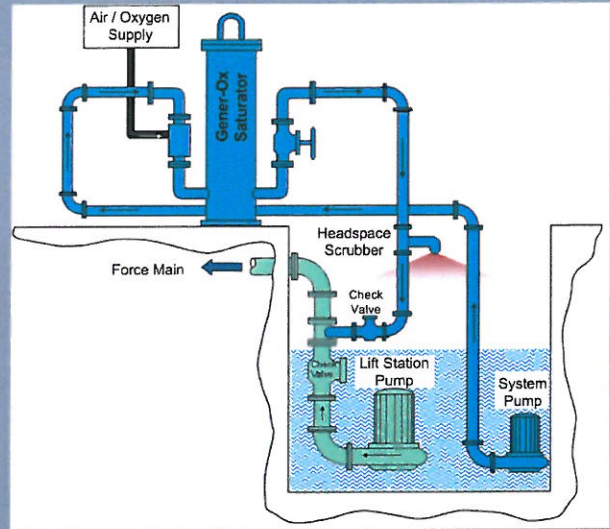


GENER-OX

What is Gener-Ox?

Force mains are nutrient-rich anaerobic environments. In this environment, Sulfate Reducing Bacteria (SRBs) can reduce sulfates to sulfides, while simultaneously depressing the pH. Under acidic conditions, sulfides form hydrogen sulfide, a common sewer gas, which readily volatilizes upon agitation of the sewer water, leading to odor complaints. At locations within the sewer line where oxygen in the air can be present, the hydrogen sulfide vapor will react with oxygen to form sulfuric acid, which condenses on surfaces, causing corrosion to concrete and steel.

IER's Gener-Ox system changes the anaerobic environment of the force main into an aerobic environment, causing the SRBs to encapsulate and eventually die. No SRBs, no sulfide formation. No sulfide formation, no odor or corrosion. In a typical installation, the Gener-Ox system will draw a side-stream of sewer water from a wet well, pressurize it, aerate it, and dissolve oxygen into it to achieve the required DO level for reinjection in the force main. An optional headspace scrubber may be provided to scrub sulfides from the wet well headspace.



How Does it Work?

Hydrogen sulfide is naturally generated by Sulfate Reducing Bacteria in an anaerobic environment. Depending on the chemical nature of the sewer line, a force main can become a sulfate-rich anaerobic environment. Therefore, the sulfide problem is the result of chemistry and anaerobic microbiology.

The chemical-free Gener-Ox system works on a very simple principle: change the environment, change the biology, change the results. Most chemical approaches to the sulfide problem attempt to sterilize the force main using either chlorine or other oxidants or strong alkalis. A newer popular approach is to feed the force main with a nitrate salt which the anaerobes preferentially reduce to odor-free nitrogen.

The Gener-Ox system is the only approach that addresses the root cause of the problem. Gener-Ox inhibits the formation of hydrogen sulfide in the first place by making the force main aerobic, rendering all anaerobes and sulfate-reducing bacteria inactive or nonexistent.

In order to maintain aerobic conditions in a force main, the DO level at the start of a force main must often be higher than the saturation DO level in the wet well. For example, a lift station pumping 500,000 gpd through a 12-inch, 10,000 foot force main with an oxygen uptake rate of 0.08 mg/L/min will require a DO level at the start of the force main of about 56 mg/L in order to maintain aerobic conditions upon discharge. This is accomplished by aerating under pressure, driving more oxygen into solution than is possible in an open vessel.

The saturation DO level of water depends on temperature and oxygen pressure. Sewage in an open vessel, such as a wet well, has a saturation DO level of about 8.5 mg/L at 70°F. However, in a force main under 30 psi pressure aerated with oxygen, the saturation DO level is in excess of 120 mg/L. In this example, a Gener-Ox system fed with oxygen will dissolve 26 SCFH of oxygen into 25 gpm of sewer water (132 SCFH air into 125 gpm wastewater for air-fed) from the wet well and inject it into the force main, maintaining aerobic conditions throughout the force main.

By aerating under pressure, the Gener-Ox system is able to raise the DO concentration to previously unattainable levels, enabling cleaner, simpler solutions to the sulfide problem.

Available Systems and Specifications

Model Number	Flow Rate (GPM)	Oxygen Dissolution Rate (Air-Fed)	Oxygen Dissolution Rate (Oxygen-Fed)	Dimensions (L x W x H)
MTS 10	5 - 15	2 - 5 Lbs / Day	8 to 25 Lbs / Day	3' x 3' x 5'
MTS 25	12 - 40	4 - 13 Lbs / Day	20 - 65 Lbs / Day	4' x 4' x 6'
MTS 50	25 - 75	8 - 25 Lbs / Day	41 - 123 Lbs / Day	4' x 4' x 7'
MTS 100	50 - 150	16 - 49 Lbs / Day	82 - 246 Lbs / Day	5' x 4' x 9'
MTS 250	125 - 375	41 - 123 Lbs / Day	205 - 614 Lbs / Day	5' x 5' x 10'

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Comparison of Sewer Line Odor Control Treatments For A Wastewater Facility in Montana

SUMMARY

This study represents a comparative evaluation of Bioxide (Nitrate salt) chemical treatment versus Gener-Ox chemical-free, superoxygenation for H₂S suppression in a dedicated sewer line running from the force main injection point to the main POTW.

Treatment was initiated into the pressurized force main at a point leaving a malting facility. The main complaint was from Manhole #4049 which is approximately one mile from the malting plant. All other manholes are in sequential order to the WWTP, each with gravity flow conditions.

The results shown below were while feeding Bioxide product prior to the Gener-Ox installation

DATE 10/28/2008		DATE 10/29/2008		DATE 10/30/2008	
Manhole#	H ₂ S (ppm)	Manhole#	H ₂ S (ppm)	Manhole#	H ₂ S (ppm)
4049	83 ppm	4049	39 ppm	4049	148 ppm
4041	36 ppm	4041	3 ppm	4041	66 ppm
4026	24 ppm	4026	1 ppm	4026	45 ppm
4071	8 ppm	4071	1 ppm	4071	29 ppm
4069	3 ppm	4069	1 ppm	4069	26 ppm
4068	3 ppm	4068	1 ppm	4068	21 ppm
4067	3 ppm	4067	1 ppm	4067	20 ppm
Headworks		Headworks		Headworks	

The results shown below were achieved after commissioning of the Gener-Ox system

DATE 4/6/2009		DATE 4/7/2009		DATE 4/8/2009	
Manhole#	H ₂ S (ppm)	Manhole#	H ₂ S (ppm)	Manhole#	H ₂ S (ppm)
4049	2 ppm	4049	1 ppm	4049	2 ppm
4041	1 ppm	4041	1 ppm	4041	1 ppm
4026	3 ppm	4026	1 ppm	4026	2 ppm
4071	1 ppm	4071	0 ppm	4071	1 ppm
4069	1 ppm	4069	1 ppm	4069	1 ppm
4068	1 ppm	4068	0 ppm	4068	1 ppm
4067	1 ppm	4067	0 ppm	4067	1 ppm
Headworks		Headworks		Headworks	

CONCLUSION

IER's Gener-Ox chemical-free superoxygenation technology significantly outperformed the chemical application of Bioxide (Nitrate salt) for H₂S suppression in the force main, as well as the entire 5.5 mile sewer line through to the POTW.

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