Technical Memo
Department of Ecology
Northwest Regional Office, TCP
Tacoma Smelter Plume Project
July 9, 2003

To: Dr. Mimi Walker, Vashon School District Superintendent
From: Norm Peck, Asst. NWRO Site Manager
Via: Marian Abbett, TSP Project Manager, Guy Barrett, NWRO TSP Site Manager

Re: Interpretation of soil sample results from selected sample locations at the Vashon School District property.

Executive Summary: Samples were collected at 4 locations on Vashon School District property on June 4, 2003; The School District Garden (DU-1, VSD2003), the Chautauqua Elementary Garden (DU-2, VSD2003), the Chautauqua Elementary Kindergarten Play Area (DU-3, VSD2003) and the Chautauqua Elementary School Parking Lot North Parking Lot Grass Strip (DU-4, VSD 2003). Sampling was to evaluate soil-mixing experimental remediation at three areas and evaluate contamination levels at the elementary school garden. Samples were screened with a Niton XL-700 XRF instrument on June 5 and 9, transferred to lab-provided sample jars and labeled on June 10 and delivered to OnSite Environmental, Inc. in a verified Chain of Custody on June 11, 2003. The School District Garden (Administration 009 DU-1, VMI-CUA2000) is Decision Unit One (DU-1) in this study, Kindergarten Play area (Chautauqua Elementary 006 DU-3,, VMI-CUA2000) is DU-3 and North Parking Lot Grass Strip (Chautauqua Elementary 006 DU-2, VMI-CUA2000), DU-4 in this study had been previously sampled during Vashon-Maury Island Child Use Area sampling (see Public Health – Seattle and King County and Greg Glass, 2002), the Elementary School Garden was previously unsampled, and assigned as DU-2 in this study. Sampling was at the health screening level, and limited to the 0-2 and 2-6" depth intervals. No individual samples or decision unit (DU) averages exceeded Interim Action Trigger Levels (100 mg/kg for As, 700 mg/kg for Pb), and none exceeded the 250 mg/kg lead (Pb) cleanup standard established by the MTCA (Ch. 173-340 WAC) regulations. In two DUs, there were no exceedances of the MTCA arsenic (As) cleanup standard of 20 mg/kg. At the Kindergarten Play area, two samples exceeded the As cleanup standard (86 mg/kg and 27 mg/kg), but the DU average and the average for each depth interval did not exceed the standard. At one location, the School District Garden, the average As concentration in both depth intervals and the DU as a whole exceeded the MTCA cleanup standard (0-2" average of 23.2, 2-6" average of 24.6 and DU average of 23.9 mg/kg As), but showed lower As contaminant levels than in previous sampling.

Definitions:
Decision Unit: an area used by children being sampled to determine the levels of lead (Pb) and arsenic (As). A decision unit is a discrete area used in a way that differs from the use of surrounding areas, therefore requiring a specific set of use assumptions to assess potential risk posed by a particular set of activities.
Health Screening-level sampling: sampling designed to assess potential exposure to lead (Pb) and arsenic (As) during routine use of a particular area. Limited to the top 6" (six inches) of soil, assumed to be the soil most likely to be contacted (and therefore ingested) in the course of most normal activities by children (particularly those under 6 years of age).

