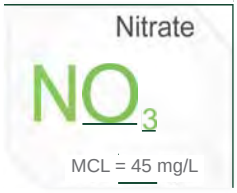
ENVIROGEN TECHNOLOGIES

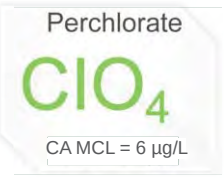
A Lifecycle Performance Company

Fluidized Bed Reactors for Wastewater and Groundwater Treatment

Envirogen's FBR systems handle high flows at low cost with typical treatment efficiencies of 99% or higher.

Alcohols	Chlorinated Solvents	NDMA
Ammonia	Hexavalent Chromium	Nitrate
Aromatics	Ketones	Perchlorate
BTEX/PAH	MTBE/TBA	Selenium





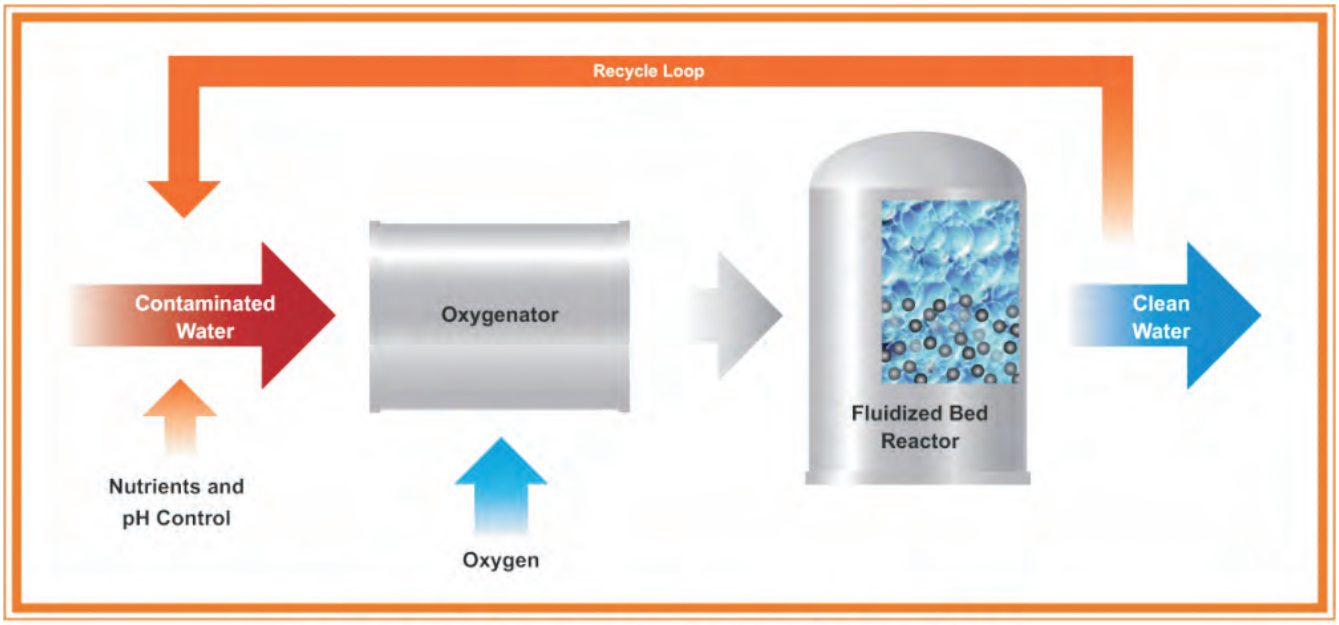
Envirogen's Fluidized Bed Reactor Systems

Envirogen Technologies, Inc. offers microbiological solutions that result in high-performance bioreactor systems engineered to eliminate even recalcitrant chemicals from aqueous streams, providing high-quality, potentially potable and recyclable water.

FBR system treating aniline- and nitrobenzene-contaminated wastewater in Jew Jersey. This technology has been certified by the State of New Jersey's DEP Innovative Environmental Technology Certification Program.

