HEALTH/SCIENCES Consulting
Public Health and Environmental Sciences

1 September 1994

Mr. Dick Rudloff, Public Works Coordinator
City of Alameda, Public Works Department
City Hall, Rm. 204
2263 Santa Clara Ave.
Alameda, CA 94501-4455

Dear Mr. Rudloff:

Subject: Lead in Surficial Soil at Krusi Park, Alameda, California

The City of Alameda requested ACC Environmental Consultants evaluate the potential threat posed by lead detected in surficial soil at Krusi Park. *HEALTH/SCIENCES Consulting*, under contract to ACC Environmental Consultants, performed the following evaluation of lead in soil at Krusi Park based upon information and data (see Table 1) received from ACC Environmental Consultants August 23, 1994. Please refer to ACC for the sample locations. Data were not validated as part of this evaluation.

Summary statistics for lead in surficial soil (0' bgs) are presented in Table 2. Lead in surficial soil is lognormally distributed, as is typically found for environment contaminants in soil (Gilbert, 1987). Although lead occurs naturally in soil throughout the United States, the largest source of lead in the environment is from anthropogenic sources (auto exhaust, battery plants, smelters, landfills, etc.). Lead is strongly sorbed to organic matter in soil through ion exchange with hydrous oxides or clays or by chelation with soil organic matter, therefore, it is relatively immobile (ATSDR, 1991). → Then why in water samples?

Recent toxicological and epidemiological research indicate chronic low-level lead exposure has a continuum of adverse health effects; it does not appear to have a threshold below which no adverse health effects occur; and it may be carcinogenic at high level exposures. Blood lead levels as low as 10 micrograms lead per deciliter (ug/dl) blood in children are believed to be associated with adverse health effects. Numerous investigators have detected an inverse linear relationship between IQ and blood lead levels, regardless of socioeconomic status and that lead retards growth in children. There is a growing body of evidence that suggests lead affects the cardiovascular system in humans resulting in increases in blood pressure in middle-age men at very low levels of exposure (down to 7 ug/dL without a threshold). Animal data support the human data and demonstrate that lead increases blood pressure (ATSDR, 1991). The federal Environmental Protection Agency (EPA) has classified lead as a B2, probable human carcinogen based on sufficient animal evidence. Most studies found a carcinogenic response only at the highest dosage used in the study (EPA, 1994a).

Current EPA guidelines have set a residential screening level for lead in soil as 400 mg/kg based on the EPA's new Integrated Exposure Uptake Biokinetic Model (IEUBK) (EPA, 1994b; 1994c). This level is not a cleanup goal but rather a concentration above which there may be enough concern to warrant a site-specific investigation of risk. Lead concentrations in all surface soil samples (0' bgs) taken from the site are below this screening level. Surface soil is the primary concern for areas in which children play as they may ingest soil through mouthing activities while playing. Soil below 6 inches in depth, is in general, not available to children. However, all soil samples, regardless of depth, detected lead at concentrations below 400 mg/kg. Because soil lead is less than 400 mg/kg screening level for residential settings, EPA guidance suggests no further action is required at the site.

Use of this screening level for lead at the Krusi Park site is conservative. Residential exposure was used to generate the EPA screening lead level. Since the site is a park, exposure would occur over a shorter duration and with less frequency than at a residence. Therefore, 400 mg/kg lead in soil is a conservative estimate of the concentration of concern for the site.

The Department of Toxic Substances Control (DTSC) has developed a empirical approach relating exposure to lead in environmental media to blood lead levels (Leadspread, blood lead beta test version). Inputs to the DTSC spreadsheet are the concentrations of lead in soil and dust, water, and air with default concentrations available for all media except soil (CalEPA, 1992). Using the maximum concentration of lead detected in surface soil (150 mg/kg) in the DTSC spreadsheet results in a 99th percentile blood lead level of 9.1 ug/dL for children (Table 3). This means that exposure to soil lead concentrations of 150 mg/kg by typical children would have an estimated risk of no more than 1 percent of exceeding a blood lead level of 9.1 ug/dL. Using the 95th upper confidence limit of the mean concentration, the 99th percentile blood lead level is 8.6 ug/dL. Therefore, intake of lead at this concentration is protective for young children as it is below the 10 ug/dL concentration of concern.

Based upon current EPA guidance and the limited analysis presented above, further risk evaluation of lead in soil at the Krusi Park site does not appear to be warranted.

Should you have any questions on the approach or conclusion, please do not hesitate to call.

Sincerely,

Donna L. Dehn, M.S., M.P.H.
Environmental Health Scientist

cc. Susan B. Churchill/ACC Environmental Consultants

References

Gilbert, R.O. 1987. Statistical Methods for Environmental Pollution Monitoring. Van Nostrand Reinhold, New York, NY.

ATSDR. 1991. Toxicological Profile for Lead. US Department of Health and Human Services, Atlanta, GA.

