Odor Control Case Study

Eastern Tennessee

The ETX and STX Process

Prepared by
Source Technologies, LLC

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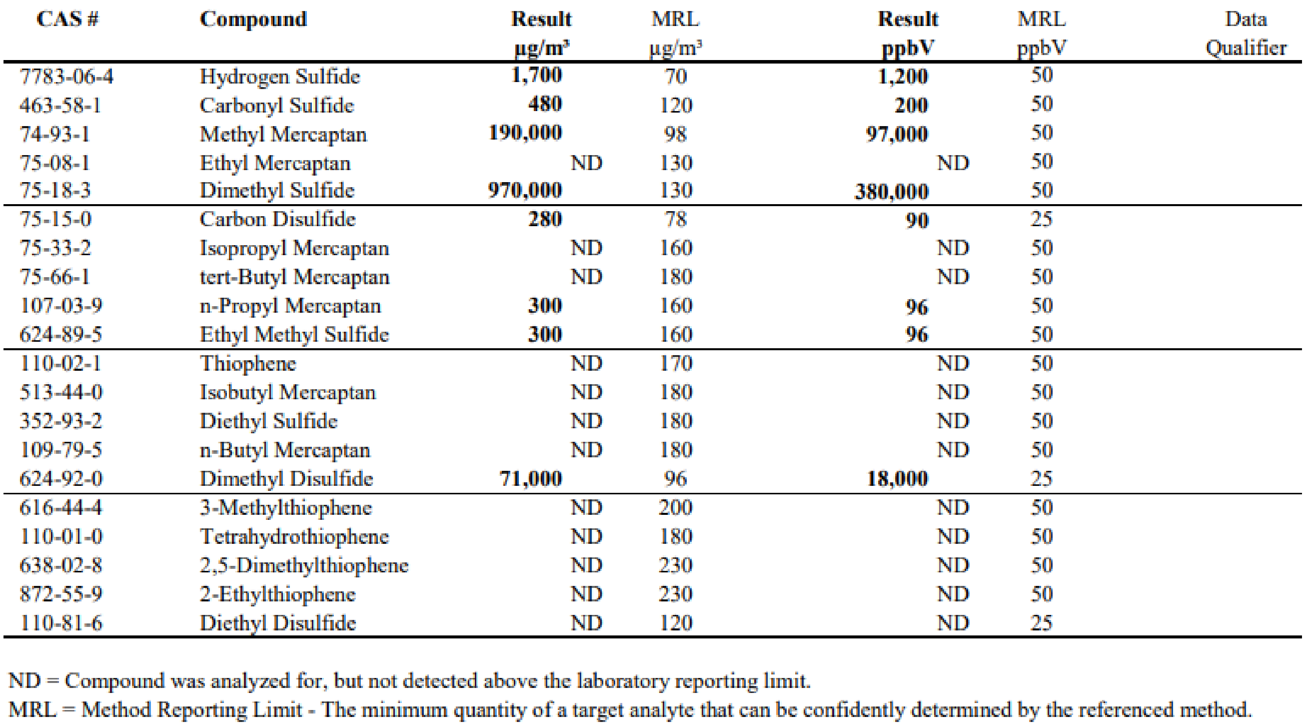
Observations

Eastern Tennessee

Background: This Eastern Tennessee utility sought to improve their system and resolve a persistent odor concern at their dewatering facility. The utility had previously been using Calcium Nitrate (Bioxide), but this traditional approach failed to achieve the client's goals.

Goal: Eliminate odor complaints. Reduce Hydrogen Sulfide levels to prevent corrosion and protect infrastructure. Reduce operating costs.

Process: The initial focus area for this study was a specific building within the wastewater treatment plant, which averages a substantial flow rate of 140,000 to 180,000 gallons per day (GPD). A critical operational factor is the facility's schedule: it typically does not operate on weekends. This hiatus creates a consistent operational challenge, as the worst odor production days invariably occur on Monday mornings. This increased odor intensity is directly attributed to the sludge being held and settling over the two-day weekend period before operations, particularly the sludge dewatering process, recommence. To accurately identify the source of the odors, a targeted air sampling campaign was initiated. Personnel from Source Technologies collaborated with utility employees to collect untreated air samples while the facilities' centrifuges were operating on a Monday morning. The methodology relied on vacuum-filled Mylar test bags to capture and securely seal the atmospheric contents. Immediately following collection, the air samples were overnighted to ALS Laboratories.



