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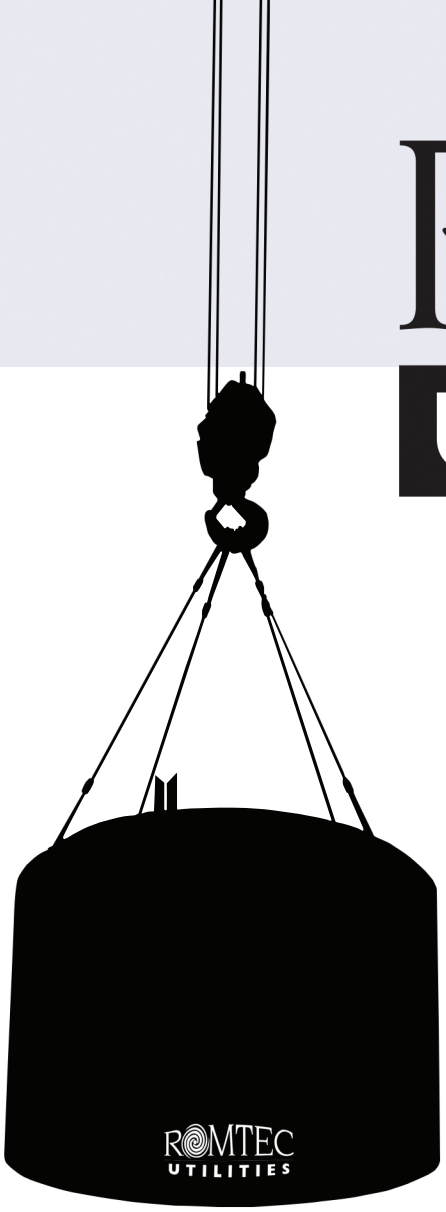

Understanding Odor Control Technologies
for Wastewater Lift Stations

Romtec Utilities
Technical White Paper

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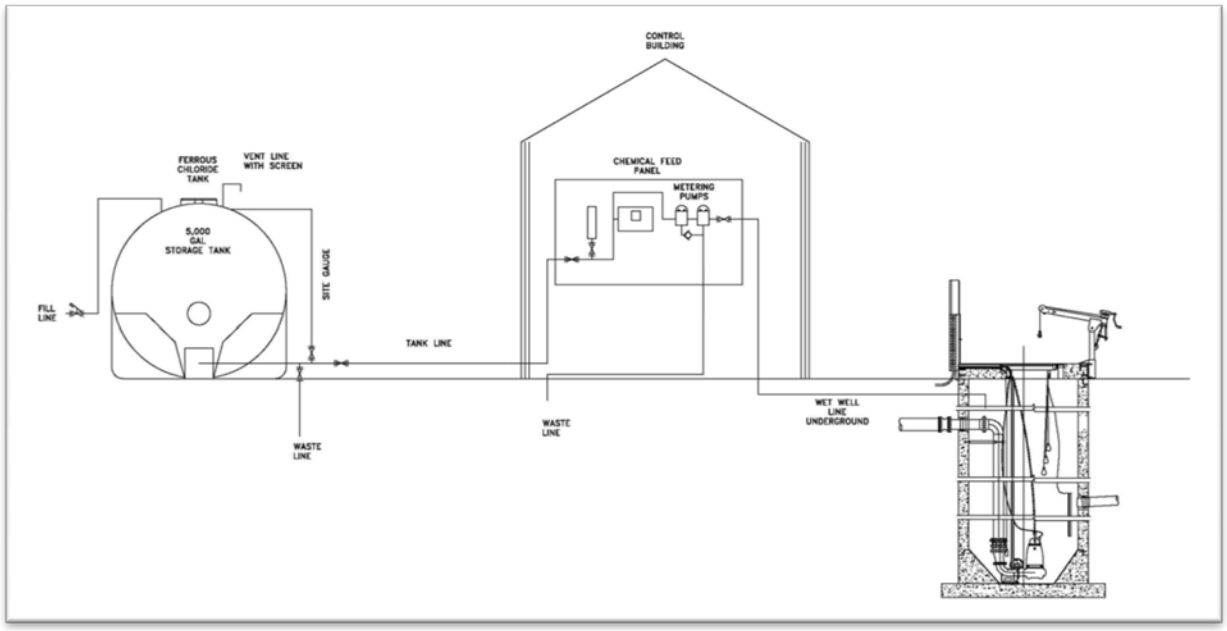


