

Bioremediation

SPECIALLY LICENSED FACILITIES

Bioremediation is conducted in specially licensed facilities situated at Waste Management landfills throughout North America. All are specifically designed, licensed and operated to provide waste generators and remediation companies with a responsive program for the expeditious removal, treatment and disposal of hazardous and non-hazardous industrial waste. (Not all facilities are licensed to accept RCRA waste.)

TOSSSM TWO-STEP STATIC SYSTEM*

TOSSSM is a two-stage solid phase bioremediation technology that involves both anaerobic and aerobic treatment stages. In the first stage, explosives-contaminated soil is combined with a carbon source, an inoculum, vitamins and water to achieve anaerobic conditions. The resulting mixture is formed into a static pile or placed in a bermed construction or box to facilitate the chemical reduction of nitroaromatic and nitramine explosives.

In the second stage, the anaerobically treated soil is combined with yard waste compost and built into an aerated biopile. The biopile may be aerated by forced air conveyed through perforated piping buried within the pile or by turning the pile with a compost turner. Previous testing of TOSSSM has demonstrated TNT removal efficiencies of >99%.

* U.S. PATENT #6,066,722

BIO-IN-A-BOXSM

Bio-In-A-BoxSM is a Waste Management process for remediating petrochemical-contaminated soils in quantities of 1,000 cubic yards or less. In this process, the contaminated soil is moistened, mixed with nutrients and custom-grown micro-organisms and then placed in enclosed containers called "solid phase bio-reactors" for incubation. These containers may or may not be linked to aeration and vacuum pipes, depending on the contaminants being processed. In just a few weeks, the decontaminated soil will be ready for landfill disposal or reintroduction into the environment.

THE BIOSITESM SYSTEM

The BioSiteSM System is Waste Management's proprietary system for the large-scale bioremediation of soils contaminated with petrochemicals including, but not limited to:

- Acetone
- Alcohols
- Benzene
- Ethylbenzene
- Methyl Ethyl Ketone (MEK)
- Methyl Isobutyl Ketone (MEK)
- Petroleum hydrocarbons
- Toluene
- Two- and three-ring PAHs
- Xylene

The BioSiteSM System can also handle other contaminants, including:

- Aliphatic chlorinated hydrocarbons (e.g., Trichloroethylene)
- Chemical manufacturing wastes
- Pesticides
- Spent molecular sieve from packing towers

Regulated compounds including Underlying Hazardous Constituents (UHC) are screened prior to acceptance. Soils co-contaminated with metals may be accepted depending on their concentration.

Using the Daramend[®] bioremediation process licensed from Adventus Remediation Technologies, Inc., BioSiteSM works by forming the contaminated soil into earthen biopiles around vented pipes that circulate air through the mixture. Specially cultivated hydrocarbon degrading micro-organisms and a blend of inorganic nutrients are then introduced to the pile. A synthetic cover is placed over the biopile and, within a few months, the contaminants are safely and naturally broken down into less-toxic compounds. Once treated, the material may be landfilled, treated for metals, reused or returned to the customer in accordance with regulatory requirements.

DDT contaminated soils may be treated using the Xenorem[®] bioremediation process licensed from AstraZeneca.



Treating contaminated soils on-site at bioremediation facilities is ultimately less expensive and more environmentally friendly.

To find out if off-site bioremediation is right for you, contact your local Waste Management Landfill and Industrial Services sales representative.

From everyday collection to environmental protection, Think Green.™ Think Waste Management.



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BIOREMEDIATION

Because Contaminated Soils Need Responsible Solutions.

Think Green.™

On-site remediation of soils and media contaminated with petrochemicals, pesticides, explosives or hazardous organics can be an expensive and time-consuming process. There are also serious legal and regulatory issues to consider when decontaminating soils on location, issues that can jeopardize the viability of a construction or re-development project.