CAS #	Compound	Result µg/m³	MRL µg/m³	Result ppbV	MRL ppbV	Data Qualifier
7783-06-4	Hydrogen Sulfide	**1,700**	70	**1,200**	50	
463-58-1	Carbonyl Sulfide	**480**	120	**200**	50	
74-93-1	Methyl Mercaptan	**190,000**	98	**97,000**	50	
75-08-1	Ethyl Mercaptan	ND	130	ND	50	
75-18-3	Dimethyl Sulfide	**970,000**	130	**380,000**	50	
75-15-0	Carbon Disulfide	**280**	78	**90**	25	
75-33-2	Isopropyl Mercaptan	ND	160	ND	50	
75-66-1	tert-Butyl Mercaptan	ND	180	ND	50	
107-03-9	n-Propyl Mercaptan	**300**	160	**96**	50	
624-89-5	Ethyl Methyl Sulfide	**300**	160	**96**	50	
110-02-1	Thiophene	ND	170	ND	50	
513-44-0	Isobutyl Mercaptan	ND	180	ND	50	
352-93-2	Diethyl Sulfide	ND	180	ND	50	
109-79-5	n-Butyl Mercaptan	ND	180	ND	50	
624-92-0	Dimethyl Disulfide	**71,000**	96	**18,000**	25	
616-44-4	3-Methylthiophene	ND	200	ND	50	
110-01-0	Tetrahydrothiophene	ND	180	ND	50	
638-02-8	2,5-Dimethylthiophene	ND	230	ND	50	
872-55-9	2-Ethylthiophene	ND	230	ND	50	
110-81-6	Diethyl Disulfide	ND	120	ND	25	

ND = Compound was analyzed for, but not detected above the laboratory reporting limit.
MRL = Method Reporting Limit - The minimum quantity of a target analyte that can be confidently determined by the referenced method.

The lab report showed that Hydrogen Sulfide, Methyl Mercaptan, Dimethyl Sulfide and Dimethyl Disulfide were the largest contributors to odor concerns for the facility.

Assessment - STX Process

Eastern Tennessee

To implement an odor control strategy, new chemical injection points were strategically installed on the sludge feed line (force main). These points were placed after the gravity thickener, but critically, just before the centrifuges. This placement was intentional: by injecting the chemicals immediately upstream of the pumps that feed the centrifuges, maximum agitation and rapid mixing of the odor control agents were achieved. This physical turbulence was essential for encouraging proper chemical dispersion and efficacy, despite a very limited contact time of less than three minutes before the sludge reached the centrifuge.

Two different products were piloted by Source Technologies to determine which would be most beneficial to the dewatering facility. The STX process and the ETX process provide similar benefits, though they work differently to destroy and abate malodorous compounds. Chemical feed systems were set up to feed only while the centrifuges were actively running. Treated air samples were taken on Mondays at approximately the same time of day as the untreated sample.