On June 4, 2003, Nicole Fus (Public Health – Seattle and King County) and I met briefly with Vashon School District staff and Dr. Walker, and began collection of soil samples. Through the day, soil samples were collected at the District Garden east of the Vashon School District offices, at the Elementary School Garden southwest of Chautauqua Elementary School, the Kindergarten Play Area immediately northeast of Chautauqua Elementary School, and the grass strip at the north end of the parking lot to the north of Chautauqua Elementary School. The locations sampled, and sample number of each location and the DU number for this study are noted in Figures 1-4. Sampling was conducted in accordance with the general recent mainland child use area sampling methods and as detailed in the Field Sampling Plan for the Vashon School District, as developed by the Department of Ecology on April 15, 2003 and subsequently reviewed and approved by Dr. Walker and Vashon School District staff. Samples were collected at two depth intervals, 0-2" and 2-6" using specially constructed core samplers. For those sample locations at which soil was too dry to be retained in the coring device, the area described by the coring device was collected using a washed stainless steel spoon. Most samples were transferred from the coring device directly to a new 1qt. sealing-type plastic "freezer" bag for field screening with an X-ray fluoroscopy field instrument prior to being transferred to laboratory-supplied sample jars. Each bag and jar was labeled with the DU and sample number and dare and time of sampling. Sample locations were noted on DU maps provided below as Figures 1-4. Samples split to provide blind field duplicate samples were placed in a stainless steel bowl, mixed thoroughly for 30-45 seconds with a washed stainless steel spoon and placed in two separate bags, appropriately numbered and analyzed using XRF, then subsequently provided for laboratory analysis as separate numbered samples indistinguishable from other samples (to the analytical lab). Samples were stored on (double bagged) ice in coolers or refrigerated in a locked refrigerator (June 6-10) until XRF results were obtained and recorded. Samples were then transferred to 8-oz jars with teflon lined lids, previously acid washed to assure no metals present in the sample jar interior, as supplied by OnSite Environmental, Inc. OnSite Environmental, Inc. is an Ecology certified analytical laboratory in Redmond, WA, and conducted laboratory analysis using EPA Method 6020 inductively-coupled plasma/mass spectroscopy following microwave digestion to extract metals from an aliquot (small part) of the submitted soil sample. Samples were sieved to 2 mm or less prior to extraction per MTCA standard methods for metals. Samples were delivered to OnSite Environmental, Inc. in a verified Chain of Custody on June 11, 2003. Results were received by Ecology and the Vashon School District on June 15, 2003.

Results

Because of the variability in contaminant distribution even over very small distances established in previous studies, the sample locations and number of samples were commensurate with providing a reasonable representation of conditions at each DU sampled, but no inferences can or should be made to other areas not sampled. The results for each DU are discussed separately for that reason. These sample results represent only developed play areas. As established in previous studies, contaminant levels in undisturbed (forested) areas are significantly higher, and corresponding potential for exposure are also higher if children use these areas to play in.

DU-4, Chautauqua Elementary School Parking Lot, north grass strip

The Vashon School District reports that, following sampling in 2001, this area was deep-tilled to a depth of 12-18 inches, thoroughly mixing the soils to that depth.

