

Risk-Based Remedies

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April 8, 2009

Mr. Richard H. Krumrine
Supervisor of Buildings and Grounds
Great Valley School District
47 Church Road
Malvern, PA 19355

Dear Mr. Krumrine:

Based on our discussions of last week, this letter presents a brief and qualitative risk assessment for the potential for adverse effects to occur if garden vegetables are grown on the property acquired by the Great Valley School District. The property is located approximately one-quarter mile north of the Foote Mineral Superfund Site on Bacton Hill Road in East Whiteland Township, Chester County. The property is currently a cornfield and has historically been used for agricultural purposes. The District has proposed to farm approximately 2 acres of the 50 acre property as a school project.

The approach to our evaluation is to consider the past, current and future uses of the land, the residual substances that may be present in the soil, the vegetables intended to or likely to be grown, the potential toxicity of the residual substances, and the likelihood that should such vegetables be grown in these soils with these residual substances, would an adverse effect potentially occur.

Evaluation of Soil Data

In July 2008, Spotts, Stevens and McCoy, Inc. (SSM) performed a Phase I Environmental Site Assessment (ESA) for the property. Four surface soil samples were collected from the 2-acre parcel on February 16, 2009, and submitted for analysis of constituents identified during the Phase I ESA. The samples were analyzed for eight inorganic substances [antimony, arsenic, boron, chromium (total), chromium (hexavalent), copper, lead, and zinc], volatile organic compounds (1,2-dichloroethane, benzene, ethyl ether, n-hexane, tetrachloroethene, tetrahydrofuran, toluene, and trichloroethene), polychlorinated biphenyls (PCBs), lithium, thorium, uranium, bromide, and methanol. Of these, the only constituents reported at detectable concentrations were the inorganic substances (except antimony which was not detected) and lithium.

To evaluate whether the detected constituents are present at concentrations that may be a concern with respect to human health exposure, the relevant exposure pathways are considered. Three relevant pathways have been identified for this site. First, persons that may be involved in the farming activities could contact constituents in the soil via direct contact (for example, incidental

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ingestion of or dermal contact with the soil). Second, constituents in soil may be taken up into the crops that are planted, and persons could consume the produce. Finally, constituents in soil have the potential to leach to groundwater.

Direct Contact with Soil

The Pennsylvania Department of Environmental Protection (PADEP) has established acceptable risk-based concentrations for the soil direct contact pathway. The concentrations of all detected constituents are below the available PADEP (2001) Act 2 medium-specific concentrations (MSCs) for residential direct contact, indicating that there is negligible potential for adverse health effects resulting from direct contact with the soil.

Ingestion of Produce

Concentrations of constituents in soil can accumulate in produce via root uptake. The potential for adverse health effects is related to the concentration in soil, the degree of uptake of the constituent, the potential toxicity of the constituent, and the amount of produce consumed. Soil-to-plant uptake factors (the amount of a particular substance that will be absorbed by a particular type of plant) are based on scientific research and are available from the United States Environmental Protection Agency (USEPA, 2005) for above-ground vegetables, root vegetables, and grains; for the inorganic substances detected at the site, the available uptake factors range from 0.005 (chromium) to 0.9 (zinc). All values are less than 1, indicating that the constituent concentrations would decrease as they translocated from the soil to the plant. Uptake factors from USEPA (2005) are not available for boron, copper, or lithium due to their low potential for human toxicity, although these constituents are expected to behave in a manner similar to the other constituents.

Studies of inorganic substance uptake into produce, such as lettuce, barley, radish, tomato, carrot, broccoli and beans indicate no significant difference in germination or yield between soils containing these substances and derived from dredged river or lake sediment in comparison to reference topsoil (Darmody et al., 2004; Ebbs, 2006). There was not a consistent statistically significant difference in the content of inorganic substances among tomatoes grown in soils containing these substances or those grown locally in gardens. Arsenic, cadmium and copper were found in lettuce and snap beans at higher concentrations for crops grown in soil containing these substances relative to the reference soil, although the concentrations were below those considered to be potentially hazardous (Darmody et al., 2004).

Based on available information regarding uptake of inorganic substances into produce, there is negligible potential for adverse health effects resulting from ingestion of produce grown on the property.

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Soil Migration to Groundwater

PADEP has established acceptable standards for the potential for substances to migrate from soil to groundwater. These values assume that groundwater is used as a source of drinking water, which is not the case for this property. With the exception of boron and lithium, the concentrations of detected constituents from the four soil samples are below the PADEP (2001) comparison values for migration to groundwater on the highest use (residential) property. Boron was detected at a maximum concentration of 72 milligrams per kilogram (mg/kg), which is above the migration to groundwater comparison value of 60 mg/kg. The relatively low toxicity of this substance poses no potential for harm to those farming or ingesting the produce from the site. Lithium was detected at a maximum concentration of 20.2 mg/kg, which exceeds the PADEP comparison value of 0.5 mg/kg. This value also poses no potential for harm to those farming or ingesting the produce from the site. The USEPA does provide Regional Screening Levels (RSLs) for lithium that are risk-based values (ORNL, 2008). The maximum detected concentration of lithium (20.2 mg/kg) is below the USEPA soil migration to groundwater RSL (22 mg/kg).

Summary and Conclusions

Available information about the property including past, current and future land use and the residual substances detected in the soil from the 2-acre property indicate that there is negligible potential for adverse health effects resulting from direct contact with the soil or from ingestion of produce grown on that property. Available reference materials indicate that concentrations of substances are below relevant comparison values for most substances. For boron and lithium, the data suggest that the levels in soil are comparable to naturally occurring concentrations in soil (USGS, 1981). Boron concentrations in samples collected across Pennsylvania were reported within a range of 20-70 mg/kg. Lithium concentrations in samples collected across Pennsylvania were reported within a range of 20-80 mg/kg. In summary, the available land use information, soil data from the Great Valley School District 2-acre property and research on the uptake of substances from soil to edible plants indicate that the ingestion of produce grown on the property would not pose a potential for harm due to the presence of residual substances in the soil.

Please do not hesitate to contact me at 724-846-4096 if I can provide additional information or answer any questions.

Sincerely,

Bruce E. Fishman, Ph.D. DABT
Chief Toxicologist

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