect and enhance the environment, to ensure public health, environmental quality and economic vitality, by regulating hazardous waste, conducting and overseeing cleanups, and developing and promoting pollution prevention.

State of California

California Environmental Protection Agency

Executive Summary

This fact sheet has been prepared to ensure that inappropriate fill material is not introduced onto sensitive land use properties under the oversight of the DTSC or applicable regulatory authorities. Sensitive land use properties include those that contain facilities such as hospitals, homes, day care centers, and schools. This document only focuses on human health concerns and ecological issues are not addressed. It identifies those types of land use activities that may be appropriate when determining whether a site may be used as a fill material source area. It also provides guidelines for the appropriate types of analyses that should be performed relative to the former land use, and for the number of samples that should be collected and analyzed based on the estimated volume of fill material that will need to be used. The information provided in this fact sheet is not regulatory in nature, rather is to be used as a guide, and in most situations the final decision as to the acceptability of fill material for a sensitive land use property is made on a case-by-case basis by the appropriate regulatory agency.

Introduction

The use of imported fill material has recently come under scrutiny because of the instances where contaminated soil has been brought onto an otherwise clean site. However, there are currently no established standards in the statutes or regulations that address environmental requirements for imported fill material. Therefore, the California Environmental Protection Agency, Department of Toxic Substances Control (DTSC) has prepared this fact sheet to identify procedures that can be used to minimize the possibility of introducing contaminated soil onto a site that requires imported fill material. Such sites include those that are undergoing site remediation, corrective action, and closure activities overseen by DTSC or the appropriate regulatory agency. These procedures may also apply to construction projects that will result in sensitive land uses. The intent of this fact sheet is to protect people who live on or otherwise use a sensitive land use property. By using this fact sheet as a guide, the reader will minimize the chance of introducing fill material that may result in potential risk to human health or the environment at some future time.

Overview

Both natural and manmade fill materials are used for a variety of purposes. Fill material properties are commonly controlled to meet the necessary site specific engineering specifications. Because most sites requiring fill material are located in or near urban areas, the fill materials are often obtained from construction projects that generate an excess of soil, and from demolition debris (asphalt, broken concrete, etc.). However, materials from those types of sites may or may not be appropriate, depending on the proposed use of the fill, and the quality of the assessment and/or mitigation measures, if necessary. Therefore, unless material from construction projects can be demonstrated to be free of contamination and/or appropriate for the proposed use, the use of that material as fill should be avoided.

Selecting Fill Material

In general, the fill source area should be located in nonindustrial areas, and not from sites undergoing an environmental cleanup. Nonindustrial sites include those that were previously undeveloped, or used solely for residential or agricultural purposes. If the source is from an agricultural area, care should be taken to insure that the fill does not include former agricultural waste process byproducts such as manure or other decomposed organic material. Undesirable sources of fill material include industrial and/or commercial sites where hazardous ma-

Potential Contaminants Based on the Fill Source Area

Fill Source:	Target Compounds
Land near to an existing freeway	Lead (EPA methods 6010B or 7471A), PAHs (EPA method 8310)
Land near a mining area or rock quarry	Heavy Metals (EPA methods 6010B and 7471A), asbestos (polarized light microscopy), pH
Agricultural land	Pesticides (Organochlorine Pesticides: EPA method 8081A or 8080A; Organophosphorus Pesticides: EPA method 8141A; Chlorinated Herbicides: EPA method 8151A), heavy metals (EPA methods 6010B and 7471A)
Residential/acceptable commercial land	VOCs (EPA method 8021 or 8260B, as appropriate and combined with collection by EPA Method 5035), semi-VOCs (EPA method 8270C), TPH (modified EPA method 8015), PCBs (EPA method 8082 or 8080A), heavy metals including lead (EPA methods 6010B and 7471A), asbestos (OSHA Method ID-191)

**The recommended analyses should be performed in accordance with USEPA SW-846 methods (1996). Other possible analyses include Hexavalent Chromium: EPA method 7199*

Recommended Fill Material Sampling Schedule

Area of Individual Borrow Area	Sampling Requirements
2 acres or less	Minimum of 4 samples
2 to 4 acres	Minimum of 1 sample every 1/2 acre
4 to 10 acres	Minimum of 8 samples
Greater than 10 acres	Minimum of 8 locations with 4 subsamples per location

Volume of Borrow Area Stockpile	Samples per Volume
Up to 1,000 cubic yards	1 sample per 250 cubic yards
1,000 to 5,000 cubic yards	4 samples for first 1000 cubic yards +1 sample per each additional 500 cubic yards
Greater than 5,000 cubic yards	12 samples for first 5,000 cubic yards + 1 sample per each additional 1,000 cubic yards

terials were used, handled or stored as part of the business operations, or unpaved parking areas where petroleum hydrocarbons could have been spilled or leaked into the soil. Undesirable commercial sites include former gasoline service stations, retail strip malls that contained dry cleaners or photographic processing facilities, paint stores, auto repair and/or painting facilities. Undesirable industrial facilities include metal processing shops, manufacturing facilities, aerospace facilities, oil refineries, waste treatment plants, etc. Alternatives to using fill from construction sites include the use of fill material obtained from a commercial supplier of fill material or from soil pits in rural or suburban areas. However, care should be taken to ensure that those materials are also uncontaminated.

Documentation and Analysis

In order to minimize the potential of introducing contaminated fill material onto a site, it is necessary to verify through documentation that the fill source is appropriate and/or to have the fill material analyzed for potential contaminants based on the location and history of the source area. Fill documentation should include detailed information on the previous use of the land from where the fill is taken, whether an environmental site assessment was performed and its findings, and the results of any testing performed. It is recommended that any such documentation should be signed by an appropriately licensed (CA-registered) individual. If such documentation is not available or is inadequate, samples of the fill material should be chemically analyzed. Analysis of the fill material should be based on the source of the fill and knowledge of the prior land use.

Detectable amounts of compounds of concern within the fill material should be evaluated for risk in accordance with the DTSC Preliminary Endangerment Assessment (PEA) Guidance Manual. If metal analyses are performed, only those metals (CAM 17 / Title 22) to which risk levels have been assigned need to be evaluated. At present, the DTSC is working to establish California Screening Levels (CSL) to determine whether some compounds of concern pose a risk. Until such time as these CSL values are established, DTSC recommends that the DTSC PEA Guidance Manual or an equivalent process be referenced. This guidance may include the Regional Water Quality Control Board's (RWQCB) guidelines for reuse of non-hazardous petroleum hydrocarbon contaminated soil as applied to Total Petroleum Hydrocarbons (TPH) only. The RWQCB guidelines should not be used for volatile organic compounds (VOCs) or semi-volatile organic compounds (SVOCS). In addition, a standard laboratory data package, including a summary of the QA/QC (Quality Assurance/Quality Control) sample results should also accompany all analytical reports.

When possible, representative samples should be collected at the borrow area while the potential fill material is still in place, and analyzed prior to removal from the borrow area. In addition to performing the appropriate analyses of the fill material, an appropriate number of samples should also be determined based on the approximate volume or area of soil to be used as fill material. The table above can be used as a guide to determine the number of samples needed to adequately characterize the fill material when sampled at the borrow site.

Alternative Sampling

A Phase I or PEA may be conducted prior to sampling to determine whether the borrow area may have been impacted by previous activities on the property. After the property has been evaluated, any sampling that may be required can be determined during a meeting with DTSC or appropriate regulatory agency. However, if it is not possible to analyze the fill material at the borrow area or determine that it is appropriate for use via a Phase I or PEA, it is recommended that one (1) sample per truckload be collected and analyzed for all compounds of concern to ensure that the imported soil is uncontaminated and acceptable. (See chart on Potential Contaminants Based on the Fill Source Area for appropriate analyses). This sampling frequency may be modified upon consultation with the DTSC or appropriate regulatory agency if all of the fill material is derived from a common borrow area. However, fill material that is not characterized at the borrow area will need to be stockpiled either on or off-site until the analyses have been completed. In addition, should contaminants exceeding acceptance criteria be identified in the stockpiled fill material, that material will be deemed unacceptable and new fill material will need to be obtained, sampled and analyzed. Therefore, the DTSC recommends that all sampling and analyses should be completed prior to delivery to the site to ensure the soil is free of contamination, and to eliminate unnecessary transportation charges for unacceptable fill material.

Composite sampling for fill material characterization may or may not be appropriate, depending on quality and homogeneity of source/borrow area, and compounds of concern. Compositing samples for volatile and semivolatile constituents is not acceptable. Composite sampling for heavy metals, pesticides, herbicides or PAH's from unanalyzed stockpiled soil is also unacceptable, unless it is stockpiled at the borrow area and originates from the same source area. In addition, if samples are composited, they should be from the same soil layer, and not from different soil layers.

When very large volumes of fill material are anticipated, or when larger areas are being considered as borrow areas, the DTSC recommends that a Phase I or PEA be conducted on the area to ensure that the borrow area has not been impacted by previous activities on the property. After the property has been evaluated, any sampling that may be required can be determined during a meeting with the DTSC.

For further information, call Richard Coffman, Ph.D., R.G., at (818) 551-2175.