MONITORING NITRATES IN DRINKING WATER AND WASTEWATER

Nitrate is present in high levels in wastewater due in part to the high nitrates present in human sewage but also from some types of industrial effluent entering the municipal sewer system.

Nitrate is also a very common contaminant in both surface water and ground water. Nitrate occurs naturally in source water as a result of decaying plants. However, there are other manmade sources of nitrate than can increase the presence of nitrate in source waters to dangerous levels. Agricultural sources of nitrates include livestock waste matter and chemical fertilizers.

NITRATE IN GROUND WATER AND SURFACE WATER
Because nitrate is highly soluble in water it tends not to get filtered out like some other contaminants as the water seeps through the soil layers to the ground water level. How much nitrate will reach the groundwater zone from agriculture is determined by varying levels of crop watering and irrigation as well as changing levels of rainfall. Another source of nitrates in ground water is from human sewage disposal systems such as unmaintained septic tanks. It is therefore important to monitor nitrates as often as possible in groundwater since nitrate levels can be difficult to predict.

The same sources of nitrates can lead to elevated levels of nitrates in surface water due to runoff from agricultural land into lakes and rivers whether the source is livestock or fertilizer for crops. Surface water is also particularly susceptible to natural nitrate sources such as decaying leaves which varies both seasonally and with weather events. Again, the levels of nitrate tend to vary and are fairly unpredictable; so frequent monitoring is essential.

HEALTH EFFECTS OF NITRATES IN DRINKING WATER
When babies under the age of 6 months have excessive levels of nitrates in their system, they can develop a health condition known as “blue baby syndrome.” This condition prevents the blood from providing enough oxygen to cells in the body which gives the skin a characteristic blue color, leading to very serious health problems. Studies have indicated that people who have heart or lung disease, certain inherited enzyme defects, or cancer may be more sensitive to the toxic effects of nitrate than others. In addition, some experts believe that long-term ingestion of water high in nitrate may increase the risk of certain types of cancer. Nitrates must not be allowed to be present in any significant amount in drinking water which has led to nitrate becoming a regulated water quality parameter.

NITRATES IN WASTEWATER
The removal of nitrates and nitrogen from municipal wastewater is often termed nutrient removal. If nitrogen nutrients are not properly removed from the wastewater before it is released into the environment, the nitrogen nutrients can start to build up to excessive levels in a process called eutrophication. As could be expected, this buildup of nutrients can cause extreme overgrowth of weeds and algae. When an algae bloom occurs, the algae actually grows so aggressively that it cannot sustain itself, at which time the algae begins to die out. As the dead algae decomposes it promotes the growth of bacteria which in turn causes fish and other animals...
to die due to severely depleted oxygen levels from the increased levels of bacteria. Because nitrogen can cause such significant environmental devastation if not properly removed, it is very important to properly monitor the nitrogen removal process in the wastewater plant.

**NITRATE REMOVAL IN WATER AND WASTEWATER**

Nitrates are generally not removed sufficiently during coagulation and simple filtration, which is partially due to the excellent solubility of nitrates in water. EPA approved methods for removing nitrates in drinking water applications include ion exchange and reverse osmosis.

In wastewater, nutrient nitrogen is first converted to nitrate via the process of nitrification, after which the converted nitrogen along with existing nitrate from the naturally decomposing sewage is reduced to nitrogen gas, commonly termed denitrification. The nitrogen gas is then harmlessly released to the atmosphere.

**REAL TECH’S SOLUTIONS FOR MONITORING NITRATES**

Monitoring of nitrates in real-time for drinking water and wastewater is straightforward with the use of Real Tech’s Real UV Spectrum series instruments. Nitrates have a natural peak at around the 220nm wavelength. Common interferences with the nitrate measurement at 220nm include organics and turbidity or suspended solids. However, Real Tech’s Real Spectrum series instruments allow the use of chemometrics to compensate for these potential interferences using spectral absorbance data from hundreds of individual wavelengths of light.

In wastewater, the Real Spectrum 2000 series are ideal for dealing with the high levels of suspended solids. For wastewater applications, Real Tech recommends the use of Real Tech’s specially designed Pump and Clean systems to ensure minimal maintenance requirements. Because nitrate is colorless, odourless and tasteless it is not easily detected in drinking water unless it is properly monitored. Real Tech’s Real Spectrum Series instruments are ideal for detecting nitrates in drinking water whether monitoring the raw water source or the finished water.