Mazzei®

CASE STUDY

Mitigating Environmental Impact Of Gold Mine's Wastewater Through Ozone Oxidation And Aquifer Re-injection

Mazzei GDT™ Ozone Contacting System
North of Nome, Alaska, USA

The Problem: Installing and operating an ozone oxidation system for wastewater remediation at a gold mine located in a remote region of Alaska is full of challenges. Cyanide leaching, carbon in pulp (CIP), and electrowinning processes utilized to extract gold from the mine's ore are only some of the difficulties that need to be taken into consideration. In addition, there are unique equipment designs required to ensure the reliability of an ozone system in a remote and isolated location.

The US Environment Protection Agency (USEPA) requires mining operations to remediate their waste streams prior to environmental discharge. Wastewater streams from gold mine operations can be particularly toxic due to the potential for cyanide contamination and the concentration of metals contained in the wastewater effluent. At this cluster of low grade gold deposits 13 km North of Nome, they used open pit mining to extract the ore and utilized cyanide leaching (electrowinning) and a carbon in pulp (CIP) process to extract the gold from the excavated ore.The stripped cyanide is returned to the CIP process, circulating between the leach ponds and electrowinning cells in a continuous closed loop. The majority of fluid from the dewatering process goes directly into the tailings pond—this pond has a finite capacity, losing water only through natural evaporation. The excess dewatering effluent produces a waste stream which must be processed and discharged from the mining operation. (At the time of this writing, the primary contaminants found in the dewatering stream consisted of measurable concentrations of antimony and arsenic, with cyanide and cyanide compounds below detection limits.)
To avoid the open discharge of dewatering effluent, the mine applied for a permit to establish an Underground Injection Control (UIC) program. The proposed UIC program, requested permitting for 15, Class V disposal wells in which treated dewatering effluent would be injected into the site's upper bedrock aquifer. Class V injection wells are used for disposal of fluids into current or future underground sources of drinking water. Consequently, the mine's effluent had to comply with the USEPA's Maximum Contaminant Levels (MCLs) for drinking water at the point of well injection.

The range of treatment methods that the gold mine could utilize to remediate the dewatering waste stream were limited by environmental concerns and the remote location of the mining operation. Backwash filtration systems, ion exchange media that produces a chemical regenerative stream, and any other treatment process that generates a secondary waste stream, were eliminated from consideration during the design phase of this wastewater treatment system. Treatment designs requiring material replenishment, such as modular ion exchange vessels, chlorine dioxide generators or chemical oxidants, were also not considered because of the isolation of the mining site during winter time operation. (The Town of Nome, located on the Seward Peninsula by the Bering Sea, lacks a railroad and interstate highway and can only be reached by ship or plane during the brief summer months, and only by plane when winter ice floes make its port inaccessible to cargo ships.)

World Leader in Mixing and Contacting Technologies

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The Solutions: Ozone oxidation, followed by lamella clarification, then ultra-filtration, was selected as the best treatment design that would ensure mine effluent meeting drinking water quality standards at the point of aquifer injection. The ability to provide on-site generation of both oxygen and ozone was a strong plus in favor of this ozone oxidation system. The primary contaminants in the gold mine's effluent, antimony and arsenic, are both readily oxidized by ozone. Ozone would additionally detoxify any trace amounts of cyanide contained in the dewatering wastewater stream.

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To simplify the installation and operation of the ozone oxidation system, the equipment was provided as a pre-assembled, validated ozone oxidation system housed in an 8' (2.4 m) wide x 40' (12.2 m) long x 8' (2.4 m) high, heated cargo container. The system included an air compressor, an oxygen concentrator, a 945 g/hr -10% wt ozone generator, a cooling water chiller, an ozone contacting system, and instrumentation. Space limitations within the cargo container required a high efficiency, small footprint ozone contacting and off gas design. A review of the available ozone contacting options resulted in the selection of a high efficiency Mazzei GDT™ ozone contacting and degasification skid. The skid used pressurized and high velocity gas mixing, to provide a rapid mass transfer of ozone gas to solution. Transfer was followed by the immediate removal and destruction of ozone off gas utilizing a GDT Degas Separator. (FIGURE 1).

The Result: The successful utilization of ozone at this remote mining operation in Nome, Alaska is just one example of how recent advances in the design of ozone generators and their contacting systems has resulted in an increased commercial availability of reliable, small footprint, turn-key ozone systems. As industrial operations and their local communities continue to look for the "green solution" to their environmental concerns, ozone will be playing an increasingly larger role in the design of industrial wastewater treatment systems.

To get a better understanding about how a [Mazzei GDT] system works, take a look at this animation.

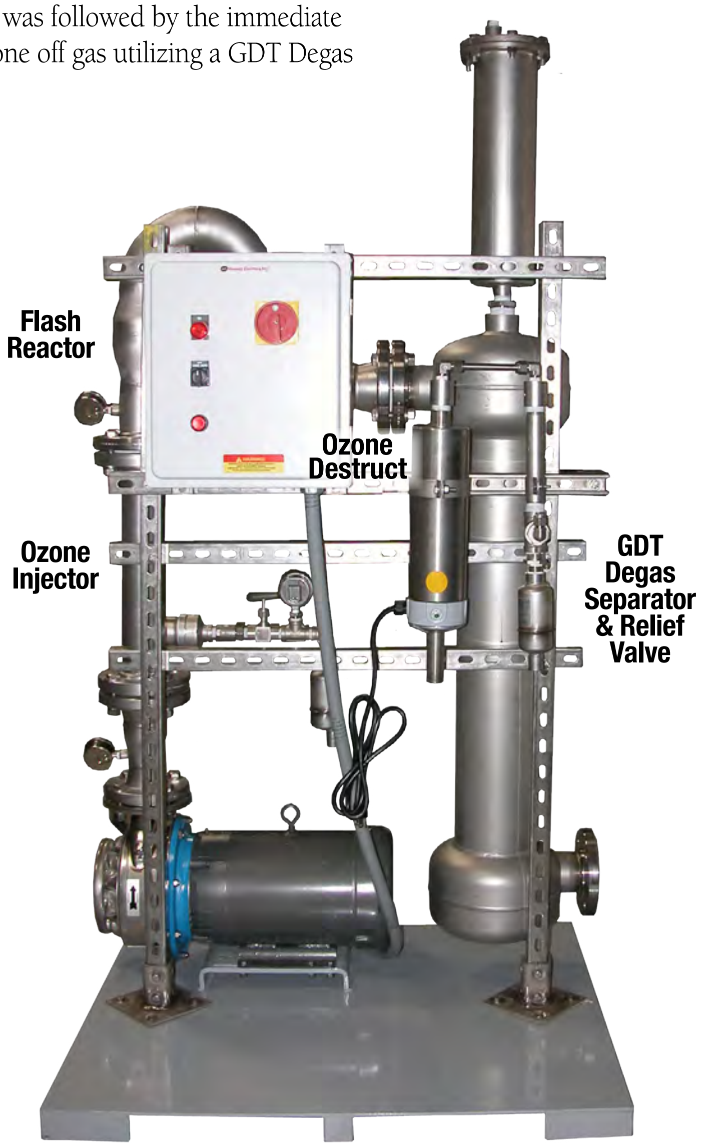

FIGURE 1: GDT process skid

For additional information on how Mazzei can assist with your water treatment goals, contact us at:

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