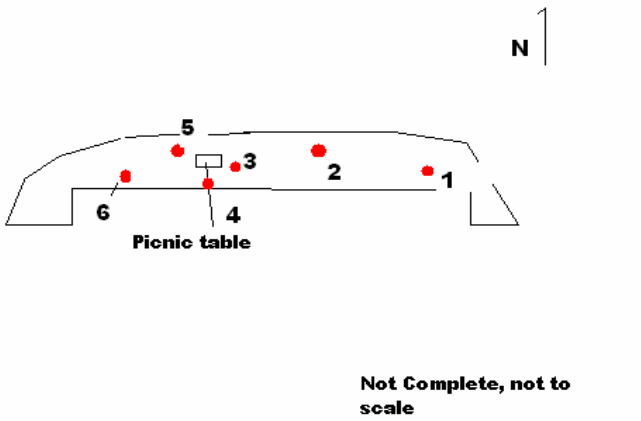

Figure 1 DU-4, Chautauqua Elementary N. parking lot grass strip sample locations

No	XLNo	VMICUA#	Lab Sample #	Notes	Lab As
1 0-2"	N/A	2-6-2-1-1	N/A		8.7
1 2-6"	N/A	2-6-2-1-2	N/A		10
2 0-2"	N/A	2-6-2-2-1	N/A		21
2 2-6"	N/A	2-6-2-2-2	N/A		13
3 0-2"	N/A	2-6-2-3-1	N/A		6
3 2-6"	N/A	2-6-2-3-2	N/A		7.8
4 0-2"	N/A	2-6-2-4-1	N/A		13
4 2-6"	N/A	2-6-2-4-2	N/A		11
5 0-2"	N/A	2-6-2-5-1	N/A		12
5 2-6"	N/A	2-6-2-5-2	N/A		12
6 0-2"	N/A	2-6-2-6-1	N/A		21
6 2-6"	N/A	2-6-2-6-2	N/A		64
7 0-2"	N/A	2-6-2-7-1	N/A		6.2
7 2-6"	N/A	2-6-2-7-2	N/A		9.7
8 0-2"	N/A	2-6-2-8-1	N/A		14
8 2-6"	N/A	2-6-2-8-2	N/A		8.1
DU averages			(all depths)		14.84
Average				0-2"	12.74
				2-6"	16.95

Table 1 Chautauqua Elementary Parking Lot North Grass Strip (VMI-CUA 2000)
Sample results from the initial round of sampling before remediation.

No & depth	XLNo	VSDSample#	Lab Sample #	Notes	Lab Pb	Lab As
Chatauqua Elementary N. Parking Strip						
1 0-2" 206	405	VSD12411	06-094-39		**12.00**	**7.30**
1 2-6" 207	406	VSD12412	06-094-40		**12.00**	**7.20**
2 0-2" 208	407	VSD12421	06-094-41		**13.00**	**9.10**
2 2-6" 209	408	VSD12422	06-094-42		**12.00**	**8.50**
3 0-2" 211	410	VSD12431	06-094-43		**19.00**	**8.80**
3 2-6" 212	411	VSD12432	06-094-44		**15.00**	**7.50**
4 0-2" 213	412	VSD12441	06-094-45		**29.00**	**13.00**
4 2-6" 214	413	VSD12442	06-094-46		**24.00**	**12.00**
5 0-2" 215	414	VSD12451	06-094 -47		**31.00**	**14.00**
5 2-6" 216	415	VSD12452	06-094 -48		**35.00**	**15.00**
6 0-2" 217	416	VSD12461	06-094-49		**11.00**	**5.60**
6 2-6" 218	417	VSD12462	06-094-50		**11.00**	**5.40**
7 0-2" 219	418	VSD12471	06-094-51	FDUP416	**11.00**	**5.30**
7 2-6" 220	419	VSD12472	06-094-52	FDUP417	**14.00**	**6.40**
DU Average					**17.79**	**8.94**
Average			0-2"		**18.00**	**9.01**
			2-6"		**17.57**	**8.86**

Table 2 Chautauqua Elementary North Parking Lot grass strip results[1] Sample 7 is a "blind" field duplicate of Sample 6. [3]

All lead (Pb) and arsenic (As) sample results and average values are below both interim action trigger levels and MTCA cleanup standards in this decision unit (DU) at depths to 6" below ground surface. Overall, As results are about 60% of the results obtained in 2000 during the Vashon-Maury Island Child Use Area Study , or about about 1/3 less.

On-site evaluation suggests that this location had also previously been graded, disturbing the soil to some degree, based on differences in elevation between the parking lot, grass strip and the adjacent, undisturbed wooded area about 10-15 meters north of the area sampled. Grass cover is well established, with strong sod formed and little if any exposed soil in most areas. There is no known barrier between soils determined to be below cleanup standards and underlying soils, which may or may not be more contaminated.

Sample collection in this DU was slightly biased toward the small concrete table and benches, which present a feature attractive to children. There is slight variation between the two sample results sets in the field duplicate set, but these are well within normally acceptable within-sample variance. Although slightly elevated above state-wide average soil values for As (7.7 mg/kg), the difference is not highly significant. Use of Safe Soil guidelines are recommended for children using this area.

DU-3, Chautauqua Elementary Kindergarten Play Area

This DU was sampled during the Vashon-Maury Island Child Use Area Study in 2000, and has had clean soil added and tilled in to a depth of 12-18 inches as reported by the Vashon School District. As a matter of observation, it appears that the grade in most of the play area is about 6-12 inches below the grade of the adjacent forested area, and it is possible that there is some drainage and associated erosion of undisturbed soils into this area from the undisturbed forest areas to the north and northeast of this play area.

