MV TECHNOLOGIES

Engineered to Guarantee Results

H_2S Treatment for Landfill Gas

What sets MV Technologies H2SPlus™ Systems apart from other systems is the combination of biologically enhanced media (BAM™) with a system design informed by a wide range of in-field application and over a decade of experience.

H2SPlus Systems provide consistent and reliable performance through scalable & flexible designs that offer the lowest total cost of ownership. Additionally, MV stands behind its system design with the MV Performance Guarantee.

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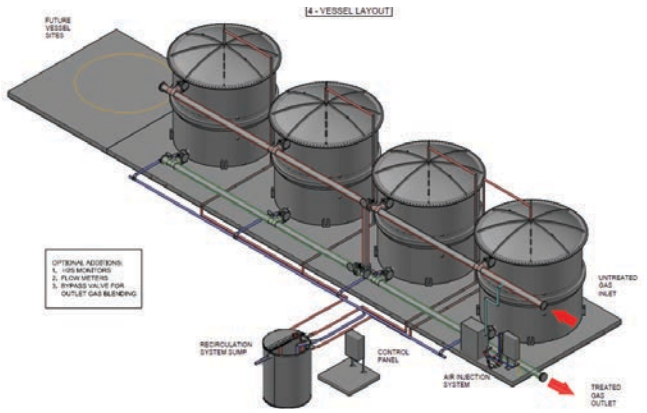
Proven H_2S Removal Technology

H2SPlus Systems are a biologically enhanced dry scrubber technology proven to remove H_2S from gas streams across a broad base of industrial clients. H2SPlus Systems are in use treating landfill gas (LFG) and digester biogas at farms, wastewater treatment facilities, food & beverage processing operations and more.

Clients use H2SPlus Systems to:

- remove H_2S and achieve SOx compliance limits;
- extend the operating life of downstream gas-to-energy equipment and reduce maintenance costs;
- comply with stringent pipeline/CNG/RNG specifications where the LFG is used as a fuel source;
- protect flares and thermal oxidizers from corrosion; and
- meet equipment warranty requirements.

4-Vessel Layout



Key Operating Advantages

- Extended Media Life
- Reduced Operating Expense
- Increased Ease of System Use
- Consistent and Reliable Performance
- Predictable, Efficient and Safe Media Changeouts

Performance Guarantee

In combination with high-performance media, our H2SPlus Systems are engineered to be flexible so short term swings in H_2S concentration are handled without issue, while your operating costs fall in line with any change in H_2S levels over time. Additionally, MV stands behind its system design, provides engineering support and media reorder service.

There are significant cost advantages to using the H2SPlus System and the MV Performance Guarantee™ ensures you that we back up the operating costs that we project or we will make up the difference!

Call an MV Engineer to help you evaluate the best H_2S removal technology for your unique project requirements.

Case Studies

PROJECT: Landfill Gas to Energy Project, Pennsylvania

APPLICATION: An environmental systems project includes a 10.2MW power plant, with two turbine packages and associated equipment, tied directly into the local power grid. The landfill gas is piped to the power generation facility. The gas is required to be treated to below 200 ppm in order to comply with the facility's air permit.

MV SOLUTION: MV supplied a six-vessel H2SPlus System, utilizing 14' diameter tanks with a 12' straight sidewall. To achieve the outlet requirement, MV designed the system with a bypass and blend approach, treating 5,500 SCFM down to 0 ppm and combining with the other 1,500 SCFM on the outlet to achieve a total H_2S outlet of less than 200 ppm. The total media requirement is 8,568 ft^3, designed for an optimized bed life of 7 months. Currently the site is treating the entire flow of gas to the turbines as they have realized significant maintenance cost savings as well as significantly more run time.

Evaluating H_2S Removal Technologies

MV Technologies Provides ALL Solutions and Will Help Evaluate the Best Technology for Your Unique Project Requirements.

	Dry Scrubber Technology MV Technologies H2SPlus™ System	Dry Scrubber Technology Iron Oxide Coated Dry Granular Media	Filter Technology Activated Carbon	Filter Technology Enhanced Activated Carbon (limited to 200 ppm)	Chemical Treatment Ferric Chloride	Wet Scrubber Technology Biological Scrubber (aqueous only – no caustic solution)
Media Cost per lb. of H_2S Removed from Gas Stream (+/- 10%)	$1.31	$5.35	$13.00	$3.58	$14.00	$0.35 to $3.00+[1]
Initial System Capital Cost	Low	Low	Low	Low	Low	1.5 to 3 times the cost of dry scrubbers
Water and Effluent Management Requirements	Nominal, < 20 gal/wk for large tanks	Gas must be fully saturated before scrubbing	Moisture must be removed from gas before filter	Moisture must be removed from gas before filter	Sulfur accumulates and may obstruct gas flow through process pipework	High, due to additional water treatment to remove solids
Operating Considerations	H2SPlus Systems allow full vessel top entry for media replacement[2]	Media changeout most always requires confined space entry[3]	Media loads up quickly and requires frequent changeouts[4]	Media loads up quickly and requires frequent changeouts[4]	Hazardous handling required, pH of 2	No media. However, system operating variables are complex and challenging to control[5]
Loading Capacity Pounds H_2S Removed/ Pound Media	0.24	0.1	0.1	0.72	0.2	No Media
Approximate Cost per Pound of Media	$0.31	$0.55	$1.30	$2.59	$1.80/gallon	No Media
Operator Attention Required	Low	Low	Low	Low	Moderate	High
Ability to Hold Fixed H_2S Outlet Concentration Levels	Excellent	Excellent	Filters may clog quickly and result in early breakthrough	Filters may clog quickly and result in early breakthrough	Poor	Poor – biological systems cannot respond quickly to fluctuations in H_2S loads
Disposal Method	Spent media may be composted, land-applied or non-hazardous landfilled	Non-hazardous landfilled	H_2S is not converted, only captured. May be considered hazardous waste. Landfilled or incinerated.	H_2S is not converted, only captured. May be considered hazardous waste. Landfilled or incinerated.	Reaction by-products go out with effluent and digestate	Sulfur may be reclaimed from effluent through subsequent processing

