Bauer Environmental in situ Techniques

BMU

BMU in situ techniques

Definition of in situ remediation

"Treatment of contaminated soil and groundwater in its natural location"

Advantages

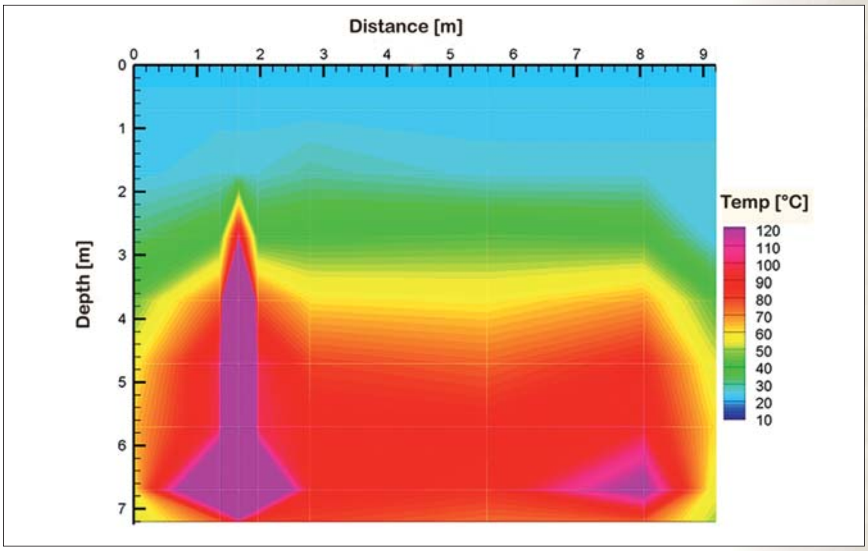
- Continued use of buildings and land during the remediation
- Suitable for site conditions where excavation is technically not possible
- Cost-effective alternative to conventional remediation methods
- Acceptable to authorities and the public at large by virtue of its environmental compatibility

Pollutants	Physical techniques	Chemical techniques	Immobilization techniques	Biological techniques
TPH		X		X
BTEX	X	X		X
PAH		X	X	X
HVOC	X	X	X	X
Other chlorinated compounds	X	X	X	X
Heavy metals		X	X	

Physical techniques

Thermo-stripping

This technique is a modification of soil vapour extraction in which the soil temperature is first increased by heating it with special lances. This increases the volatility of the pollutants and achieves a higher pollutant removal in a shorter time. A modification of this method is steam-enhanced extraction (SEE).



High-pressure vacuum extraction

In the high-pressure vacuum (or multi-phase) extraction method a strong vacuum is generated, capable of suctioning off the three media soil vapour, groundwater and floating phase all together by means of ground lances. As this procedure requires no electrical installations, smalll diameters boreholes (e. g. 2 ") are possible even in explosion-hazard zones.

Chemical techniques

The chemical techniques are characterised by the conversion of pollutants into harmless compounds, or the pollutants are destroyed, by reaction with or on a chemical substance.

Use of nano-iron

Nano-iron is made up of particles of elementary iron with a diameter of approximately 70 nm. Owing to its large specific surface area (30 m^2/g), nano-iron reacts very quickly and effectively with HVOC. BMU uses nano-iron in a suspension, introduced by specially adapted jet-grouting methods.

In situ chemical oxidation (ISCO)

A number of oxidants are capable of reacting with pollutants (such as HVOC) and destroying them. These oxidants include, for example, ozone (O_3), hydrogen peroxide (H_2O_2), potassium/sodium permanganate (K/Na MnO_4), persulphate (S_2O_8) and calcium/magnesium peroxide (Ca/MgO_2). The oxidants are introduced into the soil by grouting methods, to establish a targeted and even distribution into the soil body according to the geology.

Biological techniques

Biological techniques are based on the ability of micro-organisms to convert pollutants into harmless products such as CO_2 and water. As well as direct conversion, there is also the co-metabolism method, by which the pollutants can be degraded in the course of other metabolic processes. The biological techniques are characterized by their high degree of environmental compatibility and economy. On the other hand, they are relatively slow and sensitive to harmful environmental influences. Particular attention needs to be paid to the soil chemistry at the location when applying these methods.

Aerobic techniques

Aerobic processes are characterised by biological activity dependent on the presence of oxygen, meaning an adequate oxygen supply is essential for process control. Pollutant groups which can be degraded effectively under aerobic conditions are TPH, AHC/PAH, phenols and certain VOC (cis-DCE, VC).

Anaerobic techniques

Anaerobic biological processes take place in the absence of oxygen. Anaerobic conditions are established by adding fermentable carbon sources, such as molasses, lactate and ethanol. Anaerobic processes are used primarily to degrade CVOC.

Immobilisation techniques

In contrast to the techniques previously described, these are methods of safeguarding whereby the pollutants are not eliminated, but fixed in the soil matrix. By converting the soil into a rock-like solid body, contamination looses its mobility and no longer poses a threat to the groundwater.

Mechanical mixing techniques

Most soil-mixing techniques are on-site methods aiming at conditioning. For in situ treatment, BMU has developed a number of processes for sludge and soil by which additives are mixed into the soil matrix using an auger-like mixing tool, resulting in complete encapsulation of the pollutants with additives/fines.

The Mixed-In-Place (MIP) technology

"Mixed-In-Place" refers to the in situ mixing of binding agents and soil by means of three opposite-running augers. This patented specialist foundation process fills up the pores in the soil matrix and, based on the geometry of the triple auger, creates a solid soil body.

Use of grouting techniques

Various grouting techniques well-established in specialist foundation engineering may well be the only means of protecting ground such as hot-spots beneath historic listed buildings. Techniques may include low and high pressure grouting, both of which can be used where headroom is limited, thanks to the special equipment deployed. While in the low-pressure method micro-fine cement, for example, is compressed at 1 - 20 bar by means of inset lances, in jet-grouting binding agent suspension is introduced at pressures of around 500 bar by way of the jet-grouting rods.

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