

Phytoremediation & Soil Blending/Tilling Studies

May 20, 2010 Coffeehouse

Phytoremediation Study

Objective

To determine if certain plants could effectively remove arsenic from soil in Western New York climate and growing conditions.

NOTE: At the Agencies' request, the 2008 study was extended for a second year to monitor plants and obtain additional data on the effectiveness of brake ferns to reduce the level of arsenic in soil within the protected root zone on one of the pilot study sites.

Procedures

- Obtain access permission, assess existing trees, plot preparation
- Planting and growth monitoring activities
- Plant harvesting and post-harvest soil sampling activities

Phytoremediation Plot



Results

- Arsenic uptake by the plants was substantially lower for both fern species in comparison of other studies conducted in more southern areas of the United States.
- There was no significant correlation between arsenic bioaccumulation and decreased soil arsenic concentrations.
- Limited biomass production. (Plant growth was slow and plants did not flourish.)
- Limited bioavailability of the soil arsenic to the plants and/or the cooler and shorter growing season in Middleport may contribute to the decreased uptake of arsenic.

Results - *continued*

- It is estimated that arsenic removal by ferns in Middleport would take 133 years to reduce the current arsenic level in the upper 12 inches of soil by one half and 37 years to reduce arsenic levels by 5 mg/kg.
- The amount of arsenic that was removed is a function of the amount of plant biomass produced.

Conclusions

- Although arsenic concentrations in the ferns were higher in the 2009 vs. 2008 study, concentrations are well below the uptake of ferns grown in other states (3 to 10x less).
- The sub-tropical plants used do not produce sufficient biomass in the Middleport areas to effectively remove arsenic from the soil in a timely manner.
- Continuation of the pilot study is not warranted.
- While use of phytoremediation will be evaluated during the CMS, it does not appear to be promising.

Soil Blending/Tilling Study

Objective

To evaluate the effectiveness and feasibility of soil tilling/blending as a corrective measures technology for evaluation in the CMS.

Procedures - *continued*

- Obtain access permission, survey plot corners, install sediment control measures
- Obtain preliminary soil samples and perform analysis
- Till or blend soil using one of two methods:
 - Blending with soil mixing head attached to an excavator
 - Tilling with a roto-tiller combined with mechanical soil turn-over
- Conduct air monitoring
- Conduct soil sampling during and after soil blending activities
- Restoration

Results

- Soil tilling/blending was effective in achieving substantial reductions in the soil arsenic concentrations (~40 to 50% reductions in average concentrations).
- Soil tilling/blending can be conducted with minimal fugitive dust and noise.
- Soil tilling/blending did not result in bulking or large rocks being brought to the surface
- Soil tilling/blending is not feasible with saturated soil
- Average organic content for upper 6 inches of soil was reduced after tilling/blending. Addition of organic amendments may be needed after tilling/blending.

Conclusions

- Under certain conditions, soil tilling/blending is a viable corrective measures technology for reducing average soil arsenic concentrations on certain types of properties (*e.g., larger properties without structures where higher levels of arsenic are primarily in surface soil.*)
- Warrants further evaluation in the **CMS**.