Figure 1: Designs for a Romtec Utilities Chemical Feed System

Introduction:

Romtec Utilities has designed many odor control systems for wastewater lift stations. An interesting aspect of odor control is that for some customers the odor control device is not intended to eliminate odor at all. The intent of an odor control device can be considered a fundamental breakdown between two schools of thought.

The first school thinks about odor as a gas that can be removed from the air in a wastewater system. To this school, odor control equates to eliminating odorous gasses. The second school thinks about odor as the result of wastewater stagnating and becoming septic. To this school, odor control equates to preventing wastewater from off-gassing due to stagnation. For customers who fall into the second school, the concern about odor control is more likely a concern about pumping and treating septic water.

The true source of odor in wastewater is almost always bacteria. Bacteria in wastewater feed on chemical compounds and produce waste products. In most circumstances where wastewater is moving quickly through a system, the bacteria are supplied with oxygen which keeps the harmful waste products at a low level.

High temperature and high pressure increase the activity level of the bacteria and thus, the rate at which they consume oxygen. When the oxygen level in the wastewater becomes too low, the bacteria will begin to produce higher levels of hydrogen sulfide, ammonia, methane, and other odorous substances.

Aside from the unpleasant smell, these odorous substances can also be corrosive and difficult to treat effectively. Hydrogen sulfide is a particular hazard for the maintenance of a system and for the safety of the system operators. These concerns explain why some customers choose to use odor control methods that treat the wastewater before it turns septic.

Understanding the two schools of thought regarding odor control explains why multiple technologies have been developed. Each technology provides different benefits to a wastewater lift station and treatment system. If smell is the only concern, treating the air is an adequate solution to odor control. If the maintenance and safety issues caused by hydrogen sulfide are the biggest concern, a technology designed to treat the wastewater will be necessary. Most odor control systems can be classified into one of these three categories: Adsorption, Biological Oxidation, and Chemical Scrubbing.

Adsorption

To start discussing adsorption, it is first necessary to describe its difference from absorption. Adsorption is when ions, atoms, or molecules, from one source adhere to the surface of another element. To put it simply, adsorption is when an odor-causing gas, liquid, or dissolved chemical “sticks” to the surface of a substrate as the two parts comes into contact. Conversely, absorption is when the substrate incurs volume from the odorous substance. Absorption will be discussed below in the chemical scrubbing section. This odor control method treats the air to remove odorous gasses.

Adsorption in wastewater odor control systems primarily uses activated carbon to act as the media. This is done by forcing the odorous air displaced from the wet well across a bed of activated carbon, which produces clean air. There are several different classes of activated carbon used in odor control; however, the most effective and most used class for wastewater is “standard activated carbon” which uses physical adsorption. Additional classes are caustically impregnated carbons, blended carbon materials, and catalytic carbons, but these do not have the same adsorption properties for odorous substances. Materials other than activated carbon

Figure 2: A Wastewater Lift Station Adsorption Unit.

can be used in adsorption like zeolite, potassium permanganate, and activated alumina.

Activated carbons have one of the easiest odor control systems to manage and maintain. They have few moving parts, and the carbon system does not typically need electric sensors or instruments beyond fans and start-stop buttons. The carbon beds need to be replaced when they are spent. Once the carbon is used in physical adsorption it has no way to regenerate. A crew with a vacuum must come, remove the carbon, and dispose of it appropriately. The crew will also add the new carbon and restart the system. In most cases, an adsorption system can go up to a year without needing the carbon to be replaced.

