

VAPOR FOGGING TREATMENT (VFT) FOR VAPOR PHASE SULFIDES

Benefits

Effective

- ◆ Hydrogen Sulfide (H_2S) removal rates are greater than 90%

Versatile

- ◆ Process is applicable for small and large air flows with a wide range of H_2S concentrations

Application Areas

- ◆ Plant headworks, pump station wet wells, gravity sewers and biosolids storage tanks

Small Footprint

- ◆ The entire VFT system can fit into a 10' x 10' area (not including chemical storage)

Reaction Products

- ◆ Reaction produces sodium sulfate and water. Reaction occurs within seconds

Full Service Program

- ◆ Minimal capital investment needed (equipment lease included in chemical price)

Safe

- ◆ Engineered through Process Hazards Analysis with built-in limit controls

US Peroxide has developed a proprietary technology which involves fogging a dilute mixture of hydrogen peroxide (H_2O_2) and sodium hydroxide ($NaOH$) into an enclosed vapor space to oxidize H_2S -related odors. The process consists of two chemical storage/feed modules, a solution make-up tank, and a fogging apparatus. Applications include treatment plant headworks, pump station wet wells, gravity sewers, and biosolids storage tanks. The underlying principle is absorption of gaseous H_2S into an alkaline water solution, with concurrent oxidation of the absorbed H_2S . The principles of operation are the same as those used in packed (and mist) tower odor scrubbers:



The reaction theoretically requires 4.25 lbs- H_2O_2 per lb-sulfide (occurring within seconds) and yields sodium sulfate and water as reaction products. This technology is in effect *in-situ* scrubbing.

The process is applicable for both small and large air flows containing a wide range of H_2S concentrations, with achievable H_2S removal rates of > 90%. Chemical feed is matched to H_2S loadings to maximize cost performance.

US Peroxide Delivery Scope

US Peroxide provides the odor control demonstration as a full-service program that includes the following scope items:

- Project management
- Supply of 27% or 50% hydrogen peroxide
- Supply of 25% sodium hydroxide
- Integrated Vapor Fogging Treatment (VFT) system
- Hydrogen peroxide storage tank
- Sodium hydroxide storage tank
- VFT dosing system
- Portable eyewash system
- Installation, start up and ongoing maintenance of equipment
- Inventory and delivery management and remote system monitoring (ChemWatch™)
- Dose response testing and feed rate optimization
- Hydrogen sulfide sampling (liquid and vapor) labor and instrumentation
- Sampling and analysis of sewage temperature and pH
- Project reporting and documentation
- Safety training

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VFT Equipment Description

SOLUTION MAKE-UP / SUPPLY

The liquid handling subsystem includes water supply / preparation, chemical storage / feed, and mixing / blending. For water supply, a continuous-duty automatic ion exchange unit is included that produces softened water at a rate of 5 gph per nozzle. For NaOH storage, USP will initially utilize totes. For H₂O₂ storage, the fogging process will draw from either a USP-2100 or USP-3100 system feeding. For mixing / blending, mounted onto an aluminum plate are the sensors and controls for the water supply and the blended fogging solution, as well as mixing chambers for the chemicals.



MIXING CABINET

The fogging unit utilizes a continuous supply of 40 - 50 scfm oil-free air (per nozzle) compressed to 2 - 5 psig. The air is delivered to each nozzle where it mixes with and atomizes the blended fogging solution. Two continuous duty regenerative blowers are included: one as primary and the other as stand-by. The nozzle assembly consists of one or more pair of nozzles (a primary plus a stand-by that is activated when excess pressure "plugging" is sensed). The nozzles are designed to operate at very low pressure while allowing an adjustable liquid volume to air atomize the liquid into a < 50 micron size fog.



VFT APPARATUS

(Fogging nozzle and its operation)



The current commercial unit uses a low-pressure nozzle that is less susceptible to scaling while still delivering atomized droplets averaging 10-20 microns in diameter.

CONTROL PANEL

The control panel houses power distribution circuits and PLC-driven relays. System capabilities include programmable hourly chemical feed rates; auto-shutdown features; remote access / telemetry; and local diagnostics/data logging. The faceplate has two simple operating switches and indicator lights for system status and servicing needs.

