Ecological Laboratories INC.

Solving Environmental Problems **Naturally** Since 1976

CASE STUDIES & TESTIMONIALS

"Ecological's groundbreaking biotechnology allows nature to do it's job... without the use of toxic chemicals"

Made in the USA

Ecological Laboratories INC.

*Solving Environmental Problems **Naturally** Since 1976*

Who we are....

Ecological Laboratories Inc. is a biotechnology company that develops and manufactures novel, proprietary, liquid microbial formulations that are capable of solving many of the most challenging environmental problems facing the world today. In a wide variety of environments spanning five continents, **Ecological's** technologies have a proven track record of optimizing natural environmental processes to restore water quality and promote beneficial plant processes. On its two-acre campus in Cape Coral, Florida, **Ecological's** state of the art research and manufacturing facility focuses its growing team of microbiologists and chemists on providing ever-advancing, cost-effective, sustainable solutions to the twin challenges posed by polluted water and the need to improve crop productivity. Based on wide-ranging metabolic pathways and processes including aerobic, facultative, anaerobic and anoxic capabilities, **Ecological** technologies are designed to respond to the unique requirements of the particular ecosystem being treated. Ecological technologies provide the biological tools needed to support environments at all stages of their processes, providing different types of support depending opon specific needs. No competitive technology can offer a comparable range of capabilities.

Our Commitment....

At **Ecological Laboratories**, we are strongly aware of our responsibility to environmental stewardship and sustainable development. By providing safe, natural products we allow our customers to also be good stewards of the environment so that it will be suitable for your children and grandchildren. Unlike many other marketers of bacterial products, we produce our own bacteria, so we can be assured that everything we put our name on is 100% safe and effective.

Our Products....

MICROBE-LIFT® Bio-Remediation products serve the Municipal, Industrial, Agricultural, Aquatic Environmental Restoration sectors to assist in augmenting and accelerating the digestion of organic pollutants by returning the basic building blocks of life back into the biosphere in order to sustain life. Bacteria are nature's recyclers and **Ecological Laboratories** produces MICROBE-LIFT®, one of the world's best bio-augmentation products that allow nature to keep up with new, manmade compounds and also concentrations of pollutants that are higher than what would normally occur in nature. This unique product is made up of a special formula of beneficial bacteria, which, when introduced to a polluted area, immediately begins to reproduce and to degrade the compounds in the water or soil that cause pollution and its resulting bad odors and damage to the environment. Because MICROBE-LIFT® products are also biodegradable and non-toxic, they are safe to use around humans, pets and wildlife. They are truly some of the most environmentally friendly products available.

Our products are 100% Natural!

Our Technology....

A breakthrough in modern microbiology once thought impossible to achieve, **Ecological** technologies differ from other biological products in concept, microbial composition and performance. Comprised of a wide consortium of vegetative microbes that include photosynthetic bacteria, heterotrophs, chemotrophs, autotrophs and archaea in a shelf-stable liquid formulation, **Ecological** technologies have consistently demonstrated the capability to restore environmental processes where competitive products have failed.

To Our Clients....

We value our relationship with our clients and environmental partners and consistently look for new ways to provide better support and value for those who rely on our products. We respect the knowledge and the expertise of the environmental professionals that commit themselves to optimizing the performance of all of **Ecological Laboratories** products while providing their services to the environmental sector.

"Ecological Laboratories uses a proprietary method of manufacturing that is unique and unmatched by our competitors. Competitive attempts have failed to duplicate our product. Often imitated, Ecological Laboratories still produces the market's best bio-remediation products available."

Michael Richter

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AGRICULTURE

Microbe-Lift® Technology Improves Farm Nutrient Management Processes...

Ecological Laboratories technology addresses the biological management of nutrients in agricultures processes from manure management as well as addressing the need to deal with nutrient management associated with today's chemical farming practices.

In all nations, agriculture including both crops and livestock is a major contributor to water pollution and municipal and industrial waste pollution increases rapidly as populations and industrialization expand. Synthetic chemicals are especially harmful as they are slow to degrade.

Ecological Laboratories Bioremediation Products Provide Solutions in Several Ways....

Reduces Use of Synthetic Fertilizers

Use of our agricultural technology products helps supply nitrogen from the air by microbial nitrogen fixation and the nitrification/denitrification cycle. This can reduce synthetic nitrogenous fertilizer application to turf, cropland, and gardens by 20-80%. This reduction in use of synthetic fertilizer greatly reduces if not totally eliminates the potential for nitrogen run-off entering waterways.

Helps Restore Water Body to Natural, Pristine State

Once ponds and lakes have developed algae blooms due to nutrient contamination, Ecological's MICROBE-LIFT formulations can eliminate excess nitrogen and excess organics that encourage algae growth and help restore the water body to its natural, pristine state. With a blend of anaerobic, aerobic, and photosynthetic strains, our technology can utilize the energy of the sun to rapidly consume organic pollutants.

Removes Odors

By oxidizing hydrogen sulfide to sulfate, by anoxygenic photosynthesis, MICROBE-LIFT® technology provides a terminal electron acceptor for facultative degradation and removes problematic odors.

Removes Sludge and Surface Contamination

Treatment of the water body with Microbe-Lift not only eliminates the surface contamination and cleans the water, it also helps eliminate bottom solids or "sludge" that contributes to gassing and further environmental damage and eventual eutrophication or conversion of the lake into a swamp sometimes referred to as the "death of a lake".

Capabilities of MICROBE-LIFT® Technology Unmatched

While there are other microbial products offered on the market, their capabilities are often limited to those exhibited by Bacillus strains. If vegetative heterotrophs are included, the product is generally a dry product that contains bran and limits application procedures. We know of no other product that contains all the capabilities of Ecological Laboratory's technology, particularly stable nitrification and strong denitrification capability, photosynthetic strains, and stable vegetative heterotrophs for rapid breakdown of natural and toxic organics.

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AGRICULTURE

CROP ENHANCEMENT

A Revolution in Growth and Yield Enhancement.

Quantum Growth™

The Quantum Growth® Series of products consist of different combinations of naturally occurring microorganisms that share key traits for plant enhancement. The organisms inhabit the root zone and vascular system of a plant, helping to breakdown, hold and transport nutrients and water. Photosynthetic strains in the products are capable of converting radiant energy, including the sun's, into energy for plant growth. Other organisms have the extraordinary ability to unlock chemical bonds, facilitating nutrient uptake that would not be available to the plant in the organism's absence.

The Quantum Growth® Series replaces the natural soil microorganisms that are depleted through fumigation, tilling, harvesting and/or overuse of chemical controls. It is the only biological product on the market that is shelf stable, contains photosynthetic and other vegetative cultures and does not use growth inhibitors. There is no other product available that meets these criteria.

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CS10000

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AGRICULTURE - CROP ENHANCEMENT

10100 CITRUS CROPS

10101	Reduced Greening, Increased Yield & Orange Tree Survival
10102	Quantum Growth® HSC Leads to Healthy, Disease- Resistant Organic Citrus Trees at McLeans' Orange Orchards

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Quantum Growth® Produces Healthier, More Disease Resistant Citrus Trees

Location: **McKenna Citrus Grove, Lake Wales, FL**

Background: An orange grove endures many assaults over the season including drought, freeze, and disease. At present in the US, grove managers are working hard to combat the effects of "greening", a disease caused by a bacterium designated Huanglongbing (HLB). Transmitted by insects (psyllids) this disease origin ated in Asia and is being transmitted to Latin America and now, the US. Trees may be infected two years before symptoms appear and the disease is generally fatal to the tree. One to three percent of orange trees are killed annually in the US due to this disease

Objective: Quantum Growth® products are known to enhance the growth rate and overall health of trees. Tests were run to determine if the health improvement could help the tree withstand infection by the bacterium responsible for "greening".

Quantum Growth® is a series of biological products marketed by Applied & Experimental Microbiology (AEM) of Jacksonville, FL. This biotechnology-based product line is the result of a long-term partnership between AEM and **Ecological Laboratories Inc (ELI)**, who developed and manufactures the technology.

AEM's technical representatives proposed a treatment protocol and assisted in initiating the treatment program. For this test, small trees were dug up and repotted. All trees received grower's practice culturing growth conditions while the treated trees also received Quantum Growth® technology.

The Experiment

Treated trees were first given one 36-ounce Quantum Growth® treatment on October 14th, 2008 while they were growing in the field. One week later they were dug up and potted.

Fig 1: *These pictures taken two weeks after treatment show the treated plant on the right has increased turgor, darker color, and less sun damage.*

Quantum Growth Produces Healthier, More Disease Resistant Citrus Trees

Fig. 2: *Additional pictures of control trees (left) versus* ***Quantum Growth®*** *treated trees (right). Note less growth and lighter color on the control as opposed to deeper color, increased turgor, and sheen full carriage of the treated trees.*

Fig. 3: *A closer view of the difference between treated plant leaves (left) and untreated control (right). Treated leaves show improved color, shape, and sheen.*

Fig. 4: *Note the heavy root growth shown in the treated Valencia liner on the left 6 weeks after treatment of 4 oz per week. The treated root ball is fuller and holds water, with moist roots holding soil together. The control root mass has retained less moisture with part of the soil base falling off, still holds the shape of the liner, and shows dry roots.*

Results Achieved:

Differences were noticeable just two weeks after treatment. The results of this test were so positive that the owners decided to treat a section of the field. Since 2008, more of the grove acreage has been converted to Quantum Growth® treatment each year.

The increased health of the treated trees not only provides greater resistance to disease but the trees are growing faster and have significantly increased yield.

Use of Quantum Growth® increases food and energy available to the trees, allowing them to increase root growth and fruit production. Treatment results in a healthier, hardier, more disease resistant tree with decreased dependency on supplemental irrigation, fertilizer, and pesticides.

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Quantum Growth® HSC Leads to Healthy, Disease- Resistant Organic Citrus Trees at McLeans' Orange Orchards

Quantum Growth

Location: **Uncle Matt's Fresh/McLean Ag Chem Inc., Clermont, Florida**

Background: Ben McLean and his father, owners of the oldest organic orange juice company in the US, had been using Quantum Growth® HSC to improve the health and production of their citrus grove. Fully committed to maintaining groves free from synthetic fertilizers, herbicides, and pesticides they constantly battle insect infestations.

Objective: Mites are one of the most economically important groups of citrus pests. The Texas spider mite is an important pest. It feeds on the leaf causing visible white stippling, mesophyll collapse, and leaf drop.

Heavy infestations in moisture-stressed groves can cause serious tree injury. Grove managers in affected areas monitor populations of these mites.

Results Achieved

By routinely used Quantum Growth® on their groves, the McLeans achieved improved crop health and yield. Quantum Growth® is a series of biological products marketed by Applied & Experimental Microbiology (AEM) of Jacksonville, FL. This biotechnology-based product line is the result of a long-term partnership between AEM and **Ecological Laboratories Inc (ELI)**, who developed and manufactures the technology.

During their use of Quantum Growth®, the McLean's noticed a secondary effect.

"Whenever we spray Quantum Growth® HSC at a dosage rate of one quart per acre, we observe greatly reduced populations of the Texas citrus mite, also known as the spider mite" states Ben.

According to Ben, "During the spray treatment in November and January in the past year, we sprayed into areas that had growing mite populations. In these treated areas, we observe that the eggs that are laid on the midrib of the leaf are not hatching and they become clear instead of their normal milky color. It appears that these clear eggs have never hatched. The population of mites in the treated areas is very low when compared to a nearby, untreated section that shows evidence of viable egg production. "

While Quantum Growth® HSC does not claim insecticidal activity, it is postulated that Quantum Growth® improves the health of the tree allowing it to resist damage from insect infestations more effectively.

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CS10102

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AGRICULTURE - CROP ENHANCEMENT

10200 PEANUTS

10201 **Quantum Growth®** Increases Yield by 45.5% and Profit by 39% per Acre of Peanuts

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Quantum Growth Increases Yield by 45.5% and Profit by 39% per Acre of Peanuts

Location: **Agriculture Extension Center, University of Georgia, Moultrie, GA**

Background: In the US, over 1.3 million acres grow peanuts. The network of University Extension Centers is constantly evaluating new technologies to improve farming practices.

Objective: Since Quantum Growth® products had worked so effectively on other crops, the Agricultural Extension wanted to run a trial with Quantum Growth® on peanuts. Quantum Growth® is a series of biological products marketed by Applied & Experimental Microbiology (AEM) of Jacksonville, FL. This biotechnology-based product line is the result of a long-term partnership between AEM and **Ecological Laboratories Inc (EL),** the company that developed and manufactures the technology.

AEM's technical representatives proposed a treatment plan and assisted in initiating the program. Treated and control sites were placed side by side.

Results Achieved

Interestingly, as the plants grew it appeared that the treated plants did not show improved plant growth. In fact, if there were a difference, the treated plants would appear to have not grown as fast as the control plants.

However, when the peanuts were harvested, the difference between control plot, which utilized best grower's practice, and the plot treated with Quantum Growth® (Quantum Light & Quantum VSC) and best grower's practice were dramatic. When all the data had been tabulated, the treated plot produced a 45.5% increase in yield compared to the control plot.

Samples from the plant leaf, root, and legume (peanut) were assayed in the laboratory to determine any change in bacterial population in the treated plants versus the control plants (lab report available). Unlike the control plants, samples from the treated plants showed colonization of the beneficial strains from Quantum Light in both the endophytic zone and leaf surface. The strains detected in both these zones that were not present in the control plants included Bacillus pumilus, Bacillus circulans, Rhodopseudomonas palustris, Rhodococcus erythropolis, and Nitrobacter winogradsky.

In addition, two potentially pathogenic strains present in the control plants were no longer present in the plants treated with Quantum. This assay demonstrated that application of Quantum Light did successfully colonize the plant structure with the beneficial bacteria in Quantum with the potential to replace other less beneficial, potentially pathogenic, bacteria.

Fig 1: *This picture shows the increased yield of peanuts using added* ***Quantum Growth®*** *(right) versus growers' best practice alone (on the left).*

Use of the specialized strains in **Quantum Growth®** increases food and energy available to the plants, allowing them to increase root growth and fruit production. This results in healthier, hardier plants with decreased dependency on supplemental irrigation, fertilizers, and pesticides. In this case, with a 45.5% increase in yield, when the cost of product was factored in, the grower achieved a net profit of 39% per acre. Additional benefit can be achieved as irrigation, fertilizer and pesticide usage is optimized.

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CS10201

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AGRICULTURE - CROP ENHANCEMENT

10300 VEGETABLES

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Quantum Growth® Provides Faster, Healthier Growth of Lettuce on Farm in Mexico

Quantum Growth

Location: **Lettuce Farm, Mexico**

Background: This farm outside of Monterey, Mexico was a contract supplier for Subway. Yield is extremely critical to profitability.

Objective: This farm implemented a Quantum Growth® trial in an effort to increase productivity. A 2% solution of equal parts Quantum-Light and Quantum-VSC was applied via backpack sprayer to this lettuce crop as a foliar spray immediately after planting.

Results Achieved

In a few weeks the difference between treated and non-treated controls was dramatic. Quantum Growth® had produced plants significantly increased in size and overall heath.

Fig 1: *In addition to watering from the drip line, the plants on the right received a spray of 2% **Quantum Growth®**, made up of equal parts of **QG Light** and **QG VSC**.*

This farm continues to utilize Quantum Growth®, which provides it a competitive advantage in the marketplace.

Use of Quantum Growth® increases food and energy available to the plant, allowing the plant to increase root growth and fruit production. This results in a healthier, hardier plant with decreased dependency on supplemental irrigation, fertilizer, and pesticides.

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CS10301

Experimental Program Validates Productivity Enhancement of Potatoes in Sao Paulo, Brazil

Location: Five Potato Growers, Sao Paulo, Brazil

Background: Quantum Growth® is a series of biological products marketed by Applied & Experimental Microbiology (AEM) of Jacksonville, FL. This biotechnology-based product line is the result of a long-term partnership between AEM and **Ecological Laboratories Inc (ELI),** who developed and manufactures the technology. This technology has been tested on numerous crops and demonstrated increased productivity, resistance to disease, and drought tolerance.

In 2010, four potato growers in the state of Sao Paulo, Brazil were involved in a study supervised by Professor André Palermo Tonietti from UNIPINHAL, University of Pinhal located in the city of Espirito Santo do Pinhal. Four students also participated on the development of this experiment as a part of training program from this University.
The experiment work was designed to test initially the productivity of the cultivars Monaliza and Agata, using the production systems upland and irrigated.

Objective:

The table below summarizes the farms' cultivar and production systems utilized in the experiments.

