

# Petroleum & Petrochemicals



## Background & Challenge

- At Praxair, we are making our planet more productive. Whether it is by providing industrial gases that are used in the refining and processing of fossil fuels or technologies that allow facilities reliably meet their wastewater treatment guidelines, Praxair is helping companies be more productive.
- Petroleum and petrochemical wastewater facilities generate about 40-400 liters of wastewater/barrel of crude oil treated. Petroleum and petrochemical wastewater facilities are faced with a number of challenges in their operations, which could include:



### High strength organic loads

**Challenge:** Refinery and petrochemical wastewaters contain a variety of compounds such as fats, oils & grease, phenolics and other organic materials. The wide variety of crude oil sources from which refinery petrochemicals can be made have the possibility for significant variations in the strength of the organic loads. Cheaper crude oil sources often tend to be associated with higher organic wastewater loads.

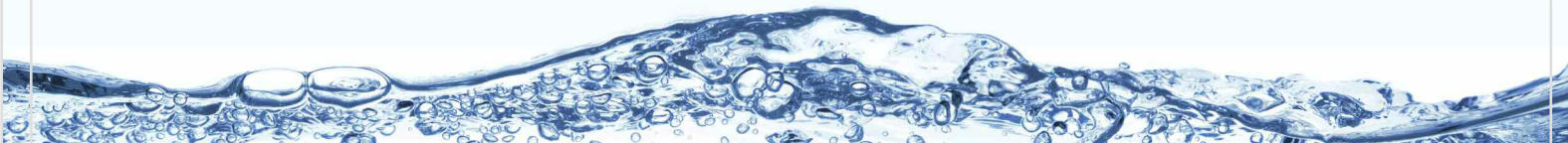
**Praxair Approach:** Praxair's high purity oxygen systems enable wastewater facilities to treat up to ten times the organic load that can be treated by a conventional air based system. With our efficient and proven oxygenation systems, mixing and oxygen transfer is decoupled. Providing enough oxygen to meet an increased organic load is as simple as turning up an oxygen supply valve to feed more oxygen to the wastewater process.



### Odors and VOC emissions

**Challenge:** Refinery wastewaters can contain significant amounts of volatile organic compounds. Often the wastewater facilities are subject not only to water regulations but also to air pollution limits – mostly centered around the control of hazardous air pollutants such as benzene, toluene, sulfur compounds, and other hazardous air pollutants (HAPs).

**Praxair Approach:** Odor results from the stripping of odorous compounds such as mercaptans from wastewater treatment systems, or the generation of hydrogen sulfide due to the lack of sufficient levels of oxygen. Similarly, volatile organic compounds are associated with the stripping of volatiles such as benzene, toluene, phenolics and other compounds from the wastewater. Conventional aeration systems generate as much as 3 - 4.5 m<sup>3</sup> of vent gas per m<sup>3</sup> of treated wastewater. In contrast, Praxair's high purity oxygen systems generate only about 0.02 – 0.15 m<sup>3</sup> of vent gas per m<sup>3</sup> of treated wastewater. These significantly reduced vent gas volumes have led to as much as 95% reduction in volatile emissions. We have enabled some of our clients to completely eliminate the use of covered wastewater basins or to reduce the size and complexity of their vent gas treatment systems.

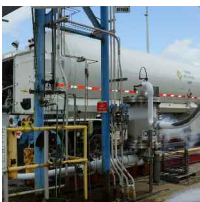




## Spent caustic treatment

**Challenge:** Petroleum and petrochemical operations often result in the generation of significant amounts of spent caustic liquors from processes such as the scrubbing of cracked gas with sodium hydroxide. Spent caustic is also generated from the extraction and treatment of acidic impurities such as hydrogen sulfide and organic acids. Spent caustic streams are also significant sources of odor.

**Praxair Approach:** Praxair's high purity oxygen systems enable refinery wastewater facilities to dispose of spent caustic in the biological process. This eliminates or significantly reduces the need for complex high temperature and pressure oxidation alternatives that are currently used today.



## Sludge reduction

**Challenge:** About 20-40 kgs of excess biological sludge is generated for every 100 kgs of chemical oxygen demand (COD) treated in a wastewater process. This translates to about 120 - 240 kgs of excess solids per 1000 m<sup>3</sup> of treated wastewater. If a refinery does not have readily available sources for sludge disposal, the disposal of this sludge can be challenging and costly.

**Praxair Approach:** Praxair's patented Lyso™ ozonated sludge reduction process enables wastewater facilities to reduce biological sludge generation by as much as 80%. The use of ozone also provides additional benefits such as enhanced sludge settling in clarifiers, and better sludge dewatering.



## Minimal treatment footprint

**Challenge:** Refinery wastewater systems are often limited in their ability to be expanded. Hence, as production capacities change, refinery wastewater systems are expected to try to do more treatment with the minimal footprint that is available.

**Praxair Approach:** While most conventional aeration systems can handle organic loads that are equivalent to about 20-80 grams O<sub>2</sub>/m<sup>3</sup>/hr, our oxygenation systems will allow facilities to effectively treat up to 400 grams O<sub>2</sub>/m<sup>3</sup>/hr in the same footprint.

## Conclusion

- Whether your wastewater treatment system is an extensive aerated lagoon, or a compact wastewater process, our technology offerings will provide you with effective and reliable treatment.
- Praxair's tested and proven wastewater offerings have been extensively deployed in petroleum and petrochemical wastewater operations
- Call us today to discuss your particular wastewater treatment process needs, and let us help you Improve your productivity.



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Printed in the United States of America  
7/14

P-40-3914-M

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