

## Methanol and Wastewater Denitrification

### What is denitrification and why is it important?

Wastewater collected in treatment facilities contains high levels of ammonia which is then converted into nitrate through bacterial degradation. If discharged into the environment, the nutrient-rich nitrate in sewage effluent can have a devastating effect on water ecosystems. Denitrification is the practice of using chemical additives to convert nitrate ( $\text{NO}_3$ ) into nitrogen gas ( $\text{N}_2$ ) which can be safely released into the atmosphere.

Although nitrogen is omnipresent, making up almost 78% of our atmosphere, when the element enters our waterways in large quantities as a solid, it causes an abundant growth of algae which feed off nitrate. The resulting algae 'blooms' can cover hundreds of square miles and absorb a disproportionate amount of oxygen from the water, suffocating all but the most extreme forms of aquatic life. A readily available organic compound must be added to eliminate the excess nitrate; the carbon source most often chosen is methanol.

### Why use methanol in the denitrification process?

Methanol's strength is in its chemical makeup. Known as "wood alcohol," methanol is a simple molecule ( $\text{CH}_3\text{OH}$ ) that serves as a carbon source for bacterial "bugs." Accelerated by the addition of methanol, anaerobic bacteria rapidly convert the nitrate to harmless nitrogen gas, which is vented into the atmosphere.

The advantages of methanol in the denitrification process are copious. As it contains no solids, no additional nutrients, has a neutral pH, is low cost and contains 100% readily degradable substrate, methanol offers the ideal solution to nitrogen reduction both in its ease of use and in its positive impact. Methanol can be made from anything that is or ever was a plant including biomass, natural gas, forest thinnings, agricultural waste, landfill gas, and even carbon dioxide captured from the atmosphere. This 'poly-generation' means that ultimately methanol can be produced from a number of renewable feedstocks and waste streams, especially those that are local to the wastewater plant adding to its overall sustainable impact.



Algae Bloom in the Chesapeake Bay



Denitrification Filter Beds



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### Where is methanol being used for denitrification?

Today, there are nearly 200 wastewater treatment plants using methanol in the denitrification process in the United States alone. One of the larger plants in the country, the Blue Plains Advanced Wastewater Treatment Facility, has had one of the best success stories related to methanol denitrification. Blue Plains, which serves the Washington, D.C. area, releases nearly 370 million gallons of treated wastewater to the Potomac River each day. Today, the Blue Plains facility releases only 10 tons of nitrogen per day, half its pre-methanol output. With methanol denitrification, Blue Plains has continually met the EPA standard of 4.7 million pounds of nitrogen released per year, and has come in well below the standard on many occasions. In other regions, nitrogen removal projects in Connecticut have drastically reduced the nitrogen pollution of the Long Island Sound. Moreover, the Rosedale Wastewater Treatment Plant in New Zealand, and the East Central Regional Water Reclamation Facility in West Palm Beach, Florida are utilizing denitrification to reuse treated wastewater to augment wetlands and recharge aquifers.

### How much does methanol denitrification cost?

Methanol is low-cost (about \$1.00 a gallon on the wholesale market, with distribution costs and volume sales determining the ultimate retail cost), naturally biodegrades, and is readily available from suppliers around the globe. In the example of Blue Plains, methanol denitrification costs \$100 million less than the closest alternative for nutrient removal. Initial capital costs vary based on the application system chosen and the energy costs associated with the treatment process. While the average nitrogen removal costs in the Chesapeake basin have been reported to be about \$4 per pound, methanol denitrification at Blue Plains, costs only \$0.50 - \$0.60 per pound of nitrogen removed.

### Need Methanol?

The Methanol Institute (MI) serves as the trade association for the global methanol industry. Facility operators and engineering firms interested in obtaining methanol for wastewater denitrification can visit our web site at [www.methanol.org](http://www.methanol.org) and complete our on-line Methanol Source Request. Tell us your methanol needs, and **we will put you in contact with major methanol providers**. Also available on our website is a collection of safety information, including a safe handling manual.



Blue Plains Wastewater Treatment Facility

