MICROBE-LIFT®

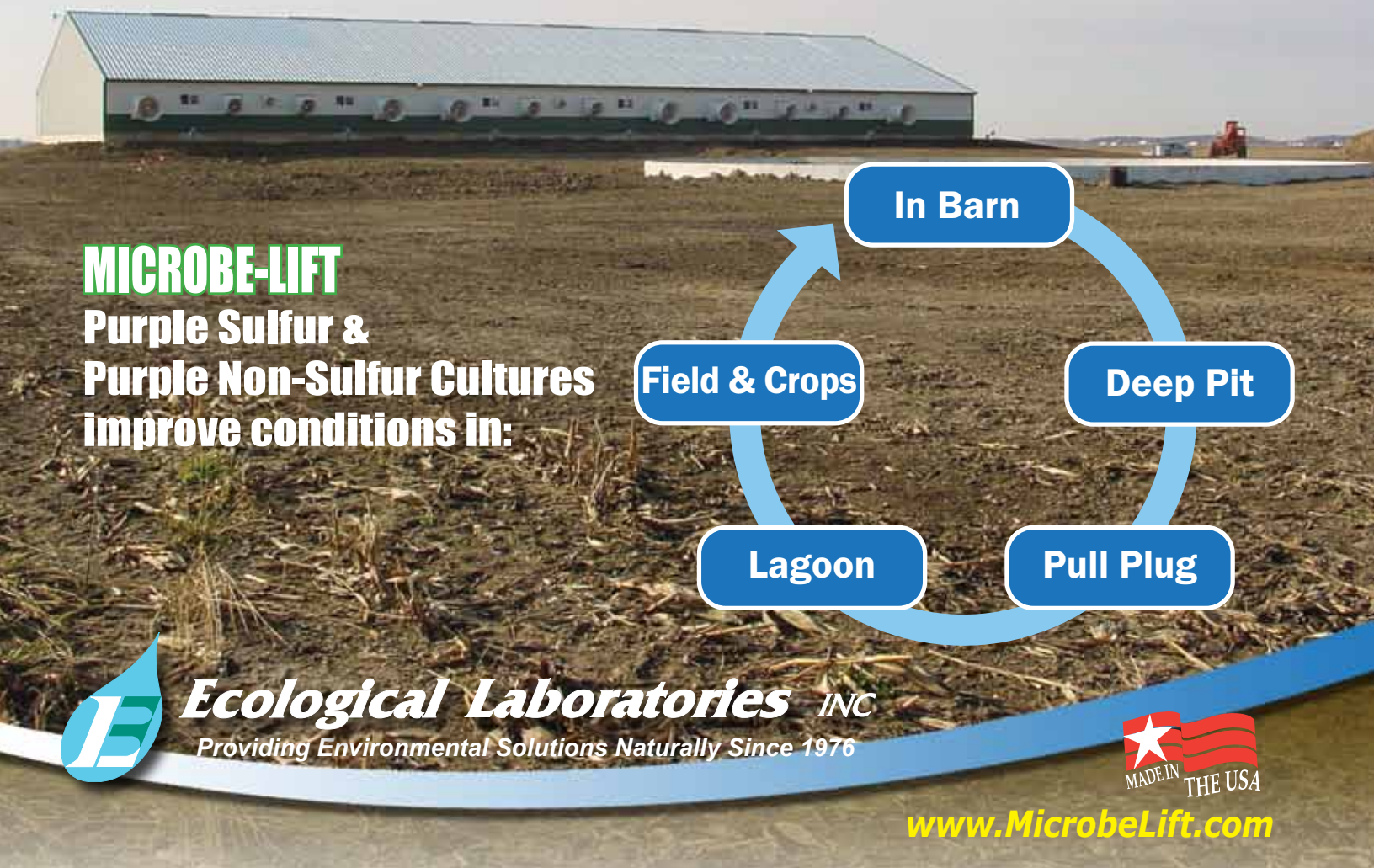
ADVANCED MICROBIAL MANURE TREATMENT

MICROBE-LIFT® Biotechnology Provides Full Circle Treatment Benefits for Barns - Pits - Lagoons - Fields & Crops

Unmatched biotechnology to enhance manure management at all levels of manure containment with multiple benefits for barn environment, pit conditions, manure value, advanced odor-abatement and crops