Envirogen's FBR is a fixed-film bioreactor that fosters the growth of microorganisms on a hydraulically fluidized fine media, typically sand or carbon. The small fluidized media provides an extremely large surface area upon which microrganisms can grow while treating the contaminants of concern. A large biomass inventory is produced while maintaining thin films, which reduces any mass transfer limitations and provides the system's high volumetric efficiency.

With aerobic, anaerobic and anoxic designs available, systems have been successfully operated at ranges from 5 to 6,000 gallons per minute while simultaneously providing high performance at low capital and operating costs.



Simplified Schematic of Once Through Aerobic FBR

Envirogen FBR Advantages

- Cost effective
  (low capital and O&M costs)
- Minimal generation of biosludge
- Variety of contaminants treated
- High-quality effluent produced
- Small footprint
- Minimal operator labor required
- Capable of handling both hydraulic and organic shock loads
- No backwashing required
- Simple, end-of-pipe solution

FBR Model EFB-3

FBR Model EFB-5

FBR Model EFB-7.5

FBR Model EFB-11.5

FBR Model EFB-14

FBRs for Denitrification

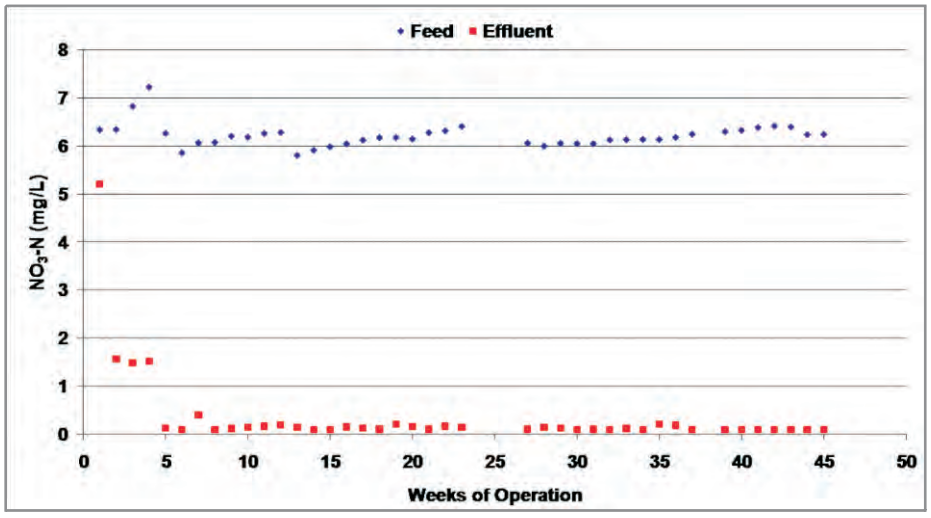
FBRs are capable of accommodating high and/or fluctuating nitrate levels, making them the system of choice for groundwater treatment applications. For applications where the nitrate concentration in the feed water is relatively steady, the addition of carbon source can simply be paced in the system proportional to the feed flow.

Nitrate Treatment FBR - San Diego, CA

For removal of nitrate, the biomass is composed of heterotropic, denitrifying bacteria that convert nitrate to nitrogen gas (N_2). Dentrification is supported within FBRs using a broad range of carbon sources, including methanol, ethanol, acetic acid, Micro-C™, Micro-CG™ and Unicarb-DN[(1)]. No backwashing is required, and there is no 'burping' that can occur, such as with static denitrification filters.

Typical Denitrification Systems				
FBR Model No.	Flow Rate at 50°F (MGD)	Flow Rate at 65°F (MGD)	Reactor Diameter (feet)	System Footprint
EFB-3	0.05-0.075	0.075-0.1	3	12' x 12'
EFB-5	0.15-0.25	0.25-0.3	5	14' x 12'
EFB-7.5	0.3-0.55	0.6-0.8	7.5	21' x 13'
EFB-9	0.45-0.8	0.85-1.0	9	23' x 13'
EFB-11.5	0.7-1.25	1.3-1.6	11.5	25' x 21'
EFB-14	1.0-2.0	2.1-2.5	14	30' x 21'
Treatment of water containing 15 mg/l of NO_3-N				

Typical FBR Nitrate Removal vs. Time



[(1)] *Micro-C™ and Micro-CG™ are trademarks of Environmental Operating Solutions, Inc. Unicarb-DN is a product of Univar USA, Inc.*