Notes

1) Includes costs of nutrients and estimated labor for active system control.
2) MVNet™ systems provide for media removal without confined space entry.
3) Media sets up "solid" if run to full life, making removal very difficult - often requires hydroblasting.
4) Vacuum truck removal is typical.
5) Active bacteria is sensitive to temperature, nutrients, pH and other environmental conditions. Systems may require up to 10 days to start and stabilize after shutdown for maintenance. Sulfur bearing effluent must be handled/managed and may pose additional water treatment considerations. Fluctuating H_2S concentrations pose operating problems. Too much H_2S and the bacterial action cannot respond quickly enough to hold to outlet concentration limits – too little H_2S and the bacteria population can "starve" and reduce effectiveness.

There are other well known and practiced technologies used to remove H_2S in much larger flow rate environments. These include: caustic scrubbing; caustic scrubbing with biological conversion of the H_2S; and iron based liquid "redox".

All of these involve much higher levels of capital expenditure than represented by the technologies compared above and, as a result, are used in applications where sulfur removal requirements exceed 1,000 Lbs per day.

PROJECT: Landfill Renewable Energy Facility, Georgia

APPLICATION: The renewable energy facility is designed, built, owned and operated by a regional energy service provider to collect the LFG, and use it as a fuel source to power generators. The facility is designed to generate 4.8MW, and requires treatment of a source H_2S concentration of 1,700 ppm at 1,600 SCFM. The facility's air emissions permit requires the H_2S concentration to be below 200 ppm.

MV SOLUTION: To meet the H_2S specification, MV supplied four 12′ diameter by 11'-8" tall vessels, with a total media capacity of 4,368 ft^3 of media. Designed media bed life is 170 days. The treated LFG has an H_2S concentration in the 0-10 ppm range. The facility bypasses a portion of the LFG and re-blends it with the treated LFG. The blended LFG is targeted to an H_2S level to comply with the air permit. By operating the system in this manner, it cuts operating cost of the H2SPlus System by 12%.

Lowest Total Cost of Ownership

We successfully partner with engineering firms, design & build companies, and end-users to help identify and design the right H_2S removal solutions for site-specific requirements from meeting permit limits to treating the LFG for beneficial end-use. MV Technologies H2SPlus Systems deliver superior value against these requirements.

H2SPlus System Difference

- Designed to meet site-specific operating conditions
- Operates at 100% effectiveness immediately upon startup
- NOT susceptible to fluctuating gas conditions
- Converts all H_2S in the LFG stream into iron sulfides and elemental sulfur
- Operates with no need for a water treatment system or sewer line access

Also, in evaluating H_2S treatment approaches, an important metric to consider is the Total Cost of Ownership (TCO). The TCO includes capital cost such as the vessel size, pumps, installation costs, and the operating costs, largely determined by media life and resulting time between replacement – itself a function of LFG flow rate and H_2S concentration. MV's enhanced iron sponge (BAM) media is guaranteed to remove up to 13 pounds of H_2S per cubic foot, one of the highest removal efficiencies in the industry.

In addition to understanding 'cost per lb. of H_2S removed', cost elements often overlooked during comparison of H_2S treatment approaches:

- Power costs – increase in pressure drop can result in increase in power costs
- Lost revenue due to system downtime – maintenance/media changes
- Replacement of proprietary nutrients and/or chemical/caustic
- The costs of testing for warranty or regulatory requirements
- Operator attention time – it is not "free"

Simply Efficient

The innovative MVNet™ system, ensures a safe and easy media changeout process and at end of life, MV's media:

- is non-hazardous;
- passes the Environmental Protection Agency's T.C.L.P test and meets O.S.H.A. definitions of a "not readily ignitable solid";
- can be composted, land-applied, or disposed of in landfills.

"Use a Net, Not a Shovel."

Lowest Cost Per Pound of H_2S Removed

The combination of the H2SPlus System design and MV's BAM™ media results in higher H_2S absorption capacity and the lowest cost per pound of H_2S removed among any of the H_2S removal technologies commercially available today.

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