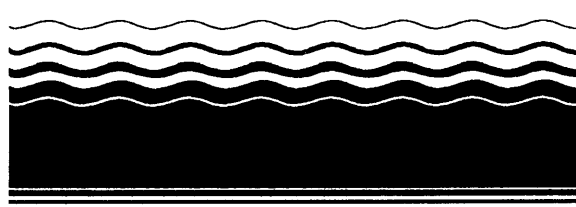




# SITE

SUPERFUND INNOVATIVE  
TECHNOLOGY EVALUATION



## Demonstration Bulletin

### ZenoGem™ Wastewater Treatment Process

ZENON Environmental Systems

**Technology Description:** Zenon Environmental Systems (Zenon) has developed the ZenoGem™ process to remove organic compounds from wastewater by integrating biological treatment and membrane-based ultrafiltration. This innovative system combines biological treatment to remove biodegradable organic compounds with ultrafiltration to separate residual suspended solids from biologically treated effluent. Zenon claims the technology reduces organic contaminants in wastewater to nondetectable levels, improves effluent quality, and reduces the quantity of sludge for disposal. The major components of the ZenoGem™ system are an influent holding/equalization tank, an enclosed biological reactor (bioreactor), a pH buffer tank, a nutrient solution tank, an ultrafiltration module, an air blower, an off-gas carbon filter, a permeate carbon filter and process, feed, and metering pumps (Figure 1). A pilot-scale ZenoGem™ system, contained in an 8-ft by 48-ft ZenoSite™ trailer, was used for the demonstration.

Contaminated wastewater is continuously introduced into a stirred-tank bioreactor that contains an acclimated aerobic microbial culture. The aerobic suspended-growth environment is maintained by diffused aeration, which continuously mixes the bioreactor's contents. The mixture of organic contaminants and microbes, called mixed liquor, is retained in the bioreactor for a period of time sufficient to allow the microbes to metabolize the organic contaminants into inorganic end-products and intermediate by-products.

The biologically treated effluent is continuously pumped from the bioreactor into the ultrafiltration module. The ultrafiltration module consists of 1-in. diameter tubes connected in series and contained in a 12-ft by 4-in. diameter polyvinyl chloride housing. The tubes support

the ultrafiltration membrane, which filters dissolved contaminants and suspended solids (concentrate) from the biologically treated effluent. Concentrate accumulating on the membrane surface is detached by cross-flow water movement. The concentrate is then continuously recycled to the bioreactor to maintain a desired biomass and to further degrade higher molecular weight organic compounds. Ideally, the filtered effluent (permeate) passing through the membrane does not contain parent organic contaminants. However, the system is equipped with a permeate carbon filter that removes trace organics before the final treated effluent is discharged. According to Zenon, the treated effluent water may be disposed of at a publicly owned treatment works (POTW), reused on site, or discharged directly to surface water under an appropriate National Pollutant Discharge Elimination System permit.

**Demonstration Approach:** The ZenoGem™ technology was demonstrated at the Nascolite Superfund Site in Millville, NJ from September through November 1994. Groundwater at this 17.5-acre site is contaminated with methyl methacrylate (MMA) and other volatile organic compounds (VOCs) from manufacturing polymethyl methacrylate plastic sheets, commonly known as plexiglass.

During the demonstration, contaminated groundwater was pumped from four production wells into a 6,000-gal equalization tank to minimize variability in contaminant concentrations during the demonstration. Following equalization, the contaminated groundwater was pumped to the 1,100 gal influent holding/equalization tank located in the ZenoSite™ trailer. During full-scale operation, Zenon uses the influent holding tank as the equalization tank prior to treatment. The contaminated groundwater was then pumped into the bioreactor for

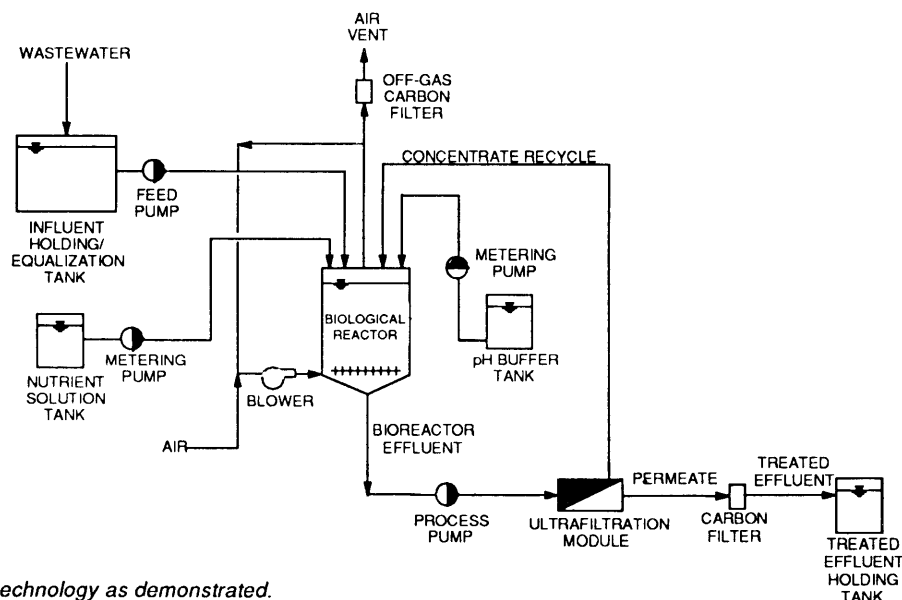


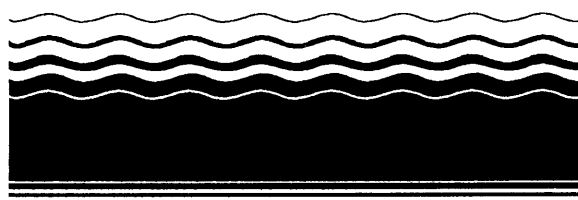
Figure 1. The ZenoGem™ technology as demonstrated.