Farm	Name of the farmer	Production system	Cultivar
Rosario	Laercio Berbamasco	Irrigated	Monaliza
Momboca	Jair Varaldo	Upland	Monaliza
Casa Branca	Toninho Gomes	Irrigated	Agata
Casa Branca	Jose Pai do Paulinho	Irrigated	Monaliza

Fig. 1: *Lists the farms and farmers involved in the study and the production methods utilized.*

Each farm was visited five times during the experiment. Product was applied according to instructions from Applied & Experimental Microbiology (AEM). In the first visit to the farm AEM representatives explained the application protocol and benefits of Quantum Growth®. On the second visit, the potato seeding was performed with the addition of one gallon per hectare of Quantum VSC (root system) to the treated plots. Thirty days later Quantum VSC was applied again to the soil and after an additional 30 days

Quantum Light was sprayed on the leaves. Plants were harvested 30 days after the last application.

Results Achieved

During each visit students applied Quantum Growth® as prescribed and recorded descriptions of visible differences between the control and the treated potato plants.

Experimental Program Validates Productivity Enhancement of Potatoes in Sao Paulo, Brazil

The following tables summarize the effect of Quantum Growth technology on productivity and economics of potato production.

Farm	Name of the farmer	Production system	Cultivar	Potato Bags Control	Potato Bags Quantum Growth	Productivity Increase Bags per hectare
Rosario	Laercio Berbamasco	Irrigated	Monaliza	600	914	314
Momboca	Jair Varaldo	Upland	Monaliza	327.29	594.34	267.05
Casa Branca	Toninho Gomes	Irrigated	Agata	873	951	78
Casa Branca	Jose Pai do Paulinho	Irrigated	Monaliza	721	848	127
				2.521.29	3.307.34	786.05

Fig.2: *Treatment increases productivity as measured by bags per hectare.*

The table above shows that Quantum Growth® technology improved overall productivity by 786 bags. This result is consistent with a paper by Thomas A. Selvig C.A. (2009) reporting that photosynthetic purple bacteria, as present in Quantum Growth® technology, produce sugar in the root rhizosphere which results in an increase in crop production mathematically commensurate with the quantity of sugar produced.

The table below confirms the economic advantage of utilizing Quantum Growth® technology:

Farm Location	Name of the farmer	Production system	Productivity Bags/hectare	Bag Value*	Return on Investment
Rosario	Laercio Berbamasco	Irrigated	314	R$ 26,70	R$ 8,383.80
Momboca	Jair Varaldo	Upland	267.05	R$ 26,70	R$ 7,130.24
Casa Branca	Toninho Gomes	Irrigated	78	R$ 35,00	R$ 2,730.00
Casa Branca	Jose Pai do Paulinho	Irrigated	127	R$ 30,00	R$ 3,810.00
Mean Values			196.5	R$ 29,60	R$ 5,513.51
				• mean values on harvest day	R$ 22,054.04 USD 12,972.9

Fig. 3: *Treatment with Quantum Growth® provided an additional R$ 5,513.51 per hectare increased productivity.*

The economic evaluation demonstrates significant economic benefit in utilizing Quantum Growth® technology based on increased productivity.

The University concluded that based on the results of the experiment, Quantum Growth® Technology successfully demonstrated its potential as a productivity enhancer and results indicate that it can be used on the Brazilian Potato Production System with success. This study was directed by Andre Palermo Tonietti, Ms and Expedito Tadeu Facco Silveira, PhD

REFERENCE

Selvig, T.A. (2009). **QUANTUM GRO, The Science of "Sudden and Significant"** Energy Growth.

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CS10302

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Quantum Growth® Helps Plants Recover from Late Blight Disease Progression in Connecticut

Location: **Organic Grower, Connecticut**

Background: Late blight (P. infestans) of tomato crops hit the Northeastern United States particularly hard in 2009. Estimates are that 25-50% of the total tomato crop in Connecticut was lost this year; with similar numbers across the Northeastern US. Organic farmers were almost completely wiped out as there are few effective controls approved for organic farmers. While copper treatment is approved, growers are generally reluctant to use this because of the potential off-target heavy metal effects. Approved biological controls (such as Serenade and Sonata) which each utilize single strains of Bacillus are preferred by organic growers but they do not exist for this application.

Quantum Growth® is a series of biological products marketed by Applied & Experimental Microbiology (AEM) of Jacksonville, FL.. This biotechnology-based product line is the result of a long-term partnership between AEM and **Ecological Laboratories Inc (ELI),** who developed and manufactures the technology. The technology has been tested on numerous crops with success for increased productivity, resistance to disease, and drought tolerance.

Quantum Growth® contains a consortium of strains including four strains of Bacillus. It is also the only growth enhancement product on the market based on actively growing (vegetative) bacteria. The vegetative state plus the full complement of Bacillus, photosynthetic strains, pseudomonads, plus other strains may provide increased plant health and associated natural resistance to disease.

Objective:

In an effort to determine if disease resistance could be effective even after infection had been well established, a pilot test was developed. A mixture of one gallon Quantum Growth® Revive, 2 drops olive oil, 1 drop liquid hand soap, 1 oz of Quantum Growth® Revive was mixed by hand and sprayed liberally on tomato plants through a backpack sprayer on tomato plants in various stages of P. infestans infection (most had approximately 25% of fruit and leaves affected; some had more advanced disease). Effort was made to spray the underside of leaves, all fruit, and surrounding soil. This treatment was repeated four days later with the mixture diluted with four parts of water. Treatments were continued weekly for 3 weeks using the 1:4 mixture.

Results Achieved

Plants with >50% initial disease tended to be dead or dying by the end of the first week after treatment began and were removed and discarded. Plants with <50% initial disease tended to have stabilized or dramatically improved after one week. Leaves and fruit that were diseased prior to treatment did not recover and were removed. In some plants, new growth appeared on the treated plants, including new fruit development. Control plants continued to deteriorate (figure 1). The organic farmer was able to save and harvest some of her tomatoes.

Quantum Growth® Helps Plants Recover from Late Blight Disease Progression in Connecticut

Fig.1: *Image of tomato plants taken from the garden of an organic grower in Connecticut eight days after treatment began. The plant on the left was treated with* ***Quantum Growth®****: the plant on the right was left untreated. The untreated plant had more diseased fruit, more infected leaves, and did not appear as healthy. Unlike the control, the treated plant had much greener leaves and actually had new growth.*

Even though the tomato plants were already infected with the late blight P. infestans, treatment with Quantum Growth® along with pruning of the dead tissue was effective in stabilizing disease progression, even to the point of recovery, where some plants had new growth after one week. New fruits were also seen to begin developing on some plants. While some products utilize Bacillus strains to control this disease, Quantum Growth® has not been validated or registered as a biopesticide and cannot claim pesticidal activity.

We believe the benefit seen above comes from the full consortium of strains in Quantum Growth® that contribute to improve health and associated disease resistance of the plants. Larger field studies need to be conducted to validate this effect, but we have seen such resistance to disease throughout a wide variety of plants against numerous diseases based on the use of Quantum Growth®.

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CS10303

Quantum Growth® on Cucumber Seedlings Reduces Fertilizer Requirement in Half in the Netherlands

Location: **Commercial Greenhouse, Netherlands**

Background: This greenhouse grows seedlings in rock wool growing medium for transplant to garden soil. They wanted to determine if microbial growth stimulants could help speed growth, produce heal their plants, and reduce the need for fertilizer. Quantum Growth® was the product of choice as it has shown these effects in many situations.

Quantum Growth® is a series of biological products marketed by Applied & Experimental Microbiology (AEM) of Jacksonville, FL. This biotechnology-based product line is the result of a long-term partnership between AEM and Ecological Laboratories Inc (ELI), who developed and manufactures the technology.

This trial was conducted for a five-week period in early 2011. The greenhouse developed its own protocol using a combination of Quantum Growth® Light (QL) and Quantum Growth® VSC (QVSC).

Objective:

The trial objectives were as follows:

- To evaluate the effect of growth stimulants QL and QVSC in enhancing plant growth after sowing based on addition of product to the rock wool growth medium.
- To evaluate whether the concentration of nutrients in the liquid fertilizer solution affects performance of the growth stimulants.
- To assess if any phytotoxicity symptoms or growth distortions would be caused by the application of an 8% concentration of QL+QVSC compared to reference concentrations.

Experimental Setup:

This trial was performed in a 250-m2 greenhouse equipped with mobile tables specifically designed for the cultivation of potted plants. The cucumber seeds, Cucumis sativus 'Proloog' were planted in a Grodan Delta rockwool cube (10 x 10 x 6.5 cm) with pre-drilled hole. Irrigation was ebb-flood with two concentrations of standard nutrient solution for cucumber: full strength and half strength. Climate set points were 20.0°C by day and 19.0°C at night. Supplemental lighting (3500 Lux) was applied by SON-T lamps for 14 hours/day.

Treatments:

The trial consisted of 8 different combinations of the QL+QVSC growth stimulants and nutrient solution concentration as shown below in Table 1. On 19 January 40 rockwool blocks per treatment were placed for 15 minutes in 20 L of solution, with the concentrations of growth stimulants and nutrient solution indicated in Table 1, prior to sowing.

Table 1:

Treatment Combinations of Quantum Growth® stimulates and nutrient solutions. Equal amounts of QL and QVSC were used to reach the final concentration. Treatments were carried out at moment of sowing and subsequently at weekly intervals from January 25 to February 23.

Nr	Name	QL+QVSC (%)	Fertilizer	Nplants
1	Untreated control	0	Full Strength	4 x 10
2	Quarter Dose	0.5	Full Strength	4 x 10
3	Half dose	1.0	Full Strength	4 x 10
4	Standard Dose	2.0	Full Strength	4 x 10
5	Phytotoxicity test	8.0	Full Strength	4 x 10
6	Quarter Dose	0.5	Half Strength	4 x 10
7	Half dose	1.0	Half Strength	4 x 10
8	Standard Dose	2.0	Half Strength	4 x 10

After 15 minutes the blocks were placed on inverted aluminum plates to drain off excess liquid. In each block one cucumber seed was placed in the hole, which was subsequently filled with vermiculite. Each table was covered with transparent plastic foil to ensure high humidity. Germination took place under plastic in the greenhouse at 20°C. After three days, the plastic foil was removed and plants were further grown under the conditions described above.

Each treatment consisted of four replicates making a total of 32 plots. All plots comprised 10 test plants; the final plot surface was approximately 1 m2 giving a plant density of 10 plants per m2. Plant blocks were placed in a randomly designed block design divided over two mobile tables as shown in Figures 1 and 2.

***Fig 1**: Positioning of treatments on table, 16 DAS*

***Fig 2:** Positioning of individual plants in plot, 16*

Per treatment 50 ml of the appropriate Quantum Growth® solution was added to each block (replaced by water for the untreated control). This was repeated on 3 February, 9 February, 16 February and 23 February. Plants were irrigated with the appropriate nutrient solutions on 28 January, and 7, 14, 21, and 25 February.

Assessments:

The following parameters were documented during the trial period:

- At 16 days, cotyledons completely unfolded, first leaf partly unfolded, and plant height was measured
- At 38 days, plant height, leaf number and total plant fresh weight was measured and root quality visually assessed
- For nutrient measurements, 2 blocks per replicate treatment were squeezed out and a sample was taken from the combined drains for measurement of free nutrients.

Results Achieved

Graphs below show data generated at the end of the 5-week trial:

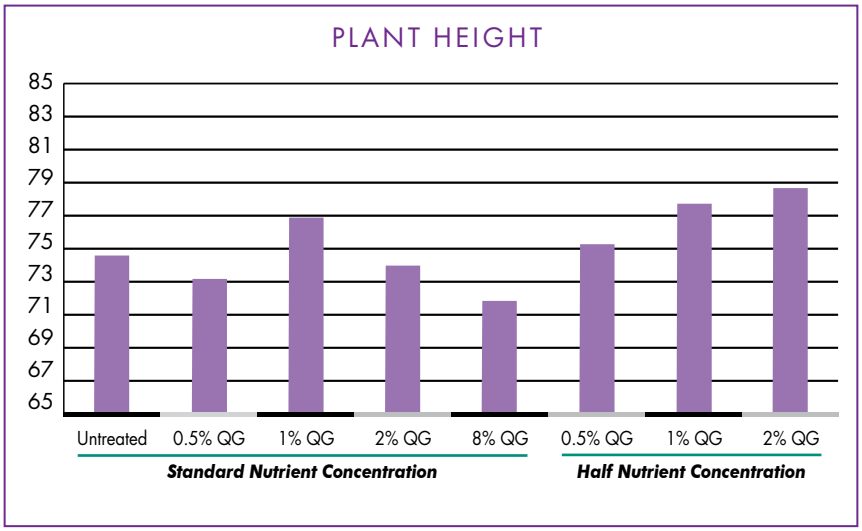

Fig. 4: *Shows slight increase in plant height for those plants with half the level of nutrient and at least 1% doses of CG.*

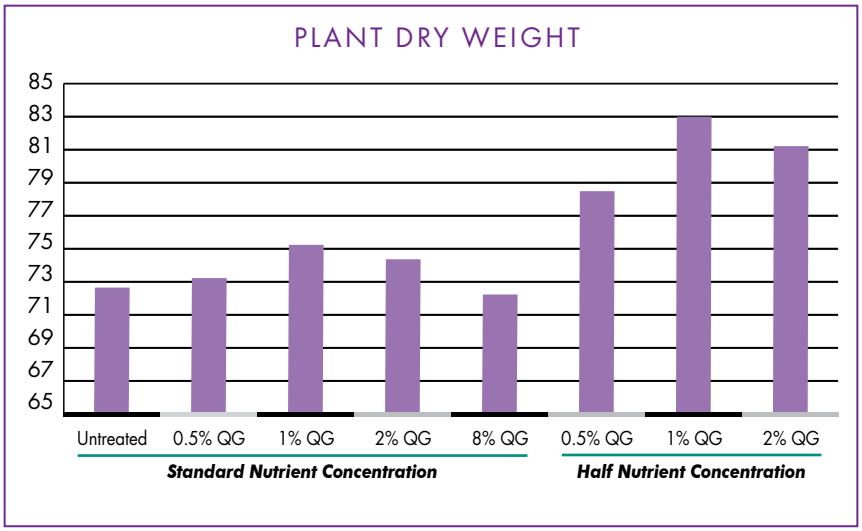

Fig. 5: *Larger increases are seen in plant dry weight with half nutrient level and at least 1% doses of CG.*

Quantum Growth® on Cucumber Seedlings Reduces Fertilizer Requirement in Half in the Netherlands

Treated plants with reduced fertilizer show the greatest increase in dry plant weight and slight increase in plant height. The general recommended dosage rate for Quantum Growth® is between 1% and 2%. These results are particularly of interest since they were developed in an optimal growth situation where nutrients and conditions have been optimized for cucumber growth with tailored nutrients and growth conditions. When plants are transplanted to field conditions, Quantum Growth® benefits are more dramatic as they compensate for less than ideal growth conditions.

Use of Quantum Growth® is well known for improving survival when these seedlings are planted on soil. It increases food and energy availability to the plant, allowing plants to increase root growth and fruit production. This results in a healthier, hardier plants with decreased dependency on supplemental irrigation, fertilizer, and pesticides.

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CS10304

Made in the USA

University Study Shows MICROBE-LIFT® Technology Increases Yield of Green Peppers >23% In Spite of Significant Reduction of Fertilizer

Quantum Growth

Location: **New Jersey Agricultural Experiment Station, Rutgers University, Camden, NJ**

Background: AEM, Applied Experimental Microbiology, is Ecological Laboratories Inc.'s exclusive marketing partner for field of commercial agriculture. Using the private label brand Quantum Growth® for formulations based on MICROBE-LIFT® core technology, AEM has developed numerous successful trials in all types of vegetable farming. One of AEM's key distributors was challenged to provide university data on the benefits of Quantum Growth® technology on the growth of green peppers.

Objective:

A test program was developed with Rutgers University, a university well recognized as a leader in agricultural studies. In 2012, the test was set up at Rutgers New Jersey Agricultural Station. This was a well-controlled study whereby acres dosed with Quantum at a rate of one gallon per acre were compared to an equivalent control plot.

Results Achieved:

The following data from this experiment shows that treatment with Quantum Growth® increased the yield of green peppers by 23.5% versus the control in spite of a 23% reduction in fertilizer used.

DATA – YIELD PER ACRE	KILOGRAMS	CARTONS	DOLLAR VALUE
Control Yield per Acre	6,349	500	$5,015
Test Yield per Acre	7,844	618	$6,196
Pounds per Unit	2.21	28	
Average price per unit	$0.79	$10.03*	
Microbial Product	Quantum	None	
Application Rate (gal/acre)	1.00	0	
Fertilizer Expense per Acre	$180.95	$235 (standard)	
Percent Reduction in Fertilization Program	23%	0	

Note: *Each carton contains 1 1/9 bushels each weighing 28 lbs.*

** Price of $10.03 per carton is the average price for all sizes of green peppers in the month of October 2012 at the Philadelphia shipping terminal.*

The following financial analysis defines the return on investment of using **Quantum Growth®** in this growth cycle based on these benefits:

- A crop worth $6,196.00 was harvested in the treated plot versus a harvest worth $5015.00 without treatment, a $1,495 increase revenue per acre.
- In addition, this increase was achieved using 23% less fertilizer for a savings of $54.05 per acre.

