APPENDIX A
Glossary

Absolute Bioavailability (ABA): The ratio of the amount of lead absorbed compared the amount ingested: ABA = (Absorbed Dose) / (Ingested Dose) (see relative bioavailability).

Absorbed Dose: The amount of a substance that penetrates an exposed organism's absorption barriers (*e.g.*, skin, lung tissue, gastrointestinal tract) through physical or biological processes (synonymous with internal dose).

Absorption Barrier: Any of the exchange barriers of the body that permits uptake of various substances at different rates (*e.g.*, skin, lung tissue, gastrointestinal-tract wall).

Absorption Fraction: Only a fraction of the lead entering the body through the respiratory or gastrointestinal tracts is absorbed into the systemic circulation. This absorption fraction is, by convention, termed bioavailability and provides the most convenient parameterization of the uptake process.

Accuracy: The measure of the correctness of data, as given by the difference between the measured value and the true or standard value.

Adult Lead Methodology (ALM): A mathematical equation used by the U.S. EPA to predict the lead concentration in soil that would be for non-residential areas (*e.g.*, industrial or commercial areas) where children are not likely to live or play.

Arithmetic Mean: The sum of all the measurements in a data set divided by the number of measurements in the data set.

Averaging Time: The default assumption for the averaging time is one year (365 days), which is sufficient time for blood lead to approach quasi-steady state.

Background Level (Environmental): The concentration of substance in a defined control area during a fixed period of time before, during, or after a data gathering operation.

Bias: A systematic error inherent in a method or caused by some feature of the measurement system.

Bioaccessibility: An *in vitro* measure of the physiological solubility of the contaminant that may be available for absorption into the body.

Bioavailability: Degree of ability to be absorbed and ready to interact in organism metabolism. The fraction of intake at a portal of entry into the body (*e.g.*, skin, lung tissue, gastrointestinal tract) that enters the blood. Bioavailability is typically a function of chemical properties,

physical state of the material that an organism ingests or inhales, and the ability of the individual organism to physiologically absorb the chemical. The absorption rate varies widely by type of substance and can greatly influence the toxicity of lead over that acute timeframe.

Biokinetics (BK): Processes affecting the movement of molecules from one internal body compartment to another, including elimination from the body.

Biokinetic Slope Factors (BKSF): µg/dL blood lead per mg/day lead uptake; an empirically-based estimate of the slope of the linear relationship between blood lead concentration and lead uptake (µg/dL per µg/day); reflects the biokinetics of absorbed, rather than ingested.

Comparability: The ability to describe likenesses and differences in the quality and relevance of two or more data sets.

Compartment: A distinct organ, tissue, fluid pool, or group of tissues within the body that are "kinetically homogeneous."

Conceptual Site Model (CSM): The CSM, a key element used in facilitating cleanup decisions during a site investigation, is a planning tool that organizes information that already is known about a site and identifies the additional information necessary to support decisions that will achieve the goals of the project. The project team then uses the CSM to direct field work that focuses on the information needed to remove significant unknowns from the model. The CSM serves several purposes: as a planning instrument; as a modeling and data interpretation tool; and as a means of communication among members of a project team, decision makers, stakeholders, and field personnel. From Waste and Cleanup Risk Assessment Glossary.

Decision Unit (DU): The mass of soil in the field for which a decision will be made based on the true concentration for that entire mass of soil. At a minimum, the DU's soil mass must be defined in terms of its location (Where is it?), spatial dimensions (What are its 3-dimensional boundaries?), and the targeted soil particle size (Everything <2 mm? Only the particles passing through a 60-mesh sieve? Or a 100-mesh sieve? etc.). The true concentration of the DU is the same concentration that would be obtained if the entire DU mass could be analyzed as a single giant sample in a single analysis.

Dose: The amount of a substance available for interaction with metabolic processes or biologically significant receptors after crossing the outer boundary of an organism. The potential dose is the amount ingested, inhaled, or applied to the skin. The applied dose is the amount of a substance presented to an absorption barrier and available for absorption

(although not necessarily having yet crossed the outer boundary of the organism). The absorbed dose is the amount crossing a specific absorption barrier (*e.g.*, the exchange boundaries of the skin, lung tissue, and gastrointestinal tract) through uptake processes; internal dose is a more general term denoting the amount absorbed, without respect to specific absorption barriers or exchange boundaries. The amount of the chemical available for interaction by any particular organ or cell is termed the delivered dose for that organ or cell.

Dust Loading (LD): The amount of dust per unit area expressed as micrograms per square meter ($\mu g/m^2$) or micrograms per square foot ($\mu g/ft^2$).

Exposure: Contact of a chemical, physical, or biological agent with the outer boundary of an organism. Exposure is quantified as the concentration of the agent in an ambient or environmental medium in contact integrated over the time duration of that contact.

