

# U.S. Geological Survey Proposal

## B. Soil

### Option B-1: Monitor Soil Quality—Average composition per field

#### Questions:

How does the application of biosolids affect soil chemistry? Is there short-term and/or long-term build-up of metals and/or radioactivity caused by the application of biosolids? Is this build-up, if any, within acceptable limits for soil quality as established by Federal and state agencies?

#### Concerns:

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

#### Objective:

To monitor the soil for concentrations of arsenic, cadmium, copper, lead, mercury, molybdenum, nickel, selenium, zinc, plutonium, and gross alpha and beta activity, and to compare these concentrations with state and Federal standards for soil quality.

#### Approach:

One “application field” will be selected for monitoring in the northern part of Metro’s property and one “application field” will be selected in the southern part. The selection will be made through consultation with Metro, Arapahoe County, Elbert County, the Deer Trail Soil Conservation District, the Agate Soil Conservation District, and the Natural Resources Conservation District. Neither of the two selected “application fields” will have received biosolids application at the time of selection but will receive biosolids routinely after initial determination of baseline concentrations of elements of interest. One “control field” will be selected 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”.

Each of the six “fields” (two “application” fields and four “control fields”) will be geochemically characterized to determine the “average” concentration of the elements of interest before biosolids application. The characterization will consist of collecting approximately 30 subsamples of soil (upper 12 inches) and compositing into one sample per “field”. Each sample will be analyzed for arsenic, cadmium, copper, lead, mercury, molybdenum, nickel, selenium, zinc, plutonium, and gross alpha and beta activity.

Each "application field" will be sampled prior to biosolids application and again after each application, post harvest (normally every other year). The "control fields" will be sampled each time the applied "fields" are sampled. Samples will be prepared and chemically analyzed by the USGS using appropriate analytical methods and quality control protocols.

Soil geochemical data will be reviewed within one month of receipt from the laboratory and will be maintained in a USGS database. Monitoring progress and data will be released by newsletter biannually. Data will also be available in electronic format.

Data will be statistically analyzed after 5 years to determine how the elements of interest vary with time. Data and interpretations will be published in a report following the fifth year.

#### Benefits:

This approach will yield high-quality data useful for determining changes in soil quality over time.

#### Limitations:

This approach provides the "average" composition of soil 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 geochemical characteristics of multiple soil types within a given field.