RETURN ON INVESTMENT CALCULATION	
Yield increase per acre	$ 1,180.99
Microbial Expense per acre	40.00
Microbial Expense per acre	$ <54.05>
Net change in Fertilization Expense per acre	$ <14.05>
Net Gain (Loss) per acre	$ 1,195.04
ROI Multiplier for Microbial Expense	$ 29.88

This ROI analysis shows that this growth cycle achieved $29.88 additional revenue for every dollar spent on **Quantum Growth®**.

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CS10305

Made in the USA

Squash Harvest in Georgia Increased by 30% with Quantum Growth®

Location: **H&R Farms, Glenville, GA**

Background: In such a competitive market farmers are always looking for means of assuring and improving their harvest. Squash is produced on over 46,000 acres in the US producing crops worth almost $250 million (2010).

Objective:

H&R Farms heard of the benefits claimed by users of Quantum Growth® products and decided to run a trial on their farm. Quantum Growth® is a series of biological products marketed by Applied & Experimental Microbiology (AEM) of Jacksonville, FL. This biotechnology-based product line is the result of a long-term partnership between AEM and **Ecological Laboratories Inc (ELI),** who developed and manufactures the technology.

Results Achieved

The technologists at EAM developed a protocol for inoculating a trial section of the farm with Quantum Growth®. The evidence of faster, healthier growth was evident just 16 days after planting.

Fig. 1: *Early growth shows obvious benefit of inoculation with Quantum Growth®.*

Squash Harvest in Georgia Increased by 30% with Quantum Growth®

Fig. 2: *The increased plant growth results from increased root mass in plants treated with* ***Quantum Growth®*** *. This picture shows the difference between treated and control plants just 16 days after planting.*

At harvest, the treated crops showed a 30% increase in yield versus control, from 8,800 to 11,424 average pounds per acre. The treated plants appeared significantly healthier throughout the trial.

The microorganisms in Quantum Growth® work naturally to provide food and energy for plants allowing them to focus on root growth and fruit production. This results in a healthier, hardier plant with increased yields and decreased dependency on supplemental irrigation, fertilizer, and pesticides.

For more information on MICROBE-LIFT® Technology contact

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CS10306

Made in the USA

Pennsylvania Farm Increases Tomato Yield by 39% with Quantum Growth®

Quantum Growth

Location: **Nolt Farm, Pennsylvania**

Background: The Nolt Farm had experienced excellent results from utilization of Quantum Light and VSC on a number of crops. They decided to extend the use of Quantum Growth® to their tomatoes.

Objective: Using a dosage rate of a total of 64 ounces (1/2 gallon) per acre at planting, the farm recorded results with the following photographs.

Results Achieved

The pictures below shows a comparison of root mass in young treated versus untreated tomato plants.

Fig 1 & 2: *The pictures above shows control root mass (left) is much smaller than the root mass of the plant treated with* ***Quantum Growth®****. The picture at the right again shows much larger root mass (left) in the* ***Quantum Growth®*** *treated plant versus the control plant.*

Fig. 3 & 4: *Treated plants (on right) showed 39% increased yields of tomatoes and provided an earlier harvest.*

For more information on MICROBE-LIFT® Technology contact

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CS10307

Renowned Agronomist Validates Increased Iowa Corn Yield with Quantum Growth®

Quantum Growth

Location: **Corn Crop, Algona, Iowa**

Background: **Dr. Michael McNeil** is an agronomist well known for his studies on modern practices of agriculture. His results have led to his activism against the use of GMO crops and glyphosate as he leads efforts to reduce the detrimental effects of these practices. Active as a crop advisor through his company, Ag Advisory Ltd., he is also a practicing farmer growing corn and soybeans in Iowa. He is highly sought after speaker addressing the falling yields in GMO and glyphosate-treated crops.
Based on data characterizing the detrimental effect of glyphosate on crops,

Objective:

Dr. McNeil claims the mineral-binding deficiencies responsible for killing weeds also contributes to decreased crop yields. As the levels of glyphosate in soils increase due to slow degradation and increased usage, soil biology and resulting crop yields suffer. Dr. McNeil understands the value of beneficial soil biology to maximize crop quality and yield.

In 2012, Dr. McNeil decided to test the use of Quantum Growth® as a means of increasing corn yields. A "strip trial" was developed where by a field was divided into four strips each containing 12 rows. The two outside strips were check or control strips. The inside two strips were treated with Quantum Growth® with low analysis starter fertilizer as opposed to normal fertilizer used in the control strips. The center 6 rows of each strip were harvested separately and assayed for yield and grain moisture.

Results Achieved

The data from this experiment shows that treatment with Quantum Growth® with reduced fertilizer increased the yield of corn by 8.7% in spite of 7% reduction in corn moisture.

Treatment	Corn yield (bushels per acre)	Grain Moisture (Percent)
Check 1	139.7	16.1%
Quantum 1	154.2	14.7%
Quantum	151.8	15.5%
Check 2	141.8	16.4%

Note: *Average yield of treated strips was 153.0 bushels versus the average control strip yield of 140.75 bushels.*

This increase in yield and resistance to stress was accomplished in spite of reduced fertilizer usage. It was also noted that where corn was planted on an end row that was severely compacted from hauling liquid hog manure to the field, rows treated with Quantum Growth® were normal in appearance while the untreated rows were severely stunted.

For more information on MICROBE-LIFT® Technology contact

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CS10308

Made in the USA

Quantum Growth® Increases Cabbage Outplanting Survival from 70% to 90% in Hastings , FL

Quantum Growth

Location: Cabbage Farm, University of Florida, IFAS Center, Hastings, FL

Background: To speed the growing season, cabbage plants are often nursery grown and transplanted to the field. This process generates a re-planting to replace plants that did not survive.

Objective: Replanting is a labor-intensive process adding significantly to the cost of the crop. In this farm's experience, approximately 30% of the plants required re-planting. They wanted to utilize natural technology to reduce this cost.

Results Achieved

When researching natural technologies, Quantum Growth® products stood out. Quantum Growth® is a series of biological products marketed by Applied & Experimental Microbiology (AEM) of Jacksonville, FL. This biotechnology-based product line is the result of a long-term partnership between AEM and **Ecological Laboratories Inc (ELI),** who developed and manufactures the technology.

AEM agreed to design a protocol utilizing Quantum Growth® to improve transplant viability. The test was conducted in conjunction with Dr. Amanda J. Givens of U. of Florida, department of IFAS Plant Pathology.

Fig 1: *The rows on the right were treated while the rows on the left, were grown by standard practices normally used by the farm. There is a clear delineation showing the beneficial effects of Quantum Growth®.*

In the words of Dr. Givens, "Initial observation of the treated areas indicated a reduction in the need for re-setting cabbage transplants. Approximately 30% of untreated field area required re-planting while less than 10% of the Quantum Growth® treated field area required re-planting."

In addition to this labor and cost advantage, the picture below shows increased growth of treated plants, a factor which should result in earlier harvest providing a significant marketing advantage.

Use of Quantum Growth® increases food and energy available to plants, allowing them to increase root growth and fruit production. This results in a healthier, hardier plant with decreased dependency on supplemental irrigation, fertilizer, and pesticides.

For more information on MICROBE-LIFT® Technology contact

Ecological Laboratories Inc.

www.EcologicalLabs.com

CS10309

Quantum Growth® Dramatically Increases Size of Corn Plants in Elysburg, PA, While Reducing Nutrient Requirement

Quantum Growth

Location: **Knoebel Farm, Elysburg, PA**

Background: Mr. Knoebel farms 1500 acres in Pennsylvania and manages large swine facilities where he uses MICROBE-LIFT®/HOG to assist in manure management and to provide a high value fertilizer for his fields. Corn is an important feed supply and, as most farmers, he continually looks for means to achieve yield improvements.

Objective: For years, Mr. Knoebel has utilized 5000 gallons of treated manure per acre to fertilize his fields and increase yields. This manure is tilled into the soil well in advance of planting.

Recently, he conducted a study to determine if the application of Quantum Growth® could further enhance his corn yields by increasing water retention and nutrient availability, fixing nitrogen, and replenishing soil biology.

Treatment:

A treatment program was initiated according to the following dosage schedule:

Treatment	Corn yield (bushels per acre)	Grain Moisture (Percent)
Check 1	139.7	16.1%
Quantum 1	154.2	14.7%
Quantum	151.8	15.5%
Check 2	141.8	16.4%

Results Achieved

Compared to his original fertilization program, the additional treatment with Quantum Light and VSC produced dramatic results.

Plants grown in section 2 showed a larger root mass within three days and grew to twice the size of control plants within 16 days. Plants in Section 3 showed 10 to 20 times the root mass when compared to the control and produced a 15 to 20 times larger plant.

Fig 1: *From the control on the left (section 1) to the 1 gallon per acre treated (section 2) in the middle and the 2 gallon per acre treated plant on the right, dramatic differences in root mass and plant size are seen.*

With similar results, the Wen-Crest Farms in Lebanon, Pennsylvania treated their corn crop with a total of 1 gallon per acre. The results are evident in the picture below with treated corn stalks 40-50% larger than untreated stalks.

Fig. 2: *Wen-Crest farm treated at 1 gal/acre. Note the taller treated stalks on the left compared to the control stalks on the right.*

The combination of Quantum Light and Quantum VSC dosed at one to two gallons per acre consistently produces faster growing corn, and higher yields.

Use of Quantum Growth® increases food and energy available to the plant, allowing them to increase root growth and yield. This results on a healthier, hardier plant with decreased dependency on supplemental irrigation, fertilizer, and pesticides.

For more information on MICROBE-LIFT® Technology contact

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CS10310

AGRICULTURE - CROP ENHANCEMENT

10400 FRUIT

For more information on MICROBE-LIFT® Technology contact

Ecological Laboratories Inc.

www.EcologicalLabs.com

CS10400

Made in the USA

Quantum Growth® Produces Record Fast Growth for Omena Organics' New Cherry Orchard in Arizona

Location: **Omena Organics Farm, Sulfur Springs Valley, Arizona**

Background: Bob Weaver grows cherries in Leelanau County, Michigan. His orchard includes several hundred acres of conventional and organic--grown red tart (sour) and sweet cherry trees. Michigan is the cherry capital of the world but Weaver's passion for cherry production led him to consider expansion to other states. Topping his list of options were Washington and Arizona. Weaver purchased 40 acres in Sulphur Springs Valley in southeastern Arizona and planted 141 trees per acre in 2009.

Objective: This was the first commercial red tart cherry farm in Arizona, a true adventure for Bob. His growing techniques had to be revised for a different climate. At 5000 feet above sea level, warm, arid conditions during the day were mixed with cold evenings providing the chill required to promote proper fruit set. Bob wanted to maintain natural conditions as much as possible.
When researching natural technologies, Quantum Growth® products stood out. Quantum Growth® is a series of biological products marketed by Applied & Experimental Microbiology (AEM) of Jacksonville, FL. This biotechnology-based product line is the result of a long-term partnership between AEM and **Ecological Laboratories Inc (ELI)**, who developed and manufactures the technology.

Results Achieved

When contacted, AEM's technical representatives proposed a treatment plan for Omena Organics' Arizona orchard. Bob decided to nurture his transplanted trees with the sole use of Quantum Growth® and water, excluding the use of other fertilizers. The following pictures show the results:

In the first seven weeks after planting, the trees had received a total of five quarts per acre Quantum Growth® and approximately three gallons of water per tree daily.

Fig 1: *Twig tree shows a bud within a week of planting.*

Fig 2: *shows a pen along side a branch of almost the same size, and a substantial leaf several weeks later.*

Fig 3: *Tape measures 18' new growth at seven weeks.*

Fig 4: *Down the row shot at seven weeks.*

Use of Quantum Growth® allowed the plants to pull nitrogen from the atmosphere eliminating the need for, and potential damage from, fertilizer. It also stimulated rapid growth, and improved soil water retention.

These trees showed 18" of new growth. Bob Weaver declared,

> *"In Northern Michigan I would only hope for 18" of growth over a season, not just in seven short weeks. In my wildest dreams I would not have expected this aggressive tree growth".*

For more information on MICROBE-LIFT® Technology contact

Ecological Laboratories Inc.

www.EcologicalLabs.com

CS10401

Produce Healthier, Beautiful Strawberries at Lower Cost with Quantum Growth®

Quantum Growth

Location: Stoney Meadows Farm, Dracut, Massachusetts

Background: Stoney Meadows Farm was founded as an apple orchard in 1820. Today they grow herbs, fruit, and flowers for use in manufacturing soaps, oils, and gifts. They have developed a substantial hydroponics system for growing strawberries.

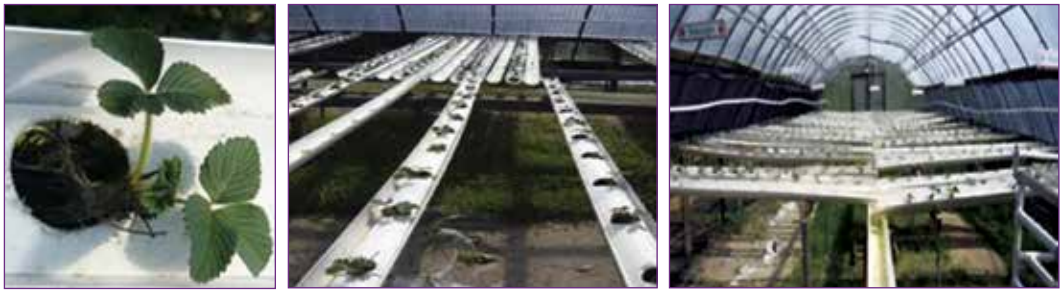

Fig.1: *This picture shows the operational strawberry growth facility.*

Objective:

The market for strawberries is highly competitive with demand for tasty, beautiful fruit at a competitive price.

Results Achieved

Based on the goal of producing better fruit at the same or lower cost, owner Jim Munger researched Quantum Growth® technology.

Quantum Growth® is a series of biological products marketed by Applied & Experimental Microbiology (AEM) of Jacksonville, FL. This biotechnology-based product line is the result of a long-term partnership between AEM and **Ecological Laboratories Inc (ELI),** the company that developed and manufactures the technology. Green Earth Agriculture is a key distributor for AEM.

After applying Quantum Growth® as recommended by the Green Earth technical representative, Jim was pleased to discover that he could reduce his fertilizer by 50% and completely eliminate the use of pesticides. Quantum Growth® helped stabilize the water pH as well.

Not only was his fruit ready for market two weeks earlier than expected giving him a significant market advantage, but the markets bought up all of his strawberries which were more symmetrical than the fruit that other farms were producing.

For more information on Quantum Growth® Products call Green Earth Agriculture 866-374-5101 www.greenearthagcom

For more information on MICROBE-LIFT® Technology contact

Ecological Laboratories Inc.

www.EcologicalLabs.com

CS10402

Strawberries in Israeli Greenhouse Regained Healthy Growth When Treated with MICROBE-LIFT® Technology

Quantum Growth

Location: **Israel**

Background: In 2012, an established greenhouse in Israel was experiencing a severe disease problem on their strawberry crop. The leaves were turning yellow which advanced to brown eventually drying the leaf. On close examination, it was apparent that disease was spreading from the base of the plants. This growth was identified as sclerotinia, the most nonspecific, omnivorous, and successful of fungal plant pathogens. Plants susceptible to this pathogen include over 361 species in 64 different plant families (Purdy, 1979) These plants demonstrated the typical dry lesions on stalks, stems, and branches. In this disease fungi attack the root and stem at the soil line. Typically lesions interfere with vascular flow causing silting and eventual death. Often a white mycelial mat appears that may eventually turn black in color.

Objective:

The greenhouse manager wanted to interrupt the disease progression in hopes of saving some marketable fruit from the crop. A program based on Ecological Laboratories core technology, sold under the Quantum Growth® brand, was recommended to promote the plants natural disease resistance and restore the health of the plants. A heavy dose including four ounces each of Quantum Light, Revive, and VSC were applied twice a week with irrigations and 2 ounces each of Quantum Light and Revive were diluted and used as a foliar spray daily.

Results Achieved

Plants began to respond after the first week of treatment. After two weeks of treatment the grower observed new broad, green foliage supplanting the old dead foliage, evidence of improved functioning of the vascular system. The disease and dramatic restoration of healthy plants is best shown by pictures.