ECOLOGICAL LABORATORIES, INC - Experience in biological product development and supply for environmental applications in agriculture markets since 1976

- **Odor Control in Barn & Field (including ammonia & hydrogen sulfide)**
- **Manure Liquefaction (consistent top to bottom)**
- **Solids Reduction (surface crust and bottom solids)**
- **Crop Enhancement (includes greater yields with no additional input)**



MICROBE-LIFT
Purple Sulfur & Purple Non-Sulfur Cultures improve conditions in:

Ecological Laboratories INC
Providing Environmental Solutions Naturally Since 1976

MADE IN THE USA

www.MicrobeLift.com

Product Review: MICROBE-LIFT HOG, DFP and Sludge-Away

MICROBE-LIFT manure treatments are designed specifically to resolve environmental issues in barns, manure storage pits, lagoons, and field application of manure. MICROBE-LIFT/HOG & DFP represent advanced novel microbial technology that differs significantly from all competitive microbial products in number of species, fermentation process and in effectiveness.

Microbial manure enhancement encompasses three areas:

1. The Barn Environment
2. Pit Enhancement Targets - manure liquefaction, consistency, value and gas reduction
3. Field Application - nutrient retention, consistent non-streak manure application, bio-active for organic reduction and organic carbon conversion, nitrogen fixation and overall enhanced crop values through restoration of biological activity in the soil

MICROBE-LIFT is the only biotechnology to incorporate a highly active consortium of heterotrophic, chemotrophic, autotrophic and phototrophic microorganisms in a single bioformulation in combination with highly valued purple sulfur and non-sulfur microorganisms. These cultures, once believed impossible to formulate and stabilize, are well recognized for their functions in manure management processes, and for their crop value in support of photosynthesis.

Odor Abatement - A novel biotechnology that effectively controls hydrogen sulfide, ammonia and other toxic gaseous reactions that occur in manure storage, a capability that is of significant importance to livestock production. MICROBE-LIFT technology offers a distinct advantage over all competitive products.

Purple Sulfur Cultures

Science Review - For years the value of Purple Sulfur cultures has been known within the scientific and agriculture community, yet these cultures were not available in a stable formulation until now!

Purple Sulfur bacteria - a diverse group of microorganisms capable of metabolizing sulfur and its compounds and important in the sulfur cycle in nature. Some of the common sulfur substances that are used by these bacteria as an energy source are hydrogen sulfide (H_2S), sulfur, and thiosulfate ($S_2O_3^{-2}$). The final product of sulfur oxidation is sulfate (SO_4^{-2}).

Source: Encyclopedia Britannica

Purple Sulfur microorganisms

Work of Sergei Winogradsky - Russian microbiologist

After studying natural sciences at the University of St. Petersburg in 1881, Winogradsky went to Strassburg, Germany in 1885. In 1887 he determined the specific physiology of sulfur bacteria, demonstrating that the colorless form of these bacteria can obtain energy by oxidizing hydrogen sulfide to sulfur, and then to sulfate in the absence of light called "light independent reactions." To our knowledge, no other product contains these microorganisms.

MICROBE-LIFT/HOG & MICROBE-LIFT/DFP oxidize hydrogen sulfide from the manure water column and metabolize it into granules of elemental sulfur. These sulfur granules are stored temporarily and then oxidized to form sulfate. The sulfur granules can be easily seen within the bacterial cells on a wet mount microscopic slide at 1000 x magnification. In high numbers, these bacteria give the water and the floc a pink or purplish tint. These cultures are extremely effective in maintaining stored manure in a liquid state, controlling gaseous odors produced biologically in anaerobic manure storage systems and providing odor reduction on land application. They also fix nitrogen, control nutrient runoff and increase crop values.

Control Gases with MICROBE-LIFT/HOG and MICROBE-LIFT/DFP

MICROBE-LIFT/HOG and MICROBE-LIFT/DFP control gaseous reactions and solids related problems associated with the containment of concentrated animal waste in pits, silos and lagoons.

The predominant organisms in MICROBE-LIFT manure technology are the purple sulfur group. This bacteria consortium is divided between two major categories: purple sulfur and purple non-sulfur organisms. The purple sulfur bacteria, which include Thiobacillus sp., utilize hydrogen sulfide as an electron donor and oxidize the sulfide to elemental sulfur, temporarily stored intracellularly and released as sulfate.