Physical adsorption with activated carbon is economical for hydrogen sulfide gasses at around 1- 5 parts per million concentration levels. Once the hydrogen sulfide concentration gets higher it is better to move onto a different type of odor control (i.e. bio-filtration or chemical scrubbing). Physical adsorption also removes other types of odor causing substances like amines compounds, but it is ineffective for removing ammonia. Physical adsorption through activated carbon is one of the most effective odor controls. It can typically remove 99.9% of all incoming contaminates.

There are a lot of companies specializing in adsorption technologies. These companies are good examples of adsorption odor control for wastewater lift stations: Pure Air Filtration (see Figure 2), Siemens, General Carbon Corporation, Carbtrol Corporation, and Cabot Norit Activate Carbon.

Biological Oxidation

Biological oxidation (bio-oxidation) employs bacteria and micro-organisms to consume odor causing substances and release carbon dioxide as a waste product. There are two main types of bio-oxidation. The first uses inorganic media and is referred to as either “bio-scrubbers” or “biotrickling filters.” The second uses organic media and is typically called “bio-filters.” Although the term filter is used

with this odor control technology, no filtering actually occurs. This process is metabolic.

Inorganic bio-scrubbers are used to remove off-gases like hydrogen sulfide in wastewater applications. Bio-scrubbers typically have a smaller physical footprint than organic bio-filters and have a lower operational cost than other odor control systems for hydrogen sulfide. They are designed to handle corrosive environments and can run in 15 - 20 year life cycles. Bio-scrubbers are used in systems with a fan, a pH meter, a recirculation pump, and electrical controls. The wastewater is distributed over the bio-scrubbing media in a large tank. This media cleanses the wastewater of odorous substances as it strains through. The height of the tank is varied depending on the system, but the overall size can be comparable to a carbon system like adsorption.

Figure 3: A Bio-filter Using Bark Mulch as the Media

Organic bio-filters function when contaminated air passes through a media consisting of micro-organisms where odorous substances are consumed. Bio-filters are typically large and used at wastewater treatment facilities, but smaller versions exist that can be used for lift stations. They are typically below-grade structures with a micro-organism media such as compost on top of an air vent or blower system. As the air exits the well, the micro-organisms in the compost consume the odorous substances. Bio-filters only treat the air and do not handle the wastewater itself.

Bio-filtering systems are best suited for off-gassing conditions with predictable concentrations because the micro-organisms can become unhealthy if the “food source” varies wildly. Bio-filters can go up to 5 years without a media change, having a shorter life cycle than bio-scrubbers, but they handle a wider array of odorous substances. Newer systems are designed to make media changes much simpler and often only require access to remove and replace the media.

Several companies can provide biological oxidation systems to serve everything from home septic tanks to huge wastewater treatment facilities. These companies offer products that are suitable for use in pump stations: Megtec, Siemens, Enduro Composites, and APC Technologies.

Chemical Scrubbing

Chemical scrubbing is the absorption of substances as discussed briefly in the first section. To restate, absorption is a process where one substance is taken on by another substance. The process can be either chemical or physical. Chemical scrubbing can work in a number of ways by either absorbing the odorous substances themselves or by altering the environment of the wastewater to prevent odorous gasses from forming. Other chemicals change the water chemistry to prevent bacteria from creating septic conditions.

In lift stations, chemical scrubbing is typically –and most economically- accomplished through a chemical feed system. These chemical feed systems can be quite complex, and in some cases, they are essentially miniature pump stations in controls and function. They use a large basin to house the chemical catalyst to be used and pump the chemical into the wet well where the wastewater collects. Just like a pump station, the chemical feed system relies on multiple sensors and a controller to dictate the amounts, rates, and intervals of the chemical additions.