Exposure Duration (ED): Period over which exposure occurs. The modeled ED should be sufficiently long to allow blood lead concentrations to approach quasi-steady state. As discussed in the guidance, the shortest period of time appropriate for an ED is three months (90 days).

Exposure Pathway: The path from sources of pollutants via soil, water, or food to man and other species or settings. The physical course a chemical or pollutant takes from the source to the organism exposed.

Exposure Point Concentration (EPC): The contaminant concentration within an exposure unit to which receptors are exposed. Estimates of the EPC represent the concentration term used in exposure assessment.

Exposure Route: The way a chemical or pollutant enters an organism after contact (*e.g.*, by ingestion, inhalation, or dermal absorption).

Exposure Scenario: A set of facts, assumptions, and inferences about how exposure takes place that aids the exposure assessor in evaluating, estimating, or quantifying exposures.

Exposure Unit (EU): The EU is generally the geographic area within which a receptor comes in contact with a contaminated medium; it should be defined based on the receptor, the exposure medium (*e.g.*, soil, water, sediment), and the nature of the receptor's contact with the medium. If the receptor is a resident exposed to soils in his/her yard, the EU will likely encompass the residential property. Other receptors, such as workers and recreators, may be exposed to contaminants across much larger areas, and a much larger EU may be appropriate.

Ex Situ: Not in the natural or original position or place. Other FP-XRF instruments require that soil samples are collected and placed in a sample cup that is then placed in a covered sample chamber for analysis.

Gastrointestinal (GI): Relating to the GI tract, or affecting the stomach and/or intestine.

Geometric Mean (GM): The central predicted value (*e.g.*, blood lead concentration) in a log-normally distributed population of observations. The IEUBK model calculates a log-normally distributed population of predicted blood lead concentrations. The predicted geometric mean blood lead concentration is the central value in that population.

Geometric Standard Deviation (GSD): The GSD describes the variability (or spread) in a log-normally distributed population of observations. The higher the GSD of the population, the greater the difference between the upper and lower tail of the population around the central value.

Guidelines: Principles and procedures to set basic requirements for general limits of acceptability for assessments.

Intake: The process by which a substance crosses the outer boundary of an organism without passing an absorption barrier (*e.g.*, skin, lung tissue, GI tract) (see potential exposure concentration).

Internal Dose: The amount of a substance penetrating across the absorption barriers (*e.g.*, skin, lung tissue, gastrointestinal tract) or an organism, via either physical or biological processes (see absorbed dose).

In Situ: In the natural or original position or place. Some FP-XRF instruments can be placed directly on the soil surface for *in situ* measurements.

Lead Absorption Factor (ABS_S): Fraction absorption from soil at low saturation (maximum absorption coefficient, active).

Lead Loading: The concentration of lead per unit area measured in micrograms per square meter ($\mu g/m^2$).

Lead Concentration in Air (PbA): The mass concentration of lead per mass of air, typically reported as micrograms per cubic meter ($\mu g/m^3$). However, IEUBK model default values for lead concentration in air can be replaced with site-specific data for indoor air lead concentration as a

percentage of outdoor air lead concentration (µg/m^3), outdoor air lead concentration (µg/m^3), time spent outdoors (hours/day), ventilation rate (m^3/day), or lung absorption (%).

Lead Concentration in Dust (PbD): The mass concentration of lead per mass of dust, typically reported as micrograms lead per gram dust (µg Pb/g dust) or in parts Pb per million dust (ppm). The IEUBK model uses lead concentration data as the metric to represent the extent and magnitude of lead in residential dust at a site.

Lead Concentration in Soil (PbS): The mass concentration of lead per mass of soil, typically reported as parts per million (µg Pb/g soil). Soil lead concentration is the only input parameter of the IEUBK model for which a site-specific value is recommended. The arithmetic mean of soil lead concentration for a representative exposure area in the yard should be used for the lead concentration in soil.

Lead Concentration in Water (PbW): The mass concentration of lead per mass of water, typically reported in micrograms lead per liter water (µg Pb/L water). Drinking water data are divided in the IEUBK model into water consumption rates and environmental concentrations based on age dependent, national averages. Consumption rates should only be changed ONLY when valid site-specific monitoring data are available.

Mass Fraction of Soil to Dust (M_{SD}): The mass fraction of soil-derived particles in indoor dust (g soil/g dust). The M_{SD} represents the mass fraction of house dust that is derived from outdoor soil. It is used in Multiple Source Analysis to compute the contribution of outdoor PbS to the indoor PbD concentration. The default value for M_{SD} recommended by the U.S. EPA is 0.70 g soil/g dust.

Median Value: The value in a measurement data set such that half of the measured values are greater and half are less.

Pathway: The physical course a chemical or pollutant takes from the source to the exposed organism.

Pharmacokinetics: The study of the time course of absorption, distribution, metabolism, and excretion of a foreign substance (*e.g.*, a drug or pollutant) in an organism's body.