MICROBE-LIFT technology incorporates a vast diversity of microorganisms to achieve an effective and natural biological solution to farm waste management problems.

MICROBE-LIFT CONSORTIUM
A Wide Consortium with Diverse Functions

- Bacillus amyloliquefaciens
- Bacillus subtilis
- Bacillus licheniformis
- Bacillus megaterium
- Bacillus circulans
- Bacillus pumilus
- Microbacterium sp.
- Rhodopseudomonas palustris
- Curtobacterium flaccumfaciens
- Pandorea sputorum
- Pseudomonas sp.
- Pseudomonas stutzeri
- Pseudomonas citronellolis
- Brevibacillus
- Micrococcus sp.
- Rhodococcus erythropolis
- Rhodospirillum rubrum
- Nitrobacter winogradsky
- Clostridium nitrophenolicum
- Actinomycetes

MICROBE-LIFT's consortium of purple sulfur, non sulfur, heterotrophic, phototrophic and autotrophic cultures are proven to reduce gas-generating reactions that result in carbon dioxide emissions via dark phase, light independent microbial processes. This novel technology resolves most, if not all, manure storage problems within barn environments and reduces land-applied manure odor, improves nitrogen retention and helps controls runoff resulting in improved nutrient management while providing enhanced soil and crop benefits.

MICROBE-LIFT Benefits

- Odor Reduction – barn, pit and field
- Pit Liquefaction
- Solids Reduction – surface crust and bottom solids
- Ease of waste removal – reduced to no agitation
- Consistent manure values top to bottom – improved, consistent manure value
- Nutrient retention in biomass
- Reduced odor attracts fewer insect pests
- Promotes animal growth as a result of reduced stress
- Improves feed conversion efficiency
- Increased weight gain through improved feed conversion
- Mortality reduction as a result of improved health
- Eliminates field streaking due to poor liquefaction and consistency
- Control runoff by improving nutrient retention
- Improves biological activity in soil to enhance root and crop growth

MICROBE-LIFT technology is the result of experience in the design and production of bio-formulations for agriculture applications since 1976. This technology has been proven to resolve tough manure-related problems while providing soil and crop enhancement.

MICROBE-LIFT/HOG Basic Application Rates			
Size of Pit/Lagoon (in Gal.)	1st App. (Purge)	Next 4 Weeks (Once per Week)	Maintenance (Once per Month)
5,001-10,000	3 gal.	1 qt.	1 qt.
10,001-50,000	4 gal.	2 qt.	2 qt.
50,001-100,000	5 gal.	3 qt.	3 qt.
100,001-300,000	6 gal.	1.0 gal.	1.0 gal.
300.001-500,000	7 gal.	1.5 gal.	1.5 gal.
500,001-1,000,000	10 gal.	2.0 gal.	2.0 gal.
1,000,001-1,500,000	15 gal.	3.0 gal.	3.0 gal.

MICROBE-LIFT/HOG is effective in all hog manure storage systems

MICROBE-LIFT/DFP is effective in all dairy manure storage systems

MICROBE-LIFT/DFP Basic Application Rates			
Size of Pit/Lagoon (in Gal.)	1st App. (Purge)	Next 4 Weeks (Once per Week)	Maintenance (Once per Month)
5,001-10,000	3 gal.	1 qt.	1 qt.
10,001-50,000	4 gal.	2 qt.	2 qt.
50,001-100,000	5 gal.	3 qt.	3 qt.
100,001-300,000	6 gal.	1.0 gal.	1.0 gal.
300.001-500,000	7 gal.	1.5 gal.	1.5 gal.
500,001-1,000,000	10 gal.	2.0 gal.	2.0 gal.
1,000,001-1,500,000	15 gal.	3.0 gal.	3.0 gal.

Enhanced Results with MICROBE-LIFT/SA (Sludge Digester) and MICROBE-LIFT/MFC

MICROBE-LIFT/SA is a biostimulant developed to speed removal of surface and bottom solids in manure containments systems and is designed for use with MICROBE-LIFT/HOG and MICROBE-LIFT/DFP.

