

CASE STUDIES

Advanced Oxidation Processes

Successful Piloting of UV Advanced Oxidation on Long Island for 1,4-dioxane Treatment

PROJECT BACKGROUND

1,4-Dioxane is a stabilizing compound classified as a “likely human carcinogen” by the United States Environmental Protection Agency (USEPA). Once it enters the environment, it can migrate easily into groundwater supplies.

On Long Island, in New York State, 1,4-dioxane has been a detected contaminant of concern in groundwater for many years. Testing mandated by the USEPA Third Unregulated Contaminant Monitoring Rule (UCMR 3) showed that over half of the tested wells on Long Island had detectable levels of 1,4-dioxane¹.

The New York State Department of Environmental Conservation (NYDEC) aggressively limits 1,4-dioxane and in 2020 established the first state-wide maximum contaminant level (MCL) for 1,4-dioxane, limiting the contaminant to a concentration of 1 part per billion in drinking water supplies². Data from UCMR 3 suggested that over 70 wells supplying public drinking water across Long Island detected 1,4-dioxane above or very close to this limit.

Long Island UV AOP Mobile Pilot Station Configuration

- Low-pressure UV treatment system using TrojanUV Solo Lamp® Technology (power panel included)
- Oxidant dosing equipment, including mixers and injectors
- Online UV transmittance (UVT) monitor
- Online controller to drive optimal UV AOP performance
- Sample collection station with four catchments
- Storage for spare UV lamps and other components

PILOTING ADVANCED OXIDATION

The NYDEC has accepted the ultraviolet advanced oxidation process (UV AOP) as a treatment solution for 1,4-dioxane³. UV AOP is a powerful treatment process capable of breaking down 1,4-dioxane, which is less effectively treated by other advanced treatment methods such as activated carbon, reverse osmosis, or air stripping.

For water providers located in Nassau County on Long Island, it was necessary to pilot UV AOP technology at the various wells requiring treatment in order to confirm treatment efficacy and obtain state approval. This meant piloting UV AOP technology at dozens of wells affected by 1,4-dioxane located across 452 square miles.



Location: Nassau County, Long Island, New York
System: TrojanUV Pilot Equipment



UV AOP pilot stations were easily transported between well sites, enabling the facilitation of 45 separate pilots in six months.

THE TROJANUV SOLUTION

Urgency for meeting the new MCL for 1,4-dioxane necessitated rapid deployment of piloting equipment across the service area in order to obtain rapid approval for the future full-scale 1,4-dioxane treatment systems needed in Nassau County.

To ensure fast and effective piloting, Trojan Technologies developed several compact UV AOP pilot stations. These stations were easily mobilized on trucks for simple transport between well sites.

At each well site, the pilot station was quickly connected to water and chemical oxidant supplies. This efficient transportability enabled the facilitation of over 45 separate pilots in six months and ensured that contaminated well sites in Nassau County could rapidly meet their groundwater remediation commitments.

PILOTING EXPERTISE

Confirming the effectiveness of UV AOP at contamination sites is important because site-specific characteristics of the water strongly influence performance. This can require bench-scale and pilot-scale testing.

Trojan's team of scientists, researchers, and technicians have analyzed thousands of water samples from around the world and are often called upon to confirm UV AOP treatability through the rapid deployment of mobile pilot stations.

Testing entails measuring characteristics of water critical to UV AOP performance, including UV transmittance, pH, nitrate ion concentration, and radical scavenging. From the test results, it can be determined if UV AOP is the optimal solution and, if it is, will enable the design of a robust UV advanced oxidation system engineered specifically for the unique treatment needs of the application.

TrojanUV advanced oxidation systems have been installed at treatment plants from California to Australia to treat a wide variety of contaminants, including 1,4-dioxane, pesticides, nitrosamines, taste-and-odor-causing compounds, and algal toxins.

Since the completion of this piloting work, Trojan, along with local engineers, has successfully designed, installed, and commissioned full-scale UV AOP at dozens of well sites in Nassau County, making it the world's largest 1,4-dioxane treatment initiative.

REFERENCES

1. "The Third Unregulated Contaminant Monitoring Rule (UCMR 3): Data Summary, January 2017", United States Environmental Protection Agency, <https://www.epa.gov/sites/production/files/2017-02/documents/ucmr3-data-summary-january-2017.pdf>
2. "DEC Releases New Guidance to Regulate PFOA, PFOS, and 1,4-Dioxane in State Waters", Department of Environmental Conservation, New York State, <https://www.dec.ny.gov/press/123915.html>
3. "SCWA 1,4-Dioxane Treatment System Approved by New York State", Suffolk County Water Authority, https://www.scwa.com/14-dioxane_treatment_system_approved/



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Environmental Contaminants Broken Down by UV AOP

VOLATILE ORGANIC COMPOUNDS

- 1,4-Dioxane
- Trichloroethylene (TCE)
- Tetrachloroethylene (PCE)

TREATMENT BY-PRODUCTS

- N-nitrosodimethylamine (NDMA)

TASTE AND ODOR CAUSING COMPOUNDS

- 2-Methylisoborneol (MIB)
- Geosmin

PESTICIDES

- Metaldehyde
- Atrazine

ALGAL TOXINS

- Anatoxin
- Microcystin

EXPLOSIVES

- Hexahydro-1,3,5-trinitro-1,3,5-triazine (RDX)

HAZARDOUS SUBSTANCES

- Cyanide

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