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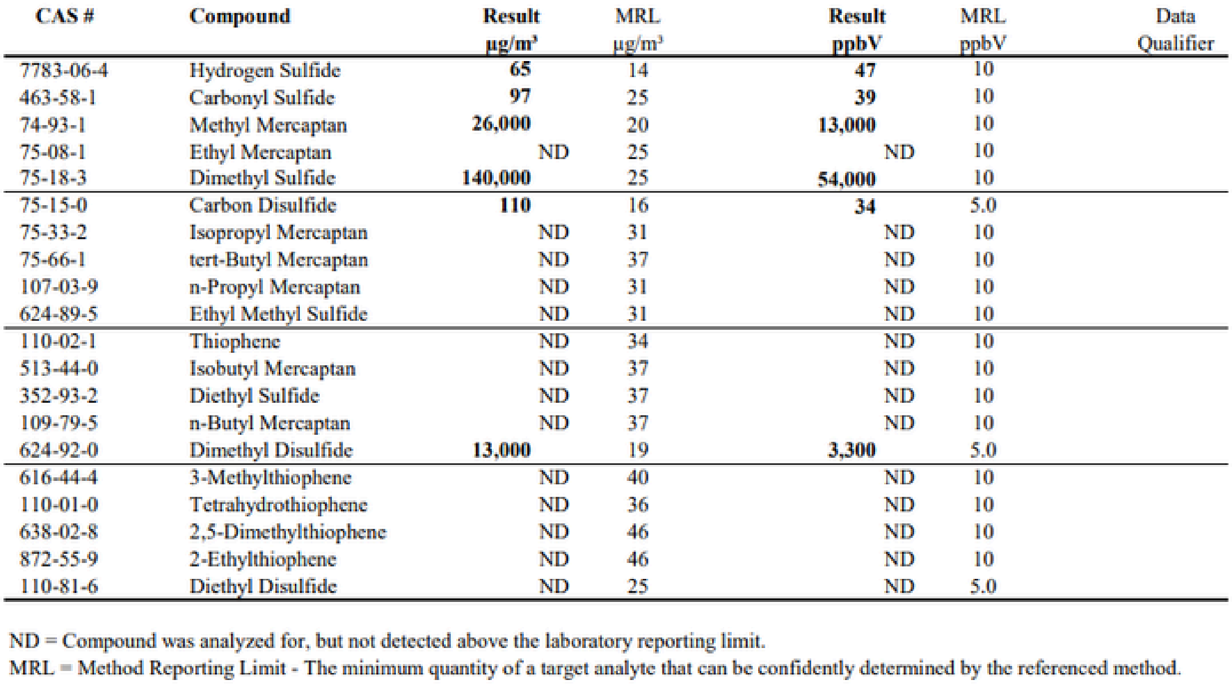
STX Treated Results:



CAS #	Compound	Result µg/m³	MRL µg/m³	Result ppbV	MRL ppbV	Data Qualifier
7783-06-4	Hydrogen Sulfide	**65**	14	**47**	10	
463-58-1	Carbonyl Sulfide	**97**	25	**39**	10	
74-93-1	Methyl Mercaptan	**26,000**	20	**13,000**	10	
75-08-1	Ethyl Mercaptan	ND	25	ND	10	
75-18-3	Dimethyl Sulfide	**140,000**	25	**54,000**	10	
75-15-0	Carbon Disulfide	**110**	16	**34**	5.0	
75-33-2	Isopropyl Mercaptan	ND	31	ND	10	
75-66-1	tert-Butyl Mercaptan	ND	37	ND	10	
107-03-9	n-Propyl Mercaptan	ND	31	ND	10	
624-89-5	Ethyl Methyl Sulfide	ND	31	ND	10	
110-02-1	Thiophene	ND	34	ND	10	
513-44-0	Isobutyl Mercaptan	ND	37	ND	10	
352-93-2	Diethyl Sulfide	ND	37	ND	10	
109-79-5	n-Butyl Mercaptan	ND	37	ND	10	
624-92-0	Dimethyl Disulfide	**13,000**	19	**3,300**	5.0	
616-44-4	3-Methylthiophene	ND	40	ND	10	
110-01-0	Tetrahydrothiophene	ND	36	ND	10	
638-02-8	2,5-Dimethylthiophene	ND	46	ND	10	
872-55-9	2-Ethylthiophene	ND	46	ND	10	
110-81-6	Diethyl Disulfide	ND	25	ND	5.0	

ND = Compound was analyzed for, but not detected above the laboratory reporting limit.
MRL = Method Reporting Limit - The minimum quantity of a target analyte that can be confidently determined by the referenced method.

