

Onion Paper

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Biological Treatment for Water Streams

VOC Treatment

ONION ENTERPRISES's CleanWater™ system is an innovative control technology for the biological treatment of contaminated water streams. CleanWater cleans pollution of all kinds, such as: VOCs, landfill leachate, pesticides/dioxins, oils/tars/gasoline, dyes/solvents, commercial washers/laundries, heavy metals, food processing wastes, lakes/streams/lagoons, and industrial process water. CleanWater degrades a variety of organic compounds such as: benzene, toluene, styrene, xylenes, methyl methacrylate, trichloroethylene, phenol, chlorophenol, crude oil, MTBE, PAH, and PCBs.

HOW IT WORKS—CleanWater systems provide large surface areas for biodegradation in small spaces. CleanWater systems contain spirally wound cartridges on which preacclimated bacteria and enzymes (biodetergent) are immobilized and uniformly distributed. Contaminated streams flow around the cartridge in direct contact with the

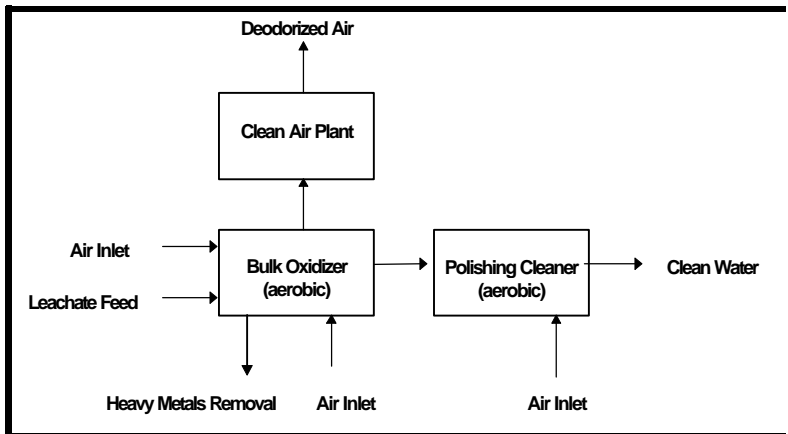
biodetergent. As contaminants come in contact with the biodetergent, they are readily broken down. For example, benzene is

totally destroyed by oxidation to carbon dioxide and

Heavy Metal Removal

Heavy metals such as Cd, Zn, Cu, Cr, Sb and Ag can be recovered from the water stream by the CleanWater system. The negatively-charged cell walls of the immobilized bacteria remove the positively-charged heavy metals. Heavy metals are trapped on the bacteria and can be removed for recycling or reuse.

CleanWater systems may be placed both above ground or below the surface to treat groundwater in place. In addition to encountering fewer permitting requirements, this option consumes less energy because the water is not pumped to the surface for treatment. Free product may be treated directly, thus increasing the radius of influence.



CW 1000. Many configurations are possible; however, we recommend this configuration. It handles floating oil and has been used in gasoline/MTBE systems.

CleanWater systems are designed modularly for convenient scale-up and may be combined with other ONION ENTERPRISES biotreatment systems for simultaneous treatment of contaminants in water and air (see figure). In this application, the system strips volatiles from water, and using the same technology, biologically degrades



ADVANTAGE

CleanWater systems have many advantages over other technologies:

- Immobilization, where bacteria are attached to a solid support, allows for portable, powerful, and inexpensive biotreatment systems that can be placed directly in the area of greatest contamination.
- Cartridges allow more flexibility in process design and eliminate changing filters.
- The spiral flow reduces channeling effects and offers a low pressure drop.
- The spirally wound cartridge provides large surface areas for biodegradation in a small space.
- Immobilized bacteria and enzymes may be reused continuously, have higher density and activity than free-cell, and have a greater resistance to contamination.
- Subsurface systems may be used to treat groundwater in place, eliminating the need to pump water to surface and lowering energy consumed.
- Heavy metals are trapped on the bacteria, which then can be recycled, reused, or sold.
- Operating costs are dramatically lowered because the systems are compact and essentially maintenance free.
- Contaminants in water and air can be treated simultaneously with combination ONION ENTERPRISES biotreatment systems.
- Systems can be easily scaled up for increased pollution destruction
- Small foot print

CASE STUDIES

- ◆ ONION ENTERPRISES's CleanWater system was field tested, along with several other technologies including carbon adsorption, resin adsorption, advanced oxidation, acid treatment, and air stripping for the most viable method for treatment of MTBE and petroleum hydrocarbons in groundwater. ONION ENTERPRISES's CleanWater system was found to be the most efficient, cost-effective technology to treat MTBE.
- ◆ Two CleanWater units were placed below the surface to treat PAH contaminated groundwater at a wood treating facility. The target PAHs were naphthalene, phenanthrene, fluoranthene, pyrene, anthracene, acenaphthene and acenaphthylene. Over a one-year period, approximately 65% of the 49 pounds of target PAHs was degraded.
- ◆ A combination system was used at a landfill to treat off-gases containing VOCs and groundwater in-situ. Two CleanWater units treated chlorinated solvents such as TCE, 1,2 dichloroethane, toluene, acetone, MEK, and MIBK, while the CleanAir unit treated the off-gases. Over an eleven-month period, approximately 80% of the 42 pounds of target compounds was degraded, exceeding the project goal by 30%.
- ◆ Using a combination system for air and water, the CleanWater system treated toluene and other byproducts from a pesticide manufacturing waste stream. The contamination in the waste stream was reduced to non-detectable levels.

COST

The size of the area to be cleaned and the amount of contamination determines the size of unit that is needed. CleanWater systems can handle flow rates of 2 GPM for small-scale pilot testing up to several thousand GPM for large-scale, highly contaminated liquid streams. Since the systems are modular, scale-up is easy. Higher flow rates are

Onion Enterprises

Partial lists of products for sale and rent

Vapor Phase Treatment

Thermal Oxidizers
chlorinated and non
Catalytic Oxidizers
chlorinated and non
Regenerative CatOx
Carbon Vessels
Concentrators
Blowers
Liquid Ring Pumps
Moisture Separators
Dual Phase Extraction

Fluid Treatment

Air Strippers
Oil-water separators
Pumps
UV Oxidation
Carbon Vessels
Tanks
Flow Indicators
Transfer Pumps

Onion Enterprises CleanWater Models - Applications and Sizes

Model No.	Application (For contaminated water, liquid product, or soil washing.)	Pollution Destruction * (lbs./day)	Operating Cost US\$/yr.**	Approx.Size and Weight(in/LB)◆
MT-50	Ideal for small scale pilot testing. Bioreactor is enclosed in a tank.	5	120	8 dia. x 31 h 30 LB
SP-500	Polisher. Quick destruction of low levels of pollutants. Degrades pollutants such as benzene to < 1 ppb. Bioreactor is enclosed in tank.	50	250	30 x 30 x 33 h 80 LB
RP-500	Bulk Oxidizer. (10 cartridges) For large scale, highly contaminated liquid streams. Achieves 80-90% destruction of 1000 ppm phenol.	50	120	20 x 33 x 35 h 85 LB
DH-150	Specially designed for small spaces. Can be lowered below ground for direct treatment of groundwater. Ideal as a substitute for air strippers. Low utilities and low operating cost.	50	80	18 dia x 32 h 40lb
CW-15000	For bulk oxidation of large volume streams.	600	480	4'x24'x7' 2000 lbs.

Bi-Ox Cleaner FOR ALL TREATMENT SYSTEMS. BioOx® cleaner provides biocatalyst, which oxidizes organics and adsorbs heavy metals. May be customized to your specifications when necessary.