Waste Management, North America's leading solid waste services company, has developed a collection of innovative off-site remediation technologies to help companies deal effectively with contaminated soils. These bioremediation services include:

- TOSSSM (Two-Step Static System) for the off-site treatment of soils contaminated with explosives
- Bio-In-A-BoxSM for the off-site decontamination of all types of contaminated soils in drums or in bulk
- The BioSiteSM System for the off-site remediation of petrochemical-contaminated soils

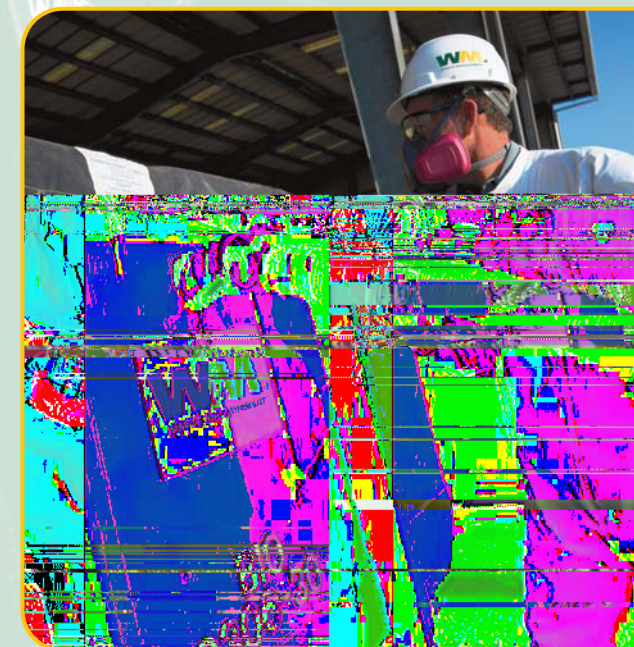
THE BENEFITS OF OFF-SITE BIOREMEDIATION

Regardless of the technique used, off-site bioremediation by Waste Management offers numerous advantages over on-site treatment, windrow composting or incineration. These include:

- Lower costs compared to treating the soil at the original site or at an intermediate location.
- An environmentally friendly process.
- Controlled access to fully equipped, insured and permitted waste sites.
- Stabilization of heavy metals (if any) prior to landfilling.
- Waste Management's comprehensive indemnification package.
- Remediation backed by the knowledge, experience and financial resources of North America's leading solid waste services company.
- Off-site bioremediation services may be accessed from most North American locations via Waste Management's WasteByRail program. For more information on WasteByRail services, visit www.wastebyrail.com.

In addition, Waste Management employs two patented processes for the rapid remediation of contaminated soils:

- Daramend[®]: Designed to accelerate the bioremediation of soils or sediments containing high concentrations of creosote, PCPs, PAHs, heavy oils and petroleum hydrocarbons, this product, licensed from Adventus Remediation Technologies, Inc., utilizes matrix-specific solid-phase organic amendments to create aquatic microsites where native micro-organisms can grow, contact contaminants and degrade them. Daramend[®] products are matrix-specific solid-phase organic particles that are manufactured from natural botanical materials.
- Xenorem[®]: Developed by the biotech firm AstraZeneca, Xenorem[®] combines organic compounds derived from wood pulp, straw and animal manure to rapidly and naturally break down chlorinated pesticides, such as DDT, from contaminated soils. By carefully controlling the temperature and oxygen level of the combined waste, Waste Management technicians can degrade pesticides in contaminated soils while producing less harmful byproducts.



Conducted under controlled conditions, BioSiteSM bioremediation uses a combination of chemicals and microorganisms to naturally break down hazardous materials into non-hazardous substances that can be recycled or buried in conventional landfills.



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Bioremediation

BioSiteSM System is a safe, cost-effective method for remediating the contaminated soils in quantities of 1000 yards or more. After being placed in a ventilated biopile, soil is treated with a blend of selected chemicals and micro-organisms that naturally break the toxins down into less harmful compounds. After treatment, treated soils can be safely landfilled or taken off-site for other uses.