# SITE

SUPERFUND INNOVATIVE  
TECHNOLOGY EVALUATION



## Demonstration Bulletin

### ZenoGem™ Wastewater Treatment Process

ZENON Environmental Systems

**Technology Description:** Zenon Environmental Systems (Zenon) has developed the ZenoGem™ process to remove organic compounds from wastewater by integrating biological treatment and membrane-based ultrafiltration. This innovative system combines biological treatment to remove biodegradable organic compounds with ultrafiltration to separate residual suspended solids from biologically treated effluent. Zenon claims the technology reduces organic contaminants in wastewater to nondetectable levels, improves effluent quality, and reduces the quantity of sludge for disposal. The major components of the ZenoGem™ system are an influent holding/equalization tank, an enclosed biological reactor (bioreactor), a pH buffer tank, a nutrient solution tank, an ultrafiltration module, an air blower, an off-gas carbon filter, a permeate carbon filter and process, feed, and metering pumps (Figure 1). A pilot-scale ZenoGem™ system, contained in an 8-ft by 48-ft ZenoSite™ trailer, was used for the demonstration.

Contaminated wastewater is continuously introduced into a stirred-tank bioreactor that contains an acclimated aerobic microbial culture. The aerobic suspended-growth environment is maintained by diffused aeration, which continuously mixes the bioreactor's contents. The mixture of organic contaminants and microbes, called mixed liquor, is retained in the bioreactor for a period of time sufficient to allow the microbes to metabolize the organic contaminants into inorganic end-products and intermediate by-products.

The biologically treated effluent is continuously pumped from the bioreactor into the ultrafiltration module. The ultrafiltration module consists of 1-in. diameter tubes connected in series and contained in a 12-ft by 4-in. diameter polyvinyl chloride housing. The tubes support

the ultrafiltration membrane, which filters dissolved contaminants and suspended solids (concentrate) from the biologically treated effluent. Concentrate accumulating on the membrane surface is detached by cross-flow water movement. The concentrate is then continuously recycled to the bioreactor to maintain a desired biomass and to further degrade higher molecular weight organic compounds. Ideally, the filtered effluent (permeate) passing through the membrane does not contain parent organic contaminants. However, the system is equipped with a permeate carbon filter that removes trace organics before the final treated effluent is discharged. According to Zenon, the treated effluent water may be disposed of at a publicly owned treatment works (POTW), reused on site, or discharged directly to surface water under an appropriate National Pollutant Discharge Elimination System permit.

**Demonstration Approach:** The ZenoGem™ technology was demonstrated at the Nascolite Superfund Site in Millville, NJ from September through November 1994. Groundwater at this 17.5-acre site is contaminated with methyl methacrylate (MMA) and other volatile organic compounds (VOCs) from manufacturing polymethyl methacrylate plastic sheets, commonly known as plexiglass.

During the demonstration, contaminated groundwater was pumped from four production wells into a 6,000-gal equalization tank to minimize variability in contaminant concentrations during the demonstration. Following equalization, the contaminated groundwater was pumped to the 1,100 gal influent holding/equalization tank located in the ZenoSite™ trailer. During full-scale operation, Zenon uses the influent holding tank as the equalization tank prior to treatment. The contaminated groundwater was then pumped into the bioreactor for

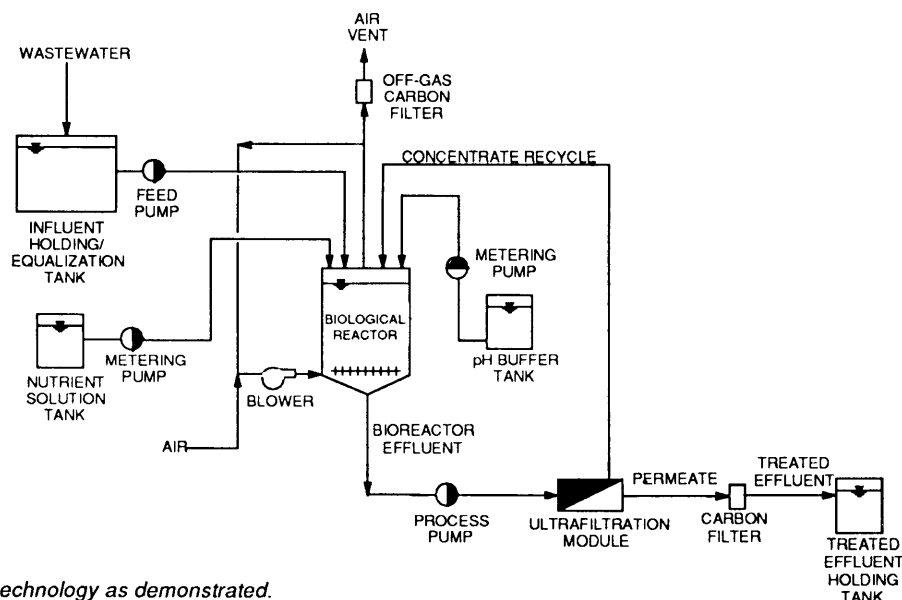


Figure 1. The ZenoGem™ technology as demonstrated.

