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SECOND DRAFT

Remedial Action Workplan

Jefferson Elementary School Site

San Leandro, California

This report has been prepared for:

San Leandro Unified School District

14735 Juniper Street, San Leandro, California 94579

April 20, 2005
Project No. 2074-1A

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April 20, 2005
2074-1A

Mr. Michael Lozano
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**RE: SECOND DRAFT
REMEDIAL ACTION WORKPLAN
JEFFERSON ELEMENTARY SCHOOL SITE
SAN LEANDRO, CALIFORNIA**

Dear Mr. Lozano:

We are pleased to submit for your review and comment this Second Draft Remedial Action Workplan (RAW) for the Jefferson Elementary School Site in San Leandro, California. We have incorporated the DTSC comments to our first draft as transmitted in your letter dated April 4, 2005. We have not included laboratory detection limits for all possible chemicals, as requested, because such a list would be 40 pages in length. The standard detection limits in the confirmation samples to be collected will be less than the remedial goal concentrations, except where interference effects result in an unavoidable increase in detection limits for some compounds.

If you have any questions, please call and we will be glad to discuss them with you.

Very truly yours,

LOWNEY ASSOCIATES

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SECOND DRAFT

REMEDIAL ACTION WORKPLAN

JEFFERSON ELEMENTARY SCHOOL SITE

SAN LEANDRO, CALIFORNIA

1.0 INTRODUCTION

On behalf of the San Leandro Unified School District (SLUSD), Lowney Associates has prepared this Second Draft Remedial Action Workplan (RAW) for the subject Site. This RAW has been prepared for submittal to the Department of Toxic Substances Control (DTSC) for their review and comment prior to public noticing.

1.1 Project Description

The SLUSD is currently redeveloping the existing Jefferson Elementary School site (Site) (Figure 1). Seven buildings (Buildings A, B, C, C/D, M, the San Leandro Child Care Building, and the Head Start Building) and a row of portable buildings currently occupy the Site (Figure 3). The planned redevelopment included construction of two new permanent classroom buildings (Buildings A and B) providing approximately 30,700 square feet and 14,000 square feet of space, respectively. These buildings have recently been completed and are currently in use. Following the construction of the new classroom buildings, the existing classroom buildings (Buildings C and C/D) were to be demolished and athletic fields and a play area will be constructed in this area. Demolition of the two buildings is complete. Four of the portable classroom buildings also will be removed. Buildings M, the Child Care Building, and the Head Start Building will remain at the Site. The planned redevelopment of the Site is shown on Figure 2.

1.2 Purpose

Site investigations identified organochlorine pesticides and lead in soils in the vicinity of the existing buildings (Buildings C/D, C, and M). The planned remedial action at the Site is the excavation of impacted soil and disposal at an appropriate off-Site facility, thereby eliminating the potential for future exposure and health risks. The excavation areas will then be backfilled with clean fill. The proposed excavation areas at the Site are presented on Figure 6.

The purpose of this RAW is to provide a technical and operational plan for the soil remedial activities.

1.3 Contact Persons, Mailing Addresses, and Telephone Numbers

The contact persons for the San Leandro Unified School District are as follows:

Mr. Leon Glaster, Assistant Superintendent
San Leandro Unified School District
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San Leandro, California 94579
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Ms. Jean Moore, Senior Project Manager
Vanir Construction Management
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San Leandro, California 94578
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The Lowney Associates contact information for the project is as follows:

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Lowney Associates
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Mountain View, California 94043
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2.0 SITE BACKGROUND

2.1 Site Location and Description

2.1.1 Site Name, Location, and Address

The Jefferson Elementary School Site occupies approximately 7½ acres and is located at 14311 Lark Street in San Leandro, California. The Site is bounded by Lark Street and residential development to the northeast, residential development to the northwest, Bancroft Avenue to the southwest, and Toyon Park to the southeast (Figure 2).

The Site is located in Section 36 of Township 2 South, Range 3 West, San Leandro Quadrangle. According to the San Leandro Planning Department, the Site is zoned as RS-Residential and Single-Family.

2.1.2 Assessor's Parcel Number

The Site is designated as Assessor's Parcel Number (APN) 77E-1568-10-2.

2.1.3 Ownership

The current owner of the Site is the SLUSD, who acquired the property in 1946. The previous owners of the Site were Charles and Edna Russell.

2.2 Operational History and Status

2.2.1 Prior Site Use

Based on a review of historic aerial photographs and topographic maps performed during a previous Phase I investigation of the Site, an orchard appeared present traversing the center of the Site and in the southeast portion of the Site as early as 1947 (Kleinfelder 2001). The remainder of the Site appeared to be vacant land. According to the Phase I report, the existing school was constructed in 1948. By 1953, three school buildings appeared to occupy the northeastern portion of the Site in a configuration similar to the existing condition. An additional building appeared present in the northwestern portion of the property in aerial photographs dated 1990 through 1999.

2.2.2 Current Site Use

The Site is currently occupied by Jefferson Elementary School, a public elementary school for kindergarten through 5th grade students. The school is comprised of five single-story buildings (Buildings C, C/D, M, the San Leandro Child Care Building, and the Jefferson Center Head Start Building) and six portable buildings (Figure 2). Two new classroom buildings (Buildings A and B) have recently been constructed in the central portion of the Site. The northwest portion of the Site contains a children's playground with blacktop and wood chip area. The area in front of the school along Lark Street consists of landscaping and walkway areas, and the areas around the buildings generally consist of asphalt and concrete pavements, landscaping, and bare ground.

2.3 Site and Regional Topography

The Site topography is generally flat with a gentle slope towards the San Francisco Bay to the southwest. Site elevation is approximately 50 feet above mean sea level (msl). In general, the topography of the area surrounding the Site also slopes to the southwest.

2.4 Geology and Hydrogeology

2.4.1 Geotechnical and Geologic Investigation

While a geotechnical investigation was likely conducted for the planned redevelopment of the Site, Lowney Associates has not been supplied with any reports documenting this work.

2.4.2 Regional Geologic Setting

Based on a review of geologic maps, the Site is underlain by alluvial fan and fluvial deposits (Helley and Graymer, 1997; Graymer, 2000) that likely are several hundred feet in thickness and overlie older bedrock units.

2.4.3 Site Geologic Setting and Soil Types

Based on information reviewed in the Phase I report, the Site appears to be underlain by soils of the Danville Silty Clay Loam, with a 0 to 2 percent slope (Kleinfelder 2001). The Danville Silty Clay Loam reportedly is a very deep, well-drained soil that formed on low terraces in alluvium derived mainly from sedimentary rock.

2.4.4 Site Hydrogeology

Based on the Phase I report, depth to ground water at the Site may be on the order of 8 to 10 feet below ground surface (Kleinfelder 2001). The anticipated ground water flow direction is to the west/southwest toward San Francisco Bay (Kleinfelder 2001).

2.5 Surrounding Land Use and Sensitive Ecosystems

Based on the Phase I report (Kleinfelder 2001), residential development was observed northeast and northwest of the Site as early as 1947. The property southeast of the Site appeared to be vacant land in 1947, but by 1953, the property was developed with a park. The property southwest of the Site reportedly was developed with an orchard in the 1947 through 1957 aerial photographs. By 1963, the property southwest of the Site appeared as residential development.

Currently, existing residential development is located immediately adjacent to the northwest of the Site and adjacent to the southeast corner of the Site. Residential development is also located to the northeast of the Site across Lark Street and to the southwest of the Site across Bancroft Avenue. Toyon Park is located adjacent to the southeast of the Site. The residential development adjacent to, and in the vicinity of, the Site, along with the park, is considered by DTSC to be a sensitive land use.

The nearest surface water body is Estudillo Canal, located approximately 1.1 miles south/southeast of the Site.

2.6 Previous Site Environmental Work

2.6.1 Phase I Environmental Site Assessment

A Phase I environmental site assessment and limited soil quality evaluation was completed for the Site in 2001 (Kleinfelder 2001). The findings of this investigation are summarized below.

At the time of the investigation, the Site was developed with the existing Jefferson Elementary School (four one-story buildings). As described in Section 2.2.1, based on a review of historic aerial photographs and topographic maps, an orchard appeared present traversing the center of the Site and in the southeast portion of the Site as late as 1947. The remainder of the Site appeared to be vacant land. The existing school reportedly was constructed in 1948. Based on historic air photos, by 1953 three school buildings appeared to occupy the northeastern portion of the Site in a configuration similar to existing conditions. An additional building appeared present in the northwestern portion of the property in aerial photographs dated 1990 through 1999.

Portions of the Site were previously used for agricultural purposes (prior to 1948), and the use of organochlorine pesticides such as DDT reportedly began in California in the late 1940s. Based on the time the school was constructed, the date of initial usage of organochlorine pesticides in California, as well as consultation with DTSC, residual pesticides in soil were not expected to adversely impact the Site; no further action was recommended.

Three aboveground transformers on concrete pads reportedly were observed in the northwest corner of the Site adjacent to the portable buildings. The transformers appeared to be owned by PG&E and appeared to be in good condition with no signs of leakage, staining, or damage. No information on the age of the transformers was provided in the report. Oil containing polychlorinated biphenyls (PCBs) historically was used in transformers, however the manufacture of PCBs was banned in 1976 and PCB-containing oils reportedly had been removed from most transformers in the area. It was recommended that PG&E be contacted if future plans included the removal of the transformers. If a greater level of comfort was desired, testing of the transformer oil was recommended.

Due to the age of the on-Site structures, soil samples were collected at the Site as part of this investigation to evaluate the potential impact to shallow soil quality around the school buildings by historic weathering of lead-based paint from the exterior of the structures. In May 2001, 20 soil samples (S-1 through S-20) were collected around the perimeters (within 1 to 2 feet of the building exterior wall) of Buildings C, C/D, M, the Child Care Building, and the portable buildings. The samples were collected from an approximate depth of 3 to 6 inches. The approximate sample locations are shown on Figure 3. The 20 samples were analyzed for total lead (EPA Test Method 6010B); the analytical results are presented in Table 1. Copies of the analytical reports were included in Appendix B of the Preliminary Environmental Assessment (PEA) report, prepared by Lowney Associates (Lowney 2004).

Table 1. Soil Analytical Results-Total Lead

(concentrations in parts per million)

Sample ID	Total Lead	Sample ID	Total Lead
S-1	220	S-11	11
S-2	**310**	S-12	21
S-3	51	S-13	69
S-4	37	S-14	44
S-5	180	S-15	220
S-6	110	S-16	56
S-7	88	S-17	100
S-8	49	S-18	200
S-9	45	S-19	92
S-10	20	S-20	82
DTSC Screening Level	255	DTSC Screening Level	255

Bold Indicates detected concentration exceeds DTSC Screening Level

As shown in Table 1, the lead concentrations detected in the samples generally did not exceed the current DTSC Schools Division screening level for lead of 255 parts per million (ppm) with the exception of sample S-2 (lead at 310 ppm) collected adjacent to the southeast corner of Building C. The DTSC LeadSpread Model (Version 7) for risk assessment was used to estimate possible levels of lead in blood that can occur in children if lead-impacted soil is ingested and/or inhaled. The DTSC screening level for lead in blood for children (99^{th} percentile estimate) is 10 micrograms per deciliter of blood (ug/dl) or less. The model was run using the maximum detected lead concentration (310 ppm) and the 95% upper confidence limit (UCL) (172 ppm) for all the sample results; the blood lead results were estimated to be 11.2 ug/dl and 8.2 ug/dl, respectively. The blood lead level of 8.2 ug/dl did not exceed the screening level of 10 ug/dl; therefore, no further action was recommended.

2.6.2 Phase II Soil Sampling

In September 2001, soil sampling was conducted at the Site to evaluate soil quality around Buildings C and C/D due to previous reported termite abatement activities at these two buildings (Winzler & Kelly 2001). Sampling was only performed around Buildings C and C/D at the locations shown in Figure 3, because these buildings were to be demolished. Eight surficial soil samples (S-1 through S-8) were collected from the perimeter of the two buildings; two 4-point composite soil samples (S-Comp-1 and S-Comp-2) were also collected from an approximate depth of 0-½ foot adjacent to the discrete sample locations. Composite sample S-Comp-1 was collected adjacent to samples S-1 through S-4, and composite sample S-Comp-2 was collected adjacent to samples S-5 through S-8. The 10 samples were analyzed for organochlorine pesticides (EPA Test Method 8081A); the analytical results are presented in Table 2. Other pesticide compounds not included in Table 2 or identified in the footnotes below Table 2 were not detected in any of the samples. Copies of the analytical reports were included in Appendix B of the PEA report.

Table 2. Soil Analytical Results-Pesticides
(concentrations in parts per million)

Sample	Dieldrin	alpha-Chlordane	gamma-Chlordane	Chlordane (Technical)	Heptachlor Epoxide	Endrin	DDT	DDE	DDD	Total DDT
S-1[a]	**0.045**	0.13	0.13	1.3	0.015	<0.008	0.0087	0.031	<0.008	0.0397
S-2	**11**	**4.6**	**5.2**	**27**	**0.15**	**1.9**	**0.73[g]**	**0.75[g]**	<0.16	**1.48**
S-3[b]	**8.6**	**2.2**	**2.5**	**11**	0.06	**1.5**	**0.37[g]**	**0.53[g]**	**0.29[g]**	**1.19**
S-4	**2.0**	**0.71**	**0.66**	**3.7**	<0.04	**0.3**	0.14	0.11	<0.08	0.25
S-5	**6.4**	**0.34**	**0.39**	**1.7**	<0.02	**0.21**	0.12	0.078	<0.04	0.198
S-6	**20**	**3.9**	**3.6**	**16**	**0.098**	**2.3**	**0.71[g]**	**0.79[g]**	**0.39[g]**	**1.89**
S-7[c]	**9.0**	**0.51**	**0.6**	**3.0**	0.01	**0.43**	0.021	0.038	0.0063	0.0653
S-8[d]	**9.9**	**0.88**	**0.9**	**5.2**	**0.087**	**0.41**	0.21	0.17	0.085	0.465
S-Comp -1[e]	**13**	**1.7**	**1.6**	**7.3**	0.049	**0.6**	0.25	0.28	0.11	0.64
S-Comp -2[f]	**25**	**0.93**	**0.98**	**5.5**	0.046	**0.69**	0.22	0.17	0.08	0.47
PRG	0.03	NE	NE	1.6	0.053	18	1.7	1.7	2.4	NE
RBRG	0.025	0.31[h]		NE	0.072	NE	NE	NE	NE	1.17
TTLC	8.0	NE	NE	2.5	4.7	0.2	NE	NE	NE	1.0

a Delta-BHC detected at 0.0041 ppm
< Indicates that the compound was not detected at or above stated laboratory detection limits
b Endrin ketone detected at 0.12 ppm; Heptachlor detected at **0.12 ppm** (exceeds PRG of 0.11 ppm)
c Delta-BHC detected at 0.0049 ppm; Endrin ketone detected at 0.071 ppm; Heptachlor detected at 0.0039 ppm
d Endrin ketone detected at 0.12 ppm
e Endrin ketone detected at 0.088 ppm
f Aldrin detected at **0.094 ppm** (exceeds PRG of 0.029 ppm); Endrin ketone detected at 0.16 ppm; Heptachlor detected at 0.04 ppm
g Detected total DDT concentration exceeds TTLC
h Sum of alpha and gamma chlordane
PRG Preliminary Remediation Goal for residential site use, USEPA Region 9-October 2004
RBRG Site-Specific Risk-Based Remedial Goal (Lowney, 2005)
NE Not established
TTLC Total threshold limit concentration for hazardous waste, CCR Title 26
Bold Indicates detected concentration exceeds RBRG and/or TTLC

Also during this investigation, seven asphalt samples were collected from the perimeter of the two buildings and analyzed for asbestos by polarized light microscopy (PLM) (EPA Test Method 600/R-93/116). Asbestos was not detected in any of the samples.

As shown in Table 2, several organochlorine pesticide compounds (primarily chlordane and dieldrin) were detected in the surface samples at concentrations that exceeded the respective preliminary remediation goals (PRGs). PRGs are risk-based concentrations developed by EPA Region 9, and are for use as screening levels in determining if further evaluation is warranted, in prioritizing areas of concern, in establishing initial cleanup goals, and in estimation of potential health risks. In addition, several samples contained dieldrin, chlordane, endrin, and/or total DDT (sum of DDT, DDE, and DDD) concentrations that exceeded the respective total threshold limit concentrations (TTLCs), California's hazardous waste threshold, of 8.0 ppm, 2.5 ppm, 0.2 ppm, and 1.0 ppm. For comparison purposes, the site-specific risk-based remedial goals (RBRGs), calculated for the constituents of concern, also are presented in Table 2. The risk-based remedial goals are discussed in detail in Section 5.0.

As the demolition of the two buildings called for removal of soil to a depth of 3 feet from the building edges to a distance of 3 feet from the building wall, it was recommended that the demolition/excavation contractor prepare a work plan for the removal, stockpiling, and waste characterization of the impacted soil. It was additionally recommended that the wood and concrete foundation materials be tested for contamination with organochlorine pesticides prior to disposal.

2.6.3 Additional Phase II Soil Sampling

Additional soil sampling was conducted in July 2003 at the Site to further evaluate the extent of pesticide-impacted soil (Winzler & Kelly 2003). The approximate boring locations are shown on Figure 3. The sampling was conducted both on the interior of and along the perimeter of Buildings C and C/D. The sampling on the interior of the buildings was performed in the main corridors that traverse the center of Buildings C/D and C (Wings 2 and 1, respectively) beneath the floor slabs. Soil samples were collected at various depths from 10 borings drilled at the Site. At Building C/D, three borings (W2-NW, W2-SC, and W2-NE) were located inside the building, and two borings (W2-E-NW and W2-E-EAST) were located near the southwest and northeast corners of the building, respectively. At Building C, three borings (W1-NE, W1-SE, and W1-WC) were located inside the building, and two borings (W1-E-NE and W1-E-SE) were located near the northeast and southeast corners of the building, respectively. The borings inside the buildings were located adjacent to reported termite spraying injection points.

Initially, soil samples collected at approximate depths of 0-½ foot and 1-1½ feet were analyzed for organochlorine pesticides and the 17 California Assessment Manual (CAM) metals (EPA Test Method 6010B/7471A). Following receipt of the initial results, samples collected at an approximate depth of 2-2½ feet from borings W1-SE, W2-NE, W2-NW, and W2-SC were analyzed for CAM 17 metals. Upon receipt of these results, an additional sample collected at an approximate depth of 3-3½ feet from boring W2-SC was analyzed for CAM 17 metals. The analytical results for metals and pesticides are presented below in Tables 3 and 4, respectively. Other metals and pesticide compounds not included in Tables 3 or 4 were not detected in any of the samples.

Table 3. Soil Analytical Results-Metals

(concentrations in parts per million)

Building	Sample	Depth (feet)	Ba	Cr	Co	Cu	Pb	Hg	Ni	V	Zn
C/D Interior	W2-SC-01	0-½	54	<1.0	84	44	19	0.081	18	72	59
	W2-SC-02	1-1½	110	29	29	65	<5.0	<0.05	42	120	63
	W2-SC-03	2-2½	61	90	<4.0	110	5.4	<0.05	39	110	40
	W2-SC-04	3-3½	72	26	20	130	<5.0	<0.05	29	96	32
	W2-NE-01	0-½	69	<1.0	33	46	14	0.065	41	52	42
	W2-NE-02	1-1½	110	18	4.0	37	24	<0.05	42	44	410
	W2-NE-03	2-2½	57	<1.0	<4.0	14	<5.0	<0.05	24	24	290
	W2-NW-01	0-½	89	<1.0	53	50	23	<0.05	<4.0	41	120
	W2-NW-02	1-1½	98	<1.0	46	49	16	<0.05	<4.0	48	120
	W2-NW-03	2-2½	87	<1.0	<4.0	25	<5.0	<0.05	<4.0	25	80
C/D Exterior	W2-E-NW-01	0-½	110	11	13	69	22	0.053	33	80	99
	W2-E-NW-02	1-1½	160	24	7.0	43	16	0.052	55	57	80
	W2-E-EAST-01	0-½	160	26	5.0	59	240	0.074	48	57	390
	W2-E-EAST-02	1-1½	170	28	5.0	60	240	0.074	53	57	400
C Interior	W1-NE-01	0-½	50	<1.0	<4.0	47	49	0.21	19	47	92
	W1-NE-02	1-1½	73	<1.0	15	51	20	0.16	21	80	68
	W1-SE-01	0-½	140	23	26	280	19	0.12	28	160	130
	W1-SE-02	1-1½	140	27	22	270	11	0.21	39	120	75
	W1-SE-03	2-2½	110	3.3	<4.0	21	<5.0	<0.05	30	26	36
	W1-WC-01	0-½	84	<1.0	21	120	21	<0.05	32	72	710
	W1-WC-02	1-1½	48	<1.0	<4.0	66	28	<0.05	13	34	150
C Exterior	W1-E-NE-01	0-½	180	23	<4.0	56	**280**	<0.05	52	51	420
	W1-E-NE-02	1-1½	160	17	<4.0	40	140	0.059	48	44	190
	W1-E-SE-01	0-½	200	16	<4.0	38	68	<0.05	42	44	130
	W1-E-SE-02	1-1½	190	13	<4.0	32	17	<0.05	47	38	73
PRG			5,400	210	900	3,100	400 (255*)	23	1,600	550	23,000

Note Ba=barium; Cr=chromium; Co=cobalt; Cu=copper; Pb=lead; Hg=mercury; Ni=nickel; V=vanadium; Zn=zinc

< Indicates that the constituent was not detected at or above stated laboratory detection limits

PRG Preliminary Remediation Goal for residential site use, EPA Region 9-October 2004

* DTSC Schools Division Screening Level

Bold Indicates detected concentration exceeds DTSC screening level

Table 4. Soil Analytical Results-Pesticides
(concentrations in parts per million)

Building	Sample	Depth (feet)	alpha-Chlordane	gamma-Chlordane	Dieldrin	DDT	DDE	DDD	Total DDT	gamma-BHC
C/D Interior	W2-SC-01	0-½	<0.001	<0.001	<0.002	<0.002	<0.002	<0.002	<0.002	<0.001
	W2-SC-02	1-1½	<0.001	<0.001	<0.002	<0.002	<0.002	<0.002	<0.002	<0.001
	W2-NE-01	0-½	<0.001	<0.001	0.036	<0.002	<0.002	<0.002	<0.002	<0.001
	W2-NE-02	1-1½	<0.001	<0.001	<0.002	<0.002	<0.002	<0.002	<0.002	<0.001
	W2-NW-01	0-½	<0.001	<0.001	<0.002	<0.002	<0.002	<0.002	<0.002	<0.001
	W2-NW-02	1-1½	<0.001	<0.001	<0.002	<0.002	<0.002	<0.002	<0.002	<0.001
C/D Exterior	W2-E-NW-01	0-½	0.37	<0.001	<0.002	<0.002	<0.002	0.018	<0.002	<0.001
	W2-E-NW-02	1-1½	0.27	<0.001	0.054	<0.002	<0.002	<0.002	<0.002	<0.001
	W2-E-EAST-01	0-½	<0.001	<0.001	**2.8**	2.0	<0.002	0.27[a]	2.27	2.6
	W2-E-EAST-02	1-1½	<0.001	<0.001	**4.0**	2.3	<0.002	0.44[a]	2.74	2.5
C Interior	W1-NE-01	0-½	<0.001	<0.001	<0.002	<0.002	<0.002	<0.002	<0.002	<0.001
	W1-NE-02	1-1½	<0.001	<0.001	<0.002	<0.002	<0.002	<0.002	<0.002	<0.001
	W1-SE-01	0-½	<0.001	<0.001	<0.002	<0.002	<0.002	<0.002	<0.002	<0.001
	W1-SE-02	1-1½	<0.001	<0.001	<0.002	<0.002	<0.002	<0.002	<0.002	<0.001
	W1-WC-01	0-½	<0.001	<0.001	<0.002	0.042	0.019	0.01	0.071	<0.001
	W1-WC-02	1-1½	<0.001	<0.001	<0.002	0.021	0.0059	0.0081	0.035	<0.001
C Exterior	W1-E-NE-01	0-½	<0.001	**0.4**	**1.6**	<0.002	<0.002	<0.002	<0.002	<0.001
	W1-E-NE-02	1-1½	<0.001	**0.31**	**1.6**	<0.002	<0.002	<0.002	<0.002	<0.001
	W1-E-SE-01	0-½	<0.001	<0.001	**2.4**	<0.002	<0.002	<0.002	<0.002	<0.001
	W1-E-SE-02	1-1½	0.034	0.03	**0.2**	<0.002	<0.002	<0.002	<0.002	<0.001
PRG			NE	NE	0.03	1.7	1.7	2.4	NE	0.44
RBRG			0.31[a]		0.025	NE	NE	NE	1.17	NE
TTLC			NE	NE	8.0	NE	NE	NE	1.0	4.0

< Indicates that the compound was not detected at or above stated laboratory detection limits
PRG Preliminary Remediation Goal for residential site use, EPA Region 9-October 2004
RBRG Site-Specific Risk-Based Remediation Goal (Lowney, 2005)
a Sum of alpha and gamma chlordane
NE Not established
TTLC Total threshold limit concentration for hazardous waste, CCR Title 26
Bold Indicates detected concentration exceeds RBRG

As shown in Table 3, an elevated lead concentration was only detected in a few of the samples. In only one of the samples (the surface sample collected from boring W1-E-NE adjacent to the northeast corner of Building C) did the detected lead concentration (280 ppm) exceed the DTSC Schools Unit remediation goal of 255 ppm. No other metals were detected at concentrations that exceeded the respective PRGs.