MICROBE-LIFT/SA's reactive organic catalysts are synthesized humic by-products including organisms, essential elements and minerals from plant tissue. These rare constituents speed microbial processes promoting a more rapid reduction of manure solids by enzymatic reactions. These processes reduce difficult surface and bottom solids while providing a significant increase in manure degrading biomass, and a consistent manure value from the surface to the bottom of containment pits and lagoons.

MICROBE-LIFT/SA improved sludge reduction from 40% to 80% over historical system performance, as well as increasing the nutrient value of the manure contained in cellular biomass for improved fertilizer value on application.

- Contains humic compounds and microorganisms
- Includes humic cellular materials that function as accelerators
- Comprises microbial nutrients that combine with manure

Directions

- For solids reduction - 5 to 20 ppm.
- For odor abatement – 25 to 50 ppm

Use MICROBE-LIFT/SA in conjunction with MICROBE-LIFT/HOG & DFP.

MICROBE-LIFT/SA Basic Application Rates

Size of Pit/Lagoon (in Gal.)	1st App. (Purge)	Next 4 Weeks (Once per Week)	Maintenance (Once per Month)
5,001-10,000	1.5 gal.	0.5 qt.	0.5 qt.
10,001-50,000	2 gal.	1.0 qt.	1.0 qt.
50,001-100,000	2.5 gal.	1.5 qt.	1.5 qt.
100,001-300,000	3 gal.	0.5 gal.	0.5 gal.
300.001-500,000	3.5 gal.	0.75 gal.	0.75 gal.
500,001-1,000,000	5 gal.	1.0 gal.	1.0 gal.
1,000,001-1,500,000	7.5 gal.	1.5 gal.	1.5 gal.

Methane & Foam Control in Hog Barns

MICROBE-LIFT/MFC (Methane & Foam Control) in liquid and dry blends is designed specifically to biologically reduce protein foam and control excessive methane production resulting from high levels of DDGS in animal feed regimens. Contact us for specific information on this product's use and functions.

Crop Enhancement

Ecological Laboratories Inc., in association with Applied Experimental Microbiology (AEM), offers products and technology for crop enhancement and soil restoration.

Visit *www.GrowQuantum.com* for additional information on how to utilize this technology for reduced-chemical or non-chemical farming and restoration of soil biology for improved crop quality and production.

IMPORTANT HEALTH AND TOXICITY INFORMATION

Reported by:

Department of Health and Human Services
Centers for Disease Control and Prevention
National Institute for Occupational Safety and Health

MICROBE-LIFT purple non-sulfur cultures control hydrogen sulfide and other toxic gas reactions that occur during manure storage under anaerobic conditions.

Hydrogen Sulfide Exposure	
0.03 ppm	Can smell. Safe - 8 hours exposure
4 ppm	Can result in eye irritation. Mask use recommended. Damages metabolism.
10 ppm	Maximum exposure 10 minutes. Kills smell 3 to 15 minutes. Eye and throat injury. Reacts violently with dental mercury amalgam fillings.
20 ppm	Exposure of more than 1 minute results in severe injury to eye nerves.
30 ppm	Loss of smell, injury to blood brain barrier through olfactory nerves
100 ppm	Respiratory paralysis in 30 to 45 minutes. Victim will become unconscious in 15 minutes. Requires prompt resuscitation.
200 ppm	Serious eye injury, permanent damage to eye nerves. Stings eye and throat.
300 ppm	Loses sense of reasoning and balance, respiratory paralysis in 30 to 45 minutes
500 ppm	Asphyxia! Requires prompt resuscitation or victim will become unconscious in 3 to 5 minutes.
700 ppm	Breathing stops, unconsciousness, permanent brain damage and death can result unless victim is rescued promptly.

MICROBE-LIFT Benefits:

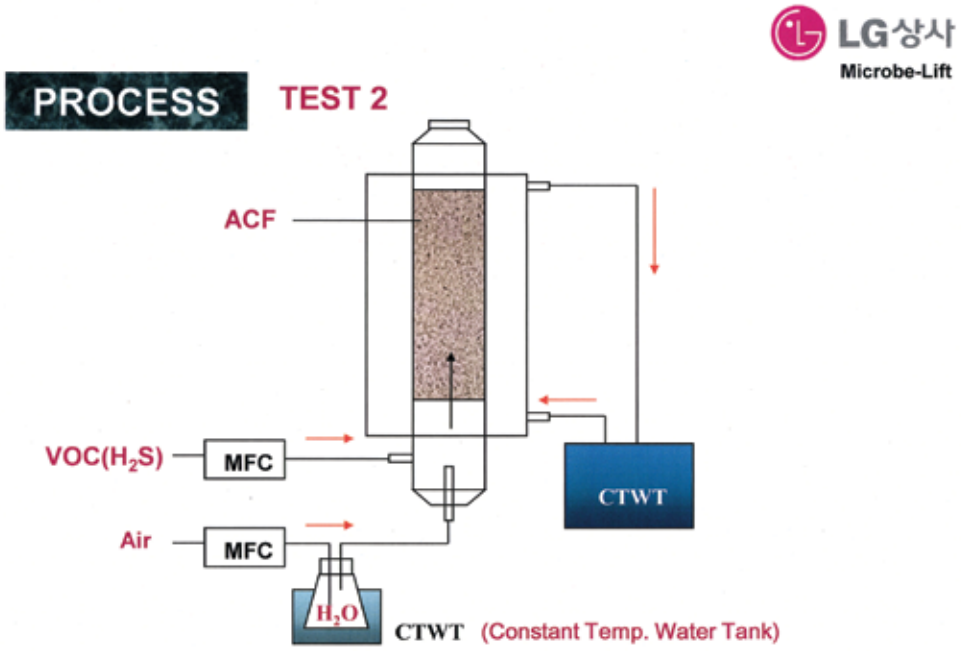
The continued use of MICROBE-LIFT manure treatment technology mitigates surface and bottom solids, promotes the release of trapped nutrients from manure solids, fixes nitrogen and stores manure released nutrients within the manure's developing biomass, referred to as a bio-active manure complex. The microbial cell structures that develop in treated manure result in a bio-active manure that is more beneficial to the restoration of soil biology and enhancement following land application. The continued use of MICROBE-LIFT manure treatment assures the storage and stability of manure nutrients and their release from the manure's bio-diversity created as a result by manure augmentation, while at the same time providing control of the production and release of toxic gases common in the storage of manure under anaerobic conditions. Only MICROBE-LIFT technology incorporates these rare biological pathways and functions.

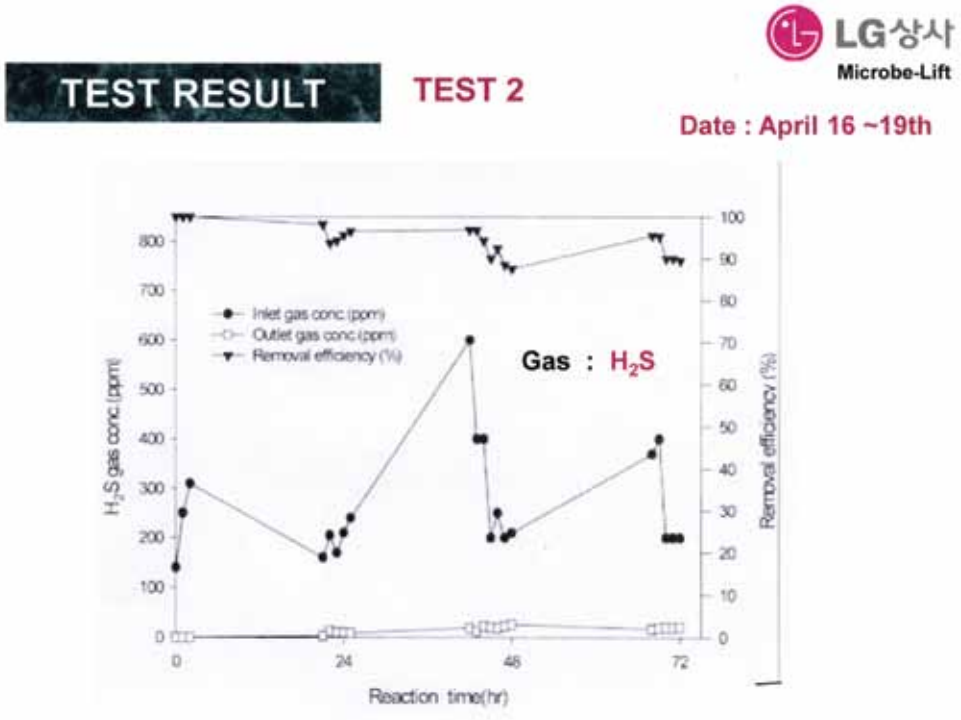
The use of MICROBE-LIFT technology in manure storage systems provides a natural, safe method to enrich manure values, improve barn and pit environments, as well as justify treatment costs through soil and crop benefits while reducing carbon loss and nutrient runoff through microbial attachment to soil particles after land application.

