ENVIRONMENTAL HEALTH COUNCIL

Soil Sample Results from Huancavelica School Grounds - October 2019

Prepared by: Bryn Thoms, RG
Technical Lead, The EHC

Nicholas Robins, PhD
Executive Director, The EHC

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Sample Collection and Analysis

On September 20, 2019 and October 10, 2019 soil samples were collected from nine school grounds for analysis of arsenic (As), mercury (Hg), and lead (Pb) to assess potential risk to children from exposure to heavy metals in shallow soil associated with historic contamination. Samples were collected from a common area were children play at each school. Five aliquots were collected from the top 5 to 8 cm of soil generally equidistant from each other throughout the play area. The aliquots were composited and homogenized to create one sample for each play area. Samples were identified by Peru's Ministry of Education school ID numbers and latitude and longitude. Sample locations are presented on the attached figure. Sample information is presented in the attached table.

Samples were shipped to Ingenería Laboratorios SAC in Lima for x-ray fluorescence (XRF) analysis of 31 metals using an InnovX Delta field portable handheld XRF analyzer. As, Hg, Pb were the metals of focus for this assessment; results are presented in the attached table. USEPA Method 6200 was generally followed for collection, homogenization, and analysis of soil samples using XRF. XRF details are attached.

Sample Results

The following are the range of detections for each metal of interest:

As – 18 to 343 parts per million (ppm)
Hg – Not Detected to 552 ppm
Pb – 18 to 1186 ppm

The limit of detection is approximately 7 ppm for all the metals. The unit of measure for XRF analysis is ppm because XRF analysis does not use a weight measurement in the analysis process. However, ppm is equal to the commonly used fixed lab unit of measure milligrams per kilogram (mg/kg).

Risk Screening

The results table presents a set of screening values based on Peru's Ministry of Environment (MINAM). Shaded cells in the table are results that are above the MINAM screening values.

Of the nine sample locations, seven of the samples had As above the MINAM screening value, eight of the samples had Hg above the MINAM Screening value, and 5 of the samples had Pb above the MINAM screening values. Sample ES6 (School ID IEP 36368) was the only sample that did not have any of the metals above the MINAM screening value. The rest of the samples had at least one of the metals above the MINAM screening value. In addition, because the target population in this risk screening are children, and because children may be exposed to increased dust ingestion when playing on a non-hardened surface playground in possible dusty conditions, and because of children's increased uptake of certain heavy metals, conservative screening values are appropriate.

Recommendations

All of the school playgrounds, except school IEP 36368 (sample ES6), have metals concentrations above MINAM screening values for residential exposures which includes exposures to children. The EHC recommends that the exposure be eliminated. This can be done by keeping children from playing in the playground, by capping the playground with a hardened surface, or removing the contaminated soil and replacing with clean soil. The most appropriate mitigation measure may be capping of the playground with asphalt or concrete. Removing soil may be difficult because the depth of contamination is unknown. Based on general contaminant delineation in Huancavelica, contamination may be several feet deep. If soil is removed and replaced with clean soil, maintenance of the clean material may be more involved than maintenance of a hardened surface. For longevity, and for assurance of full elimination of the hazard, The EHC recommends that the contaminated playgrounds be capped with a hardened surface.

Attachments –

Figure - Sample Locations
Table - Sample Results
XRF Detail Sheet


School Ground Soil Sample Locations
Huancavelica, Peru September/October 2019
Legend
Feature 1
Huancavelica
ES1
ES2
ES3
ES4
ES5
ES6
ES7
ES8
ES9
Huancayo-Huancavelica
28 De Abril
Huancavelica
Google Earth
Image © 2019 CNES / Airbus
© 2018 Google
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1 mi

Soil Sample Results
X-ray Fluorescence in Parts Per Million (ppm)
Huancavelica School Grounds, September/October 2019

Sample ID	Sample Location	Sample Date	Sample Time	Depth (cm)	Lat (DD)	Long (DD)	As (ppm)	Hg (ppm)	Pb (ppm)	Comment
ES-1	IESS Cristobal	9/20/2019	930	5-10	-12.783333	-74.96889	190	40	186	Patio de cemento solo garrenes
ES-2	IEI 1116	9/20/2019	1058	5-8	-12.788889	-74.96861	58	7	65	Construccion _ patio de tierra rustico
ES-3	IEI 582	9/20/2019	1125	5-9	-12.774167	-74.96167	32	9	41	Construccion_patio de tierra real pro tamiento
ES-4	IEP 36004	9/20/2019	1223	5-10	-12.785556	-74.98056	204	552	341	
ES-5	Aldia Infaltil	9/20/2019	1252	5-15	-12.781944	-74.98639	263	27	77	Patio de tierra
ES-6	IEP 36368	9/20/2019	1330	5-10	-12.771667	-75.00750	18	<LOD	18	Construcccion con patio de tierra material rustico aqallqui grande
ES-7	IEP 36475	9/20/2019	1405	5-10	-12.784167	-74.99222	343	165	1186	Patio es pared tierra grande_ es con tierra
ES-8	IEI 534	9/10/2019	1123	5-8	-12.78456	-74.99189	188	144	398	Patio de tierra
ES-9	IE 35001	9/10/2019	1228	5-10	-12.77935	-74.9711	170	21	214	Patio de tierra
Screening Values										
MINAM Residential							50	6.6	140	

Note
cm - centimeters
DD - Decimal Degrees
ppm - parts per million
<LOD - less than limit of detection
cells shaded indicate that the result is above the MINAM screening value