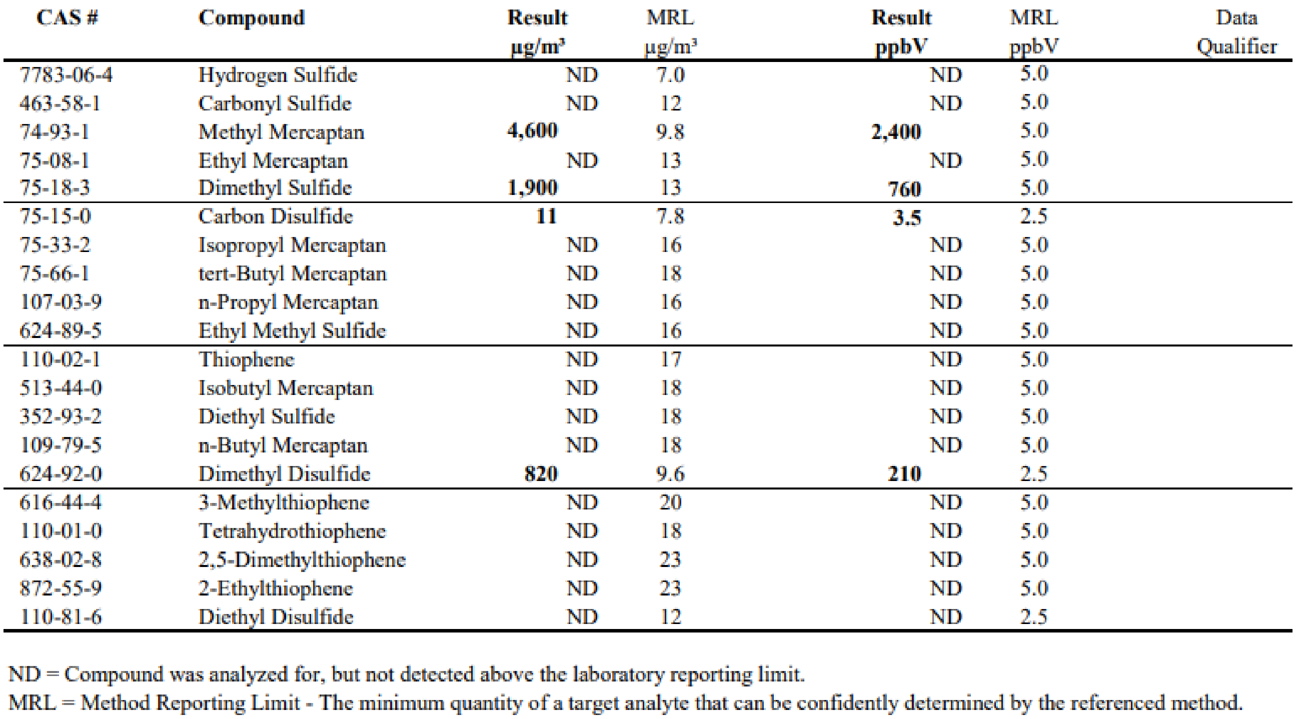
Initial Findings were promising with a 96% reduction in Hydrogen Sulfide and over 80% reduced in the other Volatile Organic Compounds (VOCs).

Hydrogen Sulfide reduction	96%
Carbonyl Sulfide reduction	80.50%
Methyl Mercaptan reduction	86%
Dimethyl Sulfide reduction	85.79%
Dimethyl Disulfide reduction	81.67%

Assessment - ETX Process

Eastern Tennessee

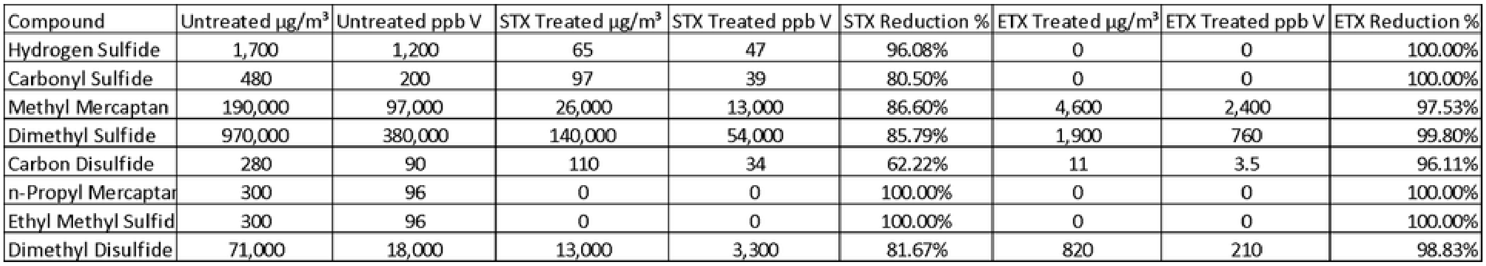
ETX Treated Results:



CAS #	Compound	Result µg/m³	MRL µg/m³	Result ppbV	MRL ppbV	Data Qualifier
7783-06-4	Hydrogen Sulfide	ND	7.0	ND	5.0	
463-58-1	Carbonyl Sulfide	ND	12	ND	5.0	
74-93-1	Methyl Mercaptan	**4,600**	9.8	**2,400**	5.0	
75-08-1	Ethyl Mercaptan	ND	13	ND	5.0	
75-18-3	Dimethyl Sulfide	**1,900**	13	**760**	5.0	
75-15-0	Carbon Disulfide	**11**	7.8	**3.5**	2.5	
75-33-2	Isopropyl Mercaptan	ND	16	ND	5.0	
75-66-1	tert-Butyl Mercaptan	ND	18	ND	5.0	
107-03-9	n-Propyl Mercaptan	ND	16	ND	5.0	
624-89-5	Ethyl Methyl Sulfide	ND	16	ND	5.0	
110-02-1	Thiophene	ND	17	ND	5.0	
513-44-0	Isobutyl Mercaptan	ND	18	ND	5.0	
352-93-2	Diethyl Sulfide	ND	18	ND	5.0	
109-79-5	n-Butyl Mercaptan	ND	18	ND	5.0	
624-92-0	Dimethyl Disulfide	**820**	9.6	**210**	2.5	
616-44-4	3-Methylthiophene	ND	20	ND	5.0	
110-01-0	Tetrahydrothiophene	ND	18	ND	5.0	
638-02-8	2,5-Dimethylthiophene	ND	23	ND	5.0	
872-55-9	2-Ethylthiophene	ND	23	ND	5.0	
110-81-6	Diethyl Disulfide	ND	12	ND	2.5	

ND = Compound was analyzed for, but not detected above the laboratory reporting limit.
MRL = Method Reporting Limit - The minimum quantity of a target analyte that can be confidently determined by the referenced method.

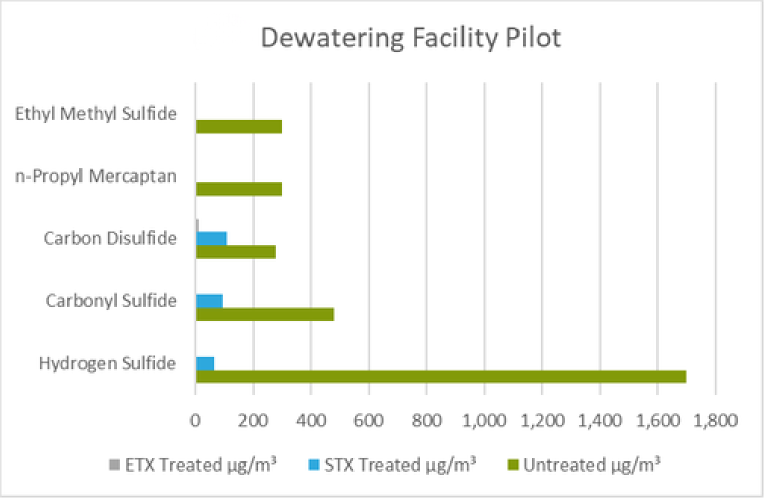
ETX provided the largest benefit to the dewatering facility based on lab results. In comparison to the Untreated sample and the STX treated sample, ETX at a side-by-side view looked as follows:

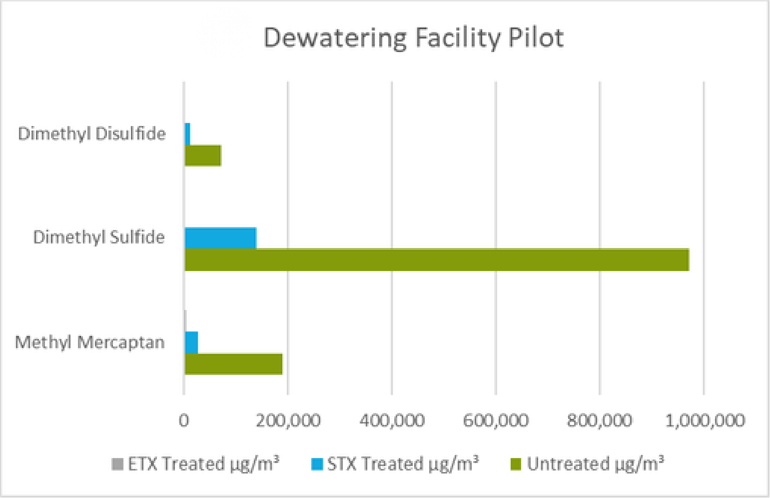


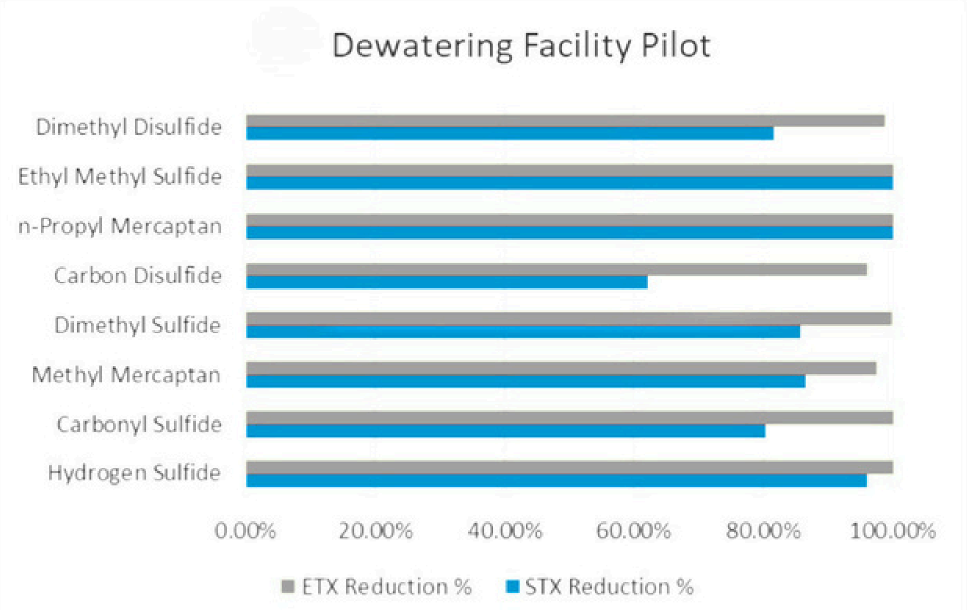
Compound	Untreated µg/m³	Untreated ppb V	STX Treated µg/m³	STX Treated ppb V	STX Reduction %	ETX Treated µg/m³	ETX Treated ppb V	ETX Reduction %
Hydrogen Sulfide	1,700	1,200	65	47	96.08%	0	0	100.00%
Carbonyl Sulfide	480	200	97	39	80.50%	0	0	100.00%
Methyl Mercaptan	190,000	97,000	26,000	13,000	86.60%	4,600	2,400	97.53%
Dimethyl Sulfide	970,000	380,000	140,000	54,000	85.79%	1,900	760	99.80%
Carbon Disulfide	280	90	110	34	62.22%	11	3.5	96.11%
n-Propyl Mercapta	300	96	0	0	100.00%	0	0	100.00%
Ethyl Methyl Sulfid	300	96	0	0	100.00%	0	0	100.00%
Dimethyl Disulfide	71,000	18,000	13,000	3,300	81.67%	820	210	98.83%