Additional Laboratory Data

LG Evaluation: MICROBE-LIFT Technology

In a separate and different laboratory evaluation conducted by LG of Korea, hydrogen sulfide reduction was verified.

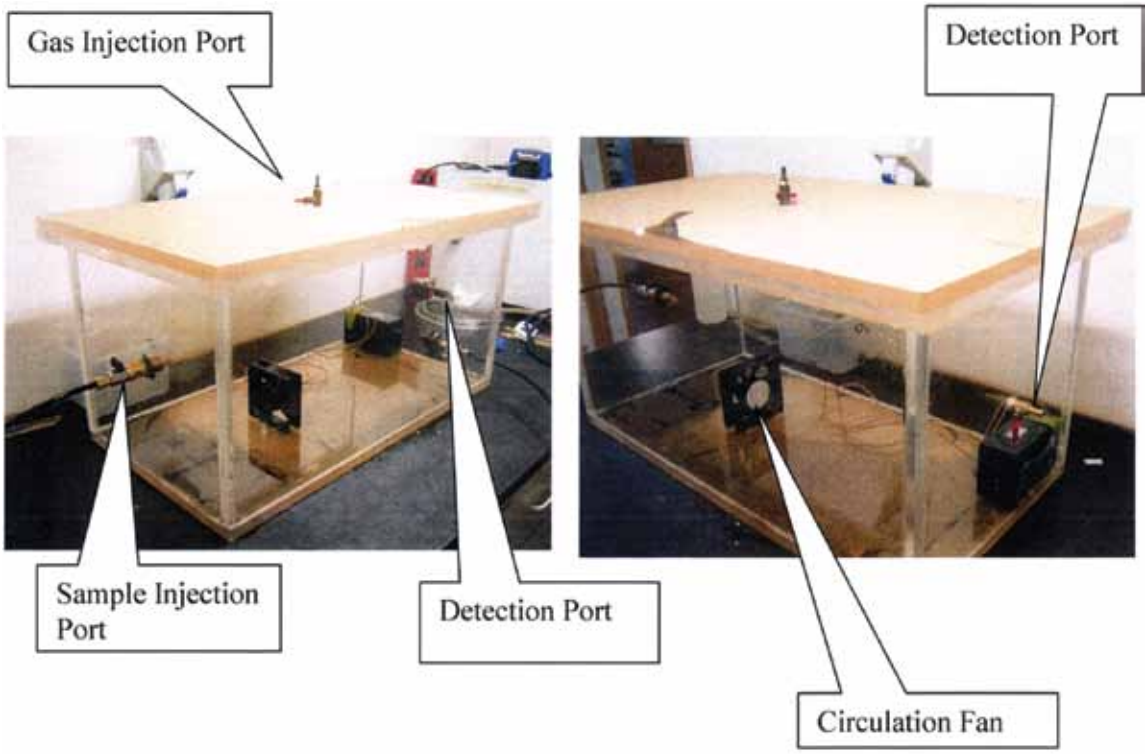




Testing Procedure and Results

In addition to hundreds of testimonials from satisfied farms using MICROBE-LIFT over the past 30 plus years, Ecological Laboratories' odor abatement technology is backed by independent studies verifying gaseous odor abatement specific to hydrogen sulfide, ammonia and other toxic gases.

The following photos show the setup of the reaction chamber:



Test Parameter	Initial Concentration	Concentration After	
		1 Hour	2 Hours
H_2S, mg/m3	28.48	11.08	2.80
Removal efficiency, %	N/A	61%	90%
Test Parameter	Initial concentration	Concentration after	
		1 hour	2 hours
NH_3, mg/m3	18.82	2.33	1.31
Removal efficiency, %	N/A	88%	93%

Conclusion

The forgoing independent laboratory data substantiates MICROBE-LIFT/HOG and MICROBE-LIFT/DFP's capability to reduce and control both hydrogen sulfide and ammonia gas effectively.