Fig. 1: *Leaves show symptomatic yellowing followed by brown color and eventually death as seen in picture on the left.*

Fig. 2: *Plants show evidence of disease as lesions form at the base of most plants.*

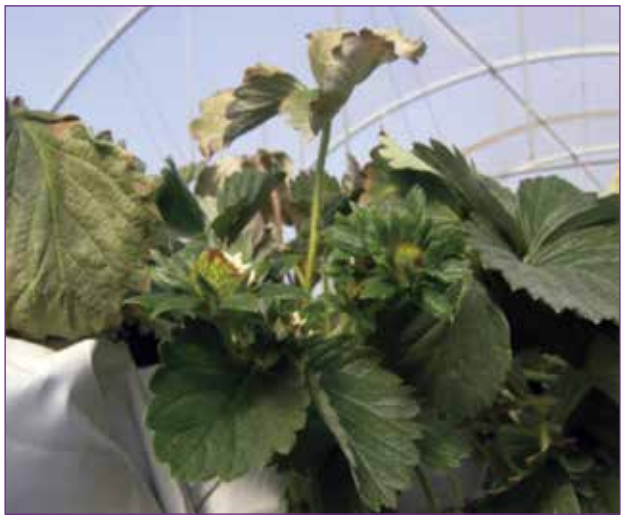

Fig. 3 & 4: *After the first week of treatment some new green growth is evident sprouting among the brown leaves.*

The plants continue to recover with healthy growth as seen in the following pictures.

Fig. 5: *Green growth and healthy sprouts continue to dominate over the brown, diseased plant sections.*

Fig. 6: *After only two weeks of treatment healthy growth becomes more obvious and eventually the entire crop responded with uniformly improved growth.*

Conclusion:

As the result of four weeks of treatment with MICROBE-LIFT® (Quantum) technology, this greenhouse was back in business. After almost losing the entire crop, it was able to recover plant health and produce a marketable crop.

Strawberries in Israeli Greenhouse Regained Healthy Growth When Treated with MICROBE-LIFT® Technology

Fig. 7: *Treated plants turned a lush green with healthy plants and fruit replacing stunted, brown, dying plants. The recovered plants are producing a good yield of healthy strawberries.*

Based on treatment with MICROBE-LIFT® technology, marketed under the Quantum Growth® brand, the infected plants were able to rally their natural defenses to resist and overgrow the fungus. Healthy growth continued and these same plants produced a healthy crop.

Ecological's unique consortium of microbes contains highly specialized microbes which provide the following benefits which promote growth and increase the plant's energy and health helping it thrive in spite of pathogens and less than ideal conditions:

- Increase plant nutrition by fixing nitrogen and carbon from the atmosphere
- Provide readily available phosphorus by solubilizing phosphates
- Convert organics and minerals to usable forms
- Produce growth-promoting hormones such as IAA, gibberellins, and cytokinen
- Breakdown toxic metals and organics
- Work synergistically with the indigenous population, supporting and enriching soil biology to maximize potential benefits from the entire biological population.

With increased nutrition, health, and energy the success of these plants is dramatic. This nursery recovered the full crop for a successful yield without the use of chemical pesticides.

For more information on MICROBE-LIFT® Technology contact

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CS10403

AGRICULTURE - CROP ENHANCEMENT

10500 OTHER CROPS

For more information on MICROBE-LIFT® Technology contact
Ecological Laboratories Inc.
www.EcologicalLabs.com

Testing Confirms Increased Water Retention with Quantum Growth® at Ace Hardware in Jacksonville, FL

Quantum Growth®

Location: **AEM Nursery Trial For Ace Hardware, Jacksonville, FL**

Background: Every nursery has to deal with management of stock with watering being a major part of inventory control. Too often stock is lost or sold at a discount because it became too dry. Customers using Quantum Growth® consistently claim improved moisture retention.

Objective: This test was set up to validate the benefit of moisture retention with Quantum Growth® technology.

Results Achieved

Two "equivalent" Vinca plants were selected; one of the plants was watered with 6 ounces of a 2% solution of Quantum Growth® while the other "control" plant was watered with 6 ounces of water. No additional watering was conducted for the remainder of the trial. The plants were maintained under roof and received no rainwater.

***Fig. 1**: Two "equivalent" plants after watering with 6 ounces of water (left) and 6 oz of 2% **Quantum Growth®** (right).*

***Fig. 2:** The treated plant is healthy and turgid, showing no signs of water deprivation. In fact, the treated pot was heavier than the control due to retained moisture. The control plant on the left is obviously in decline caused by drought.*

After six days in Florida heat without watering, the plants looked very different. The control showed a high level of drought stress while the treated plant showed no sign of stress. The treated plant remained healthy and turgid and the control pot has lost more weight than the treated plant due to loss of more moisture. This effect is easily reproduced and is consistently noted by users of Quantum Growth® technology. It is postulated that in addition to supplying nutrients, hormone precursors, and compounds that discourage disease, the microbial consortium in Quantum Growth® produces beneficial polymers and causes soil structure changes that help retain moisture.

Use of Quantum Growth® not only increases food and energy available to the plants, allowing them to increase root growth and bloom production, but it also helps the soil retain moisture. This results in a healthier, hardier plant that grows faster, produces more, with decreased dependency on added moisture.

For more information on MICROBE-LIFT® Technology contact

Ecological Laboratories Inc.
www.EcologicalLabs.com

CS10502

Made in the USA

Increased Out-planting Survival & Rapid Growth of Pine Trees with Quantum Growth®

Quantum Growth

Location: **Loblolly Pine Farm in Jacksonville, FL and Pine Tree Plantation, St. Augustine, FL**

Background: Once seedlings are transferred to soil the farmer knows that a percentage of them will be lost. Profitability depends in part on successful rates of survival.
These pine tree farmers wanted to improve the survival of their pine seedlings when they were transplanted. Applied & Experimental Microbiology (AEM) has a product line, Quantum Growth®, that increases transplant survivability of most transplants.

Objective:

This biotechnology-based product line, trademarked as Quantum Growth® is the result of a long-term partnership between AEM and **Ecological Laboratories Inc. (ELI)**, the company that developed and manufactures the technology.

AEM provided a treatment plan which recommended simply dipping seedling roots in a 30-gallon barrel that contained equal parts of Quantum Growth® Light and Quantum Growth® VSC at a 2% solution. One plot was to be transplanted seedlings using growers' best practices while an adjacent field uses growers' best practices plus the drench of Quantum Growth® solution prior to transplanting.

Results Achieved

The result, in two different farms, was a vastly improved survival rate and tree growth as seen in the following pictures.

Fig 1: *On the plot without* ***Quantum Growth®*** *many seedlings did not survive and the trees are relatively small.*

Fig. 2: *Taken at the same time as the picture above, this picture shows trees growing from seedlings treated with* ***Quantum Growth®*** *with significantly improved survival and the trees are well advanced in growth compared to control and are generally healthier.*

Likewise, similar results were seen at a former Rainier Timber site that is now a private pine tree plantation in St. Augustine, Florida.

Fig. 3: *Control pine on the left received fertilizer only. Quantum Growth® trees received fertilizer at half rate along with one-half gallon per acre of Quantum-Light and one half gallon per acre of Quantum-VSC.*

Fig. 4: *Note the density and shade of green in the treated seedlings on the right versus the untreated seedling on the left in spite of the fact that with Quantum Growth® microbial treatment fertilizer was cut in half.*

These results demonstrate a very cost-effective method of increasing growth rate and survivability of these pine trees while reducing the cost and potential run-off of fertilizers.

Use of Quantum Growth® increases food and energy available to the plant, allowing them to increase root growth and fruit production. This results on a healthier, hardier plant with decreased dependency on supplemental irrigation, fertilizer, and pesticides.

For more information on MICROBE-LIFT® Technology contact

Ecological Laboratories Inc.

www.EcologicalLabs.com

CS10503

Quantum Growth® Increases Number and Frequency of Orchid Blooms for Florida Orchid Grower

Quantum Growth

Location: **Orchid Grower, St. Augustine, FL**

Background: An avid orchid grower, Paul Jones who is active in the St. Augustine Orchid Society, maintains over 100 orchid plants. He had been using a microbial additive with success for a number of years when he decided to test Quantum Growth®

Objective: The main objective for any type of flower fertilizer program is to develop healthier plants with increased root growth that can support increased blooms. In this case, the grower was growing Cattleya orchids.

Results Achieved

Within two weeks of switching from his previous microbial additive to Quantum Growth® , this grower saw a pronounced increase in new root production. This was followed closely by lush new growth and then blooms. Several strains of Cattleya plants that had bloomed once yearly for the past four years were now blooming 3 -4 times a year with Quantum Growth® .

The most dramatic results seen was with an Oncidium Sharry Baby "Sweet Fragrance" plant that literally exploded in growth. Just two months after starting with Quantum Growth® this plant had produced five separate flower spikes each one over three feet long with branching inflorescences. This plant had over 150 blooms. Numerous other types of orchids had similar results.

Paul also saw excellent results in developing roots on new cuttings. Dozens of new roots were developed in just two weeks. One Cyprus mount completely rooted in less than two months.

In the words of Paul Jones,

> *"I use on all my orchids. No other type of fertilizer is ever used nor will it (be used) in the future. Quantum Growth® is all natural and I do not need to worry about ppm levels of artificial chemicals. I highly recommend any orchid grower give it a try on your plants, you will not regret it!"*

Use of Quantum Growth® increases food and energy available to the plant, allowing them to increase root growth and fruit production. This results in a healthier, hardier plant with decreased dependency on supplemental irrigation, fertilizer, and pesticides.

For more information on MICROBE-LIFT® Technology contact

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www.EcologicalLabs.com

CS10504

Made in the USA

Ace Garden Center Increases Profitability and Customer Satisfaction Using Quantum Growth®

Location: **Ace Hardware Garden Centers, St. Augustine, FL & Evans, IL**

Background: Garden Centers are a highly competitive business where visual plant health and blooms are very important. A significant effort is required for plant watering, sunscreen, and protection against pathogens. Inventory loss is always a significant cost. Profitability is dependent on controlling this loss.

Objective: Quantum Growth® is a series of products that is the result of a unique partnership in agricultural technology development between **Ecological Laboratories** and Advanced & Experimental Microbiology.

Based on successful application to major agricultural crops, this testing was conducted to determine the benefits of using Quantum Growth® in garden center operations. Potential benefits include:

- Improved water retention
- Increased flower yield
- Improved disease resistance
- Increased plant health
- Faster seed germination
- Reduced fertilizer requirement

Results Achieved

Every parameter measured showed a benefit of using Quantum Growth. The picture below shows increased flowering of Lantana plants in hanging baskets as a result of Quantum Growth® application.

Ace Hardware's Best Practices 08/21/09 | *Ace Hardware's Best Practices Plus TG Quantum Growth® Applied weekly (3 weeks)* | *Ace Hardware's Best Practices 09/11/09* | *Ace Hardware's Best Practices Plus Quantum Growth® Applied weekly (3 weeks)*

***Fig. 1**: With the same fertilizer and watering protocols duplicate plants were treated with **Quantum Growth®** added to their water supply. Treated plants on the right of each pair showed a dramatic increase in flowering, a factor that increases marketability.*

Ace Garden Center Increases Profitability and Customer Satisfaction Using Quantum Growth®

Janet Skimmer, the Ace Garden Center Manager in St. Augustine, FL, claimed,

> *"I've used Quantum Growth® both personally and professionally and this is truly a miracle product."*

Janet uses one-tenth the amount of fertilizer, fungicides, and insecticides compared to her use prior to using Quantum Growth®. She also noted that the plants require less water when treated with Quantum Growth®. Quantum Growth® treated plants do not suffer from the heat stress that is characteristic of the untreated plants.

> In side-by-side comparisons, Quantum Growth® treated plants always look healthier and have more blooms than untreated plants. In fact, when the center has plants that don't look as well as other plants, Janet treats them with Quantum Growth and "I see immediate recovery".

Janet much prefers to use Quantum Growth®, a non-toxic, organic product, on herbs and vegetables than chemicals.

Janet states that she derives great satisfaction from the use of Quantum Growth®.

> *"My customers at the garden center are always coming up to me to tell that I have the best looking plants in the area."*

For more information on MICROBE-LIFT® Technology contact

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www.EcologicalLabs.com

CS10505

Made in the USA

Seedling Needle Turgor & Root Mass Increase in Just 30 Days with Quantum Growth®

Location: **International Forest Company, Moultrie, GA**

Background: Large forest companies routinely re-plant harvested forests. Robust tree survival and growth are essential to a profitable business model.

Objective: A company planting Longleaf Yellow Pine Seed decided to test the benefits of using biological growth additives.

Based on prior data in forestry, Quantum Growth® products appeared to have excellent potential. Quantum Growth® is a series of biological products marketed by Applied & Experimental Microbiology (AEM) of Jacksonville, FL. This biotechnology-based product line is the result of a long-term partnership between AEM and **Ecological Laboratories Inc. (ELI),** who developed and manufactures the technology.

AEM provided a treatment plan for a test plot of one acre for approximately 900,000 container seedlings. Initial application of 1 gallon Quantum VSC and 1 gallon of Quantum Light was applied by a chemical injector through overhead irrigation just after seeds were put in flats.

A second application of the same dosage was applied through the overhead irrigation system two weeks later.

Results Achieved

After 30 days, needle vigor and root mass increase was pronounced as evidenced in the following pictures.

Fig 1: *Seedlings treated with* ***Quantum Growth®*** *are on the left in each picture. The visual evidence would indicate root mass increase on inoculated trees is greater than 25%.*

Seedling Needle Turgor & Root Mass Increase in Just 30 Days with Quantum Growth ®

Fig. 2: *In the picture on the left, the four plugs were sampled from the trees treated with growers' best practices plus* ***Quantum Growth®****. The four plugs in the picture on the right have been grown with best growers practices only.*

In the treated tree plugs roots are more evenly spread throughout the treated plugs on the left in the above picture. The microorganisms in Quantum Growth® distributes water more evenly in the soil. The roots in the picture on the right show roots extending out the plug following the water that has filtered through the soil as opposed to being absorbed and contained as in the treated plugs. Moisture retention will be especially important as these trees grow in the forest with only natural rainfall or moisture.

Fig. 3: *The tree on the left has been treated with* ***Quantum Growth®*** *. Root mass and root collar diameter of the inoculated trees are improved.*

These results demonstrate a very cost--effective method of increasing growth rate and survivability of these trees. Use of Quantum Growth® increases food and energy available to the plant, allowing them to increase root growth and fruit production. This results in a healthier, hardier plant with decreased dependency on supplemental irrigation, fertilizer, and pesticides.

For more information on MICROBE-LIFT® Technology contact

Ecological Laboratories Inc.

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CS10506

Quantum Growth® Increases Alfalfa Yield by 11 to 23% Plus Increased Nutritional Value on Southern California Farm

Location: **Southern California Farm**

Background: This southern California farm had an alkaline, clay based soil planted with hybrid alfalfa WL625 HQ.

Objective:

This test was designed to determine the effect of Quantum Growth® on yield and quality of alfalfa when applied as an addition to grower's best practices and to determine return on investment of any benefits provided.

Quantum Growth® is a series of unique biological products marketed by Applied & Experimental Microbiology (AEM) of Jacksonville, FL. This biotechnology-based product line is the result of a long-term partnership between AEM and **Ecological Laboratories Inc (ELI)**, who developed and manufactures the technology.

AEM's technical representatives provided a treatment plan and assisted in initiating the program. In the experiment four 1.5-acre blocks were designated as side by side treated vs. control:

Block 1:	Control
Block 2:	1 gal Quantum-VSC applied with boom sprayer in late April 8 oz Quantum-VSC & 8 oz Quantum-Light within one week after each cut starting after second cut on July 18th.
Block 3:	Control
Block 4:	1 gal Quantum-Light boom sprayed in late April 8 oz Quantum-VSC & 8 oz Quantum-Light within one week of each cut starting after the second cut.

Samples were taken from Blocks 1 & 2 on April 30th and June 18th and sent to Harris Laboratories to determine differences in nutrient uptake levels. Each block was cut, raked and loaded into a weigh wagon to determine the yield in pounds. Additional samples were taken after the 4th cut. Samples were sent to Agri Analysis in Leola, PA for evaluation as dairy feed.

Results Achieved

Use of Quantum Growth® VSC and Quantum-Light had significant positive impact on the yield and nutritional value of the alfalfa. (Fig.1).

	Cut 1	Cut 2	Cut 3	Cut 4	Total	% Change
Block 1	No	14,320	16,453	14,100	44,873	
Block 2	X	21,140*	18,675	15,190	55,005	+23%
Block 3	X	14,250	13,152	14,110	41,512	
Block 4	X	15,125	14,512	16,510	46,147	+11%

Fig. 1: *Both Quantum treatments in block 2 and block 4 showed increased yields ranging from 11 to 23%.*

Color and density differences were observed on treated plants:

QUANTUM GROWTH® CONTROL

FIRST SEASON NEWLY SEEDED

Fig. 2: *A distinct color and density improvement was seen in the picture on the right. The root structure of treated plants also had a more complex and thicker root system.*

The difference is further demonstrated in the picture below. The treated blocks had a darker green and held their color to the base of the plant while the control tended to "brown out" at the base:

Fig. 3: *Shows the improved lushness including size, depth of color, and density of alfalfa on the plants on the left that had been treated with Quantum Growth.*

Quantum Growth® Increases Alfalfa Yield by 11 to 23% Plus Increased Nutritional Value on Southern California Farm

ROI

Dairy analysis of the alfalfa found the treated alfalfa of both VSC and LIGHT to have higher value of milk pounds per ton of dry matter. (lab reports available). In fact, in alfalfa from block 2 the grade was increased from Good to Premium and alfalfa from block 4 was raised from Good to Premium/Supreme. These improvements provide a substantial increase in profitability. The analysis of value based on quality follows:

Calculations are based on the California Weekly Hay Report supplied by USDA Market News for Friday Nov. 13, 2009, the day when the crop analysis was reported.

