

Nitrate Removal Facility

Q: Why does Des Moines Water Works (DMWW) need a Nitrate Removal Facility?

Nitrate concentrations in the Raccoon and Des Moines Rivers, two of our water sources, are Des Moines Water Works' biggest water quality problem. Trending data shows that nitrate concentrations in the rivers has steadily increased in the past 25 years and indicates a continuation of this upward trend.

In 1989 and 1990, DMWW exceeded the Environmental Protection Agency's (EPA) maximum contaminant level (MCL) of 10 milligrams per liter (mg/L) for nitrate in drinking water. Public notices were issued to our customers. The nitrate removal facility was designed in 1989 and built during the winter of 1990-1991. Without the facility DMWW would have violated the MCL in subsequent years.

Q: How much did it cost to build the Nitrate Removal Facility?

DMWW spent \$4.1 million to design and build the facility.

Q: What is the size and capacity of the Nitrate Removal Facility?

Each of the eight removal vessels contain 450 cubic feet of ion exchange resin and 232 cubic feet of support gravel. Operating capacity is 10 million gallons of water per day (mgd).

Q: How much does it cost to operate?

To treat 10 mgd, the operating and labor costs for the nitrate removal facility can add up to \$7,000 a day. Des Moines Water Works cannot continue to meet the increasing water demand of our customers without regulation of pollutants in our source water. Record high nitrate concentrations will demand significant future capital investments to remove this pollutant and provide safe drinking water to a growing central Iowa.

Q: How many days a year is the Nitrate Removal Facility in operation?

DMWW has operated the facility from 0 to 100+ days in a year. Most recently, in 2015, DMWW has operated the nitrate removal facility a record-breaking 177 days, in order to deliver water to its 500,000 customers below the Safe Drinking Water standard for nitrate. River water nitrate levels continue to increase, as well as the length of high-nitrate episodes. Nitrate levels are also high in DMWW's shallow ground water collector system, one of the largest in the world.

Q: How is the nitrate removed from the water?

A sodium chloride-coated resin material is in each of the removal vessels. As the nitrate-laden water passes through the resin, the nitrate ions are captured and chloride ions are released into the water in a process known as ion exchange. This ion exchange process is similar to a home water softener that removes calcium and magnesium ions from the water, exchanging them for sodium ions.

Q: What happens to the Nitrate once DMWW removes it from the water?

When the resin is exhausted, it is regenerated with sodium chloride brine. Nitrate on the resin is exchanged for chloride, a reversal of the removal process. The spent brine containing the collected nitrate is diluted with partly-treated water and discharged back into the Raccoon River.

DMWW staff is also planning for infrastructure upgrades that will allow for a new method of disposal of regeneration waste. We invite and challenge those in the drainage districts to seek innovative solutions as well.

Q: Does this create a bigger problem for the cities and water utilities downstream?

No. Returning nitrate to the river does not impact the river's total nitrate load. River nitrate concentrations are so high that cities downstream would have a nitrate problem even if DMWW did not discharge back into the river. For example, the daily nitrate load in the Raccoon River can approach 700 tons; of this amount, less than 0.10% would pass through the nitrate removal facility and be returned to the river. Other practical disposal methods are not available at this time.

It's also important to remember that DMWW actually decreases the nitrate load in the Raccoon River through the diversion of river water into the Water Works Park ponds and Crystal Lake (former gravel pit) near the Maffitt Treatment Plant. In the ponds and Crystal Lake, nitrate is consumed and converted to nitrogen gas by the life processes of microorganisms before the water is discharged back into the river or treated for customer use. DMWW removes about 75,000 pounds of nitrate from the river each year in this manner.

Q: Does DMWW need special permission to discharge the nitrate back into the river?

Yes, DMWW has two National Pollutant Discharge Elimination System (NPDES) permits allowing discharge of the nitrate. Prior to issuing the permits, the Iowa Department of Natural Resources (IDNR), as authorized by the Federal Clean Water Act, requested public review and comment on the discharge permits. The permits were also reviewed and approved by the Environmental Protection Agency (EPA).

Q: How can we prevent nitrate from getting into our source water?

The optimal solution is to prevent nitrate concentrations from entering our source water through watershed protection programs and good land management practices.

Q: What are the health effects of nitrate?

In infants under six months of age, nitrate may transform into nitrite in the infant's body, reducing the ability of blood to carry oxygen. This may cause Blue Baby Syndrome, a life threatening condition requiring immediate medical attention. Symptoms of Blue Baby Syndrome include the infant looking blue and having shortness of breath.

Blue Baby Syndrome is very seldom diagnosed today. But, on the horizon are other health concerns relating to Nitrates. Research supports a strong correlation between nitrates and certain types of cancer in adults. There is also emerging data implicating nitrate as an endocrine disruptor, meaning nitrate may act as a hormone in the body.

Q: Why are babies under six months of age at risk?

The intestinal pH is higher in infants, enhancing the bacterial conversion of nitrate to nitrite. Infants require three times the fluid intake of adults, increasing the blood circulation and the nitrate absorption. The infant's immature kidneys reduce the excretion of the nitrate. The presence of the enzyme responsible for preventing Blue Baby Syndrome is lower than in adults and children over six months of age.

Q: What is DMWW doing to help reduce or eliminate the nitrate problem?

DMWW is committed to providing safe drinking water by building coalitions, implementing cost effective technology and landscapes that will protect our water sources. DMWW has implemented environmentally-friendly methods to remove nitrate from source water utilized for drinking water. Currently, these efforts are focused on a concept called off-river storage. River water is diverted into a reservoir where the tranquil water is conducive to the life-processes of microorganisms that can remove nitrate from the water. No chemicals and very little energy is used to remove nitrate in this manner, and no waste is discharged back to the river. DMWW is committed to finding solutions to reduce nitrates in source waters used for drinking water. While the steps DMWW is taking to reduce nitrates in drinking water sources are worthy, they are minimal in the overall battle to reduce Iowa's nitrate concentrations impacting the Mississippi River and ultimately the Gulf of Mexico.

For more information, call Des Moines Water Works at (515) 283-8700 or visit www.dmww.com.