The test was performed by Wellab Limited on 8th January 2008. The objective of the test was to determine the removal efficiency of MICROBE-LIFT/HOG and or MICROBE-LIFT/DFP.

Evaluation Provided by Cinotech Solution Limited

Easy Barn Monitoring for Toxic Gases

BW Gas Alert Microclip Multi-Gas Detector

Ecological Laboratories, Inc. offers monitoring equipment for on-site odor abatement evaluations within the barn and in the pit.

Ecological Laboratories, Inc. incorporates barn and pit environmental condition determination for gaseous conditions using 10-day data collection with download functions.

LCD Continuous, alphanumeric gas readout and status display advises:

Gases monitored	H_2S, CO, O_2, combustibles (0-100% LEL or 0-5.0% methane), and ammonia
Gas concentration	Simultaneous and continuously displays gas concentration(s) present (in ppm, %LEL, or % v/v)
TWA ppm or %	Records STEL and TWA exposures and displays on demand
Peak ppm or %	Records and displays peak exposure to gas and displays on demand
Alarm set points	Displayed on activation

Gaseous Odor Control and Elimination

MICROBE-LIFT/HOG & DFP

Through independent laboratory evaluations, barn trials and in hundreds of manure containment systems MICROBE-LIFT/HOG & DFP have been shown to successfully reduce and control hydrogen sulfide and ammonia, reducing or eliminating potential health issues to humans, animals and surrounding environments, resulting in toxicity and corrosion control.

Within the manure pit manure undergoes anaerobic digestive fermentation to form fertilizer. The digestive process can generate various levels of four potentially dangerous gases:

- Methane
- Hydrogen sulfide
- Carbon dioxide
- Ammonia

The accumulation of these gases within the confined space of the manure pit and barn can produce an oxygen-deficient, toxic, and/or explosive environment.

Valuable MICROBE-LIFT Biological Functions

MICROBE-LIFT/HOG & DFP can biologically regulate and control the production of excessive methane, hydrogen sulfide, carbon dioxide and ammonia in manure storage containment systems. No other biological technology offers these multiple benefits for manure contained under anaerobic conditions.

Testimonials for Manure Enhancement

The following testimonials are just a few examples of the hundreds of letters we receive from farms using MICROBE-LIFT manure treatment products.

August 15, 2011- Swartz Family Farm

We farm 400 acres and for the past 12 years have been a contract finisher with Country View Family Farm operating a 2180/head finishing hog barn with a deep pit volume of 8,000,000 gallons. We have used Microbe-Lift Hog for approximately 9 - 10 years. We had surface crusting, which resulted in a fly problem and bottom solids. We have seen improvement in less crusting and lower fly population, which results in better herd health and lower mortality. Our service person has told us our barn has performed better than other similar barns. While a hog barn will always have odor, there is less odor in our barns and we really noticed less odor in the field application. The manure certainly is more consistent from the first load to the last load out. Unaware that we were using a product our manure hauler noticed the consistency immediately when we first started using the MICROBE-LIFT/Hog. While we have not done any trials we believe there is better nitrogen utilization by the crops. I believe MICROBE-LIFT is a good tool in the overall management of the barn. I recommend Microbe-Lift Hog.

Delbert Swartz, owner Swartz Family Farm

Matthew L. McClellan - McClellan Farms Inc.

For several years now I have used a combination of MICROBE-LIFT/Hog and Sludge Away products in my facilities that I own and operate with my family. McClellan Farms Inc. consists of 2 x 2,100 head finishing operations, and 1 x 8,800 nursery operation in Bradford County, Pennsylvania. The three buildings combined give us close to 2.5 million gallons of manure to manage each year. I started using MICROBE-LIFT to reduce odor from manure applied to the land and reduce gases being exhausted from ventilation fans. I wasn't sure what to expect from the product, especially because of the relatively lower cost compared to other products on the market claiming to do the same but costing much more money!

Not only have we noticed a major improvement in the odor reduction from the manure we land apply, the product has helped create an improved air quality environment inside the facility as well! I continue to have several neighbors ask us when we are going to spread manure, and it's always a pleasure to tell them we already have. As far as the odor reduction from within the facility, I have always been a firm believer that if the air quality is poor in a facility the pigs will be the first to tell you so through performance. After the pigs complain to you, the help will be the next to let you have it, because let's face it, if you don't provide a work environment tolerable for your help they will not be your help very long!

