U.S. Army Center for Health Promotion and Preventive Medicine (Provisional)

Just the Facts

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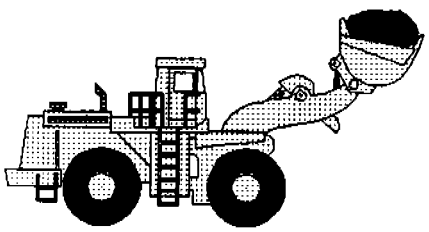
Lead Contamination and Soil Sampling



- **DPW/PVNTMED Svc**
- **TCLP**
- **Laboratory Analysis**

When Should You Consider Soil Sampling?

There are many situations which may call for an analytical assessment of lead concentrations in soil/sand. Some examples include:

1. Investigation of potential lead exposure sources in the case of a lead-poisoned child.

2. Scoping/risk assessment study for a housing area/community to identify potential sources of lead to the inhabiting child.

3. Characterization of a specific potential source to children (such as a playground, sandbox, or bare soil around a structure with chipping/peeling lead paint).

4. Assessment of "cleanliness" after demolition of lead-painted structures or after abatement projects.

5. "Future Use" clearance to ensure suitability for specific construction/future use at site.

6. Follow-up study of area previously identified as having high lead concentrations.

7. "Waste Characterization" of removed soil to determine whether soil must be treated as a hazardous waste.

Why Would Soil Sampling Be Necessary in These Situations?

For the first five situations (1-5) previously listed, soil sampling may be necessary to simply quantify the general concentration of lead in soil of a particular area or source in order to evaluate the hazards related to the specific exposure scenario. Though it will depend on the size of the area sampled, these situations typically call for limited sampling.

The sixth situation (6) previously listed would necessitate soil sampling to determine the actual extent of lead contamination once high concentrations were identified. More extensive sampling may be necessary to qualify the degree of contamination to include identifying horizontal and possibly vertical (depth) migration. Follow-up studies may also be used to evaluate the success of cleanup actions.

Finally, the last situation (7) previously listed involves a different type of laboratory analytical procedure. The analysis of a (soil) waste may be necessary to ensure that lead will not leach out of the soil when it is placed in an unlined landfill or placed back on the ground. The laboratory test, known as the Toxicity Characteristic Leaching Procedure (TCLP), does not provide the "total" lead concentration in the soil; rather, it provides a concentration of lead found in a leached "extract." This test is used specifically for evaluating already removed soil and should not be used in the situations (1-6) requiring a "total" evaluation of lead concentrations in soil.

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How Do You Design Your Sampling Strategy?

This fact sheet describes the method of collecting samples for laboratory analysis. Though a current approach using x-ray fluorescence (XRF) devices to evaluate soil-lead concentrations is becoming more and more popular, this Center considers sampling and laboratory analysis the most accurate method that, when done appropriately, is not excessively expensive. If used, XRFs should be used strictly as a screening tool and must be followed by confirmatory laboratory analyses.

Several sampling methodologies may be acceptable. You can use U.S. Department of Housing and Urban Development (HUD) guidance for certain situations. The following is suggested guidance only. We suggest you obtain further guidance/assistance to verify the appropriateness of a sampling strategy for your needs. Consult your installation environmental officer or the Waste Disposal Engineering Division at USACHPPM (Provisional).

Soil sampling for the first five situations previously listed would typically involve limited "point" sampling. The number of samples depends on the situation; however, one may consider a minimum of three samples for the smallest of areas (to allow for evaluation of variance) while larger areas may require ten or perhaps even more. These situations typically call for only an initial, general quantification of lead. Select sampling points either at random, based on bias, or both. "Biased" sample locations are selected at sites where high lead is suspected or known (such as an area adjacent to a house with visible paint chips). Obtain all the samples from the actual area of interest where there is a defined exposure potential and the soil is bare. For example, sampling next to a major highway is probably inappropriate because children are not expected to be playing there. Removing sod/vegetation to sample underlying soil is also inappropriate because of the lack of exposure potential to the bare soil.

A follow-up assessment (situation 6) most likely requires more intensive sampling - generally, a minimum of ten samples should be obtained for each area identified as a potential "hotspot." More samples may be necessary if the area is assumed to be large or if depth sampling is required. Sampling locations should radiate outward from previously identified areas (horizontally and vertically, if necessary). We suggest that you obtain further guidance before proceeding with a follow-up assessment. Waste characterization (situation 7) can be done by means of "generator knowledge" or through sampling and analysis (the TCLP). If sampling is performed, obtain and analyze two or three samples of soil that "represents" the waste.

What Do the Results Mean?

The EPA has identified soil lead levels ranging from 500-1000 parts per million (ppm) as being safe for residential scenarios. This Center currently suggests that for residential situations, a lead level at or below 500 ppm should be acceptable. This, however, does not mean that a single sample point exceeding 500 ppm is a problem. The overall results for an area should be statistically evaluated [e.g., the upper 80 percent confidence interval (CI) then compared to 500 ppm]. Specific points which exceed 500 ppm may or may not pose a problem, depending on the overall exposure potential. Whether action is required (such as soil removal or covering with clean soil or sod) will depend on the specifics of the situation. Additional assistance is advised in these cases. Keep in mind that remedial actions, such as removal, are usually costly and may not provide obvious benefits. In extreme cases where action is necessary, procedures, such as covering with clean soil or sod, are suggested.

When exposure to children is limited or unlikely, levels between 500 ppm and 1000 ppm are acceptable. Consistent concentrations above 1000, however, may indicate a threat to the environment as well as public health. In cases such as these, we advise that you obtain further guidance.

Finally, waste (removed) soil that has a lead-TCLP concentration exceeding 5 milligrams per liter (mg/L) is regulated as a hazardous waste. This involves specific handling, storage, and disposal requirements as described in Title 40, Code of Federal Regulations (CFR), Part 262, Standards Applicable to Generators of Hazardous Waste. Again, if isolated results exceed this threshold, they should be statistically assessed to identify the upper 80 percent CI.