As shown in Table 4, concentrations of dieldrin that exceeded the respective RBRG of 0.025 ppm were detected in several of the samples collected at depths of 0-½ foot and 1-1½ feet. In addition, concentrations of total DDT (2.27 ppm and 2.74 ppm) that exceeded the TTLC of 1.0 ppm were detected in two of the samples.

2.6.4 Phase I Environmental Site Assessment Update

An update to the previous July 2001 Phase I investigation for the Site was performed in April 2004 (Kleinfelder 2004). The findings of the update are summarized below.

At the time of the update investigation, the Jefferson Elementary School occupied the Site; which was developed with three one-story buildings and a row of portable buildings. A paved playground area and a play structure were present in the center of the Site. The southern and western portions of the Site were under construction with the two new buildings.

Based on the results of the investigation, no environmental concerns were identified at the Site, and no further action or Site investigation was recommended.

2.6.5 Preliminary Environmental Assessment – Lowney 2004

After review of the Phase I Update report, DTSC determined, in a letter dated May 21, 2004, that completion of a PEA was necessary for the Site. The PEA is an investigation that provides the information necessary for determining if conditions exist at the Site that could pose a risk to human health or the environment, and if further action is needed at the Site.

A Scoping Meeting was conducted on July 20, 2004 with DTSC to discuss potential environmental concerns at the Site. The identified potential environmental concerns at the Site included previous agricultural Site use (orchards), previous termite abatement activities at the Site, the presence of lead-based paint residue detected in shallow soil around the existing buildings at the Site, and the on-Site transformers, which may contain PCBs. The potential presence of naturally occurring asbestos (NOA) in soils at the Site also was identified as a concern because the Site is located within 10 miles of a naturally occurring asbestos geologic formation.

The PEA was developed based on the previous investigations at the Site described above in Sections 2.6.1 through 2.6.4, and was prepared in general accordance with the DTSC *Preliminary Endangerment Assessment Guidance Manual*, dated January 1994. The results of the PEA performed for the Site were presented in the Preliminary Environmental Assessment report prepared by Lowney Associates dated November 15, 2004 (Lowney 2004), and are summarized below.

Laboratory analysis of the soil samples collected around Buildings C, C/D, and M, the Child Care Building, and the portable buildings detected total lead concentrations ranging from 11 ppm to 310 ppm. Elevated lead concentrations were detected in several of the samples collected from depths of 0-½ foot and 1-1½ feet. The detected lead concentration in two of the surface samples exceeded the DTSC Schools Division screening level of 255 ppm. Soil samples containing total lead concentrations of greater than approximately 90 ppm likely will exceed the soluble threshold limit concentration (STLC), California's hazardous waste criteria, for lead of 5 ppm, and therefore likely would be considered a hazardous waste when excavated. The detected lead concentration in 12 of the samples exceeded 90 ppm. Additional sampling was proposed to further evaluate the vertical and lateral extent of lead-impacted soil.

The remaining metal concentrations detected generally appeared similar to typical background concentrations. In addition, none of the detected concentrations exceeded the respective PRGs.

Laboratory analysis of soil samples collected from the perimeters of Buildings C and C/D detected several organochlorine pesticide compounds (DDT, aldrin, chlordane [technical-grade], dieldrin, heptachlor, heptachlor epoxide, and gamma-BHC) at concentrations exceeding the USEPA residential PRGs and site-specific risk-based remedial goals (see section 5.0). The primary pesticide compounds detected at concentrations that exceeded the respective PRGs and site-specific risk-based remedial goals were technical chlordane and dieldrin; the remaining five compounds were detected at a lower frequency. However, technical chlordane was not detected in the samples collected during the second Winzler & Kelly event. The dieldrin, technical chlordane, endrin, and total DDT concentrations detected in several of the samples exceeded the respective TTLCs. Based on the sampling results, at some locations the impacted soil was detected at a depth of 1½ feet. Additional soil sampling was proposed to further evaluate the vertical and lateral extent of pesticide-impacted soil. Soil sampling adjacent to the other on-Site buildings not investigated by Winzler & Kelly was also proposed.

Soil samples collected from borings drilled on the interior of Buildings C and C/D near reported termite abatement injection points generally did not detect pesticides with the exception of the shallow sample collected from boring W2-NE in Building C/D (dieldrin at 0.036 ppm).

Based on the results of the PEA, it was concluded that known environmental concerns at the Site that could potentially pose a threat to human health or the environment included pesticide-impacted soil in the area around the on-Site buildings due to reported termite abatement activities, lead-based paint residues in shallow soil around the buildings due to historic weathering from the exterior walls of the structures, the potential presence of NOA in soils at the Site, and the on-Site transformers that may contain PCBs. DTSC recommended, in their letter dated November 9, 2004, further action at the Site including a Supplemental Site Investigation (SSI) to address the potential environmental concerns at the Site. DTSC also indicated that the potential for soil in the former agricultural areas of the Site to be impacted by organochlorine pesticides was not a concern because organochlorine pesticides did not come into wide use until the late 1940s, and the on-Site orchard only appeared present until 1946 and the school reportedly was constructed in 1948. Therefore, it was unlikely that organochlorine pesticides were applied to the Site for agricultural purposes. The SSI was to further address the four remaining identified potential environmental concerns at the Site. The PEA was approved by DTSC in a letter dated December 17, 2004.

2.7 Supplemental Site Investigation – Lowney 2004 and 2005

The scope of work for the SSI was outlined in the revised work plan dated December 3, 2004 and in the work plan for additional sampling dated January 17, 2005. Both work plans were submitted to DTSC for review. The scope of work was based on the following DTSC guidance documents: 1) *Preliminary Endangerment Assessment Guidance Manual*, and 2) *Interim Guidance for Naturally Occurring Asbestos (NOA) at School Sites*. The results of the SSI were presented in the Supplemental Site Investigation report, prepared by Lowney Associates and dated February 4, 2005, which was submitted to DTSC (Lowney 2005a). The work performed to address each of the environmental concerns at the Site is discussed separately below.

2.7.1 NOA and Background Metals Sampling

To evaluate the presence of Naturally Occurring Asbestos (NOA) and to determine background metal concentrations at the Site, four exploratory borings (SB-1 to SB-4) were drilled in November 2004 to an approximate depth of 6 feet at randomly selected locations across the Site at an approximate frequency of one boring for every 2 acres. The boring locations are shown on Figure 3. Soil samples were collected from each boring at approximate depths of 0-1 foot and 5½-6 feet. The four shallow samples were analyzed for NOA by transmission electron microscopy (TEM); and the four deeper samples were analyzed for CAM 17 metals. Asbestos was not detected in any of the four samples analyzed at or above the laboratory reporting limit of 0.0001%.

The results of the background metals evaluation are presented below in Table 5; other metals not shown in Table 5 were not detected in any of the samples. Copies of the analytical reports were presented in Appendix A of the SSI report.

Table 5. Analytical Results of Selected Soil Samples-Metals
(concentrations in parts per million)

Boring	Sample Depth (feet)	As	Ba	Cr	Co	Cu	Pb	Hg	Ni	V	Zn
SB-1	5½-6	4.9	120	36	8.4	17	5.7	0.059	41	31	36
SB-2	5½-6	4.8	130	38	8.3	18	5.9	0.052	41	32	39
SB-3	5½-6	4.8	130	36	9.1	19	6.2	0.065	46	28	39
SB-4	5½-6	5.0	130	37	9.6	20	6.3	0.066	50	30	41

Note As=arsenic; Ba=barium; Cr=chromium; Co=cobalt; Cu=copper; Pb=lead; Hg=mercury; Ni=nickel; V=vanadium; Zn=zinc

Since borings SB-1 to SB-4 were advanced in undisturbed areas at the site, and the soil samples collected from the borings were taken from deeper native soils, the metal concentrations presented in Table 5 likely are representative of on-Site background conditions. These concentrations also appear to be consistent with typical background concentrations presented in published documents (Scott, 1991;

Lawrence Berkeley National Laboratory, 1995). With the exception of copper, vanadium, and zinc, metals detected in soil around the existing buildings (see Table 3) also appear representative of background conditions. However, the copper, vanadium, and zinc levels detected do not exceed USEPA residential PRGs or the site-specific risk-based remediation goals, Appendix B.

2.7.2 Lead-Impacted Soil

To evaluate the lateral and vertical extent of lead-impacted soil around previous sampling locations (Kleinfelder 2001) adjacent to the buildings where the detected lead concentration exceeded approximately 90 ppm, 12 borings were drilled to an approximate depth of 2 feet in November 2004. Six of the borings (M-3, C-16, C-1, C/D-19, C/D-13, and M-1) were drilled adjacent to previous sampling locations S-1, S-2, S-5, S-6, S-7, and S-18, respectively, to evaluate the vertical extent of impacted soil; the remaining six borings (M-2, M-4, C-2, C-17, C/D-14, and C/D-20) were drilled at "step-out" locations approximately 5 feet away from the previous borings. The boring locations are shown on Figure 3. Soil samples were collected at an approximate depth of 1½–2 feet from the six borings drilled adjacent to the previous locations and at approximate depths of 0-½ foot and 1½-2 feet from the borings drilled at the "step-out" locations. The six deeper samples collected at the previous sample locations and the six shallow samples collected at the "step-out" locations were analyzed for total lead.

Based on the analytical results, four of the soil samples in which the detected lead concentration exceeded 90 ppm were additionally analyzed for soluble lead using soluble threshold limit concentration (STLC) extraction techniques. The total and soluble lead analytical results are presented below in Table 6. Copies of the analytical reports were presented in Appendix A of the SSI report.

Table 6. Analytical Results of Selected Soil Samples-Total and Soluble Lead
(concentrations in parts per million)

Building	Boring	Sample Depth (feet)	Total Lead	Soluble Lead
C/D	C/D-13*	1½-2	17	NA
	C/D-14**	0-½	150	NA
		1½-2	57	NA
	C/D-19*	1½-2	110	1.4
	C/D-20**	0-½	92	**7.1**
		1½-2	6.1	NA
C	C-1*	1½-2	10	NA
	C-2**	0-½	150	**11**
		1½-2	12	NA
	C-16*	1½-2	8.6	NA
	C-17**	0-½	130	NA
		1½-2	7.1	NA
M	M-1*	1½-2	11	NA
	M-2**	0-½	93	3.2
		1½-2	17	NA
	M-3*	1½-2	6.0	NA
	M-4**	0-½	39	NA
		1½-2	10	NA

(continued)

Table 6. Analytical Results of Selected Soil Samples-Total and Soluble Lead
(concentrations in parts per million)
(continued)

Building	Boring	Sample Depth (feet)	Total Lead	Soluble Lead
C/D	C/D-13*	1½-2	17	NA
	C/D-14**	0-½	150	NA
		1½-2	57	NA
	C/D-19*	1½-2	110	1.4
	C/D-20**	0-½	92	**7.1**
		1½-2	6.1	NA
C	C-1*	1½-2	10	NA
	C-2**	0-½	150	**11**
		1½-2	12	NA
	C-16*	1½-2	8.6	NA
	C-17**	0-½	130	NA
		1½-2	7.1	NA
M	M-1*	1½-2	11	NA
	M-2**	0-½	93	3.2
		1½-2	17	NA
	M-3*	1½-2	6.0	NA
	M-4**	0-½	39	NA
		1½-2	10	NA
DTSC Screening Level			255	NE
Soluble Threshold Limit Concentration (STLC)				5.0

* Boring located adjacent to previous sample location
** 5-foot "step-out" location
NA Not analyzed
NE Not established
STLC Soluble Threshold Limit Concentration for hazardous waste, California Code of Regulations, Title 26
Bold Indicates detected concentration exceeds STLC

As shown in Table 6, lead was detected in the surface samples at concentrations ranging from 39 ppm to 150 ppm, and in the deeper samples at concentrations ranging from 6.0 ppm to 110 ppm. Generally, the lead concentrations decreased with depth, with the exception of boring C/D-19, where the previous surface sample (S-6) and the deeper sample had equal concentrations. None of the detected lead concentrations exceeded the DTSC Schools Division screening concentration of 255 ppm.

The soluble lead concentration detected in two of the four samples analyzed exceeded the STLC hazardous waste threshold concentration of 5.0 ppm.

2.7.3 Pesticide-Impacted Soil (November 2004)

To evaluate the lateral and vertical extent of pesticide-impacted soil around Buildings C/D and C, 32 borings (C/D-1 through C/D-12, C/D-15 through C/D-18, C-1, C-3 through C-15, and C-18 through C-21) were drilled to an approximate depth of 2 feet. Eight of the borings (C/D-2, C/D-6, C/D-10, C/D-16, C-3, C-7, C-13, and C-19) were drilled near each of the previous sampling locations from 2001 (S-1 through S-8, respectively) to evaluate the vertical extent of impacted soil. One soil sample was collected from each of these eight borings at an approximate depth of

1½-2 feet. Three "step-out" borings also were drilled approximately 5 feet away from each of the previous sampling locations S-1 through S-8 to evaluate the lateral extent of impacted soil. The three "step-out" borings surrounded each previous sample location as requested by DTSC. Soil samples were collected from each of the "step-out" borings at approximate depths of 0-½ foot and 1½-2 feet. The boring locations are shown on Figure 3. Initially, only the eight deeper samples collected at the previous sample locations and the 24 shallow samples collected at the "step-out" locations were analyzed for organochlorine pesticides.

Borings C-10 and C-11 were located on the northeast side of Building C to further evaluate soil quality adjacent to Building C in areas where previous sampling was not performed. Boring C-10 was drilled adjacent to the building exterior, and boring C-11 was drilled at a "step-out" location 5 feet away from the building. Soil samples were collected from each boring at approximate depths of 0-½ feet and 1½-2 feet. Initially, only the shallow soil sample collected from boring C-10 was analyzed for organochlorine pesticides.

To evaluate soil quality around the other on-Site buildings, four borings (M-5 through M-8) were drilled adjacent to Building M, four borings (CC-1 through CC-4) were drilled adjacent to the Child Care building, and six borings (PB-1 through PB-6) were drilled adjacent to the portable buildings. Seven of the borings (M-5, M-7, CC-1, CC-3, PB-1, PB-3, and PB-5) were drilled within 1 foot of the building walls where exposed soil exists; the seven remaining "step-out" borings were drilled approximately 5 feet away from the buildings. The boring locations are shown on Figure 3. Soil samples were collected from each boring at approximate depths of 0-½ foot and 1½-2 feet. Initially, only the surface samples collected from the borings located closest to the building walls were analyzed for organochlorine pesticides.

Based on the initial analytical results, an additional 30 samples were analyzed for organochlorine pesticides to further evaluate the lateral and/or vertical extent of impacted soil. The analytical results are presented below in Table 7. Copies of the analytical reports were included in Appendix A of the SSI report.

2.7.4 Pesticide-Impacted Soil (January 2005)

To further evaluate the lateral extent of pesticide-impacted soils identified during the previous sampling event (Lowney 2004) at the 5-foot "step-out" locations, nine additional "step-out" borings (C/D-21, C/D-22, C-22 through C-26, M-9, and M-10) were drilled approximately 10 feet from the building walls. The boring locations are shown on Figure 3. The borings were drilled to an approximate depth of 4 feet, and samples were collected from each boring at approximate depths of 0-½ foot, 1½-2 feet, and 3-3½ feet. Initially, only the surface soil samples collected from the borings were analyzed for organochlorine pesticides. Following receipt of the initial results, five of the samples collected from 1½-2 feet were additionally analyzed for organochlorine pesticides.

To evaluate soil quality beneath the paved areas adjacent to Buildings C/D and C, 18 borings were drilled to an approximate depth of 4 feet. Six of the borings (C/D-23, C/D-26, C/D-29, C-27, C-30, and C-33) were drilled within 1 foot of the building walls, six of the borings (C/D-24, C/D-27, C/D-30, C-28, C-31, and C-34) were drilled approximately 5 feet from the building walls, and the remaining six borings

(C/D-25, C/D-28, C/D-31, C-29, C-32, and C-35) were drilled approximately 10 feet from the building walls. The boring locations are shown on Figure 3. Samples were collected from each boring at one or more of the following approximate depths: 0-½ foot (upper 6 inches of soils), 1½-2 feet, 2-2½ feet, 2½-3 feet, 3-3½ feet, and 4-4½ feet. The surface soil samples collected from the borings drilled adjacent to the building walls were analyzed for organochlorine pesticides.

To evaluate the potential presence of pesticide-impacted soils beneath the Building C/D floor slab near the building perimeter wall, two borings (C/D-34 and C/D-36) were drilled to an approximate depth of 4½ feet. Soil samples were collected from each boring at approximate depths of 1-1½ feet, 2½-3 feet, and 4-4½ feet. Three additional borings (C/D-32, C/D-33, and C/D-35) were drilled near the wall of the building corridor near reported termite spraying injection points. Each of the five borings was drilled near the building footing, which extended to a depth of approximately 4½ feet below the ground surface. The boring locations are shown on Figure 3. Samples were collected from borings C/D-33 and C/D-35 at approximate depths of 1½-2 feet, 2½-3 feet, and 4-4½ feet. A sample was collected from boring C/D-32 at an approximate depth of 1-1½ feet; deeper samples were not collected due to refusal. The shallow soil samples collected from each boring, and the 4-4½-foot samples collected from the borings advanced near the perimeter building wall (C/D-34 and C/D-36) were analyzed for organochlorine pesticides.

To evaluate soil quality in the area of the future handicap ramp on the northwest side of Building M, three borings (M-11 through M-13) were drilled to an approximate depth of 3½ feet. Borings M-11, M-12, and M-13 were drilled approximately 1 foot, 5 feet, and 10 feet, respectively, from the building wall in the area of the future handicap ramp. The boring locations are shown on Figure 3. Soil samples were collected from each boring at approximate depths of 0-½ foot (upper 6 inches of soil), 1½-2 feet, and 3-3½ feet. Initially, only the surface sample collected from boring M-11 was analyzed for organochlorine pesticides. Following receipt of the initial analytical results, the sample collected at 1½-2 feet from boring M-11, and the samples collected at 0-½ foot and 1½-2 feet from borings M-12 and M-13 were additionally analyzed for organochlorine pesticides.

The organochlorine pesticide analytical results for Buildings C/D, C, and the remaining buildings are presented below in Tables 7 through 9, respectively. Other pesticide compounds not included in Tables 7 through 9, or noted in the footnotes, were not detected in any of the samples (please note that technical chlordane was not detected in any of the samples but was included in the tables due to its detection during previous investigations).

Table 7. Analytical Results of Selected Soil Samples-Pesticides Building C/D

(concentrations in parts per million)

Boring	Sample Depth (feet)	alpha-Chlordane	gamma-Chlordane	Chlordane (Technical)	Dieldrin	DDT	DDE	DDD	Total DDT
C/D-1[b]	0-½	0.022	0.021	<0.05	0.0093	0.0068	<0.002	0.0092	0.016
C/D-2[a]	1½-2	<0.002	<0.002	<0.05	<0.002	<0.002	<0.002	<0.002	<0.002
C/D-3[c]	0-½	<0.002	<0.002	<0.05	<0.002	0.0025	<0.002	<0.002	
C/D-4[b]	0-½	0.006	0.0043	<0.05	0.0054	0.0026	<0.002	<0.002	
C/D-5[b]	0-½	0.016	0.012	<0.05	0.0072	<0.002	<0.002	0.0064	0.0064
C/D-6[a]	1½-2	<0.002	<0.002	<0.05	<0.002	<0.002	<0.002	<0.002	<0.002
C/D-7[c]	0-½	0.0081	0.01	<0.05	0.0045	0.0032	<0.002	<0.002	0.0032
C/D-8[b]	0-½	0.024	0.022	<0.5	**0.16**	<0.02	<0.02	<0.02	<0.02
	1½-2	<0.002	<0.002	<0.05	<0.002	<0.002	<0.002	<0.002	<0.002
C/D-9[b]	0-½	**1.6**	**1.6**	<5.0	**1.2**	0.21	<0.2	<0.2	0.21
	1½-2[e]	**0.38**	**0.35**	<0.5	**0.34**	0.024	<0.02	0.12	0.036
C/D-10[a]	1½-2	0.0034	0.0021	<0.05	0.0028	<0.002	<0.002	<0.002	<0.002
C/D-11[c]	0-½	**0.22**	**0.24**	<0.5	**0.16**	0.022	<0.02	<0.02	0.022
	1½-2	0.0038	<0.002	<0.05	0.0032	<0.002	<0.002	<0.002	<0.002
C/D-12[b]	0-½	**0.23**	**0.24**	<5.0	**4.4**	<0.2	<0.2	<0.2	<0.2
	1½-2	<0.02	<0.02	<0.5	**0.28**	<0.02	<0.02	<0.02	<0.02
C/D-15[b]	0-½	**1.2**	**1.5**	<25	**7.7**	<1.0	<1.0	<1.0	<1.0
	1½-2	0.032	0.024	<0.5	**0.15**	<0.02	<0.02	<0.02	<0.02
C/D-16[a]	1½-2	<0.002	<0.002	<0.05	0.0034	<0.002	<0.002	<0.002	<0.002
C/D-17[c]	0-½	0.11	0.19	<0.5	**0.23**	0.026	<0.02	<0.02	0.026
	1½-2	<0.002	<0.002	<0.05	0.0033	<0.002	<0.002	<0.002	<0.002
C/D-18[b]	0-½	**0.41**	**0.38**	<5.0	**4.3**	<0.2	<0.2	<0.2	<0.2
	1½-2	<0.02	<0.02	<0.5	**0.12**	<0.02	<0.02	<0.02	<0.02
C/D-21[d]	0-½	0.0047	<0.002	<0.05	0.016	<0.002	<0.002	<0.002	<0.002
C/D-22[d]	0-½	0.0055	<0.002	<0.05	0.0086	<0.002	<0.002	<0.002	<0.002
	1½-2	<0.002	<0.002	<0.05	<0.002	<0.002	<0.002	<0.002	<0.002
C/D-23	0-½	0.014	0.015	<0.25	<0.01	<0.01	<0.01	<0.01	<0.01
C/D-26	0-½	<0.01	<0.01	<0.25	<0.01	<0.01	<0.01	<0.01	<0.01
	1½-2	<0.01	<0.01	<0.25	<0.01	<0.01	<0.01	<0.01	<0.01
C/D-29	0- ½	<0.002	<0.002	<0.05	<0.002	<0.002	<0.002	<0.002	<0.002
C/D-32	1-1½	<0.002	<0.002	<0.05	<0.002	<0.002	<0.002	<0.002	<0.002
C/D-33	1-1½	<0.002	<0.002	<0.05	<0.002	<0.002	<0.002	<0.002	<0.002
C/D-34	1-1½	<0.002	<0.002	<0.05	<0.002	<0.002	<0.002	<0.002	<0.002
	4-4½	<0.002	<0.002	<0.05	<0.002	<0.002	<0.002	<0.002	<0.002
C/D-35	1-1½	<0.002	<0.002	<0.05	<0.002	<0.002	<0.002	<0.002	<0.002
C/D-36	1-1½	<0.002	<0.002	<0.05	<0.002	<0.002	<0.002	<0.002	<0.002
	4-4½	<0.002	<0.002	<0.05	<0.002	<0.002	<0.002	<0.002	<0.002
PRG		NE	NE	1.6	0.03	1.7	1.7	2.4	NE
RBRG		0.31[f]		NE	0.025	NE	NE	NE	1.17
TTLC		NE	NE	2.5	8.0	NE	NE	NE	1.0

a Boring located adjacent to previous sample location
b 5-foot "step-out" location, adjacent to building wall
c 5-foot "step-out" location, away from building wall
d 10-foot "step-out" location, away from building wall
< Indicates that the compound was not detected at or above stated laboratory detection limit
e Delta-BHC detected at 0.025 ppm
f Sum of alpha and gamma chlordane
PRG Preliminary Remediation Goal for residential site use, EPA Region 9-October 2004
RBRG Site-Specific Risk-Based Remedial Goal (Lowney, 2005)
NE Not established
TTLC Total threshold limit concentration for hazardous waste, CCR Title 26
Bold Indicates detected concentration exceeds RBRG

Table 8. Analytical Results of Selected Soil Samples-Pesticides Building C

(concentrations in parts per million)

Boring	Sample Depth (feet)	alpha-Chlordane	gamma-Chlordane	Chlordane (Technical)	Dieldrin	DDT	DDE	DDD	Total DDT
C-1[b]	0-½	**1.1**	**1.5**	<25	**11**	<1.0	<1.0	<1.0	<1.0
	1½-2	<0.02	<0.02	<0.5	**0.11**	<0.02	<0.02	<0.02	<0.02
C-3[a]	1½-2	0.065	0.092	<0.5	**0.41**	<0.02	<0.02	<0.02	<0.02
C-4[c]	0-½[e]	**0.24**	**0.21**	<0.5	**0.22**	<0.02	<0.02	<0.02	<0.02
	1½-2	<0.002	<0.002	<0.05	<0.002	<0.002	<0.002	<0.002	<0.002
C-5[b]	0-½[f]	0.089	0.093	<0.25	**0.23**	0.017	<0.01	<0.01	0.017
	1½-2	<0.02	<0.02	<0.5	**0.03**	<0.02	<0.02	<0.02	<0.02
C-6[b]	0-½	<0.2	<0.2	<5.0	**1.4**	<0.2	<0.2	<0.2	<0.2
	1½-2	0.022	<0.02	<0.5	**0.17**	<0.02	<0.02	<0.02	<0.02
C-7[a]	1½-2	0.012	0.011	<0.25	**0.23**	<0.01	<0.01	<0.01	<0.01
C-8[c]	0-½[g]	0.041	0.031	<0.25	**0.1**	<0.01	<0.01	<0.01	<0.01
	1½-2	0.0031	<0.002	<0.05	0.0088	<0.002	<0.002	<0.002	<0.002
C-9[b]	0-½	**0.27**	**0.31**	<0.5	**0.28**	<0.02	<0.02	<0.02	<0.02
	1½-2	<0.002	<0.002	<0.05	<0.002	<0.002	<0.002	<0.002	<0.002
C-10	0-½	**0.31**	**0.33**	<5.0	**1.6**	0.23	<0.2	<0.2	0.23
	1½-2	0.025	0.022	<0.5	**0.096**	<0.02	<0.02	<0.02	<0.02
C-11[c]	0-½	0.089	0.067	<0.5	**0.076**	0.02	<0.02	<0.02	<0.02
	1½-2	0.0025	<0.002	<0.05	<0.002	<0.002	<0.002	<0.002	<0.002
C-12[b]	0-½	**0.47**	**0.56**	<0.5	**0.58**	0.063	<0.02	0.022	0.085
	1½-2	0.014	0.012	<0.05	0.017	0.0039	<0.002	<0.002	0.0039
C-13[a]	1½-2	<0.04	<0.04	<1.0	**0.086**	<0.04	<0.04	<0.04	<0.04
C-14[c]	0-½	**0.24**	**0.28**	<1.0	**0.33**	0.061	<0.04	<0.04	0.061
	1½-2	<0.002	<0.002	<0.05	<0.002	<0.002	<0.002	<0.002	<0.002
C-15[b]	0-½	0.15	0.15	<1.0	**0.34**	<0.04	<0.04	<0.04	<0.04
	1½-2	<0.002	<0.002	<0.05	<0.002	<0.002	<0.002	<0.002	<0.002
C-18[b]	0-½	**0.18**	**0.2**	<1.0	**0.18**	<0.04	<0.04	<0.04	<0.04
	1½-2	<0.002	<0.002	<0.05	<0.002	<0.002	<0.002	<0.002	<0.002
C-19[a]	1½-2	0.007	0.008	<0.05	**0.038**	<0.002	<0.002	<0.002	<0.002
C-20[c]	0-½	**0.2**	**0.16**	<1.0	**0.33**	0.04	<0.04	<0.04	0.04
	1½-2	<0.002	<0.002	<0.05	<0.002	<0.002	<0.002	<0.002	<0.002
C-21[b]	0-½	**0.48**	**0.79**	<1.0	**0.86**	<0.04	<0.04	<0.04	<0.04
	1½-2	<0.002	<0.002	<0.05	<0.002	<0.002	<0.002	<0.002	<0.002
C-22[d]	0-½	0.054	<0.01	<0.25	**0.066**	<0.01	<0.01	<0.01	<0.01
	1½-2	<0.002	<0.002	<0.05	<0.002	<0.002	<0.002	<0.002	<0.002
C-23[d]	0-½	<0.002	<0.002	<0.05	0.019	<0.002	<0.002	<0.002	<0.002
C-24[d]	0-½	<0.002	<0.002	<0.05	<0.002	<0.002	<0.002	<0.002	<0.002
C-25[d]	0-½	<0.002	<0.002	<0.05	<0.002	<0.002	<0.002	<0.002	<0.002
C-26[d]	0-½	0.035	<0.01	<0.25	**0.04**	<0.01	<0.01	<0.01	<0.01
	1½-2	<0.002	<0.002	<0.05	<0.002	<0.002	<0.002	<0.002	<0.002
C-27	0-½	<0.01	<0.01	<0.25	<0.01	<0.01	<0.01	<0.01	<0.01
C-30	0-½	<0.01	<0.01	<0.25	<0.01	<0.01	<0.01	<0.01	<0.01
C-33	0-½	<0.002	<0.002	<0.05	<0.002	<0.002	<0.002	<0.002	<0.002

(continued)

Table 8. Analytical Results of Selected Soil Samples-Pesticides Building C

(concentrations in parts per million)
(continued)

Boring	Sample Depth (feet)	alpha-Chlordane	gamma-Chlordane	Chlordane (Technical)	Dieldrin	DDT	DDE	DDD	Total DDT
PRG		NE	NE	1.6	0.03	1.7	1.7	2.4	NE
RBRG		0.31[h]		NE	0.025	NE	NE	NE	1.17
TTLC		NE	NE	2.5	8.0	NE	NE	NE	1.0

a Boring located adjacent to previous sample location
b 5-foot "step-out" location, adjacent to building wall
c 5-foot "step-out" location, away from building wall
d 10-foot "step-out" location, away from building wall
< Indicates that the compound was not detected at or above stated laboratory detection limit
e Heptachlor Epoxide detected at 0.025 ppm
f Heptachlor Epoxide detected at 0.013 ppm
g Heptachlor Epoxide detected at 0.01 ppm
h Sum of alpha and gamma chlordane
I Sum of DDE, DDT, and DDD
PRG Preliminary Remediation Goal for residential site use, EPA Region 9-October 2004
RBRG Site-Specific Risk-Based Remedial Goal (Lowney, 2005)
NE Not established
TTLC Total threshold limit concentration for hazardous waste, CCR Title 26
Bold Indicates detected concentration exceeds RBRG and/or TTLC

Table 9. Analytical Results of Selected Soil Samples-Pesticides Building M, Child Care Building, and Portable Buildings

(concentrations in parts per million)

Boring	Sample Depth (feet)	alpha-Chlordane	gamma-Chlordane	Chlordane (Technical)	Dieldrin	DDT	DDE	DDD	Total DDT
M-5	0-½	0.16	0.13	<1.0	**0.14**	0.057	<0.04	<0.04	0.057
	1½-2	0.0059	0.0048	<0.05	0.013	<0.002	<0.002	<0.002	<0.002
M-6[a]	0-½[c]	**0.19**	**0.2**	<0.5	**0.27**	<0.02	<0.02	<0.02	<0.02
M-7	0-½	**1.2**	**1.2**	<10	**1.5**	<0.4	<0.4	<0.4	<0.4
	1½-2	0.044	0.033	<0.5	0.053	<0.02	<0.02	<0.02	<0.02
M-8[a]	0-½	0.086	0.081	<0.5	**0.066**	<0.02	<0.02	<0.02	<0.02
M-9[b]	0-½	0.14	0.11	<0.25	**0.11**	<0.01	<0.01	<0.01	<0.01
	1½-2	<0.002	<0.002	<0.05	<0.002	<0.002	<0.002	<0.002	<0.002
M-10[b]	0-½[d]	**0.21**	**0.21**	<0.25	**0.11**	<0.01	<0.01	<0.01	<0.01
	1½-2	<0.002	<0.002	<0.05	<0.002	<0.002	<0.002	<0.002	<0.002
M-11	0-½[e]	0.043	0.043	<0.05	**0.041**	<0.002	<0.002	<0.002	<0.002
	1½-2	<0.002	<0.002	<0.05	<0.002	<0.002	<0.002	<0.002	<0.002
M-12[a]	0-½	0.072	0.053	<0.25	**0.11**	0.034	<0.01	0.024	0.058
	1½-2	<0.002	<0.002	<0.05	<0.002	<0.002	<0.002	<0.002	<0.002
M-13[b]	0-½	0.023	0.022	<0.1	**0.032**	0.0051	<0.004	<0.004	0.0051
	1½-2	<0.002	<0.002	<0.05	<0.002	<0.002	<0.002	<0.002	<0.002
CC-1	0-½	0.0065	<0.002	<0.05	**0.046**	0.016	0.022	<0.002	0.038
	1½-2	<0.002	<0.002	<0.05	<0.002	<0.002	<0.002	<0.002	<0.002
CC-2[a]	0-½	<0.002	<0.002	<0.05	0.025	0.011	0.015	<0.002	0.026
CC-3	0-½	<0.002	<0.002	<0.05	<0.002	<0.002	<0.002	<0.002	<0.002

(continued)

Table 9. Analytical Results of Selected Soil Samples-Pesticides
Building M, Child Care Building, and Portable Buildings
(concentrations in parts per million)
(continued)

Boring	Sample Depth (feet)	alpha-Chlordane	gamma-Chlordane	Chlordane (Technical)	Dieldrin	DDT	DDE	DDD	Total DDT
PB-1	0-½	<0.002	<0.002	<0.05	<0.002	<0.002	<0.002	<0.002	<0.002
PB-3	0-½	<0.002	<0.002	<0.05	<0.002	<0.002	<0.002	<0.002	<0.002
PB-5	0-½	0.022	0.01	<0.05	**0.054**	<0.002	<0.002	<0.002	<0.002
	1½-2	<0.002	<0.002	<0.05	<0.002	<0.002	<0.002	<0.002	<0.002
PB-6[a]	0-½	0.028	0.017	<0.05	0.0038	<0.002	<0.002	<0.002	<0.002
PRG		NE	NE	1.6	0.03	1.7	1.7	2.4	NE
RBRG		0.31[f]		NE	0.025	NE	NE	NE	1.17
TTLC		NE	NE	2.5	8.0	NE	NE	NE	1.0

a 5-foot "step-out" location, away from building wall
b 10-foot "step-out" location, away from building wall
< Indicates that the compound was not detected at or above stated laboratory detection limit
c Heptachlor Epoxide detected at 0.038 ppm
d Heptachlor Epoxide and Endosulfan sulfate detected at 0.015 ppm and 0.01 ppm, respectively
e Heptachlor Epoxide detected at 0.0035 ppm
f Sum of alpha and gamma chlordane
PRG Preliminary Remediation Goal for residential site use, EPA Region 9-October 2004
RBRG Site-Specific Risk-Based Remedial Goal (Lowney, 2005)
NE Not established
TTLC Total threshold limit concentration for hazardous waste, CCR Title 26
Bold Indicates detected concentration exceeds RBRG

As shown in Tables 7 through 9, concentrations of dieldrin (ranging from 0.032 ppm to 11 ppm) that exceeded the RBRG of 0.025 ppm were detected in numerous samples collected at depths of 0-½ foot and 1½-2 feet adjacent to the on-Site buildings, primarily Buildings C/D, C, and M. Two surface samples collected adjacent to the Child Care Building and the portable buildings also had a detected dieldrin concentration that exceeded the RBRG. In the surface sample collected from boring C-1, the detected dieldrin concentration (11 ppm) exceeded the TTLC of 8.0 ppm.

Alpha- and gamma-chlordane were also detected in many of the samples; however, they only exceeded the RBRG in eighteen of the samples. Other pesticide compounds (DDT, DDE, DDD, delta-BHC, heptachlor epoxide, and endosulfan sulfate) were detected at a much lower frequency, and the detected concentrations did not exceed the respective RBRGs and USEPA PRGs. The pesticide compounds technical chlordane and endrin, previously detected at a high frequency at elevated concentrations during the 2001 Winzler & Kelly investigation, were not detected in any of the more recently collected samples. Therefore, we conclude the technical chlordane previously reported was in error.

Based on the analytical results, pesticide-impacted soil appeared present in the grass and soil areas on the northwest, northeast, and southeast sides of Building C/D (Figure 4). On the northwest side of the building, deeper soil samples (1½-2 feet) collected adjacent to the building and shallow (0-½ foot) soil samples collected 5 feet from the building did not detect dieldrin at concentrations that exceeded the RBRG. Therefore, the impacted soil appeared limited to the upper 1-1½ feet of soil in a small strip (less than 5 feet wide) adjacent to the building. On the northeast side and the grass and soil areas on the southeast side of the building, deeper soil samples (1½-2 feet) collected adjacent to the building and shallow (0-½ foot) soil samples collected 5 feet from the building detected dieldrin at concentrations that exceeded the PRG. Shallow (0-½ foot) soil samples collected 10 feet from the building did not detect dieldrin at concentrations that exceeded the RBRG. Therefore, the impacted soil appeared present in the upper few feet adjacent to the building, and in the upper 1-1½ feet of soil to at least 5 feet away from the building. Soil samples collected from the upper 6 inches of soil beneath the paved areas on the southeast and southwest sides of the building did not detect dieldrin at concentrations that exceeded the RBRG. Soil samples collected from beneath the floor slabs on the interior of the building did not detect pesticides.

Based on the analytical results, pesticide-impacted soil appeared present in the grass and soil areas on the northwest, northeast, and southeast sides of Building C (Figure 4). On the northeast side of the building, deeper soil samples (1½-2 feet) collected adjacent to the building and shallow (0-½ foot) soil samples collected 5 feet from the building detected dieldrin at concentrations that exceeded the RBRG. Shallow (0-½ foot) soil samples collected 10 feet from the building did not detect dieldrin at concentrations that exceeded the RBRG. Therefore, the impacted soil appeared present in the upper few feet adjacent to the building, and in the upper 1-1½ feet of soil to at least 5 feet away from the building. On the grass and soil areas on the northwest and southeast sides of the building, deeper soil samples (1½-2 feet) collected adjacent to the building and shallow (0-½ foot) soil samples collected 5 and 10 feet from the building detected dieldrin at concentrations that exceeded the RBRG. Therefore, the impacted soil appeared present in the upper few feet adjacent to the building, and in the upper 1-1½ feet of soil to at least 10 feet away from the building. Soil samples collected from the upper 6 inches of soil beneath the paved areas on the southwest side of the building did not detect dieldrin at concentrations that exceeded the RBRG.

Based on the analytical results, pesticide-impacted soil appeared present in the grass and soil areas on the northwest and northeast sides of Building M (Figure 4). On the grass and soil areas on the northwest and northeast sides of the building, shallow (0-½ foot) soil samples collected adjacent to, and 5 and 10 feet away from the building detected dieldrin at concentrations that exceeded the RBRG. Generally, deeper soil samples (1½-2 feet) collected adjacent to, and 5 and 10 feet away from the building did not detect dieldrin at concentrations that exceeded the RBRG.

2.7.5 On-Site Transformers

During previous investigations (Kleinfelder 2001, 2004), three pad-mounted transformers reportedly were observed in the northwest corner of the Site. The transformers were observed to be in good condition with no evidence of leakage.

During a follow-up Site visit to inspect the electrical units, one pad-mounted PG&E transformer (T-24314), one pad-mounted breaker for the portable buildings, and one pad-mounted steel shell that was determined to be empty were observed. A placard indicating ownership was not observed on the empty steel shell. No evidence of staining or leakage was observed around the units.

On November 30, 2004, PG&E was contacted to obtain additional information on the electrical units at the Site. Based on their records, the existing PG&E transformer (T-24314) was installed in 1998. To verify the absence of PCBs in the transformer, PG&E inspected the unit and it was determined to be PCB-free.

2.8 Interim Mitigation Measures

To prevent potential exposure of Site occupants to impacted soils around the outer perimeter of Buildings C/D, C, and M prior to the initiation of the remedial action, interim mitigation measures were installed at the Site. Plastic sheeting (approximately 6 mil thick) was placed over the exposed dirt areas around Buildings C/D, C, and portions of Building M (near the future handicap ramp location), extending approximately 5 to 10 feet from the building wall. An approximately a 3-inch thick layer of wood chips was then placed over the sheeting. Since Building M is not planned for demolition, a 3-inch concrete slab was poured on grade over the bare soil extending approximately 5 feet from the building wall (Figure 3). Temporary construction fencing was erected along the perimeter of the contaminated areas at Buildings C/D, C, and M to further reduce access to these areas.

3.0 NATURE, SOURCE, AND EXTENT OF CONTAMINANTS

3.1 Type, Source, and Location of Contaminants

The contaminants present in soil at the Site are residual lead and organochlorine pesticides, specifically dieldrin, alpha-, and gamma-chlordane, DDT, DDE, and DDD, and heptachlor epoxide. The compounds chlordane and dieldrin belong to a group of organochlorine pesticides called cyclodiene insecticides (this group also includes aldrin, endrin, heptachlor, and endosulfan). Cyclodiene insecticides historically were used as soil insecticides and for termite control due to their stability in soil and relative stability when exposed to sunlight. Technical-grade chlordane is a mixture of at least 50 compounds including alpha- and gamma-chlordane, and heptachlor; alpha- and gamma-chlordane are the main components of the technical chlordane mixture. Although aldrin and dieldrin are separate insecticides, in soil, aldrin is converted to dieldrin, which is more stable. Heptachlor epoxide is an oxidation product of heptachlor formed by many plants and animals, including humans, after exposure to heptachlor. The use of these compounds was banned in the United States by 1988. The chlorinated insecticide known as DDT was widely used prior to 1970 in agricultural applications. In practical application, the technical grade of DDT consisted of 77 percent DDT, 15 percent DDD, and 4 percent DDE. The use of DDT was banned in 1972. The source of the organochlorine pesticides in soil at the Site appears to be historic termite abatement activities (spraying/injection) in the area around the base of the buildings. The source of the lead in soil at the Site appears to be historic weathering of lead-based paint from the exterior of the structures.

3.2 Extent of Contamination

3.2.1 Pesticides

As with the lead-impacted soil, the extent of pesticide-impacted soil at the Site appears limited to the exposed soil and grass areas adjacent to Buildings C/D, C, and M. The lateral extent of pesticide-impacted soil away from the buildings is greater than that for lead, however. Generally, the impacted soil appears to be confined to a strip (less than 10 feet wide) adjacent to the buildings. However, adjacent to Building M, the lateral extent of impacted soil appears to extend past a distance of 10 feet from the building, as surface soil samples collected a distance of 10 feet from the building detected elevated concentrations of organochlorine pesticides. The distribution of organochlorine pesticides in shallow soil at the Site is presented on Figure 4.

3.2.2 Lead

The extent of lead-impacted soil at the Site appears to be limited to a narrow strip (less than 5 feet wide) of the exposed soil and grass areas adjacent to Buildings C/D, C, and M. The lead contamination appears to be confined to the upper foot of soil in these areas. The distribution of lead in shallow soil at the Site is presented on Figure 5.

3.3 Health Effect of Contaminants

3.3.1 Total DDT

U.S. EPA classifies DDT, a chlorinated ethane derivative, as a probable human carcinogen (B2), based on the induction of lung, liver, and thyroid tumors in laboratory animals. DDT compounds are highly persistent in the environment and stored in body fat of higher organisms, leading to biomagnification.

Total DDT can affect the body via inhalation (i.e., dust), ingestion, and absorption through skin contact. Overexposure can result in headaches, dizziness, tremors, and irritation of the eyes and skin. Chronic overexposure can cause damage to the nervous system, kidneys, and liver.

3.3.2 Dieldrin, Chlordane, and Heptachlor

Chlorinated cyclodiene insecticides that are structurally related by the same mechanism of action include dieldrin, chlordane, and heptachlor. Like DDT compounds, the cyclodienes persist in the environment and accumulate in fatty tissues of biologic organisms. The central and peripheral nervous systems are the target organs. Headache, nausea, vomiting, dizziness, and mild chronic jerking are characteristic symptoms of exposure. Increased exposure can increase the severity of these symptoms and advance to convulsions. The cyclodienes also can produce liver damage. With respect to relative toxicity, dieldrin is approximately twice as toxic as heptachlor, and approximately seven to eight times as toxic as chlordane.

All three cyclodienes are class B2 carcinogens based on liver tumors observed in experimental animals. The non-carcinogenic reference doses assigned to the cyclodienes are based on the critical effect of pathologic changes in the liver and increased liver weight of experimental animals.

3.3.3 Lead

Lead can affect the body via inhalation and ingestion pathways. Overexposure can result in weakness in the fingers, wrists, and/or ankles. Chronic overexposure can cause severe damage to the blood-forming, nervous, urinary, and reproductive systems.

3.4 Targets Potentially Affected by Site

As the Site is an active public elementary school, human access to the Site is generally unlimited. Therefore, Site occupants (students and faculty) could potentially be exposed to the contaminants in soil at the Site if remedial actions are not implemented. A childcare facility is also located on the Site. The interim mitigative measures implemented at the Site, as described in Section 2.8, have somewhat reduced the risk of exposure until the remedial action can be implemented.

During Site redevelopment, Site occupants, on-Site workers, and off-Site receptors could potentially be exposed to the COCs. The area surrounding the Site is mainly residential, and a park is present to the southeast of the Site. Following Site redevelopment, future Site users, workers, and surrounding residential receptors could potentially be exposed to the COCs unless appropriate preventative measures or remedial actions are implemented.

4.0 REMEDIAL ACTION OBJECTIVES

Remedial action objectives (RAOs) for impacted soil at the Site are selected to mitigate the threat to human health and the environment in a manner consistent with future planned and potential activities at the Site, and to maximize the redevelopment potential of the Site. They address both chemical concentrations and potential exposure pathways. Either reducing concentrations and/or reducing potential exposures can achieve these objectives. In general, RAOs are based on soil and ground water sampling results, hydrogeologic data, potential Applicable or Relevant and Appropriate Requirements (ARARs), and potential exposure pathways for the public and environment. Remedial action objectives should specify:

- The contaminants of concern
- Exposure routes and receptors
- Acceptable contaminant concentration or range of concentrations for each exposure route (USEPA 1988)

For known or suspected carcinogens, the EPA National Contingency Plan (NCP) (40 CFR 300.430) defines acceptable exposure levels as generally being conservative levels that represent an excess upper bound lifetime theoretical cancer risk to an individual of between 1×10^{-4} to 1×10^{-6}. For non-carcinogens of concern, a concentration level that represents a hazard quotient of less than 1.0 is acceptable.

The remedial action objectives for soils are to:

- Prevent ingestion of and dermal contact with soils and inhalation of dust containing chemicals at concentrations that pose a lifetime theoretical cancer risk of greater than 1 x 10^{-6} for a school setting or similar sensitive receptor.
- Prevent ingestion of and dermal contact with soils containing non-carcinogenic chemicals at concentrations that exceed a hazard quotient equal to or greater than 1 for a school setting.

For this Site, the primary RAO is to greatly reduce the potential for future exposure to contaminants in soil in accordance with the continued use of the Site as an elementary school.

4.1 Applicable or Relevant and Appropriate Requirements

Remedial action objectives must be consistent with Applicable or Relevant and Appropriate Requirements (ARARs) (40 CFR Section 300.415). The underlying definitions are derived from the National Oil and Hazardous Substances Pollution Contingency Plan (40 CFR Section 300.5).

Applicable Requirements: Remedial standards, standards of control, and other substantive requirements, criteria, or limitations promulgated under federal or state law that specifically address a hazardous substance, pollutant, remedial action, location, or other circumstance at a site.

Relevant and Appropriate Requirements: Remedial standards, standards of control, and other substantive environmental protection requirements, criteria, or limitations promulgated under federal or state law that, while not "applicable" to a hazardous substance, pollutant, contaminant, remedial action, location, or other circumstance at a site, address problems or situations sufficiently similar to those encountered at the site that their use is well-suited to the particular site.

ARARs typically are separated into three categories as follows.

Chemical-specific ARARs: These are health- or risk-based standards that define the allowable limits of specific chemical compounds found in or discharged to the environment. They can provide remediation and discharge levels, governing the extent of site remediation. Most of the chemical-specific ARARs are for ground water used for drinking water. Indoor air exposures are used for others.

Location-specific ARARs: These requirements apply to natural site features (e.g., wetlands, flood plains, endangered species) and man-made features (e.g., landfills, city zoning, places for historical or archaeological significance). Location-specific ARARs restrict the types of remedial actions that can be implemented based on the characteristics or location of the site.

Action-specific ARARs: These ARARs are technology-based or activity-based limitations that set performance and design restrictions. They specify permit requirements and engineering controls that must be instituted during site activities, and restrict particular activities.

Federal and state non-promulgated standards, policies, or guidance documents, and legal requirements, are not ARARs. However, according to NCP guidance, these criteria also are to be considered when evaluating and selecting remedial actions necessary to protect human health and the environment.

The potential ARARs for the impacted soil at the Site are discussed below.

4.1.1 Public Participation

DTSC has developed a public participation strategy to determine the level of public interest and ensure that the local community is informed of the proposed remedial action.

Community Survey: A baseline community survey was conducted through the mailing of survey forms to nearby community members. The results of the survey will be used to develop a Community Profile Report that will be prepared by DTSC.

Community Profile Report: A community profile report will be prepared for the proposed remedial action at the Site by DTSC. The community profile report is based on the information from a variety of sources including file reviews, Site visits, demographic data, community surveys and interviews, and discussions with representatives of the local elected officials. The community profile report will be updated as necessary. It is expected that the report will be completed when the draft RAW has been reviewed by DTSC and prior to public noticing.

Community Concerns: The identified concerns of the community, based on the results of the community survey and the community profile report, will be addressed.

Public Participation Activities: A public notice will be published in the local newspaper informing the community of this proposed remedial action and of the availability of the administrative record file for public inspection at two established Information Repositories. The public notice will be published in The Daily Review, a local newspaper. Copies of the PEA and SSI reports and this RAW will be placed in the Information Repositories for access by community members. In addition, a Fact Sheet in English and Spanish (Site-specific) will be circulated to all residences and businesses in the immediate vicinity of the Site. The Fact Sheet will provide the general background and update information about the Site.

4.1.2 Health and Safety Plan

A Site-specific Health and Safety Plan (HSP), included as Appendix A, has been developed to inform personnel of the potential hazards associated with implementing the RAW and to minimize exposure to Site contaminants. The HSP has been prepared in order to meet federal and California Occupational Safety and Health Administration (OSHA) standards for hazardous waste operations (29 CFR 1910.120 and 8 CCR 5192), and requirements of the California Safe Drinking Water and Toxic Enforcement Act of 1986 (Proposition 65). The Site-specific HSP includes information regarding:

- Project safety authority
- Human and environmental exposure pathways
- Hazard assessment and control measures (chemical and physical hazards)
- Air monitoring
- Personal protective equipment
- Site access
- Remedial work areas
- Equipment and personnel decontamination
- General safe work practices
- Emergency response plan
- Training

The contractor and all subcontractors performing the on-Site remedial work must prepare their own HSP and will be responsible for the health and safety of their own employees. The HSP prepared by Lowney Associates for the Site can be used by the contractor as a guide for the preparation of their own HSP.

4.1.3 Bay Area Air Quality Management District (BAAQMD)

The California Health and Safety Code, Division 26, provides requirements for controlling emissions of chemicals to the atmosphere and for an appropriate waste disposal procedure. For the Site contaminants, any emissions would be in dust generated during excavation and off-hauling. Dust control activities and nuisance dust emissions are described in Section 8.5 and regulated under this authority.

4.1.4 Hazardous Waste Management

Title 22 of the California Code of Regulations (CCR) lists TTLCs and STLCs for classification of hazardous wastes. A waste is considered hazardous in California when laboratory results of representative samples collected from the waste indicate that contaminant levels exceed their respective TTLC or STLC.

4.1.5 Listing and Characteristics

The U.S. EPA under the Resource Conservation and Recovery Act (RCRA) uses two procedures to define wastes as hazardous: Listing and Hazardous Characteristics. The listing procedure involves identifying industries or processes that produce waste which pose hazards to human health and the environment. Characteristic hazardous wastes are those that exhibit characteristics or reactivity, corrosivity, ignitability, or toxicity.

4.1.6 California Health and Safety Code

Hazardous Substance Removal Criteria: Because contaminant concentrations were detected in soil that could classify the material as a California hazardous waste when excavated, special licenses are needed during the remedial activities.

4.1.7 Cal/OSHA Injury and Illness Prevention Program Standard

Under California OSHA standard (8 CCR 3203), every employer shall establish, implement, and maintain an effective written Injury and Illness Prevention Program (IIPP). The IIPP must: identify the person or persons with the authority and responsibility for implementing the IIPP, include a means for identifying job safety and health hazards, routine documented inspections and corrective steps taken to eliminate and hazards discovered, documented training of new and current employees in general safe work practices and specific hazards related to their job assignment, methods for assuring compliance with safety requirements, and a system for communicating with employees on safety and health matters that assures employee participation. To satisfy this ARAR, every employer at the Site must have an IIPP prepared prior to the initiation of work at the Site.

4.1.8 Preliminary Remediation Goals (PRGs) (U.S. EPA 2004)

PRGs published by Region IX EPA combine current EPA toxicity values with standard exposure factors to estimate media-specific concentrations in soil that are protective of humans over a lifetime of exposure. Concentrations exceeding the PRGs do not automatically trigger a response action; however, exceeding a PRG suggests that further evaluation of the potential risk that may be posed by site contaminants is appropriate.

4.1.9 Storm Water Pollution Prevention

The State of California Water Resources Control Board, as part of the National Pollutant Discharge Elimination System (NPDES), has adopted a statewide *General Permit to Discharge Stormwater Associated with Construction Activity* (General Permit) to address discharges of storm water runoff associated with applicable construction activities. The Regional Water Quality Control Board (RWQCB) is the responsible agency for implementing and enforcing General Permit provisions. The General Permit requires all dischargers where construction activity disturbs one acre or more to develop and implement a Storm Water Pollution Prevention Plan (SWPPP) which specifies Best Management Practices (BMPs) to prevent discharge of sediments to the storm drains and drainages in the area. Since the area to be disturbed during the remedial action does not exceed one acre, a SWPPP is not required, and this ARAR does not apply.

5.0 ESTABLISHMENT OF SITE REMEDIAL GOALS

To establish soil remedial goals to be used for the remedial action at the Site, a baseline health risk and risk-based remedial goal evaluation was performed for the Site. The estimation of the risk-based remedial goals was developed using the California Environmental Protection Agency (Cal/EPA) *Guidance For Assessing Exposures and Health Risks at Existing and Proposed School Sites* (February 2004); and the Cal/EPA Preliminary Endangerment Assessment (PEA) guidance manual (January 1994) . The results of the health risk and remedial goal estimation were presented in the Estimation of Risk-Based Remediation Goals analysis prepared by Lowney Associates dated April 20, 2005 (Lowney 2005), presented as Appendix B.

Since the proposed cleanup goals established for the site will be based on the unrestricted land use scenario, the results of the evaluation using PEA guidance are presented below. A discussion of the results using the School Screen model is presented in Appendix B.

5.1 Selection of Contaminants of Concern

To identify the contaminants of concern (COCs) to be included in the risk calculations, the detected chemicals were initially screened using PEA guidance to calculate potential risks and hazards. As a conservative measure, the screening process included use of the maximum detected soil concentrations to estimate risks and hazards assuming a 30-year residential exposure via incidental ingestion, dermal contact, and inhalation of airborne chemical constituents from affected soil media. Non-carcinogenic chemicals were considered for elimination if the estimated non-carcinogenic hazard quotient was less than 1.0, and carcinogenic chemicals were considered for elimination if estimated health risks were less than 5% of the total site health risks.

The screened pesticide compounds included dieldrin, alpha- and gamma-chlordane, heptachlor epoxide, and total DDT. The pesticide compounds technical chlordane, heptachlor, aldrin, and endrin, detected during the 2001 investigation, could not be confirmed in any of the samples collected during subsequent investigations. Therefore, these compounds were eliminated from consideration. The screened metals included arsenic, barium, chromium, cobalt, copper, lead, nickel, mercury, vanadium, and zinc.

5.1.1 Contaminants Eliminated

Using the screening criteria described above, the metals barium, cobalt, copper, nickel, mercury, vanadium, and zinc were initially considered for elimination. Of these compounds, barium, cooper, mercury, and zinc provided a total non-carcinogenic hazard quotient of 0.2. These chemicals were eliminated from further consideration. Cobalt and vanadium each provided hazard quotients of 0.5 and 0.3 respectively. However, the cobalt hazard was primarily attributed to the inhalation pathway calculation that incorporated an inhalation reference dose from USEPA 2004 PRGs and the weight percent (PEA) method for calculation of the inhalation exposure point calculation. Alternatively, using the particulate emission factor (PEF) reduced the hazard quotient to 0.07. Therefore cobalt was eliminated for further consideration. Vanadium was eliminated from further consideration after discussion with Department of Toxic Substances Control (DTSC) toxicologist Dr. Brian Endlich relative to reference dose assignment and resultant low hazard quotient.

With respect to chromium, risk calculations were initially performed assuming that all chromium was hexavalent as required per PEA guidance. Even though the average chromium concentration in 28 soil samples collected at the Site was 18.5 ppm, the maximum concentration of 90 ppm was considered in the risk calculations. The range of chromium concentrations detected in on-Site soil appears to representative of background concentrations as presented in published documents (Scott, 1991; Lawrence Berkeley National Laboratory, 1995). Estimated risks using the maximum chromium concentration in soil of 90 ppm indicated that potential risks varied from 3.4×10^{-4} to 5.2×10^{-6} and were dependent upon the method used for the inhalation exposure point calculation. Because the chromium concentrations detected in on-Site are well within background levels, and since hexavalent chromium compounds were not likely used at the site, chromium was eliminated from further consideration.

Like chromium, nickel compounds yielded estimated risks from 5.7×10^{-9} to 3.7×10^{-7} that were primarily dependent upon the method used for calculating the inhalation exposure point concentration. Nickel was eliminated from further consideration due to the low risk estimates calculated.

Arsenic was not detected greater than 5 ppm in the 24 soil samples collected from a depth of 0-½ foot below ground surface (bgs). Arsenic was eliminated from further risk evaluation since the detected concentrations were within naturally occurring background concentrations in San Francisco Bay Area soils (Scott, 1991; Lawrence Berkeley National Laboratory, 1995).

The risk calculations used to eliminate potential chemicals of concern are presented in Appendix A of the Estimation of Risk-Based Remediation Goals analysis (Appendix B).

5.1.2 Selected Contaminants of Concern

Based on the screening criteria described above, the selected COCs at the Site consisted of five organochlorine pesticide compounds (dieldrin, alpha- and gamma-chlordane, heptachlor epoxide, and total DDT) and lead. Risk-based remediation goals were calculated for each of the COCs and are further discussed in Section 5.5.

5.2 Exposure Assessment

Exposure assessment is the process of identifying human populations that could potentially come into contact with Site-related chemicals and the route(s) of potential exposure.

5.2.1 Exposure Pathways

An exposure pathway is the course a contaminant takes from a source to an exposed organism. For the selected COCs, the exposure pathways addressed included inhalation of dust, incidental ingestion of contaminated soils, and dermal contact with contaminated soil.

5.2.2 Exposure Estimation

Exposure estimates (chemical intakes) are defined as the mass of a substance taken into the body, per unit of body weight, per unit of time. Exposure quantification (calculation of chemical intake or dose) incorporates algorithms and exposure variables provided in regulatory guidance that are based on assumptions about exposure conditions.

Risk-based remedial goals were estimated using PEA guidance. The potentially exposed populations, modeling approach, and exposure assumptions are discussed below.

5.2.3 Potential Receptors

For a screening level approach, the default potentially exposed receptors at schools include: 1) students from kindergarten through high school; 2) staff; 3) pregnant or nursing women; 4) pre-schoolers aged one through four; and 5) nursing infants less than one year of age in day care at the Site whose mothers are students or staff. Chronic daily intake calculations assume that a receptor is exposed 350 days per year over a period 30 years (6 years as child and 24 years as an adult). Body weight assumptions for all pathways are 70 kilograms (kg) for adults, and 15 kg for children. Hazard calculations incorporate the child receptor only, and risk calculations incorporate the sum of both receptors (child + adult). Finally, the averaging time for hazard estimation is 2190 days (6 years x 365 days/year). For carcinogenic risk estimates, the averaging time is 25,550 days (70 years x 365 days/year).

5.2.4 Exposure Parameters and Assumptions by Pathway

The parameters and assumptions used to calculate exposure factors for each exposure case are described briefly below. All exposure parameters for each receptor including body weights, surface areas of exposed skin, breathing rates, ingestion rates, exposure frequencies, and duration are provided in Appendix A of the Estimation of Risk-Based Remediation Goals analysis; the exposure algorithms for the evaluated pathways are also presented.

Soil Ingestion: The exposure algorithm for soil ingestion represents incidental ingestion of surface soil and dusts as a result of direct contact with soil on hands, followed by hand-to-mouth activity. For this exposure pathway, a child is assumed to ingest 200 milligrams (mg) of soil per day and 100% absorption of the ingested contaminant is assumed. For the adult receptor, a daily ingestion rate of 100 mg of soil per day is assumed. The Exposure frequency for ingestion is assumed to be 350 days per year.

Dermal Contact: The soil-to-skin adherence factor (AF) or loading rate, a sensitive parameter, refers to the amount of soil that remains deposited on the skin after contact. Dermal exposure is expressed as an absorbed dose by incorporating a chemical-specific absorption factor (ABS) into the exposure equation. For organochlorine pesticides, a 5% ABS factor is assumed. A child's exposed skin surface area (SA) is assumed to be 2000 square centimeters (cm^2), and a soil adherence factor (AF) of 1 milligram per square centimeter (mg/cm^2) is also assumed. With respect to dermal absorption values, the absorption fraction for chlorinated pesticides assume 5%, for arsenic 3% is assumed, and for all other metals 1% is assumed. The Exposure frequency for dermal contact is assumed to be 350 days per year.

Inhalation: For the inhalation pathway a breathing rate of 20 cubic meters (m^3) of air per day is assumed for adults and 10 m^3 for a child. Body weight assumptions for all pathways are 70 kilograms (kg) for adults, and 15 kg for children. In addition, the exposure point concentration in air assumes that the chemical of concern is present in respirable dust at the respective weight fraction as it is in site soils. The default value total respirable dust in air is assumed to be of 50 micrograms per cubic meter (ug/m^3).

5.3 Toxicity Values

Toxicity values are used to quantify the relationship between the extent of exposure to a chemical and the likelihood of adverse health consequences. EPA-derived toxicity values used in risk assessments are termed slope factors and reference doses (RfDs). Slope factors are used to estimate the incremental lifetime risk of developing cancer corresponding to doses calculated in the exposure assessment. The potential for non-cancer health effects is evaluated by comparing estimated daily intakes with reference doses (RfDs) or reference concentrations (RfCs), which represent daily intakes at which no adverse effects are expected to occur over a lifetime of exposure. Both slope factors and RfDs are specific to the route of exposure [e.g., inhalation, or ingestion (oral) exposure]. California values are used in risk-based remedial goal calculations to estimate soil concentrations at target risk levels. Toxicity parameters (slope factors and RfDs) used in the calculations are summarized in Table 3 of the Estimation of Risk-Based Remediation Goals analysis (Appendix B).

5.4 Baseline Risk and Hazard Characterization

To evaluate the current potential health risks (pre-remediation) to the receptors due to the chemicals detected at the Site, the current Site risks were calculated using the exposure point concentrations (EPCs). For the PEA risk and remedial goal calculations, maximum soil concentrations for each chemical were used for the EPCs. The EPCs are presented in Table 6 of the Estimation of Risk-Based Remediation Goals analysis.

The EPCs were used to calculate the chemical intake or dose. The resultant doses, for the exposure conditions evaluated, were then multiplied by slope factors for carcinogenic risks or divided by RfDs for non-carcinogenic hazards. To provide a pre-remedial non-carcinogenic hazard estimate for the selected COCs, the maximum hazard quotient (age group 1-2) was summed to provide a total. Estimated baseline risks and hazards are presented in Table 10 below.

Table 10. Baseline Risks

Receptor Group	Dieldrin	Chlordane(t)	Heptachlor Epoxide	Total DDT	Total Risk
Carcinogenic Risk	8×10^{-4}	3.2×10^{-5}	2.1×10^{-6}	2.3×10^{-6}	8.4×10^{-4}
Hazard	7.7	0.4	0.2	0.1	8.4
EPC	20	4.6	0.15	2.74	

To place the risk estimates in perspective, the USEPA NCP states, “For known or suspected carcinogens, acceptable exposure levels are generally concentration levels that represent an excess upper bound lifetime cancer risk to an individual of between 10^{-4} and 10^{-6}.” Also stated is that “The 10^{-6} risk level shall be used as the point of departure for determining remediation goals.” The established remediation goal of 1×10^{-6} is conservative and commonly accepted for unrestricted land use.

5.5 Calculation of Site Remedial Goals

5.5.1 Calculation of URVs

For each pesticide COC of interest, remedial goal estimates incorporate a target risk level, assumptions concerning exposure, exposure estimation, and compound-specific toxicity values to obtain a chemical concentration that can be present in soil without creating an excessive likelihood of adverse health effects assuming exposure to affected soils. To estimate remedial goals for carcinogenic chemicals of concern, a URV approach is used.

Risk–based concentrations using PEA assumptions and parameters were calculated using a URV approach. A soil concentration of 1-ppm was assumed for each COC to generate risks. The calculated URVs are presented in Appendix A of the Estimation of Risk-Based Remediation Goals analysis, Appendix B.

5.5.2 Risk-Based Remedial Goals

As mentioned in Section 4.0, the remedial action objectives for soils at the Site are to:

- Prevent ingestion of and dermal contact with soils and inhalation of dust containing chemicals at concentrations that pose a lifetime theoretical cancer risk of greater than 1×10^{-6} for a school setting.
- Prevent ingestion of and dermal contact with soils containing non-carcinogenic chemicals at concentrations that exceed a hazard quotient equal to or greater than 1 for a school setting.

Remedial goal estimates were calculated by setting the target risk (TR) to one-in-one million (1×10^{-6}). A $1x10^{-6}$ cancer risk represents a one-in-one-million additional probability that an individual may develop cancer over a 70-year lifetime as a result of the exposure conditions evaluated. Because cancer risks are assumed to be additive, risks associated with simultaneous exposure to more than one carcinogenic chemical are summed to determine a total cancer risk. Section 5.6 describes how this will be done during site remediation.

The results of the risk based remedial goal calculations (Appendix B) for carcinogenic chemicals (organochlorine pesticides) assuming a target risk equal to 1×10^{-6} are presented below in Table 11.

Table 11. Risk-Based Soil Remedial Goals-Pesticides
(concentrations in parts per million)

Receptor Group	Dieldrin	Chlordane(t)	Heptachlor Epoxide	Total DDT
Residential Scenario	0.025	0.31	0.072	1.17

Since alpha and gamma chlordane have similar toxicity values, the remedial goal for chlordane presented in Table 11 is the sum of alpha and gamma chlordane.

The risk-based remedial goal (RPRG) concentration for lead was iteratively calculated using the DTSC Lead Risk Assessment Spread Sheet (Version 7), included in Appendix A of the Estimation of Risk-Based Remediation Goals analysis, Appendix B. For a child receptor, the 99th percentile concentration is the lead concentration in soil that results in a blood lead concentration of less than or equal to 10 ug/dl in the 99th percentile of those exposed. The remedial goal for lead will be DTSC Schools Division screening level of 255 ppm.

Dieldrin appears to represent 95.5 % of the total site risk at the site. Removal of all soil impacted with dieldrin at concentrations equal to or greater than 0.025 mg/kg, will result in a projected total site risk of less than 1×10^{-6} . This is because the removal of soil impacted by dieldrin will result in the removal of significant concentrations of other organochlorine pesticide COCs. The RBRG for total DDT was calculated to be 1.17 ppm. This concentration, however, is greater than the California hazardous waste criteria (TTLC) of 1.0 ppm. To avoid leaving residual material on-Site that could be classified as a hazardous waste and require special handling if excavated, the remedial goal will be 1.0 ppm.

5.6 Summary of Remedial Goals

During confirmation sampling, each area of the site will be considered remediated when the individual RBRGs are achieved for a single chemical, and if multiple chemicals are present, the cumulative health risk is determined to be less than one-in-one million (1×10^{-6}). For total DDT, the remediation goal will be 1.0 ppm so as to not exceed the California hazardous waste threshold (total threshold limit concentration [TTLC]). For total lead, the remediation goal will be DTSC Schools Division screening level of 255 ppm.

If multiple chemicals are identified in confirmation soil samples collected during site remediation, the cumulative risk will be evaluated using PEA methods and the results will be confirmed with the DTSC.

6.0 IDENTIFICATION OF REMEDIAL ALTERNATIVES

This section provides the analysis of three remedial action alternatives for remediation of the impacted soil at the Site to acceptable levels, taking into account the current and planned continued use of the Site as an elementary school. The remedial alternatives include the following:

- No action.
- Excavation and off-Site disposal of the upper 1 foot of impacted soil and placement of a 1-foot cap over the impacted areas.
- Excavation and off-Site disposal of impacted soil.

Other potential alternatives or innovative technologies have not been included because they are unlikely to be timely, implementable, and/or cost-effective.

6.1 Alternative 1-No Action

DTSC requires the consideration of no further action as an alternative for evaluation. This alternative does not involve the removal or remediation of the impacted soil at the Site.

6.2 Alternative 2-Excavation, Off-Site Disposal, and Placement of a 1-Foot Cap

This alternative involves excavation of approximately the upper 1 foot of impacted soil from the identified areas (approximately 200 cubic yards of in-place soil) (Figure 6), transportation of the excavated material to an appropriate off-Site facility for disposal, and placement of a minimum 1-foot cap of clean fill over the impacted areas. Based on the sampling results, the upper 1 foot of impacted soil contains the highest concentrations of the COCs. Removal of the most impacted soil and placement of the 1-foot cap will limit potential exposure of future Site occupants to the residual lead and pesticides detected in the near surface soil. The field activities would be implemented using readily available standard construction equipment.

Based on the disposal facility's requirements, samples of the excavated material may need to be collected and analyzed and the soil would be profiled to establish the appropriate facility. If the excavated soil requires stockpiling, plastic sheeting would be placed beneath and on top of the temporary stockpiles to prevent contaminant migration via wind or precipitation. If soil stockpiling and profiling is not required by disposal facilities, the soil would be directly loaded into trucks from the excavations and off-hauled.

Under this alternative, a Site-specific HSP will be prepared prior to initiation of remedial activities at the Site. Construction workers at the Site will be required to have the appropriate Cal/OSHA health and safety training prior to working in this material, and will need to wear personal protective equipment during remedial activities. No special OSHA training is required of workers once the impacted material is capped.

A deed restriction would be required under this alternative for the capped areas of the Site to restrict disturbances and future uses of areas underlain by the impacted materials. An Operations & Maintenance (O&M) Plan would also be required to establish future employee and subcontractor practices and work procedures involving the impacted material, as well as to provide notices to subcontractors that may encounter this material in the future. An O&M Agreement with Financial Assurance would also be required which would commit the SLUSD to provide the necessary maintenance of the capped material.

6.3 Alternative 3-Excavation and Off-Site Disposal of Impacted Soil

This alternative involves excavation of the impacted soil with COC concentrations exceeding the remedial goals established for the Site (approximately 365 cubic yards of in-place soil) (Figure 6), and transportation of the excavated material to an appropriate off-Site facility for disposal. The field activities would be implemented using readily available standard construction equipment. Confirmation soil samples would be collected from the base and sidewalls of the excavation areas and analyzed to verify that the impacted material has been sufficiently removed from the Site. If the COCs are detected in the confirmation samples at concentrations exceeding the remedial goals, additional soil would be excavated and additional confirmation sampling would be performed.

Based on the disposal facility requirements, samples of the excavated material may need to be collected and analyzed and the soil would be profiled to establish the appropriate facility. If the excavated soil requires stockpiling, plastic sheeting would be placed beneath and on top of the temporary stockpiles to prevent contaminant migration via wind or precipitation. If soil stockpiling and profiling is not required by disposal facilities, the soil would be directly loaded into trucks from the excavations and off-hauled.

Under this alternative, a Site-specific HSP will be prepared prior to initiation of remedial activities at the Site. Construction workers at the Site will be required to have the appropriate Cal/OSHA health and safety training prior to working in this material, and will need to wear personal protective equipment during remedial activities. No special OSHA training is required of workers once the impacted material has been removed.

7.0 REMEDIAL ACTION ALTERNATIVE EVALUATION

The evaluation of each remedial action alternative must consider the nine criteria identified by the California Health and Safety Code section 25356.1. These evaluation criteria are discussed and compared below for the three proposed remedial action alternatives identified in Section 5.0.

7.1 Overall Protection of Human Health and the Environment

This criterion addresses if the remedial action provides adequate protection to human health and the environment and describes how risks posed through each pathway are eliminated, reduced, or controlled through treatment, engineering controls, or institutional controls.

Alternative 1 (no action) will not be protective of human health and the environment because no active remedial action will be taken toward the remediation of the Site. Leaving the material in place and undisturbed is not a viable option because much of the material will be disturbed during building demolition. In addition, this area is planned for use as a playfield. The impacted area around Building M, not planned for demolition, is an existing grass area with exposed bare soil. Thus, construction workers and future and current Site occupants could potentially be exposed to the impacted material, and this is not a viable alternative.

Alternative 2 (excavation of upper foot of impacted soil, off-Site disposal, and capping) is protective for the proposed use of the Site because removal of the highly impacted material (upper foot) and capping of the impacted areas will greatly reduce potential future exposure to the impacted material.

Alternative 3 (soil excavation and off-Site disposal) is protective for the proposed use of the Site because, by removing all impacted material from the Site, potential exposure to impacted soil will be eliminated.

7.2 Compliance with State and Federal Requirements

This criterion addresses if the alternative will comply with applicable state and federal regulatory requirements. In accordance with the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), a remedial alternative is required to meet ARARs or the applicant must obtain a waiver. However, CERCLA recognizes that ARARs are not the only regulatory considerations that may apply for each circumstance encountered at a Site. Therefore, relevant federal or state advisories or guidance, which are not promulgated, are classified as to be considered (TBC) and given some weight in alternative selection, though not as much as ARARs. The ability of each alternative to meet ARARs, TBCs, and other guidance was evaluated. The potential ARARs for this Site were described in Section 4.1.

Alternative 1 (no action) will not be compliant with the ARARs, as there will be no active remedial action of the impacted material. Alternatives 2 (excavation of upper foot of impacted soil, off-Site disposal, and capping) and 3 (soil excavation and off-Site disposal) will both be compliant with state and federal requirements for remedial action.

7.3 Long-Term Effectiveness and Permanence

The evaluation of the long-term effectiveness and permanence of each alternative is based on the ability to maintain reliable protection of human health and the environment once the alternative has been completed.

No action is taken to remediate the impacted material in Alternative 1 (no action). Therefore, remedial action objectives will not be met for the proposed use of the Site because nothing would be done to address the impacted soil, and it would therefore not be effective or permanent.

Under Alternative 2 (excavation of upper foot of impacted soil, off-Site disposal, and capping), the highly impacted soil (upper foot) will be removed and the impacted areas capped, thereby greatly reducing potential future exposure to the impacted material and providing long-term effectiveness and permanence. Institutional controls (deed restriction) and O&M protocols will be in place to prevent and control potential exposure to the capped material.

Alternative 3 (soil excavation and off-Site disposal) is a proven and reliable method for effectively mitigating the threat to human health and the environment posed by the impacted soil. Under this alternative, impacted soil exceeding the remediation goals will be removed, thereby eliminating the potential exposure to impacted material and providing long-term effectiveness and permanence.

7.4 Reduction of Toxicity, Mobility, and Volume

This evaluation criterion assesses the degree to which the remedial action provides a reduction in toxicity, mobility, and volume of hazardous substances as compared to conditions prior to the remedial action.

Alternative 1 (no action) will not change the toxicity, mobility, or volume of the impacted material, as it will remain in place.

Alternative 2 (excavation of upper foot of impacted soil, off-Site disposal, and capping) will reduce the volume of impacted soil on-Site because this alternative involves removal of the upper foot of impacted soil for off-Site disposal. The toxicity of the remaining impacted soil on-Site will also be reduced due to the removal of the highly impacted material. The mobility of the contamination will be greatly reduced both at the off-Site disposal facility and on-Site as the impacted soil will be capped and not subject to disturbance and mobilization, thus the potential for future exposure will decrease.

Alternative 3 (soil excavation and off-Site disposal) will reduce the toxicity and volume of impacted material on-Site because this alternative involves removal of impacted soil from the Site for disposal where potential exposure to the impacted material and mobilization would be reduced. Although excavation alone does not involve treatment to reduce the toxicity, mobility, or volume of the contamination, mobility will be reduced at the off-Site disposal facility, as well as the potential for future exposure to the impacted soil.

7.5 Short-Term Effectiveness

This criterion addresses the period of time needed to plan, construct, and implement the remedial alternative and the impact it has on human health and the environment until the remediation goals are achieved. Factors to be considered include protection of the workers and community during remedial action operations, and the time required to implement the alternative.

Alternative 1 (no action) will not achieve the remedial goals in the short-term and therefore is not acceptable.

Alternatives 2 (excavation of upper foot of impacted soil, off-Site disposal, and capping) and 3 (soil excavation and off-Site disposal) could result in temporary short-term increases in risks to workers, nearby personnel, and Site occupants from potential exposure to impacted material. However, a Site-specific HSP will be prepared and dust control measures implemented to help reduce these risks and help protect Site occupants, workers, nearby personnel, and off-Site receptors. Alternatives 2 and 3, however, will effectively achieve the remedial goals in the short-term. Alternatives 2 and 3 would both achieve the remedial goals in approximately 15 days from the start of remedial activities barring unknown variables including inclement weather, unavailability of equipment, and equipment breakdowns.

7.6 Implementability

Implementability of a remedial alternative is based on the technical and administrative feasibilities of implementing the alternative. Technical feasibility includes the availability of necessary equipment and skilled workers to implement the alternative. Administrative feasibility includes the effort and resources required to obtain approvals from regulatory agencies.

All the alternatives are technically implementable. The field activities for Alternatives 2 and 3 can be implemented using readily available standard construction equipment.

With regards to administrative implementability, Alternative 1 (no action) will not be acceptable to DTSC and other regulatory agencies for the proposed and continued use of the Site as an elementary school, as it will not be protective of human health and the environment. Alternative 2 (excavation of upper foot of impacted soil, off-Site disposal, and capping) would require some effort and resources to obtain regulatory agency approval due to the impacted material to remain at the Site. Alternative 3 (soil excavation and off-Site disposal) will be acceptable to the regulatory agencies because the threat to human health and the environment will be permanently reduced to acceptable levels.

7.7 Cost

The cost of implementing an alternative includes capital and continuing costs. Costs associated with implementing each alternative were estimated. The cost estimates for implementing Alternatives 2 and 3 are summarized in Appendix C.

There are no costs associated with implementing Alternative 1 (no action).

Cost estimates associated with implementing Alternative 2 (excavation of upper foot of impacted soil, off-Site disposal, and capping) include construction costs (soil excavation, loading, off-Site transportation, and disposal), engineering costs (e.g., preparing plans and specifications, performing construction oversight, and air sampling and analysis), reporting costs, and sampling and importing of cap material. Cost estimates associated with implementing Alternative 3 (soil excavation and off-Site disposal) include construction costs (soil excavation, loading, off-Site transportation, and disposal), engineering costs (e.g., preparing plans and specifications, performing construction oversight, and verification and air sampling and analysis), and reporting costs. The estimated costs for implementing Alternatives 2 and 3 are $254,859 and $206,885, respectively. Depending on the adequacy of documentation regarding the quality of potential import soil, the need for sampling may be reduced, thereby reducing the cost of both alternatives. These costs are calculated on a present value basis.

Also included in these costs would be annual O&M costs. Alternative 2 would incur an annual cost for inspection and repairs of the clean cap as required. Annual inspection costs would be approximately $500 and repair costs are expected to be no more than $10,000 (present value) over 30 years. A report on the condition and performance of the cap also would need to be submitted to DTSC once every 5 years. The cost to prepare the reports is expected to be no more than $15,000 (present value) over 30 years. DTSC O&M oversight costs are expected to be no more than $30,000 (present value) over 30 years.

7.8 Regulatory Agency Acceptance

Under this criterion, administrative and technical issues that may be of concern to federal, state, and local regulatory agencies are considered. This criterion evaluates whether, with the input obtained thus far, the applicable regulatory agencies will accept the selected alternative.

Alternative 1 (no action) will not be acceptable to DTSC and other regulatory agencies for the proposed and continued use of the Site as an elementary school, as it will not be protective of human health and the environment.

Alternative 2 (excavation of upper foot of impacted soil, off-Site disposal, and capping) likely will be acceptable to DTSC and other regulatory agencies, as the threat to human health and the environment will be reduced to acceptable levels with the addition of a deed restriction on the capped areas to limit the potential for future exposure.

Alternative 3 (soil excavation and off-Site disposal) will be acceptable to DTSC and other regulatory agencies because the threat to human health and the environment will be reduced to acceptable levels.

7.9 Community Acceptance

This criterion addresses the concerns of the community, based on information received during the preparation of the study. A 30-day public review and community comment period are included in the RAW process before DTSC approves the final RAW.

Alternative 1 (no action) likely would not be acceptable to the community because it does not involve active remediation of the Site and the associated disturbance to the community, e.g. truck traffic.

Alternatives 2 (excavation of upper foot of impacted soil, off-Site disposal, and capping) and 3 (soil excavation and off-Site disposal) likely will be acceptable to the community because they include remediation of the impacted soil to the remedial goals developed for the proposed and continued use of the Site as an elementary school.

7.10 Remedial Action Alternative Selection

Alternative 1 (no action) is the least effective of the proposed alternatives in mitigating impacts to human health and the environment for the proposed and continued use of the Site as an elementary school. It is not compliant with the ARARs, nor would it be acceptable to DTSC or the community because it does not involve active remediation of the Site.

Alternative 2 (excavation of upper foot of impacted soil, off-Site disposal, and capping) could result in temporary short-term increases in potential risks to Site occupants, workers, and nearby personnel from potential exposure to impacted material. These risks, however, would be mitigated and reduced through the HSP and dust control. Alternative 2 also is effective in reducing the threat to human health and the environment because it greatly reduces the potential future exposure to impacted soil by removing the highly impacted soil, capping of the impacted areas, and the application of a deed restriction to control potential future exposure to the impacted material. However, it is also the most expensive alternative.

Alternative 3 (soil excavation and off-Site disposal) could also result in temporary short-term increases in risks to Site occupants, workers, and nearby personnel from potential exposure to impacted material. These risks, however, would be mitigated and reduced through the HSP and dust control. Alternative 3 is the most effective in reducing the threat to human health and the environment because it eliminates the potential exposure to impacted soil by removing all impacted material from the Site. Alternative 3 is also the least expensive alternative, and a deed restriction on the property would not be required.

Based on a consideration of all factors, Alternative 3 is the preferred remedial action alternative for the Site. Alternative 3 will allow the proposed and continued use of the Site as an elementary school and eliminates the potential exposure to impacted soil by removing all the known impacted material from the Site. With this alternative, deed restrictions placing institutional controls on the capped areas will not be required. This alternative involves excavation of the impacted soil with COC concentrations exceeding the remedial goals established for the Site (approximately 260 cubic yards of in-place soil), transportation of the excavated material to an appropriate off-Site facility for disposal, and backfilling the excavations with imported soils. The excavation areas and depths are presented on Figure 6.

The Site remedial action will be implemented during the summer months when school is not in session to avoid potential exposure to Site occupants.

8.0 REMEDIAL ACTION IMPLEMENTATION

8.1 Site Preparation and Security Measures

Several pre-field activities will be required after the RAW is approved by DTSC and prior to the initiation of the remedial action as discussed below.

8.1.1 Permitting

The selected grading contractor will obtain all applicable permits and notification required for performing soil excavation and backfilling work from the appropriate agencies. Notification to neighbors prior to the start of remedial action operations is also required and will be administered by DTSC.

8.1.2 Utility Clearance

To attempt to locate public underground utilities, and as required by law, the grading contractor will mark the work area with white spray paint and contact Underground Service Alert (USA) at least 48 hours prior to the initiation of earthwork activities.

8.1.3 Security Measures

Additional fencing will be installed as needed to enclose the work area prior to the initiation of earthwork activities. Green or black visual shield material will be installed on all new and existing chain-link fencing. Access and egress to the work area will be controlled via gates. The gates that provide Site access to the work area will be locked after working hours. Signs instructing visitors to check in at the project support area will be posted at all entrances to the Site. Signage to comply with proposition 65 will also be posted in the support zone area.

8.1.4 Work Zones

Work zones will be cordoned off prior to the initiation of Site activities, and ingress and egress from these areas will be controlled. A more detailed discussion of work zones at the Site is presented in Section 8.3.

8.1.5 Decontamination Areas

Decontamination areas will be established prior to the initiation of Site remedial activities. A more detailed discussion of decontamination procedures and implementation is presented in Section 8.8.

8.1.6 Support Zone/Staging Area

The support zone/staging area will be set up on-Site prior to starting operations. This area will provide for administrative and support functions (command post, first-aid station, rest area, drinking facility, etc.) necessary to keep the field activities operating smoothly. The contractor shall provide potable water and wash facilities for the field personnel in this location.

8.2 Health and Safety Plan

The Site-specific HSP, included as Appendix A, has been prepared to inform personnel of the potential hazards associated with implementing the RAW and to minimize exposure to Site contaminants. The HSP has been prepared to meet federal and California OSHA standards for hazardous waste operations (29 CFR 1910.120 and 8 CCR 5192).
The contractor will be required to develop its own HSP, which must establish health and safety protocols for Site personnel in accordance with the above-mentioned standards. The contractor will be responsible for the health and safety of its own employees.

All workers at the Site will be required to have the appropriate OSHA health and safety training prior to working at the Site, and must wear personal protective equipment consistent with their work duties at all times.

8.3 Site Control

Site control is intended to control the potential spread of contamination from the Site. Prior to field activities, the Site will be divided into three zones: exclusion zone, decontamination zone, and support zone. Locations on the Site where contamination is known or suspected (at concentrations exceeding the remedial goal) are considered part of the exclusion zone. Within the exclusion zone are individual work zones where contaminated material is being excavated, stockpiled, or loaded.

8.3.1 Exclusion Zone

Ingress to and egress from the exclusion zone will be controlled. The exclusion zone and access corridors will be clearly defined in the field with a combination of fencing, barricades, and/or caution tape. Unauthorized individuals will not be allowed within the exclusion zone. Temporary access corridors will be used for travel between work zones and to the decontamination zone. The exclusion zone will remain cordoned off until remedial activities are complete.

Each access route to the "Exclusion Zone" must be posted with signs that read:

WARNING **CONTAMINATED WORK AREA** **POISON** **NO SMOKING OR EATING**	**WARNING** **This Site is contains chemicals known to the State of California to cause cancer or other reproductive toxicity.** **AUTHORIZED PERSONNEL ONLY**

8.3.2 Decontamination Zone

Prior to the initiation of remediation activities, the decontamination zone will be established. The decontamination zone will be established at the Site such that dust, debris, and soil are removed from equipment, transportation vehicles, and personnel leaving the exclusion zone. Decontamination methods may consist of brushing or high-pressure washing depending on weather conditions during the remedial activities (see Section 8.8).

8.3.3 Support Zone/Staging Area

As described in Section 8.1.6, the support zone/staging area will be established prior to the initiation of remedial activities.

8.4 Site Excavation Survey

To maintain accurate excavation dimensions, Site surveying is a critical component of the on-Site remedial activities. Surveying will be conducted by the contractor prior to the start of excavation activities. The surveying will consist of establishing excavation locations. A grade check crew also will be on-Site to evaluate excavation depths during the earthwork activities.

8.5 Dust and Erosion Control

Effective means of dust and erosion control will be utilized to minimize the generation of dust and erosion associated with excavation activities, truck and vehicle traffic onto and off the Site, and the effects of ambient wind traversing exposed soil. Total dust levels and erosion shall be mitigated during Site activities, as necessary, using a combination of engineering controls that may include:

- Misting or spraying water during soil excavation and loading of soil transportation vehicles
- Limiting vehicle speeds to 5 miles per hour on unpaved portions of the Site

- Covering stockpiled soil with plastic sheeting
- Minimizing drop heights of soil during loading/unloading activities
- Minimizing (as appropriate) water used in dust control
- Rapid cleanup of sediments deposited on paved roadways
- Temporary gravel surfacing placed along Site entrances/exits

If visible dust is observed crossing the property line, dust control measures will be increased and the DTSC project manager notified.

Excavation and off-haul activities may be suspended when the average wind speeds are greater than 25 miles per hour (mph) recorded over a 1 hour period. If at this wind speed the particulate concentrations measured do not exceed the ambient air quality standard of 50 micrograms per cubic meter (instantaneous readings), described in Section 8.6.1, then Site activities will continue. A portable anemometer will be used to monitor wind speeds and direction during the excavation and off-haul activities.

8.6 Air Monitoring

8.6.1 Perimeter Air Monitoring

Lowney Associates will conduct perimeter/fenceline dust monitoring to evaluate the potential for off-Site migration of dust during soil disturbing activities (excavation and off-haul).

Particulate meters (MIE PDR-1000s) in data logging mode will be used to measure and record the real-time airborne dust concentrations. This information can be downloaded and printed. These meters will be used to collect measurements at two downwind locations and one upwind location along the perimeter of the Site during the excavation and off-haul activities. The locations will be determined each day by the engineer in the field and will be based on the daily prevailing wind direction as determined by the field engineer. The wind direction, speed, and time of observation will be recorded in the field throughout each day and the sampling location will be modified during the day if significant changes in wind direction are apparent.

The particulate meters will be checked by the field engineer at least every 2 hours to determine if excessive dust is migrating off-Site. Each time the meters are checked, the difference between the average upwind dust concentration and the average downwind concentrations will be compared to the ambient air quality standard of 50 micrograms per cubic meter ($\mu g/m^3$) (8-hour average) for respirable dust. If this standard is exceeded, increased dust control measures will be implemented and the DTSC project manager notified. In addition, the dust concentration data from that day will be faxed to DTSC.

8.6.2 Personal Air Monitoring

Pesticide and lead exposures (airborne) above Cal/OSHA permissible exposure limits (PELs) during the excavation and off-haul activities are not expected. As detailed in Section 8.1 of the HSP (Appendix A), an evaluation of expected worst-case exposure conditions was performed using the maximum detected contaminant concentrations in soil at the Site and a conservative (worst case) dust concentration of 5 mg/m^3, which corresponds to a very thick and dark dust cloud. The anticipated exposure concentrations were well below the respective PELs. Based on these conservative calculations, the use of respirators will not be required and the need for personal air monitoring is not anticipated.

8.7 Excavation of Impacted Soil

The remedial action consists of excavation of the impacted soil with COC concentrations exceeding the Site RBSLs (approximately 365 cubic yards of in-place soil), and transportation of the excavated material to an appropriate off-Site facility for disposal. The excavation areas and depths are presented on Figure 6. The final excavation dimensions may vary based on confirmation sampling results.

Soil excavation activities will be performed by a licensed hazardous materials contractor and personnel with training in hazardous waste operations (40-hour OSHA Training). The following is a discussion of the planned soil excavation activities.

8.7.1 Construction Equipment

Excavators likely will be used to excavate the soil and also load the material into transport trucks. Loaders may be used for transporting soil from the excavators and temporary stockpiles to the transport trucks. Water trucks will be used for dust control. Pickup trucks will be used to transport equipment and materials around the Site. Drums or closed-top tanks will be on-Site to store wastewater rinsate from wet decontamination, when necessary.

8.7.2 Excavation Procedures

Excavated soil will be temporarily stockpiled on-Site, sampled to profile the material, and off-hauled to the appropriate disposal facility. Temporary stockpile locations shall be as close as possible to the excavation areas. The soil will be placed on, and covered with, heavy plastic sheeting and anchored to reduce spreading of the contamination by rainwater or wind, and contamination of the underlying soil.

During loading activities, heavy plastic sheeting will be placed beneath the trucks to collect any spilled soil. To avoid spreading of the contamination, after each truck is loaded and prior to moving off the plastic sheeting, the top rails, fences, tires, and all other surfaces with visible dust or soil spilled during loading will be removed by dry brushing methods at the point of loading. The collected soil on the plastic will be periodically removed to avoid the spreading of impacted soil on the truck tires.

Following excavation, confirmation soil samples will be collected from the excavations to evaluate if sufficient impacted soil has been removed. Excavation activities will be considered complete when the confirmation samples collected from the remaining in-place soil do not contain COC concentrations that exceed the respective remedial goals. Confirmation sampling is further described in Section 8.12.

8.8 Decontamination

Decontamination procedures will be performed before leaving the work areas as part of general protocols for preventing or reducing the physical transfer of impacted materials from the project area. The following sections discuss decontamination zones, decontamination procedures, and the disposal of wastewater from decontamination.

8.8.1 Decontamination Zone

Prior to beginning work, a decontamination zone will be established on-Site such that dust, debris, and soil are removed from equipment, transportation vehicles, and personnel leaving the work zones. The decontamination zone will be large enough to accommodate steam cleaning or pressure washing of all equipment including excavators, dozers, and loaders, if necessary. However, personnel decontamination will also take place as Site personnel leave the work zones. The location and size of the decontamination zone for personnel may change as Site conditions and operations dictate.

8.8.2 Decontamination Procedures

Decontamination procedures of equipment and transportation vehicles include both dry and wet methods. Dry methods are the primary means of decontamination and consist of brushing and scraping of impacted material. If dry methods are not effective, wet methods may be used such as steam cleaning or pressure washing without detergent. Washtubs with soap and water and rinse tubs will be provided for the cleaning of reusable equipment.

8.8.3 Disposal of Wastewater

Water used for on-Site decontamination will be collected and stored in on-Site storage containers (drums or closed-top tanks). Wastewater will be analyzed and disposed off-Site at a permitted facility.

8.9 Profiling of Excavated Soil

As described in Section 8.7.2, temporary stockpiling of the soil is anticipated to accumulate a sufficient quantity of soil and to avoid truck standby and partial loads. For temporary overnight stockpiling of soil, the material will be placed on, and covered with, heavy plastic sheeting and anchored to reduce spreading of the contamination by rainwater or wind, and contamination of the underlying soil.

To profile the material for off-Site disposal, up to five 4-point composite soil samples will be collected from the stockpiled material and analyzed for organochlorine pesticides and total lead at a state-certified laboratory. We will request that the analyses be performed on an accelerated response time to attempt to reduce project delays. If a total lead concentration exceeding approximately 90 ppm is detected in the samples, the samples will additionally be analyzed for soluble lead. It is anticipated that no soils will exceed hazardous waste threshold concentrations.

The analytical results will then be forwarded to disposal facilities to determine the appropriate destination of the impacted soil.

8.10 Transportation Procedures and Routes

This section outlines the requirements and procedures for transportation of the excavated soil to the off-Site disposal facility (Class I hazardous waste landfill, Class II non-hazardous waste landfill, or Class III sanitary landfill). The appropriate disposal facility will be determined based on the results of the soil profiling described in Section 8.9.

The following transportation procedures will be followed. These procedures are based on guidelines contained in the *Transportation Plan – Preparation Guidance for Site Remediation* (U.S. EPA 1994).

The soil will be transported by an appropriately licensed transporter. The necessary documents, such as the bills of lading and/or waste manifest forms, will be completed and accompany the truck driver to the landfill. The trucks will be loaded at the Site and appropriately covered (tarped) in accordance with Department of Transportation (DOT) regulations.

As described in Section 8.7.2, during loading activities, heavy plastic sheeting will be placed beneath the trucks to collect any spilled soil. After each truck is loaded and prior to moving off the plastic sheeting, the top rails, fences, tires, and all other surfaces with visible dust or soil spilled during loading will be removed by dry brushing methods at the point of loading.

8.10.1 Transportation Routes

Loaded trucks will exit the Site onto Lark Street heading southeast, they will then turn right onto 146th Avenue heading southwest. The trucks will then turn left onto Hesperian Boulevard heading south. Highway 238 will be accessed from Hesperian Boulevard approximately 1½ mile south of the Site, and Highway 880 will be accessed from Hesperian Boulevard approximately 2 miles south of the Site.

Highway routes are provided for transportation of the soil to the Chemical Waste Management facility (Class I) in Kettleman City, California, Altamont Landfill (Class II) in Livermore, California, or Newby Island Landfill (Class III sanitary) in Milpitas, California. These routes are the most direct and will provide the least risk of exposure to surrounding communities. None of the roadways selected is listed with the California Highway Patrol as prohibited for hauling hazardous waste. The trucks will attempt to avoid the major commute times and will avoid residential areas as much as possible. Transportation routes are illustrated on Figures 7 through 9.

The following is a description of the transportation routes:

- The route to the Chemical Waste Management facility in Kettleman City, California follows State Highway 238 east which connects with Highway 580 (I-580) east. The trucks will continue on I-580 east to Interstate 5 (I-5) south and continue on I-5 south to the Skyline Boulevard/Highway 269 exit.

The trucks will proceed on Skyline Boulevard heading south and will turn left onto Old Skyline Boulevard, along which the landfill is located.

- The route to Altamont Landfill in Livermore, California follows State Highway 238 east which connects with I-580 east. The trucks will follow I-580 east to the Greenville Road exit. The trucks will turn left onto Southfront Road heading east, and then turn left onto Greenville Road heading north. The trucks will then turn right onto Altamont Pass Road, along which the landfill is located.
- The route to Newby Island Landfill in Milpitas, California follows Highway 880 (I-880) south to Dixon Landing Road west, along which the landfill is located.

8.10.2 Emergency Service and Response

Prior to the start of transport operations, the transportation contractor's Project Manager will contact an Emergency Response Contractor (ERC). In the event of a spill, accident, or breakdown, the transport driver will stay with the truck until law enforcement, California Highway Patrol, or other assistance arrives. The driver should contact their dispatcher who will in turn contact the ERC. Also, the driver should place traffic cones around the spill and keep onlookers away from the area. The driver is not to attempt to clean up the spilled material.

The ERC is responsible for contacting all appropriate outside agencies based on the knowledge of the existing conditions (e.g., law enforcement, Caltrans, RWQCB, State or County Health Departments, California Office of Emergency Services).

Due to the number of variables that could impact any off-Site spillage scenario, specific spill mitigation procedures are not provided in this RAW.

8.10.3 Training of Transportation Personnel

The selected transportation contractor will have an on-going training program for the truck drivers; such a program will be specifically required in the transportation contract. Drivers will have:

- DOT required hazardous materials hauler training; and
- Training as required by 29 CFR 1910.120(e), specifically 40 hours of off-Site training, and 8-hour refresher training as required.

The contractor's Site Safety Officer (SSO) will provide the transportation contractor with a copy of the HSP to allow the contractor to train the drivers regarding the hazardous characteristics of the material being transported. All training will be the responsibility of the transportation contractor.

8.11 Field Documentation

8.11.1 Field Oversight and Reporting

A Lowney Associates field engineer will be present on a full-time basis during Site remediation activities. This individual will be responsible for observing excavation and off-haul activities, monitoring health and safety measures, air monitoring, confirmation sampling, and confirming that contractor activities are being completed in conformance with the DTSC approved RAW. As part of this process, daily field reports documenting Site activities will be completed and made available for inspection by authorized oversight personnel for the duration of the project.

8.11.2 Photographs

Photographs of Site activities will be taken periodically by Lowney Associates to further document the remedial action implementation. The photographs will be made available for inspection by authorized DTSC personnel for the duration of the project.

8.12 Confirmation Soil Sampling

To document adequate removal of soil with organochlorine pesticide or lead concentrations that exceed the remedial goals, confirmation soil samples will be collected from the in-place soil at the base and in the sidewalls of the excavation areas. The base confirmation samples will be collected at an approximate frequency of one sample for every approximately 150 square feet and 300 square feet of excavation base for the 3-foot and 1½-foot excavation areas, respectively. The sidewall confirmation samples will be collected at an approximate frequency of one sample for every approximately 50 lineal feet of excavation sidewall, with a minimum of one sample per sidewall. Sidewall samples will only be collected if additional dirt and/or grass areas are present beyond the excavation boundaries; sidewall samples will not be collected in areas where additional excavation cannot be performed without destruction of existing walkways, sidewalks, etc. Based on these sampling frequencies, an estimated 50 confirmation samples will be collected following the soil removal. This section describes the procedures for the collection of confirmation soil samples. Included is a discussion of the criteria for determining soil sample locations, soil sampling procedures, and analytical testing methods.

8.12.1 Soil Sample Locations and Depths

The confirmation sample locations will be randomly selected in the base and sidewalls of the excavations in accordance with the above-mentioned frequencies. The sidewall samples will be collected from the upper 6 inches of soils present in the sidewall.

8.12.2 Soil Sampling Procedure

Soil samples will be obtained by manually scraping a 1½- by 6-inch brass sampling tube into freshly exposed soil in the excavation sidewall. Bottom samples will be obtained by manually pressing a sampling tube to a depth of approximately 6 inches. If the soil is too dense to manually press the brass sampling tube into the soil, the tube will be driven into the soil using a slide hammer or equivalent device.

The ends of the liners will be covered in Teflon film, fitted with plastic end caps, taped, and labeled with a unique identification number. The samples will then be placed in an ice-chilled cooler and transported to a state-certified analytical laboratory with chain of custody documentation.

8.12.3 Laboratory Analyses

The samples collected from the excavations will be analyzed at a state-certified laboratory for organochlorine pesticides (EPA Test Method 8081A) and total lead (EPA Test Method 6010B) where elevated lead was previously identified. We will request that the analyses be performed on an accelerated response time to attempt to reduce project delays. We anticipate that it could take 48 to 72 hours to receive some sample results due to laboratory delays.

8.12.4 Additional Excavation and Confirmation Sampling

If concentrations of the COCs exceeding the Site remedial goals are detected in the confirmation samples, additional excavation will be performed. If the concentrations exceeding the remedial goals are detected in a sample collected from the base of an excavation, an additional 1 foot of soil will be excavated from that area. Similarly, if the concentrations exceeding the remedial goals are detected in a sample collected from the sidewall of an excavation, the excavation will be extended an additional 3 feet into the sidewall. This process will be repeated until the remaining concentrations detected in the in-place soil do not exceed the Site remedial goals.

9.0 IMPORT FILL

For completion of the remedial action at the Site, the excavations must be backfilled with clean soil. The clean soil will be imported from off-Site.

To minimize the potential introduction of contaminated fill onto the Site, all possible sources of import fill must have adequate documentation so it can be verified that the fill source is appropriate for the Site. Documentation should include detailed information on the previous land use of the fill source, any environmental site assessments performed and the findings, and the results of any testing performed. If no documentation is available or the documentation is inadequate, samples of the potential fill material will be collected and analyzed. The analyses selected will be based on the fill source and knowledge of the previous land use. The sampling frequency for potential fill material will be in accordance with that outlined in the DTSC *Information Advisory on Clean Imported Fill Material*, dated October 2001, included in Appendix D. The DTSC project manager will be consulted when a potential fill source is selected.

Analytical testing results of any potential fill source will be discussed with DTSC to determine the suitability and placement of the material. If no suitable import fill sources are available, import fill shall be obtained from a quarry selling virgin, bank fill materials.

10.0 REMEDIAL ACTION COMPLETION REPORT

After completion of the remedial action, a Remedial Completion and Implementation Report will be prepared and submitted to DTSC for review and approval. The RAC report will document that the remedial action has been performed in accordance with the approved RAW, and will include, at a minimum, the following elements:

- Summary of excavation activities (volume, extent, etc.)

- Procedures, location, and results (i.e., analytical reports) of the confirmation soil sampling
- Documentation of off-Site transport and disposal of excavated soil (bills of lading, waste manifests)
- Health and safety and results of air monitoring
- Documentation of excavation backfill material and procedures
- Daily field reports
- Copies of all required permits

11.0 PROJECT SCHEDULE

The remedial action is tentatively scheduled to start in May 2005 and last approximately 2 to 3 weeks for excavation and off-haul, and 2 weeks for the backfilling activities.

12.0 LIMITATIONS

This report was prepared for the sole use of the San Leandro Unified School District and California Department of Toxic Substances Control in evaluating remedial action alternatives. We make no warranty, expressed or implied, except that our services have been performed in accordance with environmental principles generally accepted at this time and location. The chemical and other data presented in this report can change over time and are applicable only to the time this study was performed. We are not responsible for the data presented by others.

In providing opinions of estimated remediation cost, the San Leandro Unified School District and Department of Toxic Substances Control understands that Lowney Associates has no control over the cost or availability of labor, equipment or materials, or over market conditions, or the Contractor's method of pricing, and that Lowney Associates' opinions of estimated remediation cost are made on the basis of our professional judgment and experience. Lowney Associates makes no warranty, expressed or implied, that the bids, the negotiated cost of work, or the actual cost of work will not vary from Lowney Associates' opinion of estimated remedial action costs.

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APPENDIX A
HEALTH AND SAFETY PLAN

LOWNEY ASSOCIATES
Environmental/Geotechnical/Engineering Services

SECOND DRAFT

Health and Safety Plan

Jefferson Elementary School Site

San Leandro, California

This plan has been prepared for:

San Leandro Unified School District

14735 Juniper Street, San Leandro, California 94579

April 20, 2005

Project No. 2074-1A

James P. Kiernan Senior Staff Engineer	Thomas F. McCloskey, R.G., C.E.G., C.HG. Principal Geologist

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SECOND DRAFT
HEALTH AND SAFETY PLAN
JEFFERSON ELEMENTARY SCHOOL SITE
SAN LEANDRO, CALIFORNIA

1.0 INTRODUCTION

On behalf of the San Leandro Unified School District (SLUSD), Lowney Associates (Lowney) has developed this Health and Safety Plan (HSP) to inform personnel of the potential hazards associated with implementing the remedial excavation activities at the Jefferson Elementary School site in San Leandro, California (Site).

This HSP was further developed (per California Code of Regulations [CCR], Title 8) to provide general health and safety guidance such that field activities can be conducted in a safe manner.

Per Cal/OSHA requirements, each contractor working at this Site must prepare a health and safety plan that addresses the safety and health hazards of each phase of Site operations and includes the requirements and procedures for employee protection. The plan must be kept on-Site. This HSP can be used by the contractors for guidance. Each contractor is solely responsible for the health and safety of their own employees. Prior to conducting work on-Site, project management and field staff must be familiar with the contents of the HSP. All Lowney Associates employees involved in activities that may expose them to chemical or physical hazards must read and understand this HSP.

It should be recognized that this development is unique; conditions can occur that may affect the health and safety of on-Site workers. If additional contamination is encountered and/or suspected, the contractor's Site Safety Officer (SSO) and Lowney Associates must be notified immediately and work in the area of the additional contamination must be stopped until appropriate actions can be taken.

1.1 Project Description

The Jefferson Elementary School Site occupies approximately 7½ acres and is located at 14311 Lark Street in San Leandro, California (Figure 1). The Site is currently occupied by Jefferson Elementary School, a public elementary school for kindergarten through 5th grade. The school is comprised of seven single-story buildings (Buildings A, B, C, C/D, M, the San Leandro Child Care Building, and the Jefferson Center Head Start Building) and six portable buildings.

The SLUSD is currently redeveloping the Site. The planned redevelopment project included the construction of two new permanent classroom buildings (Buildings A and B) in the central portion of the Site providing approximately 30,700 square feet and 14,000 square feet of space, respectively. These buildings have recently been completed and are currently in use. Following the construction of the new classroom structures, the existing classroom buildings (Buildings C and C/D) were to be demolished and athletic fields and a play area constructed in this area. Four of the portable classroom buildings will also be removed. Buildings M, the Child Care Building, and the Head Start Building will remain at the Site.

1.2 Site Background

Based on a review of historic aerial photographs and topographic maps performed during a previous Phase I investigation of the Site, an orchard appeared present traversing the center of the Site and in the southeast portion of the Site as early as 1947. The remainder of the Site appeared to be vacant land. According to the Phase I report the existing school was constructed in 1948. By 1953, three school buildings appeared to occupy the northeastern portion of the Site in a configuration similar to the existing condition. An additional building appeared present in the northwestern portion of the property in aerial photographs dated 1990 through 1999.

1.3 Site Contamination

Previous investigations at the Site have identified organochlorine pesticides and lead in shallow soils at the Site in the vicinity of the existing buildings. The organochlorine pesticide contaminants of concern (COC) at the Site are chlorinated insecticides (specifically dieldrin, alpha-, and gamma-chlordane, DDT, DDE, and DDD, and heptachlor epoxide). The compounds chlordane, dieldrin, and heptachlor belong to a group of organochlorine pesticides called cyclodiene insecticides (this group also includes aldrin, endrin, and endosulfan). Cyclodiene insecticides historically were used as soil insecticides and for termite control due to their stability in soil and relative stability when exposed to sunlight. Technical-grade chlordane is a mixture of alpha- and gamma-chlordane isomers. Although aldrin and dieldrin are separate insecticides, in soil, aldrin is converted to dieldrin, which is more stable. Heptachlor epoxide is an oxidation product of heptachlor formed by many plants and animals, including humans, after exposure to heptachlor. The use of these compounds was banned in the United States by 1988. The chlorinated insecticide known as DDT was widely used prior to 1970 in agricultural applications. In practical application, the technical grade of DDT consisted of 77 percent DDT, 15 percent DDD, and 4 percent DDE. The use of DDT was banned in 1972. The source of the organochlorine pesticides in soil at the Site appears to be historic termite abatement activities (spraying/injection) in the area around the base of the buildings.

The source of the lead in soil at the Site appears to be historic weathering of lead-based paint from the exterior of the structures. The impacted soil at the Site appears to be confined to the grass and bare soil areas (within 15 feet) surrounding Buildings C/D, C, and M.

1.4 Scope of Work

The planned remedial action at the Site is the excavation of impacted soil with COC concentrations exceeding the established Site remedial goals and disposal of the soil at an appropriate off-Site facility. Confirmation samples will be collected following excavation to evaluate if the impacted soil with COC concentrations exceeding the remedial goals has been sufficiently removed. The excavation areas will then be backfilled with clean imported fill.

The work will be performed in accordance with the final Remedial Action Workplan (RAW) for the Site approved by the Department of Toxic Substances Control (DTSC).

2.0 PROJECT SAFETY AUTHORITY

2.1 Health and Safety Personnel

2.1.1 Safety Officer

Mr. Andrew Matthew (650-967-2365) is the Health and Safety Officer (HSO) responsible for the health and safety activities solely for Lowney Associates only.

Each contractor must appoint a Site Safety Officer (SSO) for the project who will be responsible for the health and safety of on-Site personnel. The SSO is an individual who is responsible to the employer and has the authority, training, experience, and knowledge necessary to implement the Site HSP and verify compliance with applicable safety and health requirements. Each contractor will be solely responsible for the health and safety of their employees as well as for compliance with all applicable federal, state, and local laws and guidelines.

The SSO must verify that all on-Site personnel are qualified, trained, and prepared to implement the HSP and safely perform the planned Site work. Field personnel should be required to indicate in writing that they have read and understand the provisions of the HSP. Safe work practices should be emphasized during safety meetings to be conducted by the SSO and implemented throughout the project. The SSO must be advised as to the expected schedule of work at least weekly, and more often if needed.

Lowney Associates and the SLUSD will be solely responsible for the health and safety of their own employees. All other companies involved in the soil removal activities will be responsible for the health and safety of their own employees and will have their own SSO. A HSP will be required of the removal contractor and must be reviewed and approved by the DTSC prior to the initiation of site work.

2.1.2 Lowney Point of Contact

Mr. Kurt Soenen (650-967-2365) is Lowney Associates' point of contact (POC) for the project. Lowney Associates' responsibilities consist of observation of remedial activities, observation of compliance with the RAW, confirmation soil sampling, and perimeter air sampling and monitoring.

2.2 Enforcement of the HSP

Enforcement of the policies and practices of the HSP for Lowney Associates personnel will be the responsibility of the SSO. The Lowney SSO also has the authority to suspend work in the area of the Site where the provisions of the HSP or RAW are not being met. The soil remediation contractor shall be responsible for the overall site safety and shall also inform Lowney Associates in writing about individuals whose conduct is not consistent with the requirements of the HSP.

2.3 Evaluation of Effectiveness

The Contractors' SSO shall evaluate the effectiveness of the HSP. As applicable, deficiencies and associated corrective actions must be documented and a written summary evaluation prepared and maintained on-Site.

3.0 HAZARD ASSESSMENT

This HSP provides standard operating procedures for personnel involved in activities that may expose them to the COCs during the remedial excavation activities. Physical hazards also exist. For example, the heavy equipment that will be used to complete the grading presents a potential for physical hazards.

Field personnel are required to control chemical exposure primarily through the use of safe work practices and engineering controls (see Sections 4.0 through 7.0).

3.1 Chemical Hazards

The contaminants of concern (COCs) at the Site are lead and pesticides. The overall potential for occupationally significant exposure during implementation of the RAW is expected to be low. Exposures will be minimized during field operations using a combination of engineering controls (dust suppression with water mist) and safe work practices.

3.1.1 Exposure Pathways

The main potential exposure pathways for the COCs in the soil include incidental ingestion and inhalation of windblown dust, and absorption through direct skin contact (dermal contact) with soil during the field activities. The windblown dust potential exposure pathway must be mitigated by appropriate dust control measures (see Section 7.0) implemented during the Site remedial activities in the impacted soil areas. The absorption and ingestion pathways must be mitigated by following safe work practices and through the use of PPE.

3.2 Toxicity Information

3.2.1 DDT

U.S. EPA classifies DDT, a chlorinated ethane derivative, as a probable human carcinogen (B2), based on the induction of lung, liver, and thyroid tumors in laboratory animals. DDT compounds are highly persistent in the environment and are stored in body fat of higher organisms, leading to biomagnification.

DDT can affect the body via inhalation (i.e., dust), ingestion, and absorption through skin contact. Overexposure can result in headaches, dizziness, tremors, and irritation of the eyes and skin. Chronic overexposure can cause damage to the nervous system, kidneys, and liver. The overall potential for occupationally significant DDT exposure during implementation of the remedial actions is expected to be low. Exposures will be minimized during field operations using a combination of engineering controls (dust suppression with water mist) and safe work practices.

3.2.2 Chlordane, Dieldrin, and Heptachlor

Chlorinated cyclodiene insecticides that are structurally related by the same mechanism of action include dieldrin, chlordane, and heptachlor. Like DDT compounds, the cyclodienes persist in the environment and accumulate in fatty tissues of biologic organisms. The central and peripheral nervous systems are the target organs. Headache, nausea, vomiting, dizziness, and mild chronic jerking are characteristic symptoms of exposure. Increased exposure can increase the severity of these symptoms and advance to convulsions. The cyclodienes also can produce liver damage. With respect to relative toxicity, dieldrin is approximately twice as toxic as heptachlor, and approximately seven to eight times as toxic as chlordane.

All three cyclodienes are class B2 carcinogens based on liver tumors observed in experimental animals. The non-carcinogenic reference doses assigned to the cyclodienes are based on the critical effect of pathologic changes in the liver and increased liver weight of experimental animals.

3.2.3 Lead

Lead can affect the body via inhalation and ingestion pathways. Overexposure can result in weakness in the fingers, wrists, and/or ankles. Chronic overexposure can cause severe damage to the blood-forming, nervous, urinary, and reproductive systems.

3.3 Physical Hazards

Physical hazards associated with construction activities, such as occupational noise, heavy equipment, heat-related disorders, slips, trips, falls, falling objects, flying debris, electrical shock, buried utilities, overhead power lines, and excavations, may be present on-Site and can present a greater risk of injury than the COCs in soil at the Site. These hazards must be addressed by each contractor’s Site-specific HSP. Activities within the scope of this project must comply with all applicable regulations, including Cal/OSHA standards.

3.3.1 Noise Hazards

Noise-generating equipment will be used during field activities. The equipment includes excavators, loaders, trucks, and other noise generating equipment. The noise levels near this type of equipment may exceed 85 dBA. Elevated noise levels could constitute a hearing hazard and interfere with communication. Employers must protect their field personnel from noise levels exceeding 85 dBA and provide appropriate PPE. To limit disturbances to nearby residents, the work will be conducted on weekdays and within the hours recommended by the City of San Leandro.

3.3.2 Heavy Equipment Hazards

Heavy equipment can pose significant hazards to on-Site employees. Contractors must ensure that motor vehicles and material handling equipment meet the requirements specified in the Department of Industrial Relations, General Industry Safety Orders and Construction Safety Orders (8 CCR Division 1, Chapter 4, Subchapters 4 and 7). The following safe work practices are to be followed during work around heavy equipment.

- Never walk directly behind or to the side of heavy equipment without the operator's knowledge. Be aware of the location and operation of heavy equipment; do not assume that the operator is aware of keeping track of your presence.
- While working on-Site, wear reflective/visible safety vests, maintain visual contact with the operator at all times, and remain alert.
- All heavy equipment must be fitted with audible reversing signals as mandated by OSHA.
- Unless a spotter is present to guide the operator, equipment with an obstructed rear view will have an audible alarm that sounds when moving in the reverse direction.
- Establish hand signals with the operator when verbal communication is not possible.
- Whenever excavation or other operations are conducted in tight quarters, the equipment contractor should make provisions for another person to help guide the operator's movements.
- Blades, buckets, and other hydraulic systems will be fully lowered and parking brakes engaged whenever equipment is not in use.
- All non-essential personnel will be kept out of work areas.
- All heavy equipment used at the Site will remain there until excavation is completed. The contractor will be responsible for completely decontaminating equipment in the designated decontamination areas, and all wash water will be collected, contained, and characterized prior to disposal.
- On-Site employees will wear appropriate PPE while on-Site.

3.3.3 Heat-Related Disorders

The contractor is responsible for monitoring their workers for signs and symptoms of heat stress. Water must be provided on-Site and the contractor's Site supervisor should have first aid/CPR training and be familiar with the early signs of heat related disorders, and appropriate treatment procedures.

3.3.4 Slips, Trips, and Falls

Slipping, tripping, and falling are the most common sources of injuries at these types of sites. These injuries can be prevented by proper Site control measures, safe work practices, and by keeping the work area free from obstructions. Tailgate safety briefings should be held by the contractor prior to each day's field activities to identify specific Site locations of concern (slippery surfaces, trenches, or uneven terrain), and to specify work practices and controls necessary to avoid or eliminate the hazards in those areas.

3.3.5 Buried Utilities

The buried utilities at the Site must be identified through Underground Service Alert (USA). If buried utilities, such as natural gas piping, are damaged during grading activities, the area should be immediately evacuated and Emergency 911 should be immediately notified. The contractor's SSO should notify all on-Site employees of the rupture and the area of the release should be evacuated.

3.3.6 Muscular-Skeleton Injury Hazards

Field activities may require some lifting of heavy objects. No one should attempt to lift large, heavy (greater than 50 pounds), or cumbersome objects without assistance. All on-Site employees who are generally called upon to do frequent lifting are to be instructed in proper lifting procedures.

3.3.7 Biological Hazards

The biological hazards that may be encountered include snakes, spiders, and bees. A first aid kit to treat minor skin irritations, stings, and bites must be maintained by the contractor at the Site.

4.0 SAFETY EQUIPMENT AND SANITATION

4.1 Personal Protective Equipment (PPE)

PPE and clothing are used to isolate individuals from the COCs and physical hazards. Unless otherwise indicated by the results of perimeter air monitoring (see Section 8.0), the minimum level of protection for workers performing earthwork activities is generally Level D (as defined by the EPA [July 1998]) and should include the following:

1. Work coveralls
2. Reflective/visible safety vests
3. Work gloves
4. Steel-toed boots
5. Safety glasses, as necessary
6. Hard hat, as necessary
7. Hearing protection, as necessary

Experience with similar projects indicates that it is reasonable to expect that airborne COC concentrations in the work area will remain below acceptable levels as long as stringent dust control is maintained. Respirators and protective suits therefore are not required unless the personnel monitoring indicates possible over-exposure.

4.2 Sanitation

Potable water, toilet, and washing facilities must be provided at the Site in the support area by the contractor in accordance with Title 8 CCR 5192.

5.0 SITE CONTROL

Section 8.3 of the RAW provides a description of the Site control areas that must be established during remedial activities by the contractor. Site control procedures are established to control the potential spread of contamination from the Site. The Site must be fenced prior to initiation of remedial activities. Access and egress will be controlled via gates. The gates that provide site access will be locked after working hours. Signs instructing visitors to check in at the project support area should be posted at all entrances to the Site. Access to work areas that are suspected to contain impacted soil must be limited to authorized, trained personnel.

For field operations, a three-zoned approach will be implemented where possible. The three zones include the exclusion zone, decontamination zone, and the support/staging zone. Communication between field personnel and off-Site parties will proceed using cellular telephones and radios.

Each access route to the "Exclusion Zone" must be posted with signs that read:

WARNING CONTAMINATED WORK AREA POISON NO SMOKING OR EATING	**WARNING This Site is contains chemicals known to the State of California to cause cancer or other reproductive toxicity. AUTHORIZED PERSONNEL ONLY**

5.1 Visitors

All visitors desiring to gain access to any part of the Site will be required to announce themselves at the project support area and indicate their presence at the Site in the visitor log book. The contractor's SSO should be notified immediately upon the arrival of any visitors. Additionally, visitors will be required to read and indicate in writing their understanding of this HSP.

Visitors are expected to comply with all local, state, and federal training regulations and medical surveillance requirements and to provide their own PPE. Visitors failing to adhere to the provisions of this HSP will be asked to leave the Site.

6.0 DECONTAMINATION PROCEDURES

6.1 Equipment Decontamination

Decontamination procedures must be performed to reduce the physical transfer of impacted materials from the project area. Before being removed from the Site, all vehicles and equipment with visible accumulations of soil that are potentially contaminated must be thoroughly rinsed/hosed down with water and/or dry brushed to remove residual soil. Equipment decontamination must take place in the decontamination zone.

Washtubs with soap and water and rinse tubs will be provided if needed for cleaning of reusable equipment. Water used for on-Site decontamination will be collected and stored in on-Site storage containers. Wastewater will be analyzed and disposed off-Site at a permitted facility.

6.2 Personnel Decontamination

Workers should minimize the amount of dirt or dust on their hands, face, clothing, and shoes. If any of these are visibly soiled, they should be cleaned with water or left at the Site. Footwear with visible accumulations of soil must be cleaned with a brush and/or water. These activities must be performed prior to leaving the decontamination zone.

7.0 DUST CONTROL

Effective means of dust and erosion control will be utilized to limit the generation of dust associated with excavation activities, truck and vehicle traffic onto and off the Site, and the effects of ambient wind traversing exposed soil. Total dust levels and erosion shall be mitigated during Site activities, as necessary, using a combination of engineering controls that may include:

- Misting or spraying water during soil excavation and loading of soil transportation vehicles
- Limiting vehicle speeds to 5 miles per hour on unpaved portions of the Site
- Covering stockpiled soil with plastic sheeting
- Minimizing drop heights of soil during loading/unloading activities
- Minimizing (as appropriate) water used in dust control
- Rapid cleanup of sediments deposited on paved roadways
- Temporary gravel surfacing placed along Site entrances/exits

The success of dust control measures depends upon the involvement and cooperation of each worker at the Site. If equipment operators see dust being emitted from their piece of equipment while working in areas potentially containing contamination, it is their responsibility to stop work until additional moisture conditioning can be provided. Since dust control is of paramount importance, workers at the Site must do their part to assure that this is accomplished. If visible dust is observed crossing the property line, dust control measures will be increased and the DTSC project manager notified.

8.0 AIR MONITORING

8.1 Personal Air Monitoring

Pesticide exposures above Cal/OSHA permissible exposure limits (PELs) are not expected. The PELs for the COCs at the Site are presented below in Table 1; the maximum concentrations of the COCs detected in soil samples from the areas of impacted soil are also presented. A PEL is not established for alpha-chlordane, gamma-chlordane, or heptachlor epoxide.

Table 1. PELs for Contaminants of Concern

COC	Maximum Concentration Detected (mg/kg)	PEL (mg/m^3) (8-hour TWA)
Chlordane	27	0.5
Dieldrin	25	0.25
DDT	2.74 (total DDT)	1.0
Lead	310	0.05

An evaluation of expected worst-case exposure conditions can be performed using the following equation:

Dust Concentration [mg/m^3] x soil concentration [mg/kg]/10^6 mg/kg = *Anticipated Exposure Concentration*.

Using a conservative (worst case) dust concentration of 5 mg/m^3, which corresponds to very thick and dark dust cloud, and the highest detected total DDT concentration of 2.74 mg/kg, the anticipated exposure concentration is 0.0000137 mg/m^3. This is well below the PEL for DDT of 1.0 mg/m^3.

Repeating this calculation for chlordane and dieldrin using the maximum detected concentrations of 27 and 25 mg/kg, respectively, the anticipated exposure concentrations are 0.000135 mg/m^3 and 0.000125 mg/m^3, respectively. These are well below the PELs for chlordane and dieldrin of 0.5 mg/m^3 and 0.25 mg/m^3, respectively. Similar results are expected for the other pesticides of concern.

Repeating this calculation for lead using the maximum detected concentration of 310 mg/kg, the anticipated exposure concentration is 0.00155 mg/m^3, which is well below the PEL for lead of 0.05 mg/m^3.

Based on these conservative calculations, the use of respirators will not be required and the need for personal air monitoring is not anticipated.

8.2 Perimeter/Fenceline Air Monitoring

Lowney Associates will conduct perimeter/fenceline sampling to evaluate the potential for off-Site migration of dust during soil disturbing activities. Air monitoring activities to be performed are discussed in Section 8.6 of the RAW.

Perimeter monitoring will be performed during the excavation and off-haul activities.

9.0 TRAINING AND MEDICAL SURVEILLANCE

The contractor's SSO must conduct a safety briefing at the beginning of the project to ensure that on-Site workers understand the provisions of the HSP. Health and safety training and hazard communication must be implemented as addressed below and in accordance with each contractor's Site-specific health and safety plan. All Lowney personnel must be familiar with the provisions of this HSP and verify in writing that they have read it and understand it.

9.1 HAZWOPER Training

Lowney employees conducting work within the "Exclusion Zone" with exposure or potential exposure to chemical hazards must have completed a 40-Hour HAZWOPER training course. A minimum of three days of actual field experience under the direct supervision of a trained, experienced supervisor also is required. This training or an approved refresher course must be current (within the last 12 months).

Lowney workers who will only occasionally be on the Site for a specific limited task, such as for inspection or surveying purposes, and who are unlikely to be exposed over the PELs, may take the 24-hour Occasional Site Worker Training. A minimum of one day of actual field experience under the direct supervision of a trained experienced supervisor also is required. This training or an approved refresher course must be current (within the last 12 months).

9.2 Site-Specific Training Program

A Site-specific training program must be instituted prior to on-Site work. Attendees at all meetings must be documented by signature. The Site-specific training related to impacted soil must include discussion of the following:

- The health effects (acute and chronic) of the chemical and physical hazards that may be encountered at the Site
- Proper control measures for the chemical and physical hazards that may be encountered at the Site
- The importance of dust control at the Site
- Proper personal hygiene procedures
- Decontamination of equipment and personnel
- Vehicle and tool decontamination procedures
- Emergency procedures
- Proper management of impacted soil

9.3 Medical Surveillance Requirements

All personnel entering the exclusion zone are required to participate in the Medical Surveillance Program. All field personnel must have completed either a baseline or annual medical monitoring examination within 12 months of their assignment to the Site. Only medically qualified personnel, as determined by the examining physician, will be permitted to conduct field activities.

9.3.1 Site-Specific Medical Monitoring

Field personnel will not undergo specific tests prior to beginning field activities. All field personnel have had baseline medical monitoring, including annual audiometric testing (audiograms), within the last 12 months. If an exposure to lead or pesticides above the action level is documented, the employee will be automatically enrolled in a medical surveillance program and appropriate biological monitoring will be performed.

Field personnel will be informed in writing of the results of any monitoring or sampling conducted during field activities that indicate a possible exposure exceeding the PELs should such monitoring be required. Any data or other documentation indicating possible employee exposure to chemical hazards will be forwarded to the employee, the company physician, and upon the employee's request, their personal physician.

9.3.2 Exposure/Injury Medical Support

All employees who suffer an illness, injury, or chemical exposure during the course of field activities are required to see a physician. The physician responsible for conducting the employee's medical surveillance examinations will be notified and consulted to determine the type(s) of tests required to accurately monitor the employee. Workers may return to work only with written approval of the physician.

10.0 EMERGENCY AND CONTINGENCY PLANNING

10.1 Relevant First Aid Procedures

Minor injuries, including minor cuts, scrapes, and abrasions should be treated on-Site. If an injured individual requires further attention, the individual should be immediately transported to the nearest hospital. A map illustrating the route to the nearest emergency medical facility must be present on-Site. *All accidents, without regard to severity, must be reported in writing to the contractor's SSO within 24 hours.* The SSO should also maintain documentation of all accidents.

10.2 Emergency Treatment

When transporting an injured person to a hospital, this HSP must be taken with the injured person to assist medical personnel with diagnosis and treatment.

In all cases of chemical overexposure, standard procedures are to be followed as outlined below for poison management, first aid, and, if applicable, CPR. The following are four different routes of exposure and their respective first aid/poison management procedures.

1. **Ingestion:** Refer to the material data safety sheets (MSDS) (if construction chemical product, i.e. gasoline) for specific recommendations and/or CALL THE POISON CONTROL CENTER AT 911 FOR INSTRUCTIONS.

2. **Inhalation: Move the person from the contaminated environment.** Initiate CPR if necessary. Call, or have someone call, for medical assistance. Refer to the MSDS for additional specific information. If necessary, transport the victim to the nearest hospital as soon as possible.

3. **Skin Contact: Immediately wash off skin with a large amount of water.** Remove any contaminated clothing and rewash skin using soap, if available. Transport the injured person to a medical facility if necessary.

4. **Eyes: Hold eyelids open and rinse the eyes immediately with copious amounts of water for 15 minutes.** If possible, have the person remove his/her contact lenses (if worn). Never permit the eyes to be rubbed. Trans-port the injured person to a hospital as soon as possible.

10.3 Evacuation Procedures

Various emergencies may warrant a Site evacuation. Although these conditions are not anticipated, they may include fire, explosion, chemical release, or other event that could cause personal injury. Emergency evacuation procedures must be discussed in the contractor's Site-specific HSP.

10.4 Emergency Services and Contact Telephone Numbers

In the event of an emergency, the nearest emergency services to the Site are located at the San Leandro Hospital at 13855 East 14^{th} Street, San Leandro, California 94578. San Leandro Hospital is located between 136^{th} Avenue and 139^{th} Avenue. A map showing the route to the hospital is presented as Figure 2. From the Site, head northwest on Lark Street, turn left on 142^{nd} Avenue, turn right onto East 14^{th} Street, and proceed approximately 500 feet to the hospital.

If an injury is serious enough to require ambulance medical transport or the fire department, immediately call 911.

11.0 CONTRACTORS INJURY AND ILLNESS PREVENTION PROGRAM

Lowney Associates and the soil removal contractor are responsible for having their own Injury and Illness Prevention Program (IIPP) in accordance with Cal OSHA regulations in Title 8 of the CCR. The IIPP's shall include discussion of safety measures to be implemented, including all those in this HSP, to prevent illness and injury to their employees. Investigation and reporting procedures in the exempt of an accident or injury will also be discussed in the contractors IIPP.

For injuries to non-Lowney Associates personnel, the injured persons' employer, safety officer, and SSO's should be immediately contacted.

12.0 INTERNAL AND EXTERNAL COMMUNICATIONS

Lowney Associates' personnel will have a radio for communication between Lowney personnel. Although heavy equipment will generate excessive noise, due to the relatively small Site size, verbal commands, radios, and cellular telephones should be adequate means of communication.

13.0 DAILY SIGN-IN SHEETS

A daily sign-in sheet shall be maintained at the Site for all workers and visitors, and is the responsibility of the contractor.

14.0 SIGNATURES

By signing below, the following individuals verify that they have read and understand this HSP.

______________________	______________________
Print Name	Signature and Date
______________________	______________________
Print Name	Signature and Date
______________________	______________________
Print Name	Signature and Date

15.0 REFERENCES

American Conference of Governmental Industrial Hygienists. March 1, 1998. *2000 TLVs® and BEIs®. Threshold Limit Values for Chemical Substances and Physical Agents and Biological Exposure Indices.*

American Industrial Hygiene Association. 1997. *The Occupational Environment-Its Evaluation and Control, reprint 1998.*

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California Department of Industrial Relations. *Hazard Communication, Section 5194.*

Lowney Associates. November 15, 2004. *Preliminary Environmental Assessment, Jefferson Elementary School, San Leandro, California.*

Lowney Associates. February 4, 2005a. *Supplemental Site Investigation, Jefferson Elementary School, San Leandro, California.*

National Safety Council. 1971. *Fundamentals of Industrial Hygiene, 3rd Edition.*

National Institute of Occupational Safety and Health. June 1997. *NIOSH Pocket Guide to Chemical Hazards.*

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APPENDIX B
ESTIMATION OF RISK-BASED REMEDIATION GOALS

SECOND DRAFT

Estimation of Risk-Based Remediation Goals

Jefferson Elementary School

San Leandro, California

This report has been prepared for:

San Leandro Unified School District

14735 Juniper Street, San Leandro, California 94579

April 20, 2005

Project No. 2074-1A

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SECOND DRAFT
ESTIMATION OF RISK-BASED REMEDIATION GOALS
JEFFERSON ELEMENTARY SCHOOL
SAN LEANDRO, CALIFORNIA

1.0 INTRODUCTION

1.1 Purpose

The purpose of this study is to establish baseline risk values and risk-based remediation goals at the Jefferson Elementary School site (Site). The estimation of the risk-based remediation goals were developed using the California Environmental Protection Agency's (CalEPA) Guidance For Assessing Exposures and Health Risks at Existing and Proposed School Sites (February 2004) and the Preliminary Endangerment Assessment (PEA) guidance manual (January 1994).

1.2 Site Background

The Site is occupied by the Jefferson Elementary School, a public school for kindergarten through 5th grade, and is located at 14311 Lark Street in San Leandro, California. Five buildings (Buildings C, C/D, M, the San Leandro Child Care Building, and the Head Start Building) and a row of portable buildings currently occupy the Site. Two new classroom buildings (Buildings A and B) are currently under construction in the eastern and western portions of the Site. The center of the property contains a children's playground with blacktop and wood chip area. The area in front of the school along Lark Street consists of landscaping and walkway areas, and the areas around the buildings generally consist of asphalt and concrete pavements, landscaping, and bare ground.

The San Leandro Unified School District (SLUSD) is currently redeveloping the existing Jefferson Elementary School. The planned redevlopment is to construct two new permanent classroom buildings (Buildings A and B) providing approximately 30,700 square feet and 14,000 square feet of space, respectively. Following the construction of the new classroom buildings, the existing classroom buildings (Buildings C and C/D) will be demolished and athletic fields and a play area will be constructed in this area. Four of the portable classroom buildings also will be removed. Buildings M, the Child Care Building, and the Head Start Building will remain at the Site. Construction of the two new classroom buildings is nearly complete.

Currently, existing residential development is located immediately adjacent to the northwest of the Site and adjacent to the southeast corner of the Site. Residential development is also located to the northeast of the Site across Lark Street and to the southwest of the Site across Bancroft Avenue. Toyon Park is located adjacent to the southeast of the Site. The Site occupies approximately 7½ acres and is located in Section 36 of Township 2 South, Range 3 West, San Leandro Quadrangle. The Site is generally flat with a gentle slope towards the San Francisco Bay to the southwest. Site elevation is approximately 50 feet above mean sea level (msl) and is designated as Assessor's Parcel Number (APN) 77E-1568-10-2. According to the San Leandro Planning

Department, the Site is zoned as RS-Residential and Single-Family. A review of the geologic maps for the Site indicated that the Site is underlain by alluvial fan and fluvial deposits (Helley and Graymer, 1997; Graymer, 2000).

Based on previous environmental documents prepared for the Site, lead was detected in shallow soil around the existing buildings ranging from 11 to 310 ppm likely originating from historic weathering of lead-based paint from the exterior of the buildings (Kleinfelder 2001). Later sampling identified elevated concentrations of organochlorine pesticides in shallow soil, likely the result of termite abatement activities along the perimeter of some buildings (Winzler and Kelly 2001). More recent investigations conducted by Lowney Associates in November 2004 and January 2005 were performed to further evaluate the extent of lead- and pesticide-impacted soil at the Site. Additional details concerning these investigations are presented in the Supplemental Site Investigation (SSI) Report, dated February 4, 2005.

2.0 CONTAMINANTS OF POTENTIAL CONCERN

The calculation of Site-specific risk-based remediation goal concentrations relies upon the chemical data presented in the following reports:

Kleinfelder, 2001. Phase I Environmental Site Assessment, Jefferson Elementary School. July 12, 2001.

Kleinfelder, 2004. Update of Phase I Environmental Site Assessment of the Jefferson Elementary School. April 14, 2004.

Lowney Associates, 2004. Final Draft Preliminary Environmental Assessment, Jefferson Elementary School. November 15, 2004.

Lowney Associates, 2005. Supplemental Site Investigation Report, Jefferson Elementary School. February 4, 2005.

Winzler and Kelly, 2001. Sampling Report: Organochlorine Pesticides & Asbestos, Thomas Jefferson Elementary School. November 5, 2001.

Analytical results were also received from a 2003 Winzler & Kelly soil quality evaluation performed at the Site. The analytical results contained in these reports indicated the presence of metals and organochlorine pesticide compounds in Site soil.

To identify the potential contaminants of concern (COCs) to be included in the risk calculations, the detected chemicals were initially screened using Preliminary Endangerment Assessment (PEA) guidance to calculate potential risks and hazards. As a conservative measure, the screening process included use of the maximum detected soil concentrations to estimate risks and hazards assuming a 30-year residential exposure via incidental ingestion, dermal contact, and inhalation of airborne chemical constituents from affected soil media. Non-carcinogenic chemicals were considered for elimination if the estimated hazard was less than unity; and carcinogenic chemicals were considered for elimination if estimated risks were less than 5% of the total site risks.
The chemicals detected in the soil samples collected at the site during previous investigations are presented in Table 1.

Table 1. Summary of Analytical Data

Chemical	Frequency of Detection	Range of Detected Concentrations (mg/kg)	Average Concentration (mg/kg)	Location of the Maximum	95% UCL[c] (mg/kg)	USEPA PRG-Residential (mg/kg)
Dieldrin	79/132	0.0028- 20	0.91	C-7-0.5	1.3	0.03
α-Chlordane	66/132	0.0025-4.6	0.19	C/D-6-0.6	0.28	1.6[b]
γ-Chlordane	57/132	0.0021-5.2	0.21	C/D-6-0.5	0.3	1.6[b]
Heptachlor-epoxide	12/132	0.0035 – 0.15	0.02	C/D-6-0.5	0.03	0.053
DDT(t)	34/132	0.0025 – 2.74	0.11	W2-E-East-1.5	0.17	1.7
Arsenic	4/28	4.8 – 5	2.84	SB-4-6.5	3.11	0.39 (22)
Barium	28/28	48 – 200	115	W1-E-SE-0.5	129.3	5400
Chromium III[a]	18/28	3.3- 90	18.5	W2-SC—2.5	24.85	210
Cobalt	18/28	4-84	15.9	W2-SC-0.5	22.3	900
Copper	28/28	14–280	63.1	W1-SC-0.5	84	3100
Lead	24/28	5.4 – 280	46.7	W1-E-SE-0.5	71.8	150
Nickel	25/28	13- 55	33.9	W2-E-NW-1.5	39	1600
Mercury	15/28	0.052 – 0.21	0.060	W1-E-SE-0.5 W1-NE-0.5	0.08	23
Vanadium	28/28	24 – 160	58	W1-SE-0.5	69.9	550
Zinc	28/28	36 – 710	158	W1-WC-0.5	211	23000

a. Assumes Cr6 to Cr3 ratio of 1:6; b. As technical-grade chlordane; c. The 95% UCL estimates assume that chemicals were present at ½ the detection limit if they were not detected in the sample

2.1 Contaminants Eliminated

Using the screening criteria described above, the metallic compounds barium, cobalt, copper, mercury, vanadium, and zinc were initially considered for elimination.
Of these compounds, barium, cooper, mercury, and zinc provided a total hazard quotient of 0.2. These chemicals were eliminated from further consideration.

Cobalt and vanadium each provided hazard quotients of 0.5 and 0.3 respectively. However, the cobalt hazard was primarily attributed to the inhalation pathway calculation that incorporated an inhalation reference dose from U.S. EPA 2004 PRGs and the weight percent (PEA) method for calculation of the inhalation exposure point calculation. Alternatively, using the particulate emission factor (PEF) reduced the hazard quotient to 0.07. Therefore cobalt was eliminated for further consideration. Vanadium was eliminated from further consideration after discussion with Department of Toxic Substances Control (DTSC) toxicologist Dr. Brian Endlich relative to reference dose assignment and resultant low hazard quotient.

With respect to chromium, in accordance with PEA Guidance risk calculations were initially performed assuming that all chromium was hexavalent. Estimated risks using the maximum concentration in soil of 90 mg/kg indicated that potential risks varied from 3.4×10^{-4} to 5.2×10^{-6} and were dependent upon the method used for the inhalation exposure point calculation. Chromium was eliminated from further consideration since chromium concentrations are well within background concentrations (further discussed in the RAW), and since available site history information was not suggestive of the use of hexavalent chromium compounds.

Similarly, nickel compounds yielded estimated risks from 5.7×10^{-9} to 3.7×10^{-7} that were primarily dependent upon the method used for calculating the inhalation exposure point concentration. Nickel was eliminated from further consideration due to the low risk estimates calculated.

Arsenic was not detected greater than 5 ppm in the 24 soil samples collected from a depth of 0-½ foot below ground surface (bgs). Arsenic was eliminated from further consideration since the detected concentrations were within naturally occurring background concentrations in San Francisco Bay Area soils.

A description of the PEA Methods used to calculate risks and hazards for the chemical screening process are further described in Section 3.0. Screening calculations are presented in Appendix A.

2.2 Selected Contaminants of Concern

Based screening criteria described above, the selected COCs at the Site are presented below. Risk-based remediation goal concentrations were calculated for each of the COCs; and are further discussed in Section 3.0.

Organic Chemicals:

- Dieldrin,
- Alpha-Chlordane,
- Gamma-Chlordane,
- Heptachlor-epoxide,
- Total DDT

Metallic Compounds

- Lead

3.0 EXPOSURE ASSESSMENT

Exposure assessment is the process of identifying human populations that could potentially come into contact with Site-related chemicals and the route(s) of potential exposure. For risk calculations, exposure assessment includes characterizing the exposure setting and identifying potentially exposed populations, identifying exposure pathways, and quantifying exposure. Described below are the two exposure assessment methods that were used to estimate risk-based remedial goals and to calculate baseline risks. The methods used included School Screen (Cal/EPA 2004) and the Cal/EPA 1999

Preliminary Endangerment Assessment Guidance.

3.1 School Screen

The 2004 Cal/EPA guidance infers that children differ from adults anatomically, physiologically, and behaviorally in ways that may affect their exposure or their response to exposure to environmental contaminants. In addition, it recognizes the differences in activity patterns and that children are in a period of continuous change as they move from infancy through puberty and into adulthood. The guidance also addresses the differences between the school setting and other settings. The “SchoolScreen” spreadsheet adaptation of this guidance is used to estimate risk-based soil concentrations for the Site setting. The potentially exposed populations, exposure pathways, modeling approach, and exposure assumptions are discussed below.

3.1.1 Exposure Pathways

An exposure pathway is the course a contaminant takes from a source to an exposed organism. Exposure pathways include the following four elements: (1) a source; (2) a mechanism for release, retention, or transport of a chemical in a given medium (e.g., air, water, soil); (3) a point of contact with the affected medium; and (4) an exposure route at the point of contact (e.g., ingestion, inhalation). If any of these elements are missing, the pathway is considered "incomplete" (i.e., it does not present a means of exposure).