I am pleased to report reducing odor is only a small piece of the positive experiences we have had using the product. Results include consistent flow of manure from the first load to the last load hauled. Consistent flow is very important for several reasons. If your flow is consistent through the pump to the tank then your manure is liquefied. With improved liquefied manure your manure storage space is better utilized to full capacity. Achieving liquefied manure has translated into no nasty crust on the top of our manure, which is an open door for pests to run on and those horrible insects to nest and multiply!

The only drawback (really a positive) that I have seen since using the product and keeping the manure content so controlled is that sometimes it's hard to see where you've spread one load to the next because of the lighter color and better liquid consistency. However, a more consistent manure seems to be more effective in the crop production. We have been able to keep our total nitrogen, ammonium, organic, and total potash well within Pennsylvania requirements, and in turn manage the total phosphate levels at a very respectable amount.

I could go on about how pleased I am with your product, and how I truly believe that it has had a positive effect on the overall production of the pigs we are responsible for growing for CVFF.

The bottom line: MICROBE-LIFT has positively improved our manure management at our facility. But, like anything else, if we don't follow the program set up for our facility we would not get the results we have seen for our pigs, neighbors, and crops. I firmly believe that since I have started using MICROBE-LIFT it has allowed me to create a much more positive atmosphere within our facilities. I would be glad to recommend MICROBE-LIFT and share information with anyone regarding this product. Thanks for sharing your knowledge with me and getting me involved with your MICROBE-LIFT product!

Matthew L. McClellan, owner McClellan Farms Inc.

Testimonials for Manure Enhancement

Ben Hollingshead - Three Brothers Farms LLC

My name is Ben Hollingshead. I am a co-owner of Three Brothers Farms LLC. We operate a 4,800 head wean to finish hog barn for Cargill Pork in central Iowa. We started using MICROBE-LIFT/HOG and MICROBE-LIFT/SA (Sludge Away) products after we had experienced severe foaming problems in our pit, and a fire due to a result of the foaming. We had used another pit product before using Ecological Laboratories' MICROBE-LIFT products to try to take care of our pit problem. The difference with Ecological Labs' products is that they really look at the entire system and formulate products that do not just treat the bottom solids in our pit but also add in a consortium of aerobic and facultative bacteria that are critical for the health of the ENTIRE pit.

Within a few weeks of the first application we noticed a difference in the appearance and smell of our pits. However, the true dealmaker was when we pumped the pits in the spring after only two and a half months on the program. Our custom applicator was absolutely amazed at the way the manure pumped. The consistency, texture and smell of the manure completely sold us on the products.

Furthermore, as the growing season continued it was clear that the crops were more even from the application, there were no waves or streaks in the fields that we had seen before when we do our fly over aerial imagery. We are very anxious to harvest the corn from the field that we spread on because I really think we will see a yield increase simply from the better nutrient availability in the manure from using ecological labs pit products. If that is not enough proof that MICROBE-LIFT works. Our barn air quality has greatly improved and we went the ENTIRE summer with absolutely no flies. We are extremely satisfied with all the products and the service we receive and will continue to use the products.

Ben Hollingshead - co-owner Three Brothers Farms LLC

Case Studies

Dairy Waste

Mr. Wolfe - Wolfe Power Line Dairy, PA

Dairy containment 2 mg

Prior to MICROBE-LIFT/DFP's use the vessel had heavy surface and bottom solids. At draw down time no agitation was required, manure pumping only!

The use of MICROBE-LIFT/DFP at our farm eliminated blockages in the storage tank, eliminated bottom solids and surface crust, eliminated the requirement for costly tank mixing for several hours before manure removal, reduced barn and tank odor and odor on land applications which would attract flies and other pests.

In addition MICROBE-LIFT/DFP provided consistent manure from the top of the tanks (first pumping) to the bottom of the tank (last pumping).

Performance Counts! No aeration, no sludge boats, just superior biotechnology

Starting with a solid surface, two weeks after start of treatment. See bubble reactions indicating biological activity.

60 days after start of treatment, had heavy surface and bottom solids

120 days after treatment