Soil, Sediment, Bedrock and Sludge

Separation

Introduction

Separation processes concentrate contaminated solids via physical and chemical methods. These processes aim to detach contaminants from their medium such as the soil, sand, and/or binding material that contains them.

Description:

The separation processes are utilised to remove the contaminated concentrates from soils, to leave comparatively uncontaminated fractions that can be viewed as treated soil. *Ex situ* separation can be undertaken by means of several processes. Gravity separation and sieving are two well-developed methods that have long been key ways of treating municipal wastewaters. Magnetic separation is a much newer process that is still being tested.

Gravity Separation:

Gravity separation is a solid/liquid separation process, which depends on there being a density difference between the phases. Equipment size and efficiency of gravity separation relies upon the solids settling velocity (a function of the particles size), density difference, fluid viscosity, and particle concentration (hindered settling). Gravity separation can be exploited for removing immiscible oil phases, and for classification where particles of different sizes are separated. It is often preceded by coagulation and flocculation to increase particle size, thus allowing the removal of fine particles.

Magnetic Separation:

Magnetic separation is used to remove faintly magnetic radioactive particles from host materials such as water, soil, or air. All uranium and plutonium compounds are slightly magnetic whereas the majority of host materials are nonmagnetic. The procedure operates by passing contaminated fluid or slurry through a magnetised volume. The magnetised volume includes a magnetic matrix material for example steel wool that extracts the slightly magnetic contamination particles from the slurry.

Sieving/Physical Separation:

Sieving and physical separation use various sized sieves and screens to concentrate contaminants into smaller volumes. Physical separation is established on the fact that many organic and inorganic contaminants tend to bind, either chemically or physically, to the fine (e.g. clay and silt) fraction of a soil. The clay and silt soil particles are, physically bound to the coarser sand and gravel particles through compaction and adhesion. Consequently, separating the fine clay and silt particles from the coarser sand and gravel soil particles can successfully concentrate the contaminants into a smaller volume of soil that may then be further treated or disposed of.

Applicability:

The main contaminants suitable for *ex situ* separation processes are SVOCs, fuels, and inorganics (including radionuclides). The technologies may be suitable on selected VOCs and pesticides. Magnetic separation is particularly exploited for heavy metals, radionuclides, and magnetic radioactive particles, namely uranium and plutonium compounds. A key advantage of physical separation processes is that high throughputs can be accomplished with reasonably small equipment.

Limitations:

- High clay and moisture content will increase treatment cost.

- Gravity separation processes rely on a difference in the solids and liquid phase densities. Specific gravity of particles will affect settling rate and process efficiency. Additionally, settling velocity is dependent on the viscosity of the suspending fluid, which must be known to estimate process efficiency and to size equipment.
- Special measures may be required to mitigate odour problems, resulting from organic sludge that undergoes septic conditions.

Data Needs:

Particle size distribution, soil type, moisture content; contaminant type and concentration; texture; and organic content should all be known for use of this option.

Performance Data:

Gravity separation and sieving/physical separation are full-scale, well-established technologies utilised mainly for treating wastewater and contaminated soil, sediment, and sludge. Magnetic separation is a hopeful new technique to enable the removal of radioactive contaminants from soil.

Cost:

Not currently known.