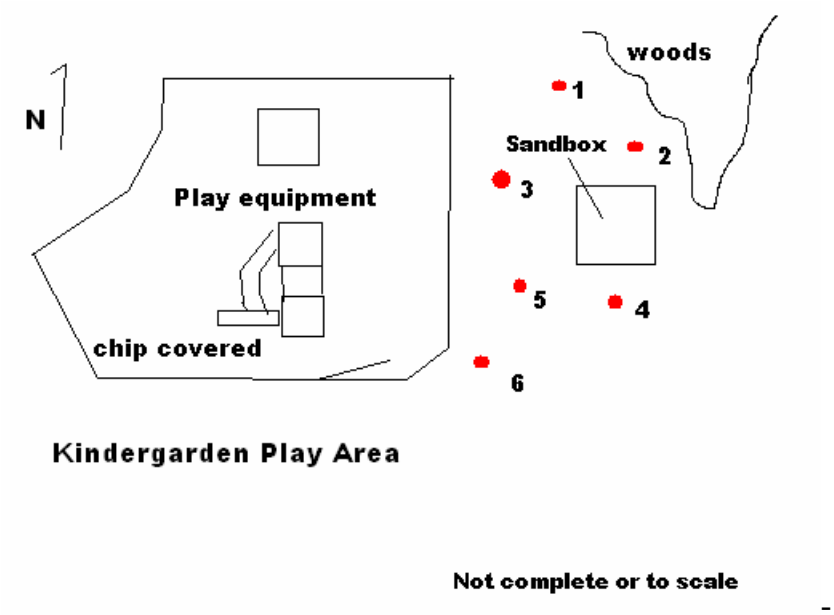

Figure 2 DU-3, Chautauqua Elementary Kindergarten Play Area sample locations

Chatauqua Elementary Kindergarten Play Area (VMI-CUA 2000 results)

No	XLNo	VMICUA#	Lab Sample #	Notes	Lab As
1 0-2"	N/A	2-6-3-1-1	N/A		16
1 2-6"	N/A	2-6-3-1-2	N/A		4.1
2 0-2"	N/A	2-6-3-2-1	N/A		11
2 2-6"	N/A	2-6-3-2-2	N/A		7.2
3 0-2"	N/A	2-6-3-3-1	N/A		59
3 2-6"	N/A	2-6-3-3-2	N/A		19
4 0-2"	N/A	2-6-3-4-1	N/A		5
4 2-6"	N/A	2-6-3-4-2	N/A		4.4
5 0-2"	N/A	2-6-3-5-1	N/A		9.4
5 2-6"	N/A	2-6-3-5-2	N/A		13
6 0-2"	N/A	2-6-3-6-1	N/A		14
6 2-6"	N/A	2-6-3-6-1	N/A		8.8
7 0-2"	N/A	2-6-3-7-1	N/A		5
7 2-6"	N/A	2-6-3-7-2	N/A		10
8 0-2"	N/A	2-6-3-8-1	N/A		2.5
8 2-6"	N/A	2-6-3-8-2	N/A		4.8
DU averages			(all depths)		12.08
Average			0-2"		15.24
			2-6"		8.91

Table 3 Arsenic results from Vashon-Maury Island Child Use Area Study (2000), Chautauqua Elementary Kindergarten Play Area (DU-3) sampling[2].

