



Bioscience, Inc.

Environmental Products & Services

ISO 9001:2015 Certified

LAB SERVICES

INTRODUCTION

Bioscience, Inc. develops engineers and supplies biological processes and products for waste site restoration. Bioscience, Inc. specializes in enhancing natural biodegradative mechanisms for the ultimate destruction of soil, water, and air contamination.

Our team is highly trained in environmental biotechnology. The staff includes microbiologists, molecular biologists, soil scientists, and chemists supported by an experienced team of technicians equipped to provide a full range of on-site bioremediation and laboratory support services. By combining laboratory and field capabilities, Bioscience, Inc. can provide all the necessary components of complete remedial cleanup programs. Bioscience, Inc. frequently supplements its specialized biotechnology capability with expertise from other specialized contractors in hydrogeology, environmental engineering, construction and analytical chemistry to provide complete turnkey services.

Our experience in site assessment and biodegradability screening studies has led us to form several specialized business areas including our remediation/equipment group, microbial products group, analytical products group, and services group.

The remediation/equipment group designs and supplies unique biological treatment processes for the treatment of soils, groundwater and wastewater. Specialized bioremediation equipment systems include aeration systems, bioventing systems, nutrient injection systems, and microbial injection systems. Our totally enclosed, submersed, fixed-film BTX treatment system is specialized for groundwater treatment and disposal. These units are factory fabricated modules specifically designed to operate either aerobically, anoxically or anaerobically.

The MICROCAT® microbial products group formulates and supplies specialized microbial inocula and chemical supplements used to enhance the action of naturally-occurring microorganisms in site remediation projects, institutional, municipal and agricultural applications, and in industrial biological wastewater treatment processes.

The analytical products group fabricates and supplies specialized biomonitoring instruments, which measure the rate of biological reactions. These instruments are used for wastewater process monitoring, toxicity screening and for detailed bioremediation, kinetic and toxicity studies. This group also manufactures and supplies chemical oxygen demand (COD) test kit and related waste testing equipment and reagents.

Our services group offers a range of laboratory (treatability, biodegradation, etc.) and field (site monitoring, oily water management, FOG control, etc.) services combining our products and technologies.

In summary, Bioscience, Inc. is your single best source for bioscientific and bioengineering environmental services, specialized bioinstrumentation and equipment and microbial inocula for your biodegradation work.

BIOLOGICAL SCIENCES & MICROBIAL ECOLOGY

Microbes are nature's recyclers. Through the action of microbes, natural and man-made organic and inorganic substances are recycled through the ecosystem. Bioscience, Inc. has extensive experience in assessing the ability of mixed microbial systems to degrade environmental pollutants in a wide range of environments. Our work involves a good understanding of the microorganisms themselves (microbiology). A firm grasp of the conditions under which the appropriate mixed culture system can be established and maintained to achieve the desired biodegradation tasks (microbial ecology) is also necessary. The final component, and perhaps the most critical, is the translation of the scientific data into cost-effective full-scale cleanup processes (environmental engineering).

Bioscience, Inc. undertakes work in microbiology/microbial ecology including the following services:

- **Soils, solids, sludge and groundwater biodegradability studies**
- **Pure compound biodegradation (OECD tests)**
- **Microbial culture identification, isolation and enhancement**
- **Microbial growth identification and control**
- **Biological groundwater treatment plant equipment supply & operations**

SITE BIOREMEDIATION THE THREE-TIER APPROACH

Bioscience, Inc. offers bench-scale studies, pilot-scale studies, laboratory analyses, process selection and design, and a full range of field support services for full-scale on site and in-situ bioremediation systems.

A potential bioremediation project must be approached with the knowledge that each site will exhibit different characteristics and will require a site specific remediation plan. Therefore, a step-by-step or "tiered" response is appropriate, starting with a screening level determination (as to whether bioremediation appears to be feasible along with a rough estimate of time and cost) and ending with a fully developed work plan including a complete budget and project management plan for the field bioremediation effort. Each tier develops more information about the site and uses this information to make determinations on whether to proceed with bioremediation, seek other technologies or develop more information before any final decision is made.

Final process selections are based on technical, economic and regulatory factors. As progress is made from one tier to the next, more information becomes available; and therefore, the decisions are made more definitive. Generally larger sums of money are committed as we move from tier to tier, but this is done with the increasing confidence that the remediation will be completed on time and within budget.

"TIER I" PRELIMINARY PROCESS SELECTION, BIOTREATABILITY TESTING & COST ESTIMATE

- Reviews all prior written studies, analytical data and site work.
- Implements biofeasibility screening and data interpretation (soil and/or groundwater parameters).
- Selects process technology (several options may be chosen leading to Tier II or Tier III).
- Data reviewed and/or developed during Tier 1:

Soil Analyticals

- BTXE or TPH
- Soil Texture
- Specific Conductance
- pH
- Soil Moisture
- Field Moisture Capacity
- Ammonia-Nitrogen
- Orthophosphate
- Nitrate
- Total Plate Count
- Hydrocarbon Degrading Bacterial Plate Count

Water Analyticals

- BTXE or TPH
- pH
- Nitrate
- Iron
- Manganese
- BOD₅
- COD
- Orthophosphate
- Ammonia-Nitrogen
- Total Plate Count
- Hydrocarbon Degrading Bacterial Plate Count

"TIER II" BIOTREATABILITY STUDIES AND PROCESS CONFIRMATION

Treatability studies are generally designed to determine the biodegradation rate, extent of degradation and optimum conditions for degradation to occur. A treatability study uses the actual site medium present, e.g. contaminated soil, sludge and/or groundwater. The medium is then treated according to the process being considered for full-scale remediation at the site, simulating as closely as possible the actual operations to be used.

Types of laboratory studies for in-situ and ex-situ modeling (water, soil and slurry):

- Respirometry
- Shake Flasks
- Soil Flasks
- Soil Columns
- Soil Boxes
- Pilot Groundwater Reactors
- Slurry Reactors

These studies provide:

- Full-Scale Remediation Modeling
- Validation of Assumptions
- Determination of Bacterial and Nutrient Requirements
- Biodegradation Rates
- Estimated Time Frame for Full-Scale Remediation
- Impact of Physical or Chemical Processes (e.g. Volatilization)

"TIER III" FULL-SCALE SITE REMEDIATION

The process chosen for full-scale remediation will be dependent upon the contaminant characteristics, site/medium characteristics, regulatory requirements, economic factors and the information generated in Tier I and Tier II. These processes may include only single biotreatment methods or, more commonly, combinations of techniques. These techniques may include:

- Solid Phase Bioremediation - Ex-situ Application
- Solid Phase Bioremediation - In-situ Application
- Bioslurry
- Pump and Treat - with submerged, fixed-film or other site specific technology
- Bioremediation - Aqueous Closed Loop Technology- for both in-situ and ex-situ applications
- Soil Venting
- Metal Removal
- Oil/Water Separation