

U.S. Geological Survey Proposal

E. Crops Near Deer Trail, Colorado

Base Program: Monitor Crop Biogeochemistry

Questions:

How does the application of biosolids to agricultural soils affect crop chemistry? Are heavy metals contained in the biosolids bioavailable and thus transported into the vegetation?

Concerns:

Biosolids are known to contain elevated concentrations of certain heavy metals. The use of biosolids as a soil amendment for agricultural purposes could, in principal, cause the content of heavy metals within the soil to increase and could, if the heavy metals are bioavailable, cause crops raised on this soil to have elevated concentrations of these metals.

Objective:

To monitor the chemistry of crops grown on soils that have received biosolids for concentrations of arsenic, bismuth, cadmium, copper, lead, mercury, molybdenum, nickel, phosphorus (total), selenium, sulfur (total), uranium, and zinc.

Approach:

One "application field" will be monitored in the northern part of Metro's property and one "application field" will be monitored in the southern part. The two "application fields" will receive biosolids routinely. One "control field" will be maintained up-gradient from each "application field" and one down-gradient from each "application field". These four "control fields" will never receive biosolids throughout the course of the project, but will otherwise be farmed in exactly the same manner as the "application fields".

Crops (usually winter wheat) grown in each "field" will be geochemically characterized to determine the "average" concentration of the elements of interest. The sampling will be performed by either the Metro staff or the resident tenant farmer. Collection should be done during the actual harvesting of the crop. Grab samples of the grain in the harvester will be satisfactory. Alternatively, the characterization will consist of collecting approximately 30 subsamples of plant material (wheat kernels) prior to harvesting and compositing into one sample per "field". Each sample will be analyzed for arsenic, bismuth, cadmium, copper, lead, mercury, molybdenum, nickel, phosphorus, selenium, sulfur (total), uranium, and zinc, in the USGS laboratories.

Crops will be sampled every crop cycle. Crops grown on the "control fields" will be sampled each time crops grown on the "application fields" are sampled. Samples will be

prepared and chemically analyzed by the USGS using appropriate analytical methods and quality control protocols.

Data will be analyzed each year and again after about 6 years to determine how the elements of interest vary with time.

Benefits:

This approach will yield high-quality data useful for determining changes, if any, in crop chemistry over time.

Limitations:

This approach provides the “average” composition of the plant material in a given field at a given time. Spatial variability of an element of interest within a given field cannot be determined by this sampling design. This approach does not allow us to distinguish different biogeochemical characteristics of crops grown on different soil types within a given “field”.