No & depth	XLNo	VSDSample#	Lab Sample #	Notes	Lab Pb	Lab As
Chatauqua	Elementary	Kindergarten	Play Area			
1 0-2" 221	420	06-094-27	06-094-27		**16.00**	**6.70**
1 2-6" 246	445	06-094-28	06-094-28		**14.00**	**5.80**
2 0-2" 247	446	06-094-29	06-094-29		**74.00**	**86.00**
2 2-6" 249	448	06-094-30	06-094-30		**17.00**	**27.00**
3 0-2" 250	449	06-094-31	06-094-31		**9.40**	**3.20**
3 2-6" 251	450	06-094-32	06-094-32		**8.50**	**3.40**
4 0-2" 252	451	06-094-41	06-094-33		**9.00**	**3.50**
4 2-6" 253	452	06-094-42	06-094-34		**9.10**	**3.80**
5 0-2" 254	453	06-094-51	06-094-35		**20.00**	**8.60**
5 2-6" 256	455	06-094-52	06-094-36		**12.00**	**5.50**
6 0-2" 257	456	06-094-61	06-094-37		**11.00**	**5.80**
6 2-6" 258	457	06-094-62	06-094-38		**11.00**	**6.10**
DU averages			(all depths)		**17.58**	**13.78**
Average			0-2"		**23.23**	**18.97**
			2-6"		**11.52**	**8.60**

Table 4: Chautauqua Elementary Kindergarten Play Area analytical results, June 2003 Vashon School District Study

Soil composition indicates that sand and/or gravel has been mixed with the native soils in this area. Grass cover is poor to nonexistent. The sandbox in this play area is constructed of fairly new wood that was treated with chromated copper arsenate (CCA) by the manufacturer/supplier. There is considerable exposed CCA treated wood, and this constitutes an additional exposure to arsenic for children playing in the area. This potential for As exposure could be considerably reduced by maintaining paint or some other material that covers the CCA treated wood of which the sandbox is constructed, or replacing the CCA wood with other, non-arsenic-containing structural material such as recycled plastic timbers or boards or a plastic/wood composite material. CCA-treated wood can contain arsenic at up to 8000 mg/kg. Fresh CCA-treated wood can contain treatment solution residue that is easily brushed off or that can adhere to human skin, particularly damp or sweaty skin. All samples in this DU were well below interim action trigger levels and MTCA cleanup standards for lead (Pb). All samples and averages were below the interim action trigger levels for arsenic (As), although the average was close to the MTCA cleanup standard of 20 mg/kg As (18.97 in the 0-2" depth interval), primarily driven by a single discrete sample near the undisturbed forested land adjacent to the play area with an arsenic level of 86 mg/kg. Overall average As concentration for this round of sampling were about 110% of the results obtained during the VMI-CUA study in 2000. This difference may or may not be significant; further sampling in the absence of measures to reduce exposure at this location would be required to establish whether or not a trend exists or whether the difference is simply due to normal variability. Variability within this CUA is very high: the standard deviation of soil As levels exceeds the mean by about 10%. This indicates a high likelihood of even higher concentrations in small localized areas not included in samples collected for analysis. Pb:As ratios for the highest samples in this DU are not typical of TSP soil contamination, and may point to another source of the As contamination, or may be due to differential migration of contaminants in or on the soil. In combination with the CCA wood sandbox structure in this area and the age of kindergarten students, there is a likely significant risk of arsenic exposure in this play area as currently configured. Without further changes in conditions

in this area, special care should be taken to assure that all children who use this area carefully wash their hands thoroughly with soap and water after using this play area, and removing shoes before entering classroom areas is recommended (shoe removal should be accomplished before hand washing to avoid re-contaminating hands with soil from shoes). In the alternative, implementing measures that reduce the potential for exposure is a viable possibility, and would reduce the attention needed to daily protection measures by individual children and their teachers. Such measures include:

- Paint sandbox CCA wood, or cover with vinyl sheeting or padding to eliminate or minimize contact with CCA treated wood
- Place an additional fence, or extend the play equipment enclosure fence to reduce access to wooded areas adjacent to the play area.
- Place a geo-textile membrane and wood or bark chips, or place rubber mats over soil in the play area. Excavation and placement of at least a foot of clean, imported soil over a geo-textile membrane would serve the same function.