With Respect to the Return of Investment (ROI):

	Cut 1	Cut 2	Cut 3	Cut 4	Total	% Change
Block 1	No	14,320	16,453	14,100	44,873	
Block 2	X	21,140*	18,675	15,190	55,005	+23%
Block 3	X	14,250	13,152	14,110	41,512	
Block 4	X	15,125	14,512	16,510	46,147	+11%

This translates to additional income per acre of $188.10

This savings is very significant when multiplied by the total acreage planted.

Quantum Growth® increases food and energy available to the plants, allowing them to increase root growth and fruit production. This results in a healthier, hardier plant with decreased dependency on supplemental irrigation, fertilizer, and pesticides.

Use of Quantum Growth® can provide a significant increase in profitability for alfalfa farmers.

For more information on MICROBE-LIFT® Technology contact
Ecological Laboratories Inc.
www.EcologicalLabs.com
CS10507

Made in the USA

Quantum Growth® Produces Increased Flower Blooms in Greenhouse while Reducing Fertilizer Requirement

Quantum Growth

Location: **Large Commercial Greenhouse, North Carolina**

Background: The most successful greenhouse products are those healthy -looking plants with plenty of blooms. Quantum Growth® products are known to enhance the growth rate, number of blooms, and increased water retention of nursery plants, often with less fertilizer added.

Objective: Each commercial greenhouse wants to validate the benefits of new technology in their own nursery. In this case, a section of the petunia plants were treated and evaluated versus the untreated control plants. Since this greenhouse was also interested in fertilizer savings, they set up separate sections with different fertilizer levels to evaluate how much the fertilizer can be reduced without sacrificing quality of the plants.

Results Achieved

Matured plants showed dramatically increased blooms and better plant structure even without any added fertilizer.

0 ppm 40 ppm 80 ppm **Fertilizer Rate** 0 ppm 40 ppm 80 ppm

CONTROL QUANTUM GROWTH®

The picture above demonstrates the increased blooms in treated plants. In addition, the above picture is a dramatic example of nitrogen fixation. The purpose of this trial by a commercial greenhouse was to compare fertilizer versus fertilizer and Quantum-1 and also determine what amount of fertilizer dosage was optimal with Quantum-1. As you can see, the 0 ppm fertilizer and Quantum-1 flat performed exceptionally well. This is an excellent example of how, in the absence of applied nitrogen, the Quantum-1 organisms sequestered atmospheric nitrogen to sustain growth. This picture also demonstrates the negative effects of excess nitrogen, as illustrated in the rightmost two flats. Excess Nitrogen leads to unregulated growth, characterized by pronounced stem elongation and lack of blooms as the plant allocates all of its resources to growth and not reproduction.

Use of Quantum Growth® increases food and energy available to the plants, allowing them to increase root growth and bloom production. This results in a healthier, hardier plant with decreased dependency on supplemental fertilizer. Other studies have shown that Quantum Growth also decreases dependency on added water and pesticides.

For more information on MICROBE-LIFT® Technology contact

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CS10508

Made in the USA

Test Confirms Increased Water Retention with Quantum Growth® in Lettuce Plants

Quantum Growth

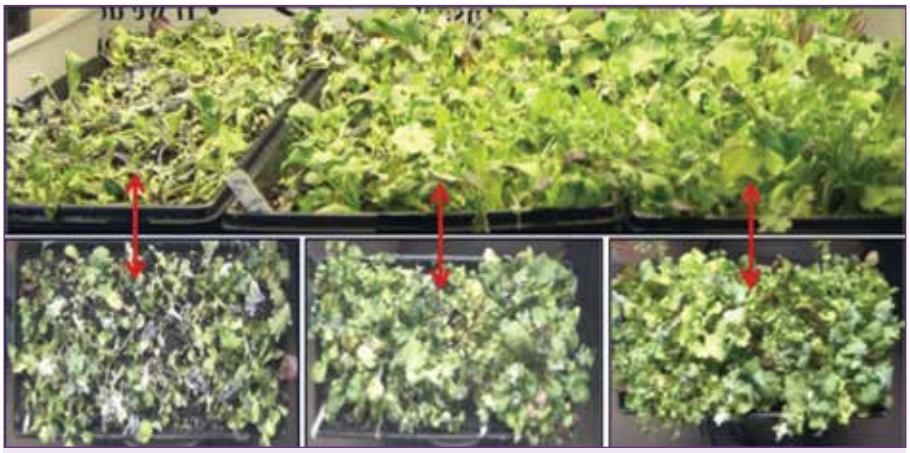
Location: **Hydroponics Store**

Background: This "test" occurred when a hydroponics store was testing the beneficial effects of Quantum Growth®.

This was an accidental situation whereby grow lights were left on over a long 3-day weekend during this test at a hydroponics store. Excess heat dried the flats more than expected and the results were dramatic. The original test targeted increased growth and healthier plants.

Results Achieved

Three flats were prepared with lettuce seeds. The first was grown by standard growers practice. The remaining two were grown by standard growers practice but with added treatments of Quantum Growth® solution. All plants received the same water and ambient moisture.



CONTROL | QUANTUM GROWTH® Low rate (0.25 oz/gal) | QUANTUM GROWTH® Normal rate (2 oz/gal)

Fig. 2: *The 2 oz/gal treated plants are healthy and turgid, showing no signs of water deprivation. Even the low rate of 0.25 oz/gal showed substantially healthier plants than the highly damaged control plants.*

Drought and sun damage are common challenges in farming produce such as lettuce. After tree days with constant exposure to grow lights in a hydroponics store, the lettuce that was treated with the standard dosage of 2% Quantum Growth showed no signs of drought or sun damage. The plant with the very low dosage (0.25%) also showed substantial resistance to drought and sun damage.

By comparison, the control plants were destroyed. This is a dramatic example of the moisture retention capabilities of Quantum Growth® technology.

This moisture retention effect of utilizing Quantum Growth® is shown consistently with many types of plants. It is postulated that, in addition to promoting a significantly more extensive root system, the microbial consortium in Quantum Growth® produces beneficial polymers and causes soil structure changes that help retain moisture.

In addition, the use of Quantum Growth® increases food and energy available to the plants, allowing them to increase root growth and production. This results in a healthier, hardier plant with decreased dependency on supplemental irrigation, fertilizer, and pesticides.

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CS10509

Made in the USA

Quantum Growth® Helps Sunset Farms increase Yield and Decrease Growing Time of Flowers in California

Quantum Growth

Location: **Sunset Farms/Sweetfield Flowers, Jamul, CA**

Background: This farm plants seedlings in screened houses exposed to the elements. Beds are lined with newspaper then filled with new organic soil at the end of each season. Plugs of various flora are planted in separate 4 ft X 100 ft beds and flowers are harvested for use by restaurants for garnishes and salads. The flowers are sugar coated for use by bakeries for wedding cakes and other confections. They are also gold dusted for use by high-end cocktail lounges in specialty drinks and gold dipped for use as jewelry. A very high quality of blooms is required.

Objective: This field test was developed using the same 4 ft X 100 ft bed whereby a section of 30 linear feet was treated and 70 linear feet remained untreated as the control.

The treated area included plugs dipped in a 4% solution of Quantum-VSC and water, then planted and watered. Control plugs were simply planted and watered.

Results Achieved

Plugs treated with Quantum Growth® VSC showed the following results compared to the control plants:

1. The root ball structure of treated plugs was much thicker, a factor that leads to a healthier, faster-growing plant.
2. Better transplant survival rate of treated plugs was evident.
3. Quicker harvestable flowers resulted from treated plants
4. Increased yield of flowers was obtained from treated plants

The pictures below show the differences between treated plants and untreated controls.

Fig. 1: *This picture was taken two weeks after treatment and planting on 10-07-08. Note the difference in thickness of the roots. The control plant is on the left while the treated plant with larger root ball is on the right.*

Quantum Growth® Helps Sunset Farms increase Yield and Decrease Growing Time of Flowers in California

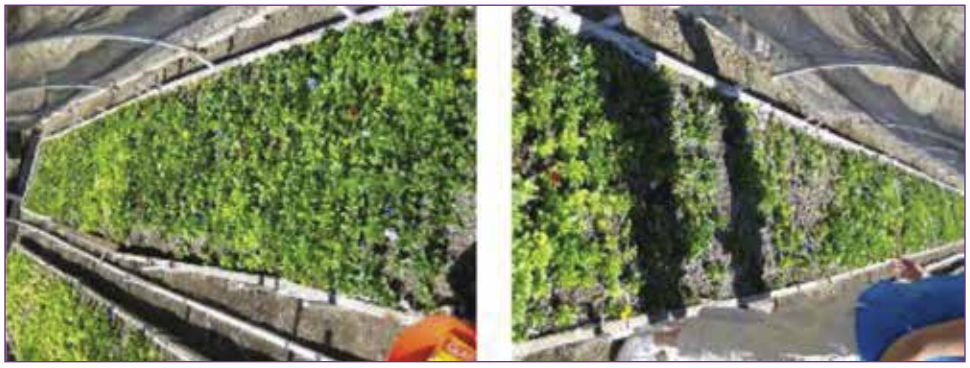

Fig. 2: *On 10-22-08, the treated flat on the left shows substantially higher survival than the control flat on the right.*

Fig. 3: *The roots of treated plants (right) consistently showed a thicker root system.*

Fig. 4: *The control on the left has produced 1 harvested flower and has 4 new buds forming while the treated plant on the right has produced 4 harvested flowers with three new buds forming.*

For this business, the use of Quantum-VSC provided greater yield and increased the speed of producing a marketable crop, both major factors in assuring profitability. This farm continues to utilize Quantum Growth, which provides it a competitive advantage in the marketplace.

Use of Quantum Growth® increases food and energy available to the plant, allowing them to increase root growth and flower production. This results in a healthier, hardier plant with decreased dependency on supplemental irrigation, fertilizer, and pesticides.

For more information on MICROBE-LIFT® Technology contact

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CS10510

MICROBE-LIFT® Technolog [Quantum Growth®] Increases Cotton Yield in California with Less Fertilizer

Quantum Growth

Location: **Cotton Farm, Buttonwillow, California**

Background: Like most agricultural operations, this cotton farmer is continually looking for cost effective solutions to optimizing yields in all types of weather and disease pressure conditions. Based on the results Microbe-Lift® technology, sold as Quantum Growth®, had achieved on other crops, he was anxious to determine potential benefits on cotton production.

Objective: The goals of the project were well defined:

1. Improve plant production volume including fiber, seed, and total weight
2. Increase production quality as determined by quality of fiber and seed
3. Improve plant health as determined by fiber and seed
4. Reduce nitrogen fertilizer use vs. standard recommended protocol

The design of the field test included five 10-acre plots. The control plot used standard fertilizer protocol with no Quantum Growth® applied. Each of the remaining plots were dosed with one acre per gallon of Quantum Growth® and various amounts of nitrogen fertilizer to determine optimal application parameters for the following season. Reductions in the application of anhydrous ammonia, ranging from 48% to 64%, were compared to the control that used the standard 250 units/acre. (One unit of fertilizer equals 1.2195 lbs. at a cost of $0.59 per unit)

Results Achieved

All plots with added Quantum Growth® increased the cotton yield per acre. Interestingly, the plots with reduced nitrogen fertilizer application performed better as the amount of fertilizer was reduced. This has been seen in field applications with other crops.

Plot	Quantum Growth®	NH_3 used Units/acre	NH_3 Reduction	Cost Savings Per acre	Yield Lbs Cotton	% Yield Increase
1	None	250	0	$ 0	5274	
2	1 g/ac	130	48	$ 71.71	5280	0.11
3	1 g/ac	120	52	$ 77.69	5334	1.14
4	1 g/ac	102	59	$ 88.71	5488	4.06
5	1 g/ac	90	64	$ 95.62	5648	7.09

With 64% reduction in ammonia fertilizer applied, a cost savings greater than the cost of Quantum Growth®, a yield increase of over 7% or 160 lbs of cotton per acre was achieved. Based on this study, further reduction in ammonia could produce additional yield increase for an even greater return on investment (ROI).

Using less than half the amount of ammonia fertilizer improved yield with the added advantage of reducing fertilizer runoff. Less fertilizer also mitigates salt build-up and negative effects of synthetic fertilizers on soil biology proving one more time the natural solution of Quantum Growth® not only improves growth and yield but it solves many of the problems resulting from farming with chemicals.

For more information on MICROBE-LIFT® Technology contact

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CS10511

Made in the USA

Quantum Growth Trial For Oil Palm Pre-Nursery Stage.

Location: **Wilmar Benih Indonesia. North Sumatra, Indonesia**

Background: Quantum Growth® trial for tissue culture palm oil pre-nursery trial to improve health, growth rate and survival rate.

Results Achieved

Using the Quantum Growth® microbial innoculant improves the health of the seedlings and reduces the mortality rate by 50%. The trial seedling shows more uniformity in the growth rate.

The Experiment:

After coming out from the tissue culture stage, the oil palm seedling is put in acclimatization stage in the soil polybag with plastic cover in the green house over 45 day period. During this stage the mortality rate is about 20-25%. The batch of 208 seedling are separated into two groups, Control group and Quantum Growth® group.

Quantum Growth® Light (250ml) and Quantum Growth® VSC (250ml) are mixed into 10 liters of water to create a Quantum Growth®mixture with 5% concentration. The seedlings are dipped into fungicide for 1 hour before being dipped into the Quantum Growth® solution for 15 minutes, before being planted into the soil polybag. The soil polybag consists of top soil, compost and sand (10:3:1 ratio).

The Quantum Growth® Mixture is then applied to each polybag at 50ml (Quantum Growth® Light & Quantum Growth® VSC total is 2.5ml/tree).

At the end of 45 days after the acclimatization period, the seedlings are observed and measured.

Data

The Seedlings are categorzed into 3 different grades:

1. **Grade A.** Very healthy and good
2. **Grade B.** Moderate health and sellable
3. **Grade F.** Dead and rejected.

From The control and the Quantum Group the data collected are as follow:

Grade Control	(total 203 seedlings)	Quantum Growth® (203seedlings)
A	57 (28%)	77 (38)
B	101 (50%	103(50%)
F	45 (22%)	23 (11%)

Quantum Growth Trial For Oil Palm Pre-Nursery Stage.

Observation:

We notice that the color of the leaves has a more homogenous green in the Quantum Growth® group compared to the control group.

It is also noted that the uniformity of the seedling size in the Quantum Growth® group as compared to the untreated seedlings shown in the picture below:

Further studies

Further studies will be conducted on the group to see how Quantum Growth® can be utilized to improve the growth rate and reduce the usage of fertilizer to offset the cost of the chemical use.

PLANETBIRU INDONESIA
ENVIROTECH COMPANY SOLUTIONS FOR THE ENVIRONMENT

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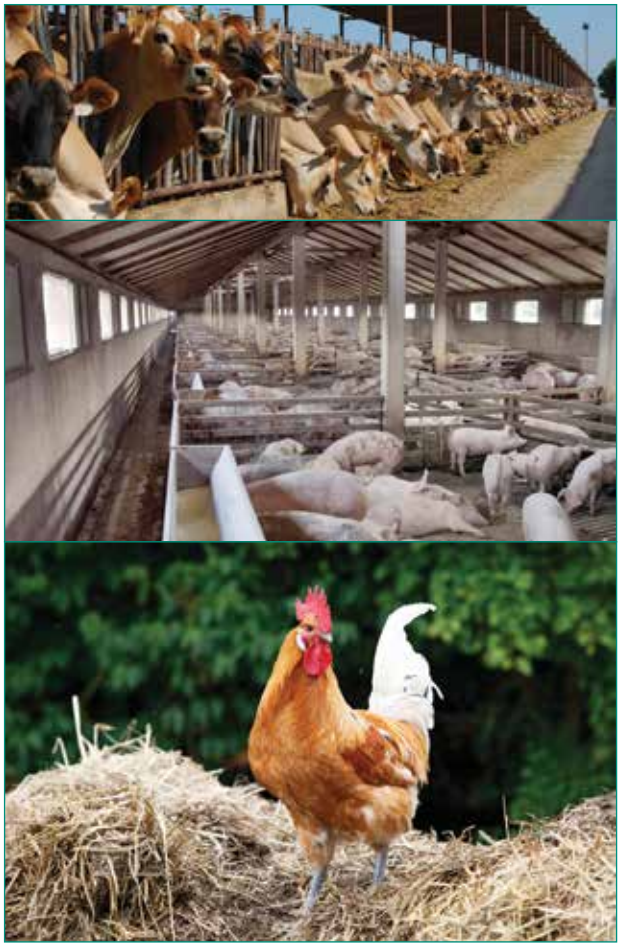
CS10512

AGRICULTURE

WASTE MANAGEMENT



Ecological Laboratories is the industry leader in biological product development and market supply for applications in the agricultural market since 1976.