Figure 4: A Typical Control Setup for a Wastewater Chemical Feed System

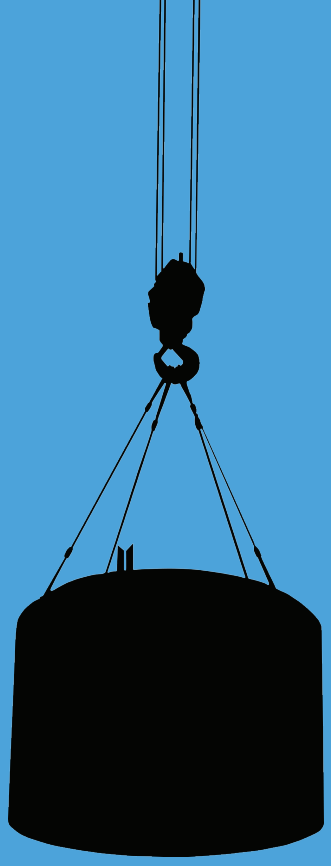
There are many different chemicals available for chemical scrubbing systems, and some are proprietary and can only be purchased with an entire chemical feed system. Siemens, for example, offers Bioxide® as a popular chemical feed solution. Increasingly, municipalities are looking toward non-proprietary chemical feed systems like ferrous chloride, hydrogen peroxide, magnesium hydroxide, and others. In most wastewater systems, choosing a chemical feed system will depend largely on the downstream system and treatment capabilities.

Chemical scrubbers are available from a number of manufacturers and can even be supplied by private contractors that install custom systems. Chemical scrubbers can be highly variable, but these companies provide reliable systems: Lantec Products Inc., Siemens, and Biorem. Romtec Utilities frequently uses Pacific Service and Supply Company as a private designer and supplier of custom chemical feed systems.

Conclusion

There are many systems available for odor control in wastewater lift stations, but primarily, the only options are to treat the air or to treat the wastewater to remove hydrogen sulfide, ammonia, and other odorous substances. Operators may choose to use adsorption or bio-filters to treat the air carrying odorous gasses. They might alternatively choose to treat the wastewater through bio-scubbers or chemical scrubbing. In many cases, odor control is a misnomer. Treating the wastewater is typically used to prevent corrosive buildup and/or hazardous conditions. The elimination of odor is a favorable byproduct but typically not the sole reason for installing a system. Romtec Utilities is willing to work with municipalities to supply an odor control system that will provide the functionality and benefits required by the customer.

Note: Information in this paper was found with the help of "Odor Control "ABC's": How to Compare and Evaluate Odor Control Technologies," by Ken Corey and Leo Zappa.



About Romtec Utilities

Romtec Utilities, Inc. designs, manufactures, supplies, and installs site specific packaged pump stations. Our pump stations include detailed drawings and specifications in the CSI format with all structural, mechanical, communication, and electrical plans. Our documentation also includes a complete bill of materials, a well-defined scope of work and services, and a complete system warranty. Our complete packaged systems serve commercial, municipal, state, federal, agricultural, and industrial applications for virtually any type of water-pumping system.

Romtec Utilities, Inc. began operation in 2000 in Roseburg, Oregon. The US economic conditions at that time fostered the growth of a booming housing market, and Romtec Utilities did a lot of business working with developers and public agencies who needed packaged lift stations. Romtec Utilities distinguished itself by offering quality designs, fast lead times, and an ability to get projects approved and installed quickly.

In the wake of the 2008 Financial Crisis, the market changed and so did Romtec Utilities. Romtec Utilities made a rigorous evaluation of its product offering to become more cost competitive. We also placed more emphasis on working with industrial clients with a broad range of applications.

In the following years, Romtec Utilities underwent dramatic changes that have ultimately made us a better company. We expanded our interests to include more stormwater, more wastewater, and more industrial water applications. We improved our vendor relationships to provide our customers with more products and capabilities at lower prices. We developed an efficient and precise documentation process to foster fast and clear communications, and we strengthened our field services and repair capabilities.

We have completed hundreds of projects across the United States and have supplied packages for international installations. Contact us for assistance. We love to talk about pumping systems of every type, shape, and size!

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