A small retaining wall in combination with the suggested fence (above) at the forest periphery would reduce the potential for erosion of contaminated soils from that area down into the play area, and is worth considering. Potential for arsenic exposure would be considerably reduced if the CCA wood sandbox were not present; soil exposure alone would be considerably less problematic. If the potential for erosion of contaminated soils from undisturbed areas down into the play area remains unchanged, resampling soils near the periphery every two to four years is recommended. These sample results should be subjected to trend analysis to determine if soil and contaminant migration from undisturbed areas into the play area is occurring.

DU-2, Chautauqua Elementary School Garden

The elementary school garden has not been previously sampled. Raised beds have been installed, where most annual food and ornamental plants are grown. The source of the soil in the raised beds had not been previously tested for metals according to the school district, so samples were collected in both the raised beds and the native soil in the garden (even though they came from off-island). The upper terrace of the garden appears to be near the elevation of surrounding areas, while the lower terrace where the raised beds are located appears to be cut significantly below the previous (pre-construction) grade. Relationship of existing grade to pre-construction grades is not known.

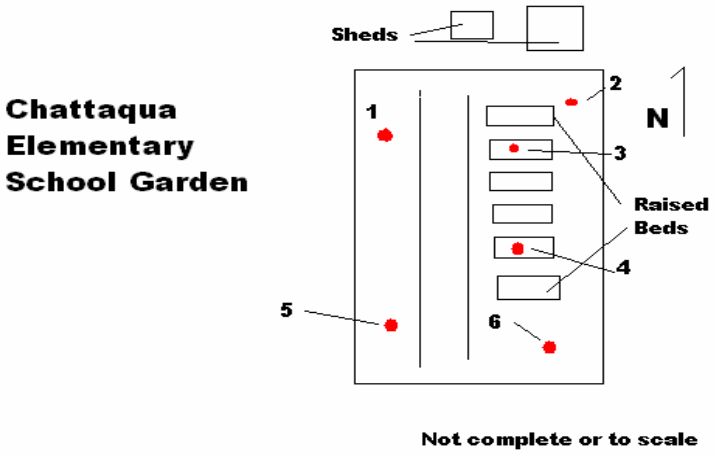

Figure 3 DU-2, Elementary School Garden Sample Locations

Chautauqua Elementary School Garden						
No	XLNo	VSDSample#	Lab Sample #	Cor1	Lab Pb	Lab As
1 0-2" 259	458	VSD12211	06-094-15		**12.00**	**7.00**
1 2-6" 260	459	VSD12212	06-094-16		**11.00**	**6.40**
2 0-2" 261	460	VSD12221	06-094-17		**23.00**	**8.50**
2 2-6" 262	461	VSD12222	06-094-18		**63.00**	**17.00**
3 0-2" 263	462	VSD12231	06-094-19	Rbed	**56.00**	**6.50**
3 2-6" 264	463	VSD12232	06-094-20	Rbed	**62.00**	**6.50**
4 0-2" 265	464	VSD12241	06-094-21	Rbed	**39.00**	**6.70**
4 2-6" 266	465	VSD12242	06-094-22	Rbed	**27.00**	**6.60**
5 0-2" 267	466	VSD12251	06-094-23		**8.80**	**5.40**
5 2-6" 268	467	VSD12252	06-094-24		**7.00**	**4.60**
6 0-2" 270	469	VSD12261	06-094-25		**20.00**	**9.90**
6 2-6" 271	470	VSD12262	06-094-26		**20.00**	**9.50**
DU Averages					**29.07**	**7.88**
Average			0-2"	0-2"	**22.55**	**7.33**
			2-6"	2-6"	**31.67**	**8.43**

Table 5 Chautauqua Elementary School Garden sample results, June 2003. "Rbed" indicates a soil sample collected from a raised bed.

All lead (Pb) and arsenic (As) results for this DU, discrete and average, are well below both interim action trigger levels and MTCA cleanup standards. This highest As discrete sample was 17 mg/kg, near the northeast corner of the garden. Pb concentrations are slightly higher in the raised beds than in native soils sampled, but the difference is not significant, and remains less than 25% of MTCA cleanup standards. Following safe soil guidelines is still recommended for other reasons than metals contamination, but risk of significant exposures to Pb and As is very low, as most sample results are near or slightly below state-wide averages. No additional remedial measures are necessary at this DU at the depth intervals tested.