Process Safety

Apart from the inherent risks associated with 27% H₂O₂ and 25% NaOH, the VFT process hazards relate to the diluted 1% - 5% mixture of the two chemicals. Alone, concentrations of < 8% H₂O₂ are non-regulated as are those of < 1% NaOH. A 1% - 5% mixture of the two thus carries hazard labels of dilute NaOH, i.e., corrosive (to personal contact). Such mixtures are used extensively in the bleaching of pulp, paper, and textile products, and are typically made up in batches and stored in vented containers. The H₂O₂ tends to decompose (gas) in alkali and so new batches are typically made up for each shift. In the VFT process, the mixture is not stored but created in-line and atomized seconds later at the nozzle.

Safety interlocks and an automatic purging procedure essentially eliminate any possibility of personal contact with the mixture prior to atomization. The primary risk is thus inhalation of the fog within the enclosed wet well or sewer. To guard against this risk, a Standard Operating Procedure is used for opening vents / hatches to the wet well.

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VFT APPARATUS

The VFT system can be divided into the following subsets or blocks:

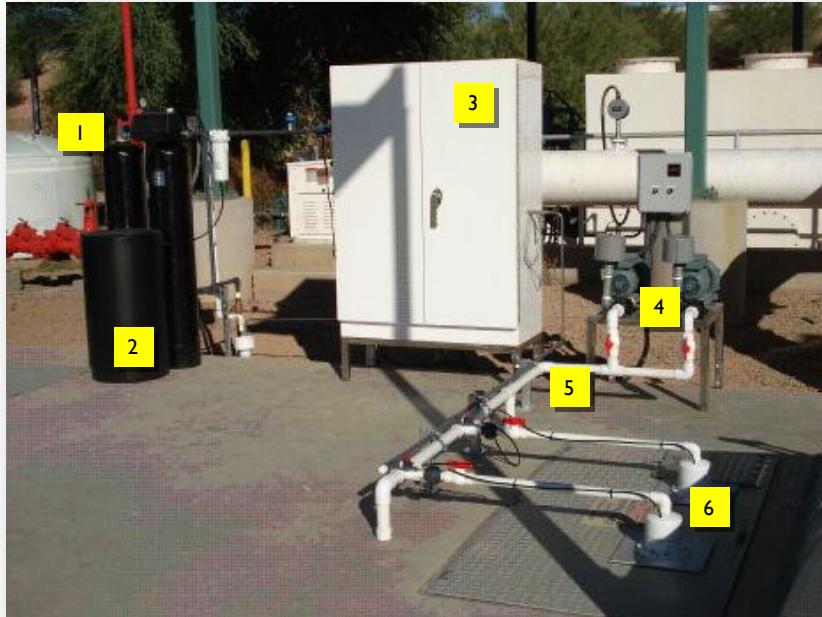
- Water softener
- Chemical feed pumps
- Chemical supply tanks
- Mixing cabinet
- Blowers
- Fogger nozzles assembly
- Control panel

The entire VFT system (absent chemical storage) can fit into a 10' x 10' footprint.

Equipment Detail

Two 2,000-gallon or two 3,000-gallon double contained, high density polyethylene, storage tanks. The secondary containment is sized to provide 110% of storage capacity. The tank comes equipped with a reverse level indicator, fill line, overflow port into the secondary containment, labels and placards compliant with local codes, and pressure relief device specific to hydrogen peroxide service.

VFT Apparatus



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|-----------------------------------|------------------------------|
| 1. Chemical Storage | 4. Air Blowers |
| 2. Deionizer Unit (Make-up Water) | 5. Liquid - Air Supply Lines |
| 3. Pump Mixing Control Cabinet | 6. Nozzle Assembly |

US Peroxide Solutions

US Peroxide is the leading supplier of hydrogen peroxide and peroxygen based technologies and services for environmental applications. We have been serving the environmental market for over 15 years and have offices and field service locations throughout North America. Our consultative approach to problem solving includes performing objective customer "needs" assessments, application modeling and development of chemical treatment programs tailored to a customer's specific requirements. Use of full-service programs successfully integrates storage and dosing equipment systems, chemical supply, inventory and logistics management, and ongoing field and technical support. This comprehensive operations and program management approach provides cost effective "hands-off" solutions to our customers.

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