We provide unmatched biotechnology to enhance manure management at all levels of manure containment with multiple befits for barns, pits, increased fertilizer value, odor elimination and increased crop yields.

Our MICROBE-LIFT® products are the ideal choice to improve manure management processes. With unparalleled capabilities to breakdown waste, reduce toxic gases, and improve manure handling, MICROBE-LIFT® Technology drives down costs, increases operational efficiency, provides return on investment and supports regulatory compliance.

The unique consortium of microbes in MICROBE-LIFT® Technology combine with indigenous microbial populations to provide a bio-system that enhances the natural elemental cycles responsible for processing manure. MICROBE-LIFT® products will reduce corrosion, pump-out time and pit solids while improving manure nutrient values and controlling odor in the barn and on application. With the additional benefit of producing higher value fertilizer containing a microbial population that improves soil biology. MICROBE-LIFT® Technology provides added benefits by contributing to plant health and yield.

- MICROBE-LIFT® /HOG
- MICROBE-LIFT® /DFP
- MICROBE-LIFT® /AOE-P

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11000

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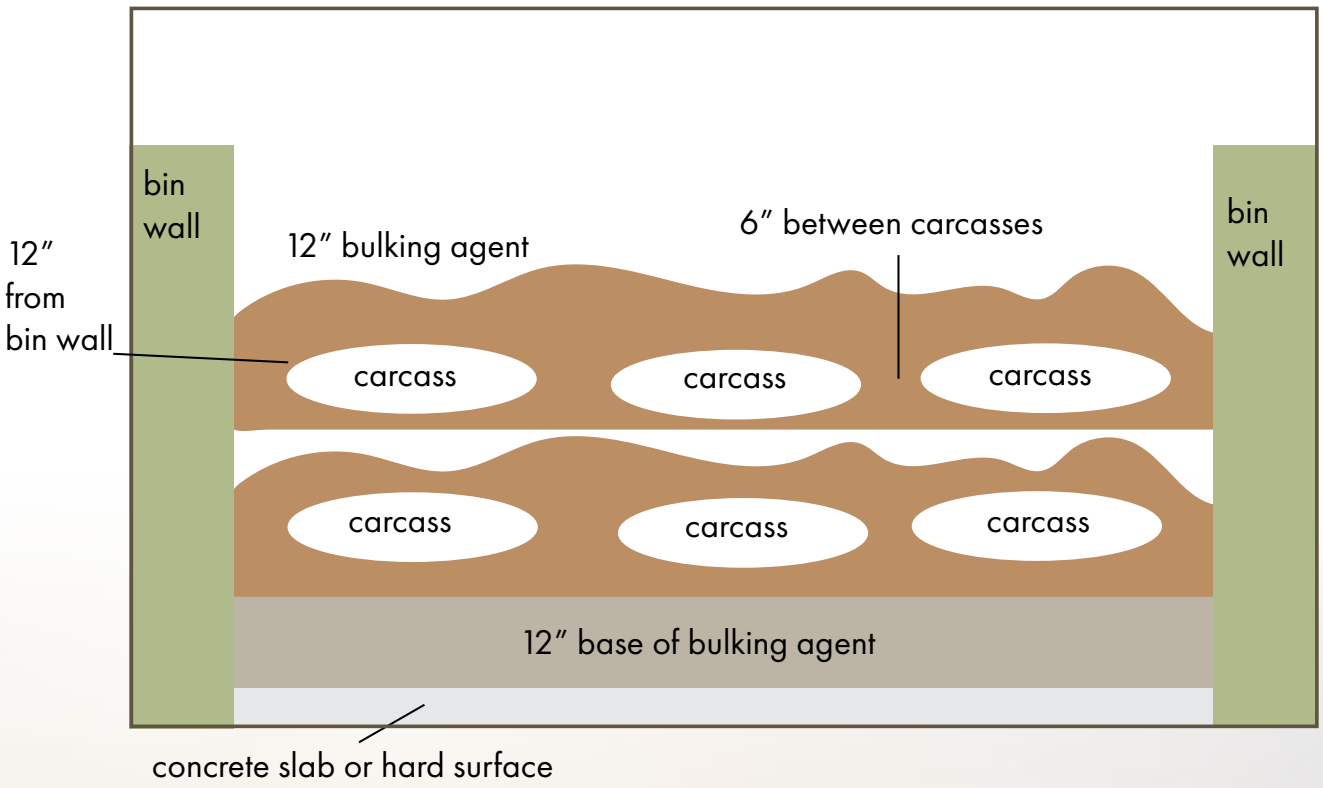
AGRICULTURE - WASTE MANAGEMENT

11000 Carcass Composting

11001 MICROBE-LIFT® Technology Assists in Odor Control in Burial Landfill in England



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CS11010

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MICROBE-LIFT® Technology Assists in Odor Control Burial Landfill in England

Location:

Tow Law Foot and Mouth Burial Site, County Durham, England

Background:

Working with the Dept. of Environment, Food, & Rural Affairs (DEFRA) in the United Kingdom, **Ecological Laboratories, Inc.** was able to run a trial to demonstrate the capability of MICROBE-LIFT® Technology. The trial at this burial site was to take place on one burial pit 150 meters long, 30 meters wide, and 10 meters deep. This pit was about 80% full with 24,000 sheep, cattle and pig carcasses. BOD in excess of 20,000 mg/l had been experienced.

The sheeting-lined pit has 3 concrete vertical columns to enable leachate containing blood and bodily fluids to be pumped to a holding tank. Thereafter, a tanker takes this effluent to a wastewater treatment plant in Newcastle about 50 miles away.

On arrival at the site, the carcasses are pressed and punctured, emptied into the pit, and covered with straw and plastic sheeting followed by a 0.5-meter thick layer of earth. This process is completed with additional layers of carcasses until the pit is full or all carcasses have been processed. Additional carcasses may be added as they arrive. This facility had been using odor control consultants, McCutcheon Enterprises (MEI). At this point they had managed to bring the odors under some control by dosing Diox (Chlorine Dioxide) to suppress odor in the pits. They are also using a sprinkler system around the site, which is spraying fine jets of a pine smelling deodorant. Since they cannot spray toxic Diox, they pour it onto areas where the odor is worst.

Four weeks prior to the trial, the pit had been bubbling on the surface with leachate, but at the time of the trial very little surface leachate was apparent. Odor could be detected in pockets but was difficult to pinpoint except for the concrete columns, which gave off bad odors.

Objective:

The objective of the trial was to provide superior odor control while eliminating the need for toxic chemicals. Based on the surface area, this trial would require 150 liters of MICROBE-LIFT® formulation mixed with 450 liters of water. This was mixed by MEI and applied with a high -pressure hose. The surface of the pit was very dry, uneven soil, which was cracked with some wet patches caused by rising leachate. The wet areas were heavily dosed, although the whole surface area was covered. A total of 350 liters of MICROBE-LIFT® formulation was used with 1050 liters of water.

Results Achieved:

At the end of the application, there was general consensus that some minor improvement had been achieved. However, as the odor problems at the time of the trial were relatively mild, it was difficult to quantify the improvement. It was agreed to reassess the next morning to determine if an additional application would be required.

On arrival at site the following morning, the MEI site manager advised that the previous evening they had experienced a small but severe spillage of leachate during pumping at another pit. The odor was extreme and he was about to dose with Diox when he decided to use MICROBE-LIFT® Technology instead. In his own words, he was amazed at how effectively and quickly the odors were controlled.

Upon revisiting the pit that had been sprayed the previous day, everyone agreed that MICROBE-LIFT® had made a considerable difference. Consequently, no further spray was undertaken. They dosed a vertical column and conducted a leachate control test by spreading leachate on the concrete apron and spraying with MICROBE-LIFT®. All of these tests proved highly successful.

The staff was very enthusiastic about MICROBE-LIFT® technology which delivered substantially more effective odor control and eliminated the toxic chemical Diox (chlorine dioxide) which is both difficult and dangerous to use, causing headaches, nosebleeds, and nausea on contact. This type of application is an extreme challenge for odor control. The success of MICROBE-LIFT® Technology, in this extreme application demonstrates its highly effective odor control capability.

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CS11011

11100 Swine Management

11101	Odor Control, Reduced Solids, Lower Mortality, & Increased Crop Yields with MICROBE-LIFT® Add Up to Increased Profits
11102	Reduced Solids & Odor Control Improves Swine Health & Farm Profits
11103	Healthier Swine, Easier Manure Handling, & Increased Crop Yields Improves Profits with MICROBE-LIFT®
11104	Solids Reduction Dramatically Improves Manure Handling In Western Pennsylvania with MICROBE-LIFT®
11105	Sludge & Crust Removal by MICROBE-LIFT® Solves Manure Handling Problems in South Dakota
11106	Reduced Odors, Decreased Mortality, & Higher Value Fertilizer Increases Profits on Swartz Farm in Pennsylvania
11107	Hog Farm Improves Work Conditions & Wastewater Treatment with MICROBE-LIFT®/HOG
11108	MICROBE-LIFT® Technology Treatment Saves Farm from Closure in Dominican Republic
11109	MICROBE-LIFT®/HOG Increases Efficiency of Operations with Healthier Environment
11110	Hog Farm Eliminates Surface Crust & Reduces Effluent BOD by 70% with MICROBE-LIFT®/HOG in South Korea

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CS11100

Odor Control, Reduced Solids, Lower Mortality, & Increased Crop Yields with MICROBE-LIFT® Add Up to Increased Profits

Location: **Hatfield's Country View Family Farms, Pennsylvania**

Background: Hatfield Farm is a producer for Country View Family Farms (CVFF), a subsidiary of Hatfield Quality Meats Company of Pennsylvania. CVFF is one of the largest swine co-ops in the United States with over 200 grow farms and 50 sow facilities. Working closely with their growers, CVFF is constantly working on technologies to improve efficiency.

Objective: Raising swine is a challenging business. Environmental and public health issues have been of real concern to farm operators worldwide. The increasing demand for production and the market pressures for price control have weighed heavily on swine producers. Economic demands have led the industry to consolidate into larger and larger facilities. With greater numbers of animals at each facility, these industrialized farms deal with increasing concentrations of waste. Manure management is an important issue for industrialized farms. EPA regulations are being enacted and enforced to control odor in increasingly populated areas, prevent pollution of water resources, and control disposal of waste solids to prevent damaging nutrient run-off.

Hatfield's Country View Family Farms decided to test MICROBE-LIFT®/HOG at several farms to determine if it could help improve manure management operations.

Results: Consistently, these tests showed numerous improvements:

- Reduction in noxious gases leading to improved animal health and decreased mortality rates.
- Odor control provides safer working conditions and reduces complaints
- Less sludge build-up eliminating pumping problems and the need to agitate manure
- Decrease in fly populations as a result of eliminating the odors and solids that attract, feed, and harbor them.
- Increased crop yields.

The unexpected result was the significantly increased crop yields that resulted from land application of higher-value manure.

Starting the program in 2000, CVFF has repeated trials over and over again on different farms with the same beneficial results. To date, MICROBE-LIFT®/HOG application has been incorporated into the operation of over 80 farms in Western Pennsylvania. Experiencing beneficial results at every farm, CVFF has developed plans to roll out the program to their other facilities.

MICROBE-LIFT® Technology has proven to be an environmentally safe and economical solution to meet the ever-increasing challenges of manure management. MICROBE-LIFT®/HOG helps swine farmers maintain the highest level of integrity in animal welfare and bio-security, while producing safe and wholesome products their consumers can trust.

For more information on MICROBE-LIFT® Technology contact

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www.EcologicalLabs.com

CS11101

Made in the USA

Reduced Solids & Odor Control Improves Swine Health & Farm Profits

Location: Pfleegor Farm, Lewisburg, PA

Background: Pfleegor Farm is a contract grower for Country View Family Farms (CVFF), one of the largest swine farm co-ops in the United States. Gary Pfleegor operates a compact 15 acre, two-barn facility on a land tract that includes his personal home. The swine farm is relatively new and Gary has incorporated some of the latest technologies to optimize efficiency. His barns are kept in excellent condition. They are cleaned and the surfaces sanitized following each "grow cycle" to minimize potential problems within each production colony.

Objective: Gary wanted to improve operations by developing more efficient manure removal, reduce bottom solids, and reduce odors and associated fly populations. Gary was convinced that the heavy fly populations were a contributing factor in the health of his animals. Since his home was located extremely close to his two barns, improvements in odor and fly populations would improve his own living conditions as well.

Manure transfer was a laborious process with the build-up of large quantities of heavy bottom solids. Agitation was required prior to removal and residual sludge solids often interfered with the pumping process.

Working closely with his contract pumper, Gary ran a trial with MICROBE-LIFT® Technology. In the spring of 2000, after the 350,000 gallon waste pit was pumped, six gallons of MICROBE-LIFT®/HOG was applied to the pit. Thereafter one gallon was added each week for four weeks, followed by one gallon per month until the pit was again pumped.

Results achieved: During the first year's trial, Gary reported a reduction in odor and fly populations in the treated barn, evidenced almost immediately. At the time of waste removal, the pit's bottom and sides were found to be extremely clean. The two feet of solids, which had usually remained after waste removal in the past, was gone.

Encouraged by initial results, Gary converted both barns to MICROBE-LIFT® Technology in 2002. He reports that his herd health is significantly better with mortality rates dropping from 5% to 2%. There is less odor in the barns and surrounding areas with far fewer flies.

Gary remains convinced that fly reduction is key to his herd's improved health as flies are known to transmit disease. When fly populations appear to increase, Gary simply applies one additional gallon to each side to the barn's pits and he notes that odors and associated fly populations decrease within twelve hours.

Gary states that treatment with MICROBE-LIFT®/ HOG " *just makes going to the barn more pleasant. I have not seen a solid manure build-up since I have been using MICROBE-LIFT®".*

While MICROBE-LIFT® Technology does not claim to control flies, it does control odors and solids build-up that often attract and harbor these insects. Gary and his family can now leave their windows open on any day or evening, even during the hottest weather, something they could never do prior to using MICROBE-LIFT®.

For more information on MICROBE-LIFT® Technology contact
Ecological Laboratories Inc.
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CS 11102

Made in the USA

Healthier Swine, Easier Manure Handling, & Increased Crop Yields Improves Profits with MICROBE-LIFT®

Location: **Brubaker Farm, Lewisburg, PA**

Background: The Brubaker Farm includes 600 acres where Jim Brubaker contracts as a grower for Country View Family farms (CVFF). His facility includes a number of deep 500,000-gallon manure pits. Jim also grows 5-600 acres of corn for feed or sale.

Objective: Like most swine farmers Jim experienced a build-up of hydrogen sulfide and ammonia gases toxic to both animals and workers. Flies were another nuisance as well as a potential for transmitting disease.

Jim was also concerned about odor generation when he land applied manure.

Results achieved

Always on the lookout for improved efficiency, Jim launched a trial of MICROBE-LIFT® Technology. Jim was extremely pleased when use of MICROBE-LIFT®/ HOG completely eliminated problems with the surface and bottom solids in his deep manure pits, removed almost all of the odor in the barns and significantly reduced odors when applying the treated manure to his farm land. He also noted a decrease in fly population in his barns and improved health of his swine.

However, these were not the only benefits Jim noted. Jim closely monitors his crop yields. Once he started utilizing treated manure as fertilizer, Jim realized that he had increased corn production from 120 bushels per acre to 180 bushels per acre, a 50% increase in yield. In addition, he tracked nitrogen content of the soil and found that MICROBE-LIFT® helped stabilize nitrogen for a much longer period in the crop cycle, an effect believed to be due to the MICROBE-LIFT® microorganisms' ability to fix nitrogen from the atmosphere.

Jim Brubaker has utilized MICROBE-LIFT® Technology for over five years consistently achieving these benefits. He is working with a local university to further document the mechanisms involved to produce these clear benefits. In simple terms, the university is studying MICROBE-LIFT® Technology to determine how the proprietary microbial blend aids the natural degradation process to establish a biomass that more effectively breaks down organic waste in the manure pits.

In the process of degrading waste manure, the bacteria in MICROBE-LIFT® increased in number and actually produce and store nutrients in a form that benefits plants when the treated manure is used as a fertilizer. Because the bacteria in treated manure help make nutrients more available to plants, they increase growth rates and overall health of crops. This treated manure also provides active microbes that attach to soil and organic matter lowering nutrient loss through run-off and oxidation. Thus, MICROBE-LIFT® treated manure helps restore microbial balance to the soil ecosystem that is so vital to healthy crop growth.

