

Ozone Treatment of Hydrogen Sulfide:

Reliable options to combat H₂S corrosion and odors in wastewater collection systems

By: Louis LeBrun, Pinnacle Ozone Solutions, LLC

While ozone oxidation of hydrogen sulfide (H₂S) has long been known to be an effective and efficient treatment method for many years, the practical limitations of previous generations of ozone generation technology and process control prevented the development of a commercially viable H₂S treatment process.

But now, special features offered by Pinnacle Ozone Solutions, LLC, (Pinnacle) has allowed for collaboration with Anue Water Technologies, Inc. (Anue) to provide higher reliability, lower maintenance, and better operating efficiency than was previously available for an H₂S treatment process that is suitable for a sewage collection system.



Anue Water Technologies Force5 ozone-based process for H₂S control at the Talega site.

In particular, Pinnacle's built-in ozone controls allows Anue's Force5™ process to provide for reduction in operating cost by as much as 70% versus previous ozone-based processes, while advanced materials and sealed-cell design for ozone generator units virtually eliminate maintenance concerns. In addition, modular design provides for flexibility and built-in redundancy, and built-in controls provide for "Ozone-On-Demand®" operation.

Since sulfur compounds are naturally occurring in all sewage, collection systems have long been subject to issues with hydrogen sulfide odor and corrosion. Problems are particularly common when sewage must be conveyed long distances, thereby providing the opportunity to become anaerobic, and allowing sulfide reducing bacteria (SRB) to multiply, producing H₂S as a part of their growth process.

The issue is especially prevalent in hotter climates, and in large collection systems with long residence times. Once problems develop, they can be very difficult to manage and mitigate, since the SRB population quickly multiplies and advances through the collection system.

At a minimum, H₂S issues lead to a rash of customer complaints about "rotten-egg" odors from manholes and lift stations. However, more serious problems can develop if issues are left unaddressed. Naturally formed H₂S combines with moisture within the collection system to form highly corrosive sulfuric acid. Over even a short period, these conditions can severely corrode the interior of pipes, manholes, lift stations, and pumps. Over the long term, these problems may result in serious line breaks and sewage spills which are costly to repair and damaging to the environment.



Robust field-based processes are made possible by Pinnacle Ozone's modular ozone generator technology

Over the years, a wide range of solutions have been applied to H₂S issues. Most sites have found conventional H₂S treatment systems to offer somewhat inconsistent results, while also being expensive and cumbersome to maintain.

In the collection system design process H₂S issues can be addressed by minimizing residence time in the collection system, and also through careful selection of corrosion resistant materials and equipment. Unfortunately, such measures can significantly increase construction cost. Unfortunately, these options are not available to existing collection systems where pipes and pump stations are already in place.

Vapor-phase solutions can effectively mitigate H₂S odors, but are best suited to larger installations, and don't address underlying corrosion issues. A range of chemical-based solutions have historically been applied to help control the formation of H₂S within a collection system, but such alternatives require chemical handling and metering.

Meanwhile, ozone oxidation of H₂S has been known to be an effective treatment method for many years. Ozone is the highly reactive tri-atomic (O₃) form of oxygen that occurs naturally when oxygen (O₂) in the air is energized by intense energy such as UV light or lightning.