Conclusion

Eastern Tennessee



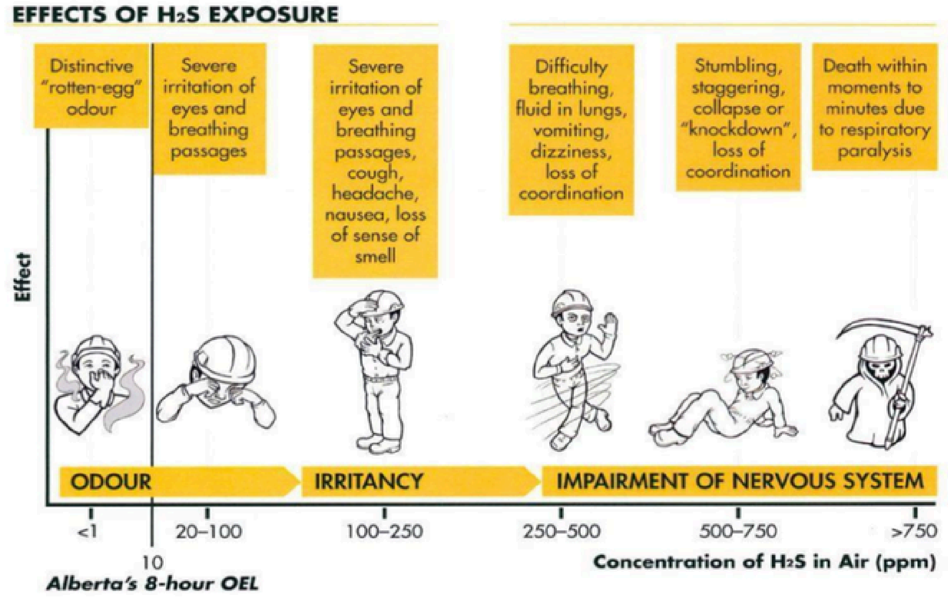




In conclusion, both the STX and ETX chemistries provided vastly improved results compared to the untreated sample. Utilizing either chemistry would benefit the facility and improve the health and safety risks. Source Technologies recommends the ETX process for this application due to its ability to reduce Hydrogen Sulfide by 100% and the other VOCs by over 96%. Overall, the results were far better across the board with ETX. Implementing a chemical feed system that injects after the gravity thickener and doses only as needed when the facility is operational will provide economic benefits, as well as the excellent results observed during the study. These benefits include reduced chemical usage, reduced chemical storage footprint, and decreased frequency of chemical deliveries.

Appendix A

Effects of H_2S

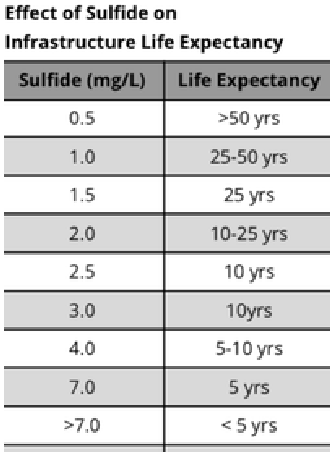


One of the methods for determining sulfide loading in solution is to use a portable colorimeter device and the methylene blue method. This test helps identify how many milligrams per liter (mg/l) of sulfide are in solution. 1 mg/l of S= can form up to roughly 250 parts per million (PPM) H_2S . Gas detection equipment can be deployed throughout the collection system to determine the concentrations of H_2S in specific locations. Once H_2S has formed, corrosion will occur.

Depending on turbulence and pH, understanding the concentrations of sulfide in solution can help determine the life expectancy of infrastructure.

Effect of Sulfide on Infrastructure Life Expectancy

Target: 3′ diameter
concrete pipe (1″ cover")
*neutral pH scenario
*Source of chart
EPA website



Effect of Sulfide on Infrastructure Life Expectancy

Sulfide (mg/L)	Life Expectancy
0.5	>50 yrs
1.0	25-50 yrs
1.5	25 yrs
2.0	10-25 yrs
2.5	10 yrs
3.0	10yrs
4.0	5-10 yrs
7.0	5 yrs
>7.0	< 5 yrs

Source Technologies, LLC

Odor and corrosion from wastewater is problematical whether occurring at the treatment plant or in the collection system winding through neighborhoods. While most of the general public recognizes hydrogen sulfide (H_2S) as the “rotten egg” smell associated with sewage treatment, facility managers know H_2S is a far more destructive and corrosive compound for wastewater treatment facilities and the collection systems that feed them. Additionally, H_2S is not only a costly nuisance, it can be a serious health and safety problem as well.

Source Technologies, whose principals have long been involved with environmental remediation and municipal wastewater treatment, formed the company to deploy the latest cutting edge technologies that apply to municipal wastewater treatment facilities, industrial pre-treatment activities and environmental restoration.

Under the leadership of CEO Suzie Richards, Source Technologies is proud to be a provider of one of the most powerful, comprehensive and cost-effective odor treatment technologies in the municipal wastewater market space. Our family of advanced oxidation and catalyzed oxygenation technologies are “green”, best-in-class, scalable and simple to operate.

For additional information, contact us.

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