For more information on MICROBE-LIFT® Technology contact
Ecological Laboratories Inc.
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CS11103

Made in the USA

Solids Reduction Dramatically Improves Manure Handling In Western Pennsylvania with MICORBE-LIFT®

Location: **Farmer Boy Agricultural Supply Co., ViewFamily Farms (CVFF),Western Pennsylvania**

Background: This was a CVFF contracted sow farm constructed with shallow manure pits in two barns, each followed by million gallon collection pits.

Objective: This farm was experiencing problems with their large pull-plug operations. The shallow pits in the barns were blocked with sludge causing additional problems in their two million gallon collection pits. One of these collection pits had developed a cone-shaped sludge pile measuring 18 feet high, extending from the pit bottom to the surface of the water level when the pit was full. It was difficult to effectively agitate the manure and pumping was almost impossible.

To resolve his problem, the contract pumper was willing to try MICROBE-LIFT® technology.

Solution: In 2006, a low dosage program to treat the shallow pits was recommended. This program resolved the shallow pit problems within the first 60 days of treatment. In addition, when the two million gallon collection pits were pumped out in the following spring, the contract pumper reported that for the first time since he had been servicing this farm, he could pump the holding lagoons without any problems. This resulted in a large savings in time and expense to CVFF. In addition, the cone-shaped sludge pile in the first million-gallon collection pit was totally eliminated in one growing season, while only treating the shallow pits in the barns.

Fig.1: *CVFF sow operation. The effluent sent to two receiving lagoons every one to two weeks.*

Treatment:

Treatment was continued in an effort to resolve problems in the downstream receiving lagoons. The results are depicted in the pictures below:

Fig. 2: *Downstream lagoon after six months of treatment of the manure pit with MICROBE-LIFT®/HOG. No treatment was added directly to this waste lagoon yet a substantial amount of crust has been removed and clear zones are beginning to appear.*

Fig. 3: *The second lagoon was completely cleared of solids after the six-month pit treatment.*

Results:

After a six-month treatment program on all barn pits, the results were impressive. Solids were eliminated from all barn pits, odor was reduced, and surface and bottom solids in the storage lagoons were eliminated. Pit pumping problems were resolved and an astonishing six to seven feet of bottom solids were removed from the lagoons.

Based on these results, Farmer Boy Supply expanded its distribution of MICROBE-LIFT® technology from Pennsylvania to New York and Ohio.

For more information on MICROBE-LIFT® Technology contact

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CS11104

Sludge & Crust Removal by MICROBE-LIFT® Solves Manure Handling Problems in South Dakota

Location: Plainview Colony, Ipswich, South Dakota

Background: Located nine miles north of Ipswich, SD, this hog operation utilizes multiple barns and maintains approximately 10,000 hogs on site. The hog operation manager, Larry Wipf, is an experienced, well-seasoned operator. The barns operate on a pull–plug manure collection system with all the hog waste draining to a common pumping station approximately 100 feet north of the 750,000-gallon concrete holding pit. The level of waste in this pit is maintained at a pre-set level and as that level is exceeded, a pumping station approximately 30 feet to the west of the pit, automatically pumps the excess to the lagoon system. The lagoon system consists of two large lagoons set-up in sequence. The primary lagoon effluent is gravity fed to the second lagoon via an installed culvert system. The secondary lagoon is pumped yearly and the effluent is land applied by a pivot irrigation system.

Objective: In early May 2003, after successfully testing MICROBE-LIFT®/HOG in a barn without a mechanical scraper, the manager inquired about a program for the concrete holding pit to reduce solid waste and control odor. Under normal circumstances, this pit is pumped in the spring and fall requiring extensive mechanical agitation. The waste is hauled by tanker trucks and land applied to selected fields. In 2003, May was a very wet month and the fieldwork started late and consequently the labor and equipment required to pump the pit was not available. The manager was advised that a treatment program using MICROBE-LIFT®/HOG may eliminate the need to pump.
On May 21, 2003, the pit was inoculated with only 10 gallons of MICROBE-LIFT®/HOG, 5 gallons introduced directly into the pit and, since the crust on the top of the pit was 5-6 inches thick, 5 gallons of MICROBE-LIFT®/HOG was mixed with water and spray-applied to the thick crust. The manager reported that after only 72 hours the pit bubbled and the crust began to open up

Results achieved

Five days after this initial treatment, substantial bubbling was evident and the solid crust had been significantly reduced on two-thirds of the pit surface. MICROBE-LIFT®/ HOG application to the pit was continued at the rate of 2 gallons weekly during the next 4 weeks and 2 gallons monthly thereafter.

After 26 days of treatment extensive bubbling had occurred and crust was reduced to only a couple of inches on the entire pit surface except for approximately 12-15 feet on the southern end of the pit. The manager happily reported very minimal odor release from the pit. He also noted continued release of chunks of solids from the bottom of the pit as MICROBE-LIFT®/HOG continued to degrade the waste.

After 47 days, sludge reduction was dramatic. No crust was visible on two-thirds of the pit and the remaining crust had been reduced to approximately one inch or less. Again, the manager reported that there was minimal odor further supporting the success of treatment.

Elimination of solids by MICROBE-LIFT®/HOG treatment solved expensive, labor-intensive sludge handling problems. There was no longer a need for extensive mechanical agitation during bi-annual clean out. In addition to sludge and crust removal in just five weeks of treatment, the manager reported significant odor control.

During the trial the manager also reported that he normally experiences significant problems with solid waste buildup in the common pumping station often resulting in pump malfunctions. MICROBE-LIFT®/HOG was introduced into this pumping station as part of the weekly treatment program. MICROBE-LIFT®/HOG treatment successfully degraded the solid waste in the pumping station eliminating the associated pumping problems.

MICROBE-LIFT®/HOG very successfully treated the barn pits and the concrete holding pit at Plainview Colony and controlled odors. The hog operation manager was very satisfied and expanded the use of MICROBE-LIFT®/HOG to other pits in the barns.

Fig 1: *After 26 days of treatment the crust shows evidence of bubbling and chunks of sludge being brought to the surface.*

Fig 2: *After 47 days of treatment most of the surface scum and bottom solids have been eliminated.*

For more information on MICROBE-LIFT® Technology contact

Ecological Laboratories Inc.

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CS 11105

Reduced Odors, Decreased Mortality, & Higher Value Fertilizer Increases Profits on Swartz Farm in Pennsylvania

Location: Swartz Family Farm, Thompson, PA

Background: Swartz Family Farm works 400 acres. For over 12 years this farm has contracted with Country View Family Farms (CVFF) as a finisher operating a 2180 head finishing hog barn with a total deep pit volume of 800,000 gallons.

Objective: As with most swine farms, odors and associated fly populations, caused problems for animals and workers alike. Manure crusting and sludge build-up also interfered with efficient pumping and land application. But the major problem for Delbert Swartz was the bothersome fly population.

Results achieved

Delbert became aware of the potential benefits of MICROBE-LIFT® technology from an associate farmer who had used MICROBE-LIFT®/HOG with resulting improvement in barn conditions and reduction in fly population. Delbert applied MICROBE-LIFT®/HOG to his 300,000-gallon pits at a level slightly below the recommended application rate. He used 6 gallons for the first charge after pumping the pit, then 1 gallon per week for the following four weeks, followed by one gallon per month until the pit waste was removed for field application.

Not only did Delbert achieve almost complete fly reduction in his barns, he noted additional benefits. The most significant benefit was the reduction in mortality rate from an average of 4-5% to 3% during initial product introduction. Mortality is currently averaging 2%, a significant achievement and substantial cost savings.

In addition to substantial reduction in barn odors, surface solids in the pit were eliminated easing pit waste removal. This ease of removal was due also to a dramatic reduction in pit bottom solids accumulation which was apparent at the time of pumping. There was also a significant reduction in odor when the manure was land applied.

While Delbert Swartz was looking for a solution to reduce his fly population, he developed a wide range of benefits that improve the profitability of his operation:

- Resolved surface solids crusting problem
- Significantly lowered odors
- Reduced fly populations in and around the barn resulting from decreased odor
- Reduced mortality rate from 4-5% to a current 2%
- Reduced odor generated on land application of manure
- Provided higher value manure fertilizer that is more homogeneous and easier to spread.

After a decade of use, Delbert Swartz remains a committed user of MICROBE-LIFT® technology today.

For more information on MICROBE-LIFT® Technology contact
Ecological Laboratories Inc.
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CS 11106

Made in the USA

Hog Farm Improves Work Conditions & Wastewater Treatment with MICROBE-LIFT® /HOG

Location: **Swine Farm, Southeast Georgia**

Background: This twenty-year old farm consisted of several barns each of which was equipped with two 242-gallon rinse tanks that were used to flush the pit area under the barns twice daily. The manure pits discharged to a 5.5 million gallon lagoon. The lagoon was not meeting the discharge permit levels. Examination determined that there was no presence of biological activity in the lagoon and the solids build-up on the lagoon surface was at a critical level. H_2S odor was so severe that plant employees were often unable to perform their duties because of respiratory problems and eye irritation.

Objective: A three-pronged MICROBE-LIFT®/HOG treatment program was prescribed.

Results Achieved: The waste lagoon was treated with a single application of 45 ppm (250 gallons) of MICROBE-LIFT®/HOG resulting in immediate reduction of offensive odor emanating from the lagoon. Within 14 days, the lagoon showed signs of increased biological activity along with a substantial reduction in surface solids. Twenty-one days after treatment, the lagoon was extremely active with biological activity. The water and surface solids were virtually eliminated.

The barns were also treated by addition of MICROBE-LIFT®/HOG. The product was added to the 242-gallon rinse tank in each barn at a rate one quart per tank. Each barn contained 2 tanks that were used to flush the pit area under the barns twice daily. The hydrogen sulfide reduction was immediate. Covers were removed from the junction boxes and no offensive odors were detectable.

MICROBE-LIFT®/HOG was also used in the cleaning process of the farrowing barn. The product was applied with the use of a chemical input line on a pressure washer at a rate of 6 ounces per gallon. The entire interior of the barn was washed with the product. The results were outstanding. The only odor apparent in the farrowing barn following the treatment came from the feed in the barn.

The treatment program continued for a test period of two months. The plant employees reported remarkable reductions in the side effects of hydrogen sulfide as levels were substantially reduced.

MICROBE-LIFT®/HOG treatment was considered a success. It solved the TSS and BOD problems in the waste lagoon after a single treatment. The lagoon was functioning effectively just 21 days following treatment. Hydrogen sulfide odors, and associated toxicity, were greatly reduced by using MICROBE-LIFT®/HOG in the pit rinse system and cleaning systems in the barns.

For more information on MICROBE-LIFT® Technology contact

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CS11107

Made in the USA

MICROBE-LIFT® Technology Treatment Saves Farm from Closure in Dominican Republic

Location: Company, Dominican Republic

Background: The Agrotel Company owns and operates a wholesale agricultural supply company as well as a swine farm in Moca, Dominican Republic. The farm maintains 450 to 500 sows and approximately 10,000 piglets. The barn wash-down and manure wastewater is collected, the solids are separated for feed and fertilizer, and the wastewater flows into a lagoon. There is no surface exit for runoff, but water does percolate through the soil and emit odors downstream.

Objective: In spite of superior design and management, odor from the waste lagoon was causing complaints from the surrounding neighbors and city authorities threatened to close the farm if the problem could not be resolved. Juan Carles Inea, the farm's operational manager, tried numerous odor control technologies and nothing worked. An exclusive international distribution partner for wastewater treatment, convinced Juan to try a simple treatment plan using MICROBE-LIFT® Technology.

Results achieved: With only one gallon per week using MICROBE-LIFT® Technology, they were able to eliminate the odors in the lagoon, In addition, the sludge build-up in the lagoon began to decrease to the point that they could use the water for crop irrigation in the surrounding fields.

Fig 1: *Modern Agrotel Company Farm in Dominican Republic*

After treatment, Juan was quoted as saying *"MICROBE-LIFT® Technology saved my farm from being shut down".*

Fig. 2: *Waste lagoon after treatment with MICROBE-LIFT® Technology shows improved water clarify and reduction in solids.*

Based on their initial success, Juan is now using MICROBE-LIFT® Technology to improve their composting of carcasses. The compost system is in a series of concrete silos where carcasses are allowed to degrade in water. One liter of MICROBE-LIFT® Technology was applied every other week to the water in the silos and, after treatment, the runoff water was clean enough to be used to fertilize the fields surrounding the lagoon.

MICROBE-LIFT® Technology speeds the composting process while producing a value-added liquid fertilizer from the compost runoff. Juan also noted a significant reduction in flies around the composting unit validating the reduction of odor.

For more information on MICROBE-LIFT® Technology contact

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CS 11108

Made in the USA

MICROBE-LIFT®/HOG Increases Efficiency of Operations with Healthier Environment

Location: **McClellan Farms Inc., Bradford County, PA**

Background: McClellan Farms is a contract grower for Country View Family Farms (CVFF). The farm consists of two 2100-head finishing operations and one 8800-head nursery operation. The swine in these three buildings produce close to 2.5 million gallons of manure each year that must be managed efficiently.

Objective: Foul-smelling odors emanating from the field application of manure and gases exhausted from barns by the fans were causing problems with neighbors. Mathew McClellan also had concerns for the health, safety, and overall environment to which his animals and workers were exposed.

Results Achieved: Mathew had heard of successful applications of MICROBE-LIFT® technology from other CVFF contract farmers. He was skeptical due to the comparatively low cost of treatment but he applied MICROBE-LIFT/HOG and MICROBE-LIFT®/SA (Sludge Away) as directed.

Not only did Mathew see a major reduction in odor when they land applied manure, but he is convinced that the treatment has helped create an improved air quality within the facility as well.

Mathew states "*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*".

After treatment, Mathew was also pleased to report that odor control was only a small part of the benefits he received from the use of MICROBE-LIFT® The collected manure was much more consistent without any of the solid crust or settled sludge that usually interfered with pumping. Liquefied consistency means that the manure containment system is operating efficiently without the typical development of crust that can harbor rodents and insects. Treated, liquefied manure can be applied consistently as fertilizer without the uneven application normally caused by clumping. Consistency and the incorporation of key beneficial microorganisms from the MICROBE-LIFT® consortium in their manure fertilizer have helped the farm to stabilize nutrient effluent levels within Pennsylvania requirements.

Mathew has consistently utilized MICROBE-LIFT® technology for approximately five years. He states that he believes it has had a positive effect on the overall production of the pigs and creates a much more positive atmosphere for anyone directly or indirectly involved with his facilities. He heartily recommends this technology to other swine farmers.

For more information on MICROBE-LIFT® Technology contact
Ecological Laboratories Inc.
www.EcologicalLabs.com
CS 11109

Made in the USA

Hog Farm Eliminates Surface Crust & Reduces Effluent BOD by 70% with MICROBE-LIFT®/HOG in South Korea

Location: **Swine Farm, South Korea**

Background: This hog farm had a concrete lagoon system that had a completely encrusted surface that caused problems with pumping and field application of the manure. Odor was a problem.

Objective: This farmer applied MICROBE-LIFT®/HOG and the results are recorded in the following photos.

Results Achieved: Results started showing in the first three days and by the end of 45 days of lagoon treatment the lagoon surface was completely clear.

Fig.1:
On the day of inoculation, the crust was very thick and covered the entire lagoon.

Fig.2:
In only three days the crust has been disrupted with clear patches evident

Fig.3:
At four days, more clear patches are noted and the crust has dissolved into a slurry form.

Fig.4:
With only five days of treatment, most floating solids have disappeared.

Fig.5:
At the end of the 45-day treatment program, the surface of the lagoon is absolutely clear with no visible floating solids.

As a result of treatment, the scum was eliminated, odors were gone, and effluent BOD was reduced by 70%.

The novel microbial consortium in MICROBE-LIFT®/HOG provides excellent degradation capabilities with extreme ecological diversity that allows it to excel in anaerobic, facultative, aerobic, and photosynthetic environments. Its capabilities provide the energy and metabolic capability required to meet the demands of today's higher volume production facilities.

For more information on MICROBE-LIFT® Technology contact

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CS11110

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AGRICULTURE - WASTE MANAGEMENT

11200 Dairy Manure

11201	MICROBE-LIFT® Achieves Odor Control and More Efficient Manure Handling at Wolfe Dairy
11202	MICROBE-LIFT® Technology Solves Waste Treatment Problems for Feed Lot in Vera Cruz, Mexico
11203	MICROBE-LIFT® Technology Removes Two Feet of Surface Scum from Manure Pit

For more information on MICROBE-LIFT® Technology contact

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CS 11200

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MICROBE-LIFT® Achieves Odor Control and More Efficient Manure Handling at Wolfe Dairy

Location: Wolfe Power Line Dairy, Milton, PA

Background: The Wolfe Power Line Dairy is a 750-head dairy farm with a 1.8 million gallon, above-ground manure storage silo designed to hold six to twelve months of manure production. The storage system is 30 feet below the barn grade and utilizes gravity to feed manure to the bottom of the containment vessel.

