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Spreader fan distributing a mixture of biosolids and fly ash on the Palmerton, PA Site
# Mine Reclamation Using Biosolids

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DEFINITIONS OF SELECTED TERMS AND ACRONYMS

Air slaking: The process of breaking up or sloughing when an indurated soil is exposed to air

Anhydride: A chemical compound formed from another, often an acid, by the removal of water

Caustic lime: Calcium hydrate or slacked lime; also, in a less technical sense, calcium oxide or quicklime

Fly ash: The very fine particle ash that results from the combustion of coal, and is mainly silica oxide and alumina oxide.

Inductively Coupled Plasma Spectrometer: Inductively coupled plasma is a high energy, optically thin excitation source. Power from a radio frequency generator is coupled to a flow of ionized argon gas inside a quartz tube encircled by an induction coil. Liquid samples, in the form of aerosols, are injected into the high temperature environment caused by the plasma. The spectrometer analyzes form free atoms and ions that emit characteristic spectra, which allows for identification.

Line transect method: A marked cable, line, or tape measure is placed across the surface of a field for which an estimate of the percentage of ground cover is desired. Careful observation of the number of marks that occur above various types of ground residue and/or cover may be counted and extrapolated into an estimate of protective cover for the entire field. This is then used to predict the impact on soil erosion.

MSW: Municipal solid waste facility.

Oxidation: The loss of electrons from an atom, compound, or molecule. Generally, the term is applied to the chemical reaction of a substance with oxygen or an oxygen-containing material that adds oxygen atoms to the compound being oxidized.

POTW: Publicly owned treatment works.
The purpose of this report is to describe the current uses of biosolids in the United States, especially the progress being made at mine reclamation sites. The background section will define and describe the production and traditional uses of biosolids. It will respond to common concerns over biosolid use, such as leaching, and explain the safeguards associated with every biosolids project. Finally, case studies will be examined and analyzed to determine the best use of biosolids to date.

Biosolids have proven effective in the reclamation and treatment of former mining sites. They are able to cost efficiently establish a vegetative cover on contaminated lands and limit the movement of metals through erosion, leaching, and wind. A cap is formed upon the application of biosolids because their permeability and water adsorption characteristics prevent water contact with contaminants in the soil below. Depending on the amendments added, biosolids can serve many purposes, including pH control, metal control, and fertilization. Their adaptability allows them to conform to the specific characteristics of any reclamation site.

Although biosolids limit the phytoavailability and bioavailability of toxic metals, they do not remove metal contaminants from the soil. Their application serves to control the mobility of heavy metals and various other contaminants, such as sulfates, through the soil. When combined with phytotechnologies, however, biosolids not only could contain contaminants, but also provide higher degrees of extraction than that offered by typical vegetative covers. Phytotechnologies use plants to contain, stabilize, reduce, detoxify, and degrade contaminants in soil, ground water, surface water, or sediments.

Phytotechnologies can be applied in situ or ex situ and can address organic compounds such as petroleum hydrocarbons, gas condensates, crude oil, chlorinated compounds, pesticides, and explosive compounds plus inorganics including high salinity, heavy metals, metalloids, and radioactive materials (U.S. EPA, 2001a). If biosolids and phytoremediation were used in tandem, they could possibility restore and return a site to near its original condition.

Even though the application of biosolids to remediate mining sites is considered an innovative technology, unlike many others, it can be used effectively and efficiently now. Biosolids technology is already available. It is just a matter of overcoming a few remaining obstacles before the technology can be fully utilized.

Biosolids reclamation use is expected to rise as public support increases and increasing amounts of biosolids are being produced. With increased production comes a greater need for disposal options. With tipping fees at landfills expected to increase and heightened regulations on incineration, land application is quickly becoming the most cost effective disposal method. The amount of biosolids estimated to be in beneficial use by 2010 is nearly 5.7 million dry tons. Many mining sites are still in need of some form of reclamation and biosolids are continually being tailor made for each of these sites.

Today, there is speculation as to how well biosolids perform and under what conditions they can be productive. Test sites such as Bunker Hill, Palmerton, Silesia, Leadville, along with other reclamation projects, will answer many questions regarding biosolids application to mining sites. Results from these sites are promising and biosolids use should only expand in the future.