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November 21, 2017

Anthony Daniel
Director of Utilities
City of Broken Arrow
485 N Poplar Avenue
Broken Arrow, OK 74013
Email: adaniel@brokenarrowok.gov

Subject: SULFeND® Pilot Study for Sulfide Control on the County Line Road Sewer Interceptor

Dear Anthony,

Thank you for inviting Pencco Inc. to evaluate the critical hydrogen sulfide odor concern emanating from the County Line wastewater line. Pencco Inc. recognizes this odor concern is a high priority for the Broken Arrow as the County Line Road line segment produces high sulfide loadings and odor complaints to the area of the city near 101st and County Line.

Pencco Inc. is pleased to provide Broken Arrow with the following proposal for a 45 day pilot study SULFeND® program to control odors along the County Line Road line.

Prior to this proposal, Pencco Inc. conducted an extensive sulfide field survey on the County Line Road line to fully understand the sulfide loadings. Based on our findings, vapor levels along the County Line Road segment exceed over 180 ppm vapor H₂S and liquid sulfide loadings over 138 lbs/day. Based on the sulfide levels measured, we estimate a target feed of 180-210 gallons per day of SULFeND® for complete control during the summer and winter seasons to achieve 25 ppm on daily average for vapor H₂S and < 0.5 mg/L for dissolved sulfide. The target usage was derived from our sampling data and extrapolated for the year based on normal conditions. In similar applications, we have observed seasonal fluctuations which can be utilized for optimization of chemical usage, with winter and spring generally requiring less treatment. The proposal is comprehensive in nature and include full-service delivery of the chemicals, equipment, labor and services required to reliably and safely apply the technology or the duration of the pilot project, excluding any required dose site civil work or improvements. The tentative start of the program is the week of February 18, 2018.

The attached diagram shows dosing and monitoring points on the County Line Road line.

Program Cost

Cost for the 45 day SULFeND® pilot program at the city of Broken Arrow:

- Mobilization Fee: \$4,000.00
 - SULFeND Price per gallon: \$2.47 (3 loads of 4200 gallons)
 - \$5,000 demobilization fee in the event that the program is successful and the City does not elect to go forward
 - Total Cost \$40,122.00 plus applicable tax
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SULFeND® Technology

SULFeND® is a manufactured chemistry that combines an oxidizer with ferrous ion to provide the highest level of removal per gallon of any product. The SULFeND® program combines the highest removal technology with advanced equipment that allows Pencco to match the chemical addition to the production level of hydrogen sulfide at any part of the day. The chemistry works as follows:

Ferrous Salts – Ferrous is an immediate reacting iron ion that ties up sulfide into a non-gaseous form, ferrous sulfide. The concentration of this ion can be adjusted to provide the right amount of immediate removal to meet hydrogen sulfide goals at the addition point of the SULFeND™.

Low Redox Oxidants - Oxidants are especially good at total control of hydrogen sulfide in wastewater. The typical problem is that they are so strong and react so fast that side reactions occur and consume the majority of the product that is being added. In addition, the product is considered very hazardous and as an oxidizer. Pencco has developed a manufacturing technique to add several different low grade oxidants to SULFeND™. Each reactant has a different resonance time of reaction and each are completely or predominantly sulfide ion specific. The advantages to low grade oxidizers are:

- Safety – The solution is not considered an oxidizer
- Sulfide Ion Specific reactions
- SULFeND™ oxidation reactions occur at a negative Redox potential
 - No VFA (volatile fatty acid) Destruction/possible VFA production
 - No side oxidation reactions
 - Complimentary to Biological Nutrient Removal
- The oxidizers continuously react with sulfide that frees up the ferrous to react further with side streams that contain hydrogen sulfide reducing the number of dose stations
- Low grade oxidizers can last up to hours in a line

Combination of Iron and Oxidizers – By combining the best of iron salts with low grade oxidizers, SULFeND™ contains more active ingredients per gallon than any other product on the market. This means that gallon for gallon; SULFeND™ will remove more pounds of hydrogen sulfide. This allows less dose stations, smaller tanks, and fewer deliveries. In addition, several of our formulations are less hazardous than either the iron salts or the oxidizers that they replace