Objective: : Ray Wolfe wanted to remove bottom solids that had built-up and blocked the flow of manure to the containment vessel. This build-up had effectively reduced the manure capacity, which had been designed for six to twelve months' volume to only three to four month's capacity. Ray also wanted to remove manure surface crust and to reduce odors in the barn and during land application, both of which were major concerns. He decided to test the ability of MICROBE-LIFT®/DFP to meet his needs.

Results achieved

In June 2002, MICROBE-LIFT®/DFP (dairy) was introduced to the barn through the primary manure discharge line. The first treatment was initiated following normal pumping of the storage pit pump-down. Twelve gallons of MICROBE-LIFT®/DFP were applied in the first treatment, followed by a dosage of two gallons per week for four weeks, and then reduced to one and a half gallons per month until the tank was pumped again.

Mr. Wolfe achieved his initial goal of removing the sludge build-up that prevented full utilization of the containment vessel. He also noted significantly reduced odor both in the barn as well as during land application. The use of MICROBE-LIFT®/DFP also degraded the surface manure cap of 15 to 20 inches saving both time and fuel by eliminating the need for agitating manure prior to land application. Successful liquefaction of the manure provides a very consistent, easy to apply, high value fertilizer.

For more information on MICROBE-LIFT® Technology contact

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CS 11201

MICROBE-LIFT® Technology Solves Waste Treatment Problems for Feed Lot in Vera Cruz, Mexico

Location: **Cattle Ranch Feedlot, Vera Cruz, Mexico**

Background: This ranch has a capacity of 22,000 head of cattle. The waste system consists of 16 lagoons (12 X 18 X 5 meters each). Twelve lagoons are saturated, 2 are closed, and 2 are new lagoons. In the lot, there are 7 separate sections with two lagoons collecting waste from the holding yards. In the pits, the fall manure is mixed with the existing manure daily, collected in lagoons, and gravity fed to the waste lagoon system. Total pit volume is 1,083 M^3.

Objective: There were a number of issues of concern to the management. There was visual pollution with 5 cm. of surface solids and heavy sludge build-up in each containment lagoon. There were significant odor issues and a concern that effluent waste was contributing to river pollution and affecting downstream ranches. This ranch was facing potential environmental fines for exceeding effluent discharge limits.

Their goal was to:

1. Remove surface crust and sludge from lagoons
2. Achieve a liquid, flowing waste in receiving pits liquefying the entire water column in the pits
3. Improve liquefaction of waste for improved consistency and flowability throughout the system
4. Increase waste degradation to meet effluent parameters
5. Stop polluting nearby land and rivers

Ecological Laboratories developed a program using MICROBE-LIFT®/DFP (ML/DFP) including dosage to each lagoon.

The following before and after pictures show the dramatic results as the scum and sludge are removed from the lagoons and pits.

Fig.1: *Shows two pictures representing the condition of the lagoon before and after treatment. These pictures show dramatic improvement, eliminating the surface crust in this lagoon.*

Fig.2*: This figure shows another lagoon before and after treatment. Visible crust on a lagoon is almost completely removed after treatment with* MICROBE-LIFT® /DFP.

Fig.3: *These two pictures show another lagoon before and after treatment with* MICROBE-LIFT® /DFP

Fig 4: Another lagoon cleaned by highly active microbes in MICROBE-LIFT® /DFP shows dramatic improvement.

Fig 5: The following pictures show an additional three lagoons cleaned by MICROBE-LIFT® /DFP with the before pictures on the left and the treated lagoons on the right.

Fig. 6: *Cleaner effluent is discharged to the river. Note the scum on the "before" picture on the left and the much cleaner water on the river after treatment on the right.*

Conclusion:

In conclusion, just as scum removal is evidenced by these dramatic pictures, all the defined objectives of this application were achieved by the described treatment program with MICROBE-LIFT® /DFP:

- Reduced surface and bottom solids
- Reduced odor
- Better flow of solids-free waste to the lagoons
- Improved effluent water quality to meet effluent parameters and reduced pollution impact on river and downstream farms.

For more information on MICROBE-LIFT® Technology contact

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CS 11202

MICROBE-LIFT® Technology Removes Two Feet of Surface Scum from Manure Pit

Location: Dairy Farm, Shelby, Ohio

Background: Merlin Newswenger's dairy farm includes a 70' X 70' lagoon with 8' walls that holds 39,200 cubic feet or approximately 300,000 gallons. This farm currently maintains 72 cows, using straw and shavings as bedding. Due to capacity constraints, the lagoon needed to be cleaned out approximately every four months based on cow numbers and rainfall. Surface solids (crust) were up to 24 inches thick that required extra payment to a manure hauler to agitate the pit before pump-out.

Objective: Merlin wanted to determine if utilizing MICROBE-LIFT® technology would eliminate the need and associated cost for agitation and provide a more consistent manure fertilizer for crops.

In late December 2004, Merlin removed the liquid portion from the lagoon from under two feet of frozen crust and then added the 6 gallons of MICROBE-LIFT®/DFP. One gallon of MICROBE-LIFT®/DFP was added per week for the next four weeks and thereafter one gallon was added per month for February, March, and April. Additional liquid was removed from the lagoon at the end of February due to capacity concerns, as the Newswengers did not think they would have enough capacity to hold until the expected clean out in early May.

Results achieved: At clean out in early May the entire 24 inches of surface solids (crust) was gone. A thin scum was left on top and very little agitation was used to incorporate this scum into the liquid. Merlin Newswenger and his manure hauler were equally impressed and commented that the lagoon was consistent from top to bottom. They were both shocked that the crust was gone and the regular agitation was not required. Land application of this treated manure seemed much more even as the manure had a consistent color and lacked the chunks normally seen. Odor had not been a serious problem for this farm due to its remote location. Therefore, no observations were documented regarding the reduction in odor that is typically seen with this treatment.

It was estimated that agitation would have cost an additional $50 per clean out from the manure hauler. In addition, Merlin's time would have been required to check on agitation equipment set up by the manure hauler. Merlin would normally have to monitor and move this equipment several times over a two-hour period.

Based on his experience, Merlin Newswenger has no doubt regarding the benefit of MICROBE-LIFT®/DFP to eliminate surface scum and produce a more consistent, easy to handle manure for fertilization.

Additional benefits include odor control for farms where odor is a concern and the increased value of beneficial microbes in manure used for crop fertilization. Once the microorganisms in MICROBE-LIFT® technology have been established in the manure collection system, reduced dosages will make this technology increasingly cost effective.

For more information on MICROBE-LIFT® Technology contact
Ecological Laboratories Inc.
www.EcologicalLabs.com
CS11203

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AGRICULTURE - MANURE MANAGEMENT

11300 Poultry Manure

11301 Long-term Odor Control Achieved in Poultry Farm with MICROBE-LIFT®/AOEP

11302 Syrian Poultry Farm Increases Profits by 34% with MICROBE-LIFT® Technology

11303 MICROBE-LIFT® Technology Provides Easier & Faster Manure Composting for Poultry Farmer in Central America

11304 Ammonia Reduction & Reduced Beetle Larvae with MICROBE-LIFT® Technology in Poultry Composting

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CS11300

Made in the USA

Long-term Odor Control Achieved in Poultry Farm with MICROBE-LIFT®/AOEP

Location: **Bledsoe Poultry Farm, Jamestown, TN**

Background: Jim Bledsoe operates several grow houses for chickens. As in other poultry operations, ammonia is a concern that needs to be addressed. Jim had used every product he found on the market that claimed to provide ammonia removal, including market leaders such as All Clear and PLT, but had not achieved the ammonia control desired.

Objective: When introduced to MICROBE-LIFT® /AOEP, Jim decided to run a trial to maximize ammonia control. He found that the method of application was the key to the product performance.

MICROBE-LIFT® /AOEP was applied as follows:

1. De-crust and wait one day or more to allow drying of the litter (24 hours).
2. Apply MICROBE-LIFT® /AOEP at a rate of two to three gallons per house diluted with 40 gallons of water (1 to 40 with tap water). Allow drying for one day, then apply top dress litter and allow an additional 4 to 5 days drying cycle.
3. Just prior to the introduction of birds, close the windows (vents) and turn on the heat in preparation for bird introduction (24 hours). The increase in temperature will cause a temporary release of ammonia, raising the ammonia level within the house as the ammonia is driven off.
4. The birds are added at this time, the day after barn heating, and following the application of MICROBE-LIFT® /AOEP, and top dress. The ammonia level will still be at a noticeable level however the ammonia level will stabilize and then drops off within a day or two to an acceptable level .

Results Achieved: Through application to numerous cycles it was determined that the following benefits were achieved with proper use of MICROBE-LIFT® /AOEP:

- Effective ammonia management control
- Lower cost of application
- Efficacy greater than other chemical and microbial technologies
- Longer term control than competitive products

When the above procedure was followed, MICROBE-LIFT® /AOEP reduced ammonia effectively and held it at a lower level than achieved by other odor control technologies. MICROBE-LIFT® /AOEP provided ammonia control for the entire growth cycle while competitive technologies offered two weeks control. Jim advised that he liked the advantages MICROBE-LIFT® /AOEP provided in both cost and performance. Jim had supplied other similar farm operations in the area with MICROBE-LIFT® /AOEP technology and they reported the same long-term ammonia control.

For more information on MICROBE-LIFT® Technology contact
Ecological Laboratories Inc.
www.EcologicalLabs.com
CS11301

Made in the USA

Syrian Poultry Farm Increases Profits by 34% with MICROBE-LIFT®Technology

Location: **Poultry Farm, Syria**

Background: The idea of using MICROBE-LIFT® in poultry production was encouraged by fact that many international manufacturers of veterinarian products have recently introduced feed additives containing various forms of live bacteria. These probiotic products, which usually contain a short list of non-pathogenic bacteria, work on the basic premise of symbiotic growth of the bacteria adhering to the intestinal lining and remaining after the food moves down the digestive track. As the bacteria contained in MICROBE-LIFT® play the same role when used on the solid surfaces (walls, pipes, floors, etc.) of stables, barns and food processing plants, it was logical to think that the non-pathological bacteria consortium in our products would be worth studying in this capacity.

This effort was supported by the fact that MICROBE-LIFT® was used successfully in shrimp farm trials in the USA and Taiwan a few years ago, and the results of these trials on increasing growth, individual weight, and reduction of feed were quite astonishing.

Objective

This trial was designed to determine the effect of MICROBE-LIFT® usage on poultry production through:

- Adding MICROBE-LIFT® to the birds drinking water in order to minimize the effects of pathogenic bacteria in birds intestine and stomach, with the goal of reducing the mortality rate and improving the birds overall health.
- Spraying MICROBE-LIFT® on the floors of the barns, thus eliminating the various gases produced by the chickens' manure, to improve environmental conditions, which in turn would result in healthier birds and increase over all production profits.

Benefit analysis was measured by tracking the following data:

- Mortality rate versus standard control.
- Weight of average chicken versus standard control.
- Feed conversion coefficient versus standard control.

Methodologies and Procedures

Barns and Poultry Population Groups

Two barns, each measuring 700 square meters, were selected and fully disinfected by an iodine-based disinfectant.

Each barn was stocked with 10,200 birds. The populations of experimental birds were all from the same source, hatched within one day of each other, stocked in the barns at the age of one to two days, and all were inspected and considered to be in good health.

During the entire trial, the two herds were subject to the same preventive medical plan, and when there was a need for therapeutic action, the same antibiotics were administered to both Groups. In this manner, care was taken to limit the variables, other than the usage of MICROBE-LIFT®

Syrian Poultry Farm Increases Profits by 34% with MICROBE-LIFT®Technology

MICROBE-LIFT® Application

Product was diluted at 1:40 parts of water and sprayed on the barns floors, and walls. This application was implemented three times: at day 7, day 21, and day 35. (Total product used in this fashion was 26.25 Litres)

Product was mixed with the drinking water of the herd as follows:

1. One part of MICROBE-LIFT® to 3000 parts of water starting from the 1st day through the 7th day, then
2. One part of MICROBE-LIFT® to 2000 parts of water starting from the 8th day through the 15th day, then
3. One part of MICROBE-LIFT® to 1000 part of water starting from the 16th day through the 46th day of the trial.

(Total product used in above a, b, c phases was 139.08 Litres)

Results Achieved: The following data provides assessment of the effect of treatment:

Description	Control Herd	Experiment Herd
Herd's No.	1039	1040
Area of Barn	700 M2	700 M2
Populations	10,200 birds	10,200 birds
Starting Date	Oct.30.2005	Oct.30.2005
Duration of Experiment	46 days	46 days
Mortality Rate	22.17%	9.91%
Mortality Count	2261 birds	1011 birds
Average Weight	1365 gm/bird	1812 gm/bird
Conversion Coefficient	3.14	2.8

Economic Analysis: Microbe-Lift experimental herd produced the following savings:

$4,500.00	Cost of 1250 birds was less due to lower mortality
$7,097.46	Cost of the weight increase was less due to improved feed conversion
$1,862.46	Cost of feed savings which amounted to 4,828.6 kg
$13,489.92	Total savings vs. control
$1,965.60	Less cost of ML
$11,524.32	NET PROFIT BENEFIT

Conclusion

This poultry trial project demonstrates the efficacy of using MICROBE-LIFT® as a cost-effective food additive in poultry production. The economic benefits to the poultry industry can be summarized as follows:

- **Increased Average Weight**

  As referenced in the trial, the average bird weighted 0.447 kg. more than the control birds, which amounted to a value of some U.S. $0.894 per bird.

- **Reduced Mortality Rate**

  The experimental group exhibited a mortality of only 9.91% versus 22.17% for the control group, amounting to increase of U.S. $0.493 per bird.

- **Reduced Feed Cost**

  The conversion rate improved from 3.14 kg. of feed to one kg. of meat, to 2.85 kg. of feed to one kg. of meat, resulting in a savings of U.S. $0.203.

While net savings will vary by market, this trial in Syria resulted in a 34.61% increase in profit based on the total selling price of experimental herd versus the control herd. The additional benefit, albeit subjective, was the significant reduction in odor. This was noticed by staff and neighbors, a true benefit to our position in the community. This farm manager was very pleased with the results and will continue to use MICROBE-LIFT® as a fundamental part of the production regimen.

For more information on MICROBE-LIFT® Technology contact

Ecological Laboratories Inc.
www.EcologicalLabs.com

CS11302

MICROBE-LIFT® Technology Provides Easier & Faster Manure Composting for Poultry Farmer in Central America

Location: **Poultry Farm, Central America**

Background:

One of the major functions of a poultry farm is the handling of manure and composting it to be utilized as fertilizer. In Central America, stabilized manure is a source of revenue as it is sold as fertilizer.

Many barns designed for laying chickens in Central America are up to 150 meters long and 14 meters wide. They are approximately 2,100 square meters in area with barn floors built 3 meters above the ground, making them accessible for front-loaders and manual labor.

Manure piles collect underneath each barn often building to a depth of 40 to 50 centimeters (1.5 feet). The chicken manure is allowed to create a solid heap underneath the barns.

The manure creates a tremendous odor problem and the compost is slow to stabilize (degrade). The piles are typically not turned for aeration. Therefore they are removed and dried for fertilizer about every 12 to 16 months.

Objective:

- This farm wanted to reduce odor, as they had numerous complaints from adjacent properties.
- They also wanted to speed up the composting process and (as a side benefit) improve the fertilizer value of the composted manure.

Treatment

MICROBE-LIFT® technology made by Ecological Laboratories, typically reduces the time required to stabilize a compost pile by up to 40 or 50%. Fertilizer value will also be improved as demonstrated by up to 30 to 50% increased crop yields. Generally, MICROBE-LIFT® formulation is diluted 1:50 with water and sprayed at the rate of 1 gallon diluted mixture for every 20 sq. ft. of surface area to a moisture level of approximately one inch.

The best way to determine that the manure is stabilized is the odor. Poultry manure has very high nitrogen content that leads to ammonia creation. MICROBE-LIFT® treatment will produce an odor that is more earthy, not repugnant or putrid, and the ammonia odor will be reduced and eventually eliminated.

A critical step is to achieve a temperature of 60° to 75°C (140 to 175°F) indicating good biological activity. The volume is reduced as organics degrade and gas is evolved. As the harder-to-degrade organics are oxidized, the compost is stabilized and ready to apply as fertilizer.

Different methods of composting affect the time of stabilization. The heap or pile method can take many months, even up to a year depending on the composition. If the pile is bulked up with coarse material such as wood chips to allow for air circulation, the reaction will be faster. The windrow method takes only 45-90 days depending on the composition of the pile and how often the piles are turned.

For best results, treat barns that have had their piles removed and spray the MICROBE-LIFT® dilution on the piles as they build up. Odor changes help determine when the piles are ready to be dried and sold. This process will be accomplished in less time, often a 50 to 60 percent shorter time frame when treated with MICROBE-LIFT®. technology.

For existing piles, turn the manure and apply the MICROBE-LIFT® dilution as the piles are turned.