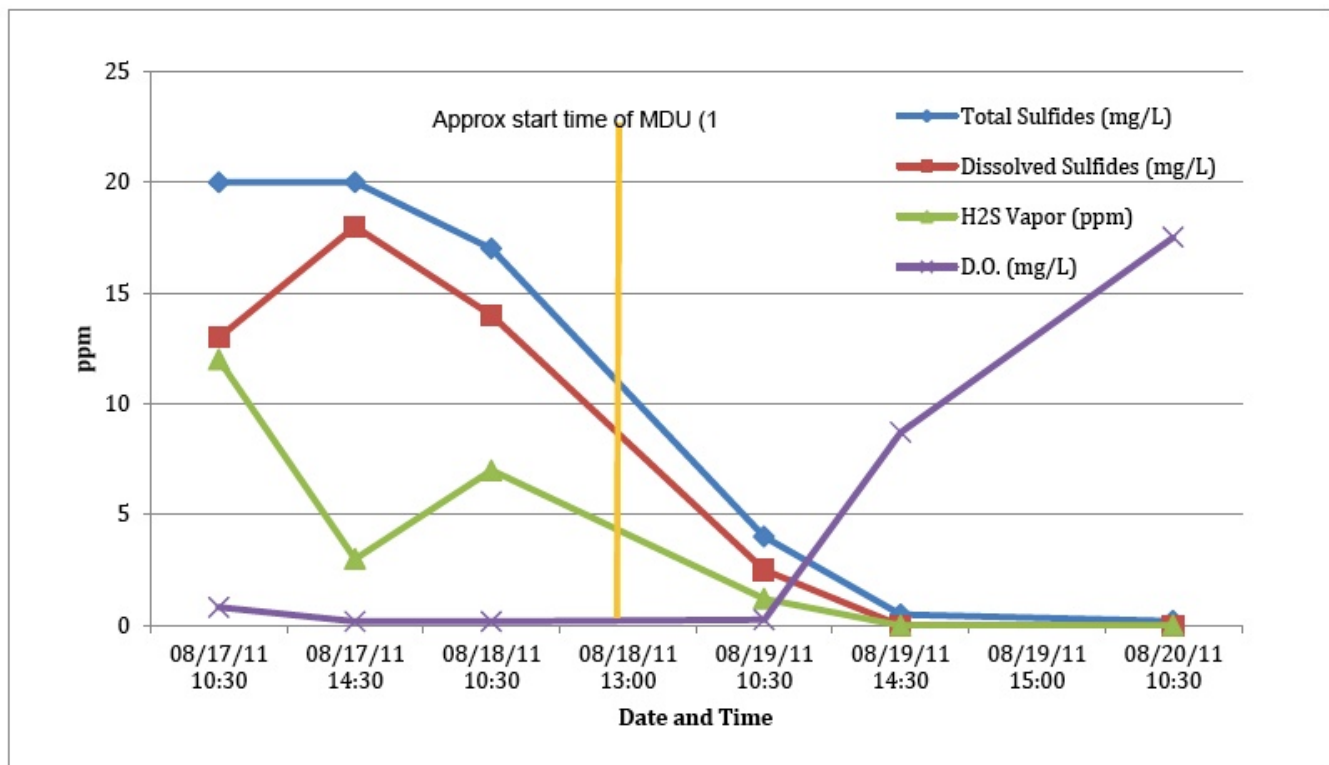
Onsite, ozone is most efficiently generated in a controlled process using oxygen gas exposed to electrical current. The resulting ozone gas can be readily dissolved in water to react with and destroy a wide range of contaminants. Because it reacts so quickly in wastewater, ozone is safe and efficient to use. While very efficient, the practical limitations of older ozone generator equipment prevented the development of a commercially viable H₂S treatment process until now.

Anue's Forse5 treatment process injects ozone and oxygen into sewer lines to destroy H₂S. This process directly oxidizes H₂S, helps to oxygenate sewage, and improves overall conditions within the collection system. Forse5 systems are available in a range of sizes, and can be either permanent installations or mobile (trailer) based solutions, thereby providing municipal users with valuable options. The ozone treatment provides lasting benefits throughout the collection system, while significantly reducing or eliminating H₂S issues.

The modular design of Pinnacle's ozone systems offers many advantages for demanding field applications. Each system can be flexibly configured to specifically match the specific needs of a particular site or application. Modularity provides a high level of built-in redundancy to assure the highest reliability, while also providing for easy expansion to accommodate future needs. Pinnacle's ozone cells offer the highest energy efficiency available, and the sealed-cell design virtually eliminates maintenance. All of these factors contribute to the highest level of system reliability and the lowest total lifetime operating cost.

The combination of Anue's Forse5® process and Pinnacle's advanced control system allows for completely automatic H₂S mitigation and treatment. The process produces ozone and oxygen onsite, which is then rapidly and efficiently dissolved into a small side-stream of sewage. The treated side-stream is then injected back into the collection system to effectively destroy H₂S gas, oxygenate the waste stream, and promote a healthy aerobic biological culture.

In use, H₂S concentrations of over 3,000 ppm are effectively reduced to below 10 ppm within 24-hours of initiating treatment. Dissolved oxygen (DO) levels within the system show rapid increases confirming the presence of healthy conditions in the collection system. Testing at multiple sites has also revealed that the Forse5 process effectively eliminates many problematic SRB bacteria and inoculates the system against further issues for several days to a week.



Force5 performance results showing a significant increase in collection system DO and reduction in H₂S within a short time of starting treatment

Moreover, total lifecycle costs for ozone treatment have been shown to provide significantly lower OPEX and total lifecycle costs than more conventional alternatives. Since the system is fully automated and can be remotely monitored, treatment can be provided on a continuous and/or automatic basis to provide an effective scheme for H₂S management.

Anue Water Technologies Forse5 system efficiently leverages Pinnacle Ozone Solutions advanced generator technology to provide a treatment option that was not available until today. For more information on H₂S treatment and ozone technology please visit www.anuewater.com or www.pinnacleozone.com.