DU-1, Vashon School District Garden

The Vashon School District garden was sampled during the Vashon-Maury Island Child Use Area study by PHSKC in 2001 (see PHSKC and Greg Glass, 2002). Results showed moderate levels of contamination, with maximum of 41 mg/kg As. The school district subsequently tilled and added compost and other soil amendments. Soil appeared well mixed and high in organic content.

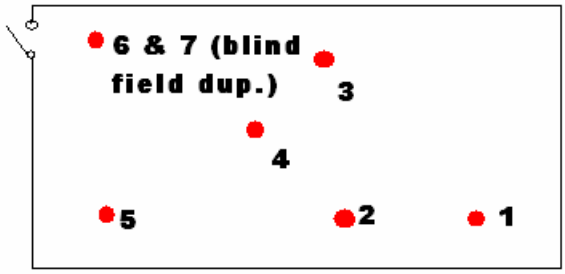

Figure 1 School District Garden

Figure 4 DU-1, Vashon School District Garden Sample Locations. Sample # 7 is a "blind" field duplicate of sample # 6

No	XLNo	VMICUA#	Lab Sample #	Notes	Lab As
1 0-2"	N/A	2-9-1-1-1	N/A		19
1 2-6"	N/A	2-9-1-1-2	N/A		19
2 0-2"	N/A	2-9-1-2-1	N/A		35
2 2-6"	N/A	2-9-1-2-2	N/A		41
3 0-2"	N/A	2-9-1-3-1	N/A		32
3 2-6"	N/A	2-9-1-3-2	N/A		20
4 0-2"	N/A	2-9-1-4-1	N/A		36
4 2-6"	N/A	2-9-1-4-2	N/A		38
DU averages			(all depths)		30.00
Average				0-2"	30.50
				2-6"	29.50

Table 6 Vashon School District Garden VMI-CUA 009 (2000) results

Vashon School District Garden						
No. & depth	XLNo	VSDSample#	Lab Sample #	Notes	Lab Pb	Lab As
1 0-2" 272	471	VSD12111	06-094-01		**16.00**	**7.70**
1 2-6" 273	472	VSD12112	06-094-02		**20.00**	**9.20**
2 0-2" 274	473	VSD12121	06-094-03		**49.00**	**25.00**
2 2-6" 275	474	VSD12122	06-094-04		**46.00**	**23.00**
3 0-2" 276	475	VSD12131	06-094-05		**45.00**	**24.00**
3 2-6" 277	476	VSD12132	06-094-06		**42.00**	**22.00**
4 0-2" 279	478	VSD12141	06-094-07		**65.00**	**31.00**
4 2-6" 280	479	VSD12142	06-094-08		**68.00**	**33.00**
5 0-2" 281	480	VSD12151	06-094-09	FDUP478	**65.00**	**30.00**
5 2-6" 282	481	VSD12152	06-094-10	FDUP479	**68.00**	**34.00**
6 0-2" 283	482	VSD12161	06-094-11		**41.00**	**23.00**
6 2-6" 284	483	VSD12162	06-094-12		**52.00**	**29.00**
7 0-2" 285	484	VSD12171	06-094-13		**36.00**	**22.00**
7 2-6" 286	485	VSD12172	06-094-14		**36.00**	**22.00**
DU averages					**46.36**	**23.92**
Average			0-2"		**45.29**	**23.24**
			2-6"		**47.43**	**24.60**

Table 5 Vashon School District Garden sample results, June 2003. Sample 5 is a "blind" field duplicate of sample 4.