Pica: Deliberately ingesting soil. Individuals exhibiting pica behaviors may have soil ingestion rates well in excess of the typical ingestion levels used in most U.S. EPA risk assessments. Pica exposure is generally not assessed in Superfund lead risk assessments.

Potential Exposure Concentration: The amount of a chemical contained in material ingested, air breathed, or bulk material applied to the skin (see intake).

Precision: A measure of the reproducibility of a measured value under a given set of conditions.

Preliminary Remediation Goal (PRG): In the process of screening a soil against a certain contaminant, we define the health-risk-based PRG as the contaminant concentration above which some remedial action may be required. Thus, the PRG is the first standard (or guidance) for judging a site.

Probability Samples: Samples selected from a statistical population such that each sample has a known probability of being selected.

Quasi-Steady State: An intake over a sufficient duration for the blood lead concentration to become nearly constant over time. Based on estimates of the first-order elimination half-time for lead in blood of approximately 30 days for adults, a constant lead intake rate of over a duration of 90 days would be expected to achieve a blood lead concentration that is sufficiently close to the quasi-steady state.

Quincunx: a geometric pattern consisting of five points arranged in a cross, with four of them forming a square or rectangle and a fifth at its center.

Random Samples: Samples selected from a statistical population such that each sample has an equal probability of being selected.

Range: The difference between the largest and smallest values in a measurement data set.

Reasonable Worst-Case Exposure or Risk Range: The lower portion of the “high end” of the exposure, dose, or risk distribution. An estimate of the individual dose, exposure, or risk level received by an individual in a defined population that is greater than the 90^{th} percentile but less than that received by anyone in the 98^{th} percentile in the same population (“maximum exposure or risk range”).

RSL: Residential screening level for soil.

Relative Bioavailability (RBA): The ratio of the absolute bioavailability of lead present in some test material compared to the absolute bioavailability of lead in some appropriate reference material: RBA = ABA(test) / ABA(reference).

Representativeness: A measure of how closely the sample (a sub-set of a population) matches the target (entire) population.

Representative Sample: A subset of a statistical population that accurately reflects the members of the entire population. A representative sample should be an unbiased indication of what the population is like. http://www.investopedia.com/terms/r/representative-sample.asp

Reproducible: The coefficient of variation or relative standard deviation (equal to the ratio of sample standard deviation to the mean) is acceptable given site DQOs.

Residential Properties: Residential properties include single- and multi-family dwellings, apartment complexes, vacant lots in residential areas, schools, daycare centers, community centers, playgrounds, parks, green ways, and any other areas where children may be exposed to site-related contaminated media (U.S. EPA, 1996a, 1997a, 1998a).

Risk: A measure of the probability that damage to life, health, property, and/or the environment will occur as a result of a given hazard.

Route: The way a chemical or pollutant enters an organism after contact (*e.g.*, by ingestion, inhalation, or dermal absorption).

Sampling Unit (SU): The mass, volume, or area of soil in the field represented by a single sample and single data result(s) [the sample data can consist of results for many analytes]. Where a DU is represented by a 30-increment incremental sample, the DU is the same physical area as the SU. But the term "SU" is usually reserved for masses of soil that are smaller than DUs. SUs are commonly used to detect concentration trends or boundaries between "clean" and "contaminated" areas. For example, a nine-point composite sample might be used to represent a four-square foot SU area. A line of 10 nine-point-composite 100 square feet (9.3m^2) might form a transect looking to pin down a spill boundary. Unlike grab samples, the nine-point composites avoid the risk that results will be biased high or low by short-scale heterogeneity. An SU of one square foot area should be sampled with at least five increments. An even better approach when the targeted surface soil layer is thin (*i.e.*, only a few inches deep) is to collect the entire volume encompassed by the one-square foot by X-inch depth.

Scenario Evaluation: An approach to quantifying exposure by measurement or estimation of both the amount of a substance contracted and the frequency/duration of contact, and subsequently linking these together to estimate exposure or dose.

Structural Equations Model: A statistical model of a process, in which several regression equations are solved simultaneously, and outputs or responses from one equation may be used as inputs or predictors in another equation. Note: Useful in pathway modeling. https://en.wikipedia.org/wiki/Structural_equation_modeling

Surrogate Data: Data from studies of test organisms or a test substance that are used to estimate the characteristics or effects on another organism or substance.

Upper Confidence Level (UCL): The upper limit of a confidence interval for a population parameter, such as the mean, at a specified level of confidence (*e.g.*, 95 percent [%]). For example, the 95% UCL of a mean is defined as a value that, when calculated repeatedly for randomly drawn subsets of site data, equals or exceeds the true mean 95 percent of the time.

Uptake: Entrance into the body; mass of lead absorbed per day from diet or inhalation) into the systemic circulation of blood (µg/day).