



## TERRAFERM®-SOIL PURIFICATION

### Biological soil remediation and utilization of organic and mineral wastes

**Process description:** The TERRAFERM®-Biosystem-Soil enables microorganisms living in the soil to break down organic compounds that act as harmful pollutants in the soil. We launched the TERRAFERM®-process onto the market in the 1980's to remediate soil contaminated by mineral oil hydrocarbons. Following further developments, it is now also ideal for the treatment of other organic and mineral wastes. The process is designed to keep all of the relevant process parameters that are decisive or the activity of the pollutant-degrading microorganisms at an optimum. It can be used either separately or in combination with the TERRALAVAR® soil purification technology and thermal soil purification technologies. The TERRAFERM®-system is used on-site as well as in off-site plants.

#### Biodegradable Compounds

The following pollutants can be degraded by a microbiological remediation process:

- mineral oil hydrocarbons (MOH)
- aromatic hydrocarbons (benzene, toluene, phenol)
- polycyclic aromatic hydrocarbons (PAH)

MOH and aromatic hydrocarbons, like benzene and toluene, are the main constituents of mineral oil products. Therefore they are found as pollutants at sites of the mineral oil processing industry. In terms of the quantities that are stored, transported and handled, MOH is by far the most important group of pollutants. Phenol and PAH are mostly found in soil at sites where gas works and coal plants are in operation or



where coal processing in the widest sense of the word takes place. These two groups of pollutants are plentiful spread in the environment. This is because nearly every large city had a gas works in the past.

**Preliminary investigation:** Selective control of the complex material conversion process is decisive for the successful biological treatment of soil and other organic wastes. The material is initially tested for its substance-specific and process-relevant parameters. The investigation results and the maximum pollutant levels in the approvals of each authorized plant according to the German Federal Immission Control Act (BImSchG) determine which wastes can be accepted. The process parameters are defined on the basis of preliminary investigations of the biodegradability of the pollutants.

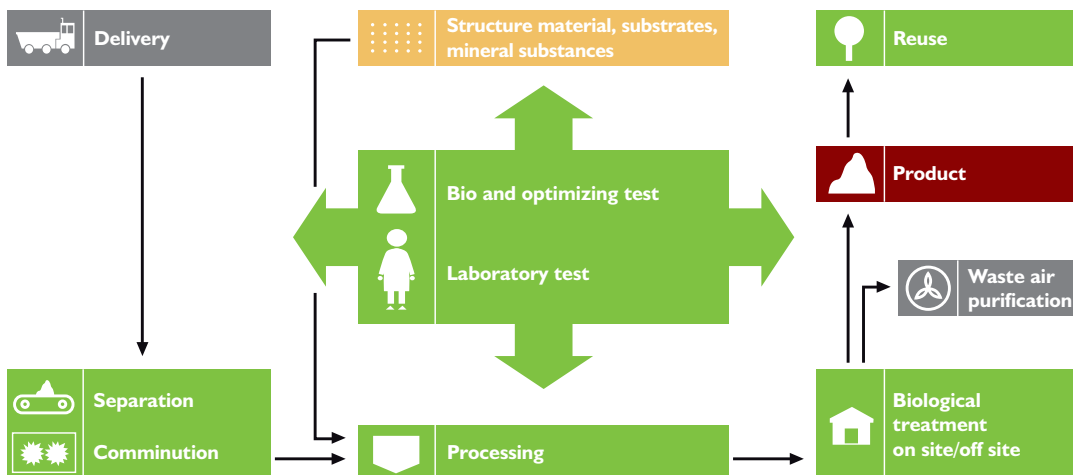
**Process description:** After delivery, larger amounts of soil or waste are broken down and interfering materials are extracted. Organic substrates especially adapted to the waste structure (e.g. wood chips, straw, shrub trimmings) are added to the material to improve the conditions of biodegradation. The addition of supplementary nutrients provides a well-balanced carbon nitrogen phosphorus ratio wherever necessary. These measures serve the purpose of a faster and more complete biodegradation of the organic pollutants. Treatment takes place either in a closed plant with adequate waste air purification (in case of highly volatile pollutants or intensive odors) or in an open soil disposal site depending on the emission assessment. The environmental conditions for microbial pollutant degradation such as moisture, structure and nutrient supply are adjusted using suitable treatment technologies (use of a "Mole" mixing crusher, choice of appropriate substrates in appropriate quantities, turning rhythm of the soil waste disposals). The most important process parameters (e.g. microbial activity, current concentration of pollutants) are checked regularly during the micro-

bial remediation. The biological purification is completed when the target remedial figure is reached. Successful treatment is documented by a representative sample and through an analytical inspection by an external laboratory followed by a certified clearance of the respective batch. The evaluation and utilization of the purified soil is carried out on the basis of the LAGA (national work group for wastes) – guidelines requirements for the substance utilization of mineral residues. Other products from the biological treatment are assessed and used according to the respective technical regulations (e.g. RAL seal of approval of the NQAC, National-Quality-Association for Compost e.V.).

**Recycling:** The goal of soil and waste treatment is the production of substances for a sustainable cyclic economy. The quality of the products is defined by type, origin and characteristics of the input-material on the one hand and the market requirements for the soil and substrates to be recycled on the other. The versatility of soil can be restored by biological remediation. This opens up a variety of possible uses for the purified soil, e.g. in landscaping (construction of noise protection walls) or recultivation measures. The ZECH UMWELT group uses the substrates that are produced in four different steps:

- Bioactive additives for soil remediation
- Recultivation material from purified soil and valuable additives
- Soil improvers with a high humus share
- Organic fertilizer rich in nutrients

Until 2004 a total amount of > 6.5 Mio. tons of polluted soil and organic wastes were successfully biologically treated, remediated and utilised with the TERRAFERM®-technology.



**Umweltschutz Nord**  
Ganderkesee  
Tel.: +49(0) 4222/7909-90  
Fax: +49(0) 4222/400-43

**Umweltschutz Süd**  
Nürnberg  
Tel.: +49(0) 911/968685-21  
Fax: +49(0) 911/968685-18

**Umweltschutz West**  
Gladbeck  
Tel.: +49(0) 2043/9634-0  
Fax: +49(0) 2043/9634-50

**Umweltschutz Ost**  
Berlin  
Tel.: +49(0) 30/6581117-0  
Fax: +49(0) 30/6581117-5