

Case Study: Torrent3 Treatment System

remote deployment for excess capacity during wet weather events



District Name and Deployment Location:

Milwaukee Metropolitan Sewerage District (MMSD)
Bypass Station BS0405 59th and State, Wauwatosa, WI 53208

Introduction

Rapid Radicals Technology's Torrent3 Treatment System is an advanced, high-rate wastewater treatment platform designed to rapidly remove solids, organics, and pathogens within 30 minutes of total treatment time. Housed within a 45-foot transportable container, the Torrent3 integrates rapid solids removal with a proprietary ozone-based advanced oxidation process. The system provides scalable auxiliary treatment capacity for utilities and for industrial producers seeking reliable, compact treatment solutions.

Developed through collaboration with MMSD and Marquette University, the Torrent3 advances the goal of eliminating sewer overflows and basement backups by offering decentralized, rapid-response treatment that meets or exceeds discharge permit requirements for BOD, TSS, and E. coli. The system's semi-automated control and remote monitoring features enable reliable, efficient operation during peak flow events.

Deployment Summary

From June 2023 to June 2024, Rapid Radicals deployed the Torrent3 Treatment System at MMSD's 59th & W. State Street Bypass Station (BS0405) in Wauwatosa, Wisconsin. The objective was to evaluate Torrent3's ability to meet wet weather discharge permit limits for total suspended solids (TSS < 30 mg/L), biochemical oxygen demand (BOD < 30 mg/L), and E. coli (<126 CFU/100 mL) within a treatment time of less than 30 minutes.



The Torrent3 was operated as a mobile pilot system, pumping combined sewer water directly from a 96-inch main interceptor sewer approximately 30 feet below grade. Data collection focused on

treatment efficiency, ozone dose response, and system reliability under variable wet weather conditions including snowmelt, industrial slugs, and low-flow periods.

System and Operating Specifications

Parameter	Value / Range
Flow Rate	35–65 gallons per minute (gpm)
Water Temperature	10–20 °C
Total Treatment Time	30–50 minutes
Influent Type	Combined sewer water
Ozone Dose	1.4 mg O ₃ /L
Detention Volume	2,000 gallons

Performance Results

Torrent3 achieved consistent effluent quality that met MMSD's Wisconsin Pollutant Discharge Elimination System (WPDES) discharge permit requirements for all tested parameters. Performance was stable across a broad range of wastewater temperatures, demonstrating robust kinetics and effective ozone transfer under field conditions.

Parameter	Influent	% Removal	Effluent	Permit Target
COD (mg/L)	310 ± 30	65 ± 3	110 ± 20	Not regulated
BOD (mg/L)	160 ± 20	86 ± 3	20 ± 3	30
TSS (mg/L)	130 ± 20	88 ± 3	16 ± 1	30
E. coli (CFU/100 mL)	10 ⁵	99.96%	150 ± 60	126 / 410*

*126 CFU/100 mL monthly average; <10% exceedance of 410 CFU/100 mL

Pathogen Inactivation: The City of Milwaukee Health Department analyzed samples for viral inactivation. The Torrent3 achieved complete SARS-CoV-2 inactivation (up to 3-log reduction) and 1.5-log reduction of Pepper Mild Mottled Virus (pmmov), a surrogate for human sewage viruses. Virus removal was strongly correlated with influent organic load, confirming that Torrent3's ozone-based advanced oxidation process provides simultaneous disinfection and organics oxidation.

Key Takeaways

1. Successfully treated over 800,000 gallons of combined sewer water to permit standards.
2. Achieved >85% BOD and TSS removal and >4-log E. coli reduction in less than 30 minutes.
3. Demonstrated robust, operator-safe automation under variable wet weather conditions.
4. Field deployment provided critical insight for system optimization and informed subsequent Torrent3 improvements.