Equipment Provided

- (1) 6000 gallon high density polyethylene tank (see attached drawing)
- Ultrasonic level transmitter and high fill switch
- (1) 16.5' by 16.5' Poly lined Steel Containment with steps for ingress and egress
- Leak Detection System for Containment
- (1) NEMA 4 Fiberglass Enclosure including:
 - 500 ml Calibration System
 - Pump Mounting Shelf
 - Dual Fan Cooling System
 - Double Pole Power Switch Box
 - Power Outlet for Pumps
 - Leak Detection System

- Drain to Containment
- Chemical Inlet and Outlet
- Field Connection Enclosure
- Control Panel Mount
- Stainless Steel Frame mount for Panel and Piping
- Alarm Light on Panel
- (1) NEMA 4 Polycarbonate Control Panel including:
 - Touchscreen Monitor and Controls
 - Independent Cooling System
 - Sierra Wireless LS300 Programmable Modem for Web monitoring and control which includes the City having daily access to dose rates and hydrogen sulfide gas readings.
- PLC Control System with
 - 48 point Curve Fit
 - 48 point modified flow pace capability with customer flow signal
 - Spare discrete and analog inputs and outputs for custom communication to customer system
- (2) Blue White A2V Variable Speed Peristaltic Pumps (up to 14.7 gph)
- Portable Eye Wash and Shower System
- Solar Power 120v power set-up
- RTX OdaLogs for testing and optimization
- Delivery to Site
- Complete assembly and installation on prepared site
- Start-up, Calibration, and testing

The scope includes the following service:

Service Provided by Pencco

1. Mobilization and Installation of storage and feed system, Start-up, and Optimization
2. SULFeND® Solution
3. Sampling and data collection/Reporting. Once every other week.
4. Program management
5. Emergency Service

Work Provided by Broken Arrow

- Gravel 12'x12' pad with concrete curb
- Fencing for security
- 120v service @ 15 amps (only 3 amps are required for normal operation)

Program Report

Pencco will provide ongoing progress reports and data throughout the 45 day test period. Upon completion of the test:

1. Pencco will submit five draft final reports for Broken Arrow Staff review.
2. A follow-up meeting and presentation of the results will be scheduled and executed.
3. Pencco will issue five copies and an electronic copy of the Final Report

Program Goals at Final Control Point (on map below @ Jasper):

- <25 ppm average H₂S in vapor
- <0.5 mg/L Dissolved Sulfide in liquid

SULFeND® Program

Upon successful completion, the City of Broken Arrow can elect to continue the program. The standard SULFeND program includes:

- The SULFeND System deployed for the test
- Monthly Service
 - Mechanical System check and wear part replacement
 - An RTX OdaLog placed at the terminal control point
 - Liquid Sampling Check
- Program Engineer Overview
 - Routine reviewing of data
 - Maintaining the Website
 - Inventory Management
- Web Cellular service
 - Complete access by Customer – monitoring and control
 - Future web upgrades
- Emergency Service
- Priority Access to our survey team for future odor and corrosion control situations

Cost for Program if the City decides to continue beyond the pilot

1. SULFeND Price per gallon: \$2.47 (locked until January 1, 2019)
2. Program Fees: \$1,450.00 per month

Notes:

1. Pricing does not include applicable tax
2. Proposal is valid for 90 days
3. Terms are Net 30
4. SULFeND pricing is locked until January 1, 2019, price adjustments are based on our documented cost changes for raw materials and manufacturing costs
5. In the event that the program is successful and the City does not elect to go forward, there is a \$5,000 demobilization fee.

We appreciate the opportunity and look forward to serving you and the City.

If approved, please sign below and return.

Sincerely,

Vince Marano

Vincent Marano
Pencco, Inc.
951-970-9106

Read and Approved by: _____ (please print)

Position with the City _____

Signed: _____ Date: _____

Approved as to form *Lesli Myers*
Asst. City Attorney

County Line Road Line Diagram