All lead (Pb) results, average and discrete, are below both interim action trigger levels and MTCA cleanup standards, and are not of particular concern. Arsenic (As) results are below the interim action trigger levels, but slightly above the MTCA cleanup standards; this is true of both discrete results and averages. Overall, the average soil arsenic value is about 80% of the average value found during the 2000 VMI-CUA sampling. The reduction in variability in As concentration (the standard deviation drops from a little over 9 to just over 7) indicates a slightly more uniform concentration of As in the soil. In an area such as the Tacoma Smelter Plume, where very high localized variability in contaminant concentration is characteristic, evening out the distribution gives more confidence to the observed reduction attributable to addition of clean soil admix material. It appears that levels are lower and more uniform that those found in the Vashon-Maury Island Child Use Area testing two years ago, but As levels remain above cleanup standards. Because the primary users of this garden are older students, it is easier to assure that behavioral controls (e.g. washing hands, removing shoes after working in the garden and before entering the classroom, etc.) will be implemented. Since food crops are grown in this garden, special care should also be taken to wash all vegetables and fruits grown here, and washing and peeling of root crops (potatoes, carrots, beets, radishes, etc.) before consumption is strongly recommended if root crops are grown. If you continue the practice of adding clean (i.e. containing no As or Pb) compost and tilling the garden, it seems likely that over the course of a few more years As levels in the soil will continue to attenuate to below MTCA Method A cleanup standards. Actions taken to reduce arsenic levels in the soil in this garden are considered remedial actions, and are eligible for remedial action grant monies from Ecology's Solid Waste and Financial Assistance Program, at a 50% matching grant level after entering into an Agreed Order with Ecology.

Re-sampling of soils in this garden is recommended, along with keeping good records of soil amendments added and actions (e.g. tilling, turning over soil) to track the effects of your actions, and add to the level of knowledge of ways to deal with this type of contamination.
Safe Soil Guidelines are strongly recommended for anyone working with soils or plants in this garden. Any produce harvested from the garden should be thoroughly washed (scrubbed) and rinsed, and root crops should be scrubbed and peeled. If you have additional questions about practices to reduce risk from activities in this garden, Public Health – Seattle and King County has literature and staff to assist in providing answers and/or training in some instances.

Summary

All DUs sampled are below interim action trigger levels and MTCA cleanup standards for lead (Pb) in the top six (6) inches of soil children are most likely to be exposed to. Two of the four DUs are below interim action trigger levels and MTCA cleanup levels for arsenic (As) in all sample locations in the top six inches. Two DUs had either average or very high discrete sample results for arsenic (As) in the top six inches of soil that exceed MTCA cleanup standards, but are below Interim Action Trigger Levels. Because of the age of the children using the Kindergarten Play Area, and the presence of exposed CCA treated wood as an additional exposure source for arsenic, combined with the difficulty in assuring behavioral practices to reduce exposure in these young children, some additional measures to reduce exposure potential are suggested in this area beyond Safe Soil Guidelines (which are recommended for all soils). In the District Garden, if Safe Soil Guidelines are followed, they should be adequate to reduce or minimize exposure to arsenic, and are more easily practiced regularly by older students, who are also less likely to ingest soil inadvertently or intentionally. Thorough cleaning and/or peeling of vegetables to be eaten from this garden is strongly recommended. In the long term, this DU seems likely to be remediated through normal use practices, and tracking arsenic contamination levels is recommended, along with keeping good records of practices in the garden.

If you have questions about technical aspects of this report, please contact Norm Peck at (425) 649-7047 or Guy Barrett at (360) 407-7115.

[1] XRF screening results were taken for all samples in the VSD 2003 soil study, but are not presented here. A comparison of XRF and Laboratory data will be completed in a separate report.

[2]Data from the VMI-CUA Study were excerpted from Ecology's EIM database using data migrated from the PHSKC TSP database. Lab sample numbers are not available in the EIM database, and no XRF screening was conducted prior to 2003.

[3] Field (blind) duplicate samples were included in calculation of the average soil concentration for the DU and depth interval in lieu of either averaging the results of the original and duplicate sample or eliminating the duplicate from the calculation. While there are valid arguments for any of these approaches from a statistical perspective, the difference in using any of these approaches does not change the results in this instance.