Soil, Sediment, Bedrock, and Sludge

Biopiles

Introduction:

Excavated soils are formed into piles and are located in above ground areas. It is an aerated process in which contaminated soil is fashioned into piles and aerated with blowers or vacuum pumps.

Description:

Biopiling is a full-scale technology in which excavated soils are piled and typically constructed in a treatment area that consists of a leachate collection and aeration system. It is commonly applied to reduce concentrations of petroleum components in soils through utilising the process of biodegradation. Moisture, heat, nutrients, oxygen, and pH require controlling to enhance biodegradation.

The treatment area will in general be covered or contained with an impermeable liner to minimise the risk of contaminants leaching into uncontaminated soil. The drainage itself may be treated in a bioreactor prior to recycling. Vendors have developed proprietary nutrient and additive formulations and methods for integrating the formula into the soil to stimulate biodegradation. The formulations are habitually tailored to site-specific conditions.

Soil piles and cells normally have an air distribution system buried under the soil to pass air through the soil either by vacuum or positive pressure. The soil piles in this case can be up to 6 m high though it is not recommended to exceed 2-3 meters. Soil piles may be covered with plastic to control runoff, evaporation, and volatilisation and to promote solar heating. If there are VOCs in the soil that will volatilise into the air stream, the air leaving the soil may be treated to remove the VOCs before they are released to the atmosphere.

Biopiling is a short-term technology. Time of operation and maintenance can be a few weeks up to a number of months.

Applicability:

Biopile treatment has been employed to treat non-halogenated VOCs and fuel hydrocarbons. Halogenated VOCs, SVOCs, and pesticides can also be treated, but the effectiveness of the process will vary and may therefore be applicable only to some compounds within these groups.

Limitations:

- Excavation of contaminated soils is required.
- Treatability testing should be performed to establish the biodegradability of contaminants and appropriate oxygenation and nutrient loading rates.
- It is a static treatment process and consequently may result in less uniform treatment of the soil than with a process that involves periodic mixing.

Data Needs;

Initial steps in preparing a design for biotreatment of contaminated soil include:

- Site characterisation.
- Soil sampling and characterisation.
- Contaminant characterisation.
- Laboratory and/or field treatability studies.
- Pilot testing and/or field demonstrations.

Site, soil, and contaminant characterisations should be used to:

- Identify and quantify contaminants.
- Determine requirements for organic and inorganic amendments.
- Identify potential safety issues.
- Determine requirements for excavation, staging, and movement of contaminated soil.
- Determine availability and location of utilities (e.g. electricity and water)

Laboratory or field treatability studies are needed to identify:

- Amendment mixtures that best promote microbial activity.
- Any possible toxic by-products as a result of degradation.
- The potential degradation rate.

Performance Data:

Biopile treatment has been effectively demonstrated for fuel-contaminated sites.

Cost:

Costs are reliant upon the contaminant that requires degrading, any need for additional pre- and post-treatment, and potentially for air emission control equipment. Biopiles are relatively simple and require a small number of personnel for operation and maintenance. Average costs with a prepared bed and liner are £ 45 to £ 160 per cubic meter.