EPA. 1994a. Integrated Risk Information System (IRIS), on-line January 1994. Office of Health and Environmental Assessment, Environmental Criteria and Assessment Office, Cincinnati, OH.

EPA. 1994b. Integrated Exposure Uptake Biokinetic Model (IEUBK) for Lead in Children. EPA/540/R-93/081, Office of Emergency and Remedial Response, Washington, D.C.

EPA. 1994c. Revised Interim Soil Lead Guidance for CERCLA Sites and RCRA Corrective Action Facilities. OSWER Directive #9355.4-12, July 14, 1994, Washington, D.C.

California Environmental Protection Agency (CalEPA). 1992. LeadSpread, beta test version spreadsheet. Department of Toxic Substances Control (DTSC), Sacramento, CA.

Table 1
Analytical Results for Soil Samples
Krusi Park, Alameda, CA

Sample Number	Depth Below Ground Surface (feet)	Lead (TTLC) (mg/kg)	Lead (STLC) (mg/l)	Copper (TTLC) (mg/kg)	Copper (STLC) (mg/kg)	TRPH (mg/kg)
B1	5	340.0	25.0	61	nt	250
B1	15	6.0	nt	19	nt	12
B1	25.5	4.0	nt	8	nt	14.3
B2	3.5	49.0	nt	23	nt	22.85
B2	20.5	<4.0	nt	14	nt	10.6
B3	3.5	340.0	5.3	1200	nt	335
B3	14.5	5.0	nt	12	nt	10.4
B4	5.0	13.0	nt	11	nt	10.7
B4	15.5	8.0	nt	11	nt	8.3
B8	1.0-1.5	100.7	2.37	37.1	nt	11
B8	3.0-3.5	22.7	nt	31.5	nt	<2.1
B8	7.0-7.5	118.3	2.46	73.2	nt	117
B10	4.0-4.5	8.7	nt	36.7	nt	214
B12	1.5-2.0	16.5	-	20.8	nt	40.3
B13	1.5-2.0	75.1	23.6	32.2	nt	88.3
B14	1.5-2.0	278.6	133	44.3	nt	217
E1	3.5	350.0	27	52	nt	36.4
E2	3.5	140.0	8.9	29	nt	68.6
E3	4.5	36.0	nt	38	nt	27.3
A-1a	0	50.0	2.6	17	0.31	nt
S-1b	0	49.0	2.7	16	0.32	nt
S-2	0	100.0	3.8	20	0.28	nt
S-3	0	140.0	6.5	20	0.65	nt
S-4	0	150.0	7.4	21	0.4	nt
S-5	0	56.0	1.8	19	0.31	nt
S-6	0	56.0	1.9	16	0.16	nt
S-7	0	60.0	2.6	16	0.15	nt
S-8	0	58.0	2.3	18	0.16	nt
S-9	0	68.0	2.9	20	0.34	nt
S-10	0	44.0	1.7	12	0.12	nt
L1	0	36	1.1			
L2	0	16	0.71			
L3	0	6.8	0.26			
L4	0	21.	0.64			
L5	0	17	0.98			

nt = not tested

Table 2
Summary Statistics for Soil Lead Concentrations at 0' Depth
Krusi Park, Alameda, CA

Statistic	Value
Mean	57.99
Lognormal mean	62.13
Standard deviation	41.09
Median	53
Minimum	6.8
Maximum	150
Count	19
r2 lognormal	0.934
95 UCL (Lands method)	103.91

Table 3
Lead Risk Assessment Spreadsheet
Krusi Park, Alameda, CA

INPUT		
Medium	**Units**	**Value**
Lead in Air	(ug/m3)	0.18
Lead in Soil	(ug/g)	150
Lead in Water	(ug/l)	15
Plant Uptake?	1=Yes 0=No	0
Airborne Dust	(ug/m3)	50

OUTPUT						
		Percentiles				
		50th	**90th**	**95th**	**98th**	**99th**
Blood Pb, Child	(ug/dL)	4.0	6.3	7.1	8.2	9.1

EQUATIONS	**Children**	**(Typical)**				
Pathway	**ug/dL**	**Route-specific Constant**	**Concentration in Medium**	**Contact**	**Rate**	**Percent of Total**
Soil Contact	0.02	1E-04 (ug/dL)/(ug/day) *	150 ug/g *	1.4	g soil/day (5 g/m^2 * 0.28 m^2)	1
Soil Ingestion	0.58	0.0704 (ug/dL)/(ug/day) *	150 ug/g *	0.06	g soil/day	15
Inhalation	0.36	1.92 (ug/dL)/(ug/m^3) *	0.19 ug/m^3			9
Water Ingestion	0.96	0.16 (ug/dL)/(ug/day) *	15 ug/l *	0.4	l water/day	24
Food Ingestion	2.08	0.16 (ug/dL)/(ug/day) *	10.0 ug Pb/kg diet *	1.3	kg/diet day	52