Students and others at the school Site may be exposed to soil on the campus as bare dirt is present around portions of some existing school buildings. Soil may be ingested or may contaminate the skin. Interior dust surfaces including floors, desks, shelves, and windowsills, may accumulate a layer of dust between cleanings. This dust may come from multiple sources, including tracked-in or blown-in outdoor soil. Dust may be ingested or may contaminate the skin.

For the selected COCs, this screening level appraisal will address the following exposure pathways: inhalation of outdoor dust and re-suspended indoor dust, inhalation of outdoor and indoor vapor-phase chemicals, and dermal and ingestion exposure to the COCs present in Site soil. A Site conceptual model that identifies the exposure pathways considered is presented on Figure 1 in Appendix A.

3.1.2 Exposure Estimation

Exposure estimates (chemical intakes) are defined as the mass of a substance taken into the body, per unit of body weight, per unit of time. Exposure quantification (calculation of chemical intake or dose) incorporates algorithms and exposure variables provided in regulatory guidance that are based on assumptions about exposure conditions.

Risk–based remedial goals were estimated using guidance documents and methods provided by Cal/EPA (Cal/EPA 2004). Previous CalEPA Preliminary Endangerment Assessment guidance has primarily focused on residential or occupational exposure scenarios, and has generally treated childhood as a homogeneous life stage (DTSC, 1999). The 2004 CalEPA guidance document recognizes that children differ from adults anatomically, physiologically, and behaviorally in ways that may affect their exposure or their response to exposure to environmental contaminants. In addition, it recognizes the differences in activity patterns and that children are in a period of continuous change as they move from infancy through puberty and into adulthood. The guidance also addresses the differences between the school setting and other settings. The "SchoolScreen" spreadsheet adaptation of this guidance is used to estimate risk-based soil concentrations for the Site setting. The potentially exposed populations, modeling approach, and exposure assumptions are discussed below.

3.1.3 Potential Receptors

For a screening level approach, the default potentially exposed receptors at schools include:

1) Students from kindergarten through high school,
2) Staff,
3) Pregnant or nursing women,
4) Pre-schoolers aged one through four, and
5) Nursing infants less than one year of age in day care at the school site whose mothers are students or staff.

Other receptors that may use or visit the school facilities are not considered since it is assumed that their visits would be less frequent than the students and staff, and that their long-term average exposure would be less than that of the receptors listed above.

3.1.4 "SchoolScreen" Modeling Approach

This guidance outlines a modeling approach to predict exposures and risks to preschoolers, students, teachers and other school personnel, and their offspring, from chemicals in the soil and air at the school Site. The model includes up to 12 pathways by which school users could be exposed to chemicals at the school Site. Each pathway is represented by an equation that describes a concentration in the source medium, and transfer factors that relate the concentration in the source medium to a concentration in an intermediate or exposure medium, and a contact rate that describes the daily intake of, or contact with, the exposure medium.

For non-carcinogenic hazards, the model provides the pathway-specific annual average daily dose of each COC. Doses via all pathways that involve the same exposure route (e.g. ingestion) are added together to determine the route-specific annual average daily dose. The average annual daily dose is divided by the route-specific reference dose (RfD) to arrive at the route-specific hazard quotient (HQ). In a screening level analysis, the chemical-specific HQs for each chemical are added to give the Hazard Index (HI).

For carcinogenic chemicals, the route-specific annual average daily dose is converted to a route-specific lifetime average daily dose by multiplying by the fraction of a lifetime represented by each exposure scenario (ED/AT), i.e. 1/70 of a lifetime for each year of exposure. The route-specific lifetime average daily dose is multiplied by the route-specific cancer potency factor to obtain the risk for that pathway. The route-specific risks for relevant pathways are added to give the chemical specific risk. In addition, the chemical-specific risks for each chemical are added to give the total cancer risk. Annual risks may be added for a series of years to obtain the total risk for that period.

3.1.5 Exposure Parameters and Assumptions by Pathway

The parameters and assumptions used to calculate exposure factors for each exposure case are described below. All exposure parameters for each receptor including body weights, surface areas of exposed skin, breathing rates, ingestion rates, exposure frequencies, and duration are provided in Appendix A.

Soil Ingestion

The general equation for calculating exposure through incidental soil and dust ingestion is presented in Appendix A. The algorithm represents incidental ingestion of surface soil and dusts as a result of direct contact with soil on hands, followed by hand-to-mouth activity. For this exposure pathway, 100% absorption of the ingested contaminant is assumed.

Dermal Contact

The exposure algorithm for dermal contact presents the general method for calculating dermal absorbed dose. Dermal exposure is expressed as an absorbed dose by incorporating a chemical-specific absorption factor (ABS) into the exposure equation. For organochlorine pesticides, a 5% ABS factor is assumed.

The soil-to-skin adherence factor (AF) or loading rate, a sensitive parameter, refers to the amount of soil that remains deposited on the skin after contact. Recent data from U.S. EPA 2000a indicates that soil adherence varies across different parts of the body, varies with soil properties, and varies with activity. EPA recommends that body part-weighted AFs be calculated from activities that best represents soils, body parts, and activity. For remedial goal calculations, default assumptions from “SchoolScreen” were used. The exposure algorithm is presented in Appendix A.

Inhalation

The general exposure algorithm for inhalation of chemical contaminants is presented in Appendix A. Inhalation of wind blown, re-suspended dusts, and vapor phase chemicals were estimated by “SchoolScreen”. Default “SchoolScreen” breathing rates for all receptors were used and 100% absorption through the inhalation route was assumed.

3.2 Preliminary Endangerment Assessment Guidance

PEA Guidance was also consulted for a screening level human health evaluation and to provide risk based concentration estimates. In accordance with this guidance, maximum concentrations were used to estimate baseline risks for three major exposure pathways. The pathways considered completed include inhalation of dust, incidental ingestion of contaminated soils, and dermal contact with contaminated soil.

Chronic daily intake calculations assume that a receptor is exposed 350 days per year over a period 30-years (6 years as child and 24 years as an adult). For the inhalation pathway a breathing rate of 20 cubic meters (m^3) of air per day is assumed for adults and 10 m^3 for a child. Body weight assumptions for all pathways are 70 kilograms (kg) for adults, and 15 kg for children. In addition, the exposure point concentration in air assumes that the chemical of concern is present in respirable dust at the respective weight fraction as it is in site soils. The default value total respirable dust in air is assumed to be of 50 micrograms per cubic meter (ug/m^3).

For soil contact, a child is assumed to ingest 200 milligrams (mg) of soil per day, the child's exposed skin surface area (SA) is assumed to be 2000 square centimeters (cm^2), and a soil adherence factor (AF) of 1 milligram per square centimeter (mg/cm^2) is also assumed. With respect to dermal absorption values, the absorption fraction for chlorinated pesticides assume 5%, for arsenic 3% is assumed, and for all other metals 1% is assumed. The Exposure frequency for ingestion and dermal contact is assumed to be 350 days per year.

For the adult receptor, a daily ingestion rate of 100 mg/day and a frequency of 350 days per year is assumed. For dermal contact, SA is assumed to be 5800 cm^2, AF is 1 mg/cm^2, and exposure frequency is 100 days per year. The same dermal absorption values are assumed for this receptor.

Hazard calculations incorporate the child receptor only, and risk calculations incorporate the sum of both receptors (child + adult). Finally, the averaging time for hazard estimation is 2190 days (6 years x 365 days/year). For carcinogenic risk estimates, the averaging time is 25,550 days (70 years x 365 days/year).

Table 2 below summarizes the PEA exposure assumptions for remedial goal and risk calculations.

Table 2. PEA Exposure Assumptions

Exposure Scenario	Bwt	SA (cm^2)	AF (mg/cm^2)	IR (mg/day)	BR (m^3/d)	Exposure Frequency and Duration
Residential Child	15 kg	2000	1	200	10	350 days per year for 6 years
Residential Adult	70 kg	5800	1	100	20	350 days per year for 24 years 100 days per year for dermal contact

3.3 Toxicity Values

Toxicity values are used to quantify the relationship between the extent of exposure to a chemical and the likelihood of adverse health consequences. EPA-derived toxicity values used in risk assessments are termed slope factors (SFs) and reference doses (RfDs). Slope factors are used to estimate the incremental lifetime risk of developing cancer corresponding to doses calculated in the exposure assessment. The potential for non-cancer health effects is evaluated by comparing estimated daily intakes with RfDs or reference concentrations (RfCs), which represent daily intakes at which no adverse effects are expected to occur over a lifetime of exposure. Both slope factors and RfDs are specific to the route of exposure [e.g., inhalation, or ingestion (oral) exposure]. However, for chemicals where inhalation reference concentration or reference dose information was unavailable, in accordance with PEA Guidance, PEA screening hazard calculations incorporate oral reference doses. California values are used in risk-based remediation goal calculations to estimate soil concentrations at target risk levels. Toxicity parameters (slope factors and RfDs) used in the calculations are summarized in Table 3.

Table 3. Chemical Specific Toxicity and Dermal Absorbance Factors

Chemical	ABS	SFi (mg/kg-day)$^{-1}$	Sfo (mg/kg-day)$^{-1}$	RfDi (mg/kg-day)	RfDo (mg/kg-day)
Selected Chemicals					
Dieldrin	0.05	16	16	0.00005	0.00005
Chlordane (alpha,gamma)	0.05	1.2	1.3	0.0002	0.0005
Heptachlor-epoxide	0.05	13	5.5	0.000013	0.000013
DDT(t)	0.05	0.34	0.34	0.0005	0.0005
Eliminated Chemicals					
Arsenic	0.03	12	9.5	0.0003	0.0003
Barium	0.01	NA	NA	0.00014	0.07
Chromium6	NA	510	NA	NA	NA
Chromium	0.01	NA	NA	1.5	1.5
Cobalt	0.01	NA	NA	0.0000057	0.02
Copper	0.01	NA	NA	0.04	0.04
Nickel	0.01[d]	NA	NA	0.0000143[a]	0.02
Mercury	0.01	NA	NA	0.000086[b]	0.0003
Vanadium	0.01	NA	NA	0.007[c]	0.007[c]
Zinc	0.01	NA	NA	0.3	0.3

Table notes: Slope factors are California values
Reference doses are from U.S. EPA 2004 PRGs unless otherwise indicated
NA = not applicable
ABS = dermal absorption factors
a. Converted California REL
b. Based on elemental mercury
c. Based on discussion with DTSC Toxicologist Dr. Brian Endlich.
d. ABS used for screening hazard calculation

4.0 BASELINE RISKS AND HAZARD CHARACTERIZATION

To evaluate the current potential health risks (pre-remediation) to students, staff, and others, Site risks were calculated using both School Screen and PEA guidance. Site risks using School Screen were calculated using 95% UCL soil concentrations. The 95% UCL concentrations were calculated from the data set comprised of 132 soil samples collected at various depths at the Site. For the PEA risk and remedial goal calculations, maximum soil concentrations for each chemical were used for the EPCs.

EPCs were used to calculate the chemical intake or dose. The resultant doses, for the exposure conditions evaluated, were then multiplied by slope factors for carcinogenic risks or divided by RfDs for non-carcinogenic hazards. Estimated baseline risks and hazards are presented in Tables 4 to 6.

Table 4. Baseline Risks- School Screen

Receptor Group	Dieldrin	Chlordane(t)	Heptachlor Epoxide	DDT(t)	Total Risk
Pre-School (Ages 0-5)	$1.3x10^{-5}$	$4.8x10^{-7}$	$1.1x10^{-7}$	$4.3x10^{-8}$	$1.4x10^{-5}$
K-5 (Ages 5-11)	$6.6x10^{-6}$	$2.3x10^{-7}$	$5.1x10^{-8}$	$1.7x10^{-8}$	$6.9x10^{-6}$
Jr. High (Ages 11-14)	$1.7x10^{-6}$	$5.2x10^{-8}$	$1.2x10^{-8}$	$3.6x10^{-9}$	$1.8x10^{-6}$
High School (Ages 14-18)	$1.7x10^{-6}$	$5.6x10^{-8}$	$1.3x10^{-8}$	$3.7x10^{-9}$	$1.8x10^{-6}$
Total School (Ages 0-18)	$2.3x10^{-5}$	$8.1x10^{-7}$	$1.8x10^{-7}$	$6.8x10^{-8}$	$2.4x10^{-5}$
Staff	$1.6x10^{-5}$	$5.2x10^{-7}$	$1.2x10^{-7}$	$3.4x10^{-8}$	$1.6x10^{-5}$
Mothers	$4.0x10^{-7}$	$1.3x10^{-8}$	$3.0x10^{-9}$	$8.8x10^{-10}$	$4.2x10^{-7}$
EPC (mg/kg)	1.3	0.58	0.03	0.17	

Table 5. Baseline Hazard Quotient- School Screen

Receptor Group	Dieldrin	Chlordane(t)	Heptachlor Epoxide	DDT(t)	Total (HI)
Age 1-2	$3.6x10^{-4}$	$1.7x10^{-5}$	$3.2x10^{-5}$	$4.7x10^{-6}$	$4.1x10^{-4}$
EPC (mg/kg)	1.3	0.58	0.03	0.17	

Table 6. Baseline Risks and Hazard Quotients- PEA Guidance

Receptor Group	Dieldrin	Chlordane(t)	Heptachlor Epoxide	DDT(t)	Total
EPC (mg/kg)	20	4.6	0.15	2.74	
Carcinogenic Risk	8×10^{-4}	3.2×10^{-5}	2.1×10^{-6}	2.3×10^{-6}	8.4×10^{-4}
Hazard	7.7	0.4	0.2	0.1	8.4

In order to place the risk estimates in perspective, the EPA NCP states, "For known or suspected carcinogens, acceptable exposure levels are generally concentration levels that represent an excess upper bound lifetime cancer risk to an individual of between 10^{-4} and 10^{-6}…". Also stated is that "The 10^{-6} risk level shall be used as the point of departure for determining remediation goals…". The established remediation goal of $1x10^{-6}$ is conservative and commonly accepted for unrestricted land use.

5.0 CALCULATION OF SITE REMEDIAL GOALS

5.1 Calculation of URVs

For each pesticide COC of interest, remedial goal estimates incorporate a target risk level, assumptions concerning exposure, exposure estimation, and compound-specific toxicity values to obtain a chemical concentration that can be present in soil without creating an excessive likelihood of adverse health effects assuming exposure to affected soils. To estimate remedial goals for carcinogenic chemicals of concern, a URV approach is used.

For the School Screen method, the model was run using a 1-mg/kg soil concentration for each COC to generate risks for the total Student Receptor group (ages 0-18). . The model was run in default (TierI) mode to generate risk values that represent the URV or risk per mg/kg soil concentration [risk $(mg/kg)^{-1}$]. The calculated URVs are presented in Appendix A.

Risk–based concentrations using PEA assumptions and parameters were also calculated using a URV approach. The results of these calculations are summarized in the section below. URVs using the PEA methods are also presented in Appendix A.

5.2 Remedial Goal Estimates

Remedial goal estimates were calculated by setting the target risk (TR) to one-in-one million (1×10^{-6}). A $1 \text{x} 10^{-6}$ cancer risk represents a one-in-one-million additional probability that an individual may develop cancer over a 70-year lifetime as a result of the exposure conditions evaluated. Because cancer risks are assumed to be additive, risks associated with simultaneous exposure to more than one carcinogen are aggregated to determine a total pathway cancer risk. Total cancer risks are summed to determine the total cancer risk for the population of concern.

5.2.1 Carcinogenic Chemicals

The results of risk-based remediation goal concentration calculations for carcinogenic chemicals (organochlorine pesticides) are presented in Table 7. School Screen model output including risk estimates for all receptors, calculated URVs, and a summary of baseline risks are presented in Appendix A. In addition, risk calculations using PEA methods are also provide in Appendix A.

Table 7. Multi-Pathway Risk-Based Soil Concentrations using School Screen and PEA Methods
(Target Risk = 1 x 10^{-6})

Receptor Group	Dieldrin (mg/kg)	Chlordane (mg/kg)	Heptachlor-Epoxide (mg/kg)	DDT(t) (mg/kg)
School Screen Total School Receptor	0.056	0.71	0.17	2.5
PEA (Residential Receptor)	0.024	0.31	0.072	1.17

The risk-based remedial goal concentrations presented in Table 7 were derived assuming ingestion, dermal, and inhalation exposures to selected carcinogenic chemicals of concern. However, since there are multiple chemicals present on site, the final remedial goal concentrations should account for additive carcinogenic risks.

5.2.2 Non–Carcinogenic Chemicals

The risk-based remediation goal concentration for lead was iteratively calculated using the CalEPA DTSC Lead Risk Assessment Spread Sheet (Version 7). The concentrations estimated using the DTSC spreadsheet are presented in Table 8. For a child receptor, the 99^{th} percentile concentration is the lead concentration in soil that results in a blood lead concentration of less than or equal to 10 micrograms of lead per deciliter of blood (ug/dl) in the 99^{th} percentile of those exposed. Similarly, the 95^{th} percentile is the concentration that would not result in blood lead concentrations exceeding 10 ug/dl in the 95^{th} percentile of those exposed.

Table 8. Lead Target Blood Lead Concentration = 10 ug/dl

Chemical	95^{th} Percentile (mg/kg)	99^{th} Percentile (mg/kg)
Lead	247	146

5.2.3 Recommended Remedial Goal Concentrations

After extensive review of the data set, dieldrin appears to represent 95.5 % of the total site risk from an inventory basis. With the exception of one sample location (W2-E-NW), based on the data set, removal of all soil impacted with dieldrin at concentrations equal to or greater than 0.025 mg/kg, will result in a projected total site risk of less than 1 x 10-6 (PEA Calculation). This is because the removal of soil impacted by dieldrin will result in the removal of significant concentrations of other organochorine COCs. Based on the data set, after soil removal, the maximum concentration of chlordane is projected to be 0.001 mg/kg, the maximum heptachlor-epoxide concentration is projected to be 0.001 mg/kg, and the maximum total DDT concentration is projected to be 0.004. This inference assumes that the soil in the vicinity of W2-E-NW is also excavated.

Therefore, the recommended remedial goals for this project are as follows:

Dieldrin 0.025 mg/kg

Lead 146 mg/kg.

The risk-based remediation goal concentrations calculated represent chemical-specific soil concentrations that can be present without creating an excessive likelihood of adverse health effects assuming human exposure through oral, dermal, and inhalation exposure. Other agencies including the Regional Water Quality Control Board and the U.S. EPA publish similar risk-based concentrations for individual compounds using different exposure assumptions and methods. The selection of exposure variables, assumptions and methods is a risk management decision that should be based on regulatory guidance, site-specific conditions, and future development of the site. In addition, it is common to alter exposure variables and assumptions to provide a range of concentrations to be considered for future onsite remedial actions.

6.0 REFERENCES

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Appendix A

PEA Screening Calculations
PEA Risk and Hazard Calculations
Exposure Algorithms
SchoolScreen Output
DTSC Lead Spread Sheet
Chemicals Eliminated From Consideration

APPENDIX C
OPINION OF ESTIMATED REMEDIAL ACTION COSTS

Jefferson Elementary School
San Leandro, California
Alternative 2: Excavation, Off-haul, Capping, and Deed Restriction

	TASK DESCRIPTION	QUANTITY	UNIT OF MEASURE	APPROXIMATE UNIT COST	APPROXIMATE TOTAL
1	RAW Preparation	1	Each	$ 30,000	$ 30,000
2	Construction Facilities				
	Perimeter Security Fencing Rental	1,600	Lineal Feet	$ 3.75	$ 6,000
	Truck Rock Exit, Wash Facility, and Signage	3,800	Square Feet	$ 1.25	$ 4,750
	Staging Area Wash Facility and Signage	1	Each	$ 1,000	$ 1,000
3	Surveying	1	Each	$ 2,500	$ 2,500
4	Excavation of Pesticide-Impacted Material	200	Cubic Yard	$ 30	$ 6,000
5	Stockpile Composite Sampling	1	Each	$ 1,000	$ 1,000
6	Off-haul from Site, Transportation, and Disposal	350	tons	$ 34	$ 11,900
7	Placement of Plastic Indicator below Cap	4700	Square feet	$ 0.09	$ 423
8	Sampling of Import Soil	1	Each	$ 5,000	$ 5,000
9	Import and Placement of Clean Soil (includes transporation and 25% contingency)	280	Cubic Yards	$ 17.00	$ 4,760
10	Dust Control				
	Mitigation Water, Transport, and Storage	5	Days	$ 1,500	$ 7,500
	Mitigation Water Truck (18,000 gal)	1	Weeks	$ 550	$ 550
11	Perimeter Dust Monitoring and Air Sampling	1	Each	$ 5,000	$ 5,000
12	Engineering Costs				
	Field Oversight	15	Days	$ 1,400	$ 21,000
	Data Evaluation, Report, Project Management	1	Each	$ 20,000	$ 20,000
13	DTSC Oversight and Report Review Fees	1	Each	$ 10,000	$ 10,000
14	Other Costs				
	Long-Term Inspection and Maintenance of Cap	30	Years	$ 500	$ 15,000
	Cap Repairs	1	Each	$ 10,000	$ 10,000
	Report to DTSC every 5 years	6	Reports	$ 2,500	$ 15,000
	DTSC O&M Oversight Costs	30	Years	$ 1,000	$ 30,000
	Deed Restriction	1	Each	$ 5,000	$ 5,000
	SUB-TOTAL				$ 212,383
	CONTINGENCY (20%)				$ 42,476.6
	TOTAL ESTIMATED COST				$ 254,859.6

Notes and Assumptions:

Estimated in-place excavation volumes based on dimensions shown on Figure 6
In-place soil volume multiplied by 1.4 to account for bulking factor during importing
Assume 1.75 tons per yard
Excavation and off-hauling estimated at 15-days
Excavation and off-haul costs based on material being accepted at the Altamont Class II disposal facility
Perimeter dust monitoring performed during first three days of earthwork activities
Verification and stockpiling soil samples will be analyzed on a 24-hour laboratory response time

Jefferson Elementary School
San Leandro, California
Alternative 3: Excavation and Off-haul

TASK DESCRIPTION	QUANTITY	UNIT OF MEASURE	APPROXIMATE UNIT COST	APPROXIMATE TOTAL
1 RAW Preparation	1	Each	$ 30,000	$ 30,000
2 Construction Facilities				
Perimeter Security Fencing Rental	1,600	Lineal Feet	$ 3.75	$ 6,000
Truck Rock Exit, Wash Facility, and Signage	3,800	Square Feet	$ 1.25	$ 4,750
Staging Area Wash Facility and Signage	1	Each	$ 1,000	$ 1,000
3 Concrete Demoliton and Disposal Around Building M	1	Each	$ 2,500	$ 2,500
4 Surveying	1	Each	$ 2,500	$ 2,500
5 Excavation of Pesticide-Impacted Material	365	Cubic Yards	$ 30	$ 10,950
6 Stockpile Composite Sampling	1	Each	$ 1,000	$ 1,000
7 Off-haul from Site, Transportation, and Disposal	638.75	tons	$ 34	$ 21,718
8 Sampling of Import Soil	1	Source	$ 5,000	$ 5,000
9 Import and Placement of Clean Soil (includes transporation and 25% contingency)	511	Cubic Yards	$ 17.00	$ 8,687
10 Dust Control				
Mitigation Water, Transport, and Storage	5	Days	$ 1,500	$ 7,500
Mitigation Water Truck (18,000 gal)	1	Weeks	$ 550	$ 550
11 Perimeter Dust Monitoring	1	Each	$ 5,000	$ 5,000
12 Engineering Costs				
Field Oversight	15	Days	$ 1,400	$ 21,000
Verification Sample Analysis (24-hour)	50	Samples	$ 285	$ 14,250
Data Evaluation, Report, Project Management	1	Each	$ 20,000	$ 20,000
13 DTSC Oversight and Report Review Fees	1	Each	$ 10,000	$ 10,000
SUB-TOTAL				$ 172,405
CONTINGENCY (20%)				$ 34,480.9
TOTAL ESTIMATED COST				$ 206,885.4

Notes and Assumptions:

Estimated in-place excavation volumes based on dimensions shown on Figure 6
In-place soil volume multiplied by 1.4 to account for bulking factor during import
Excavation and off-hauling estimated at 15-days
Assume 1.75 tons per yard
Excavation and off-haul costs based on material being accepted at the Altamont Class II disposal facility
Perimeter dust monitoring performed during first three days of earthwork activities
Verification and stockpiling soil samples will be analyzed on a 24-hour laboratory response time

APPENDIX D
DTSC ADVISORY ON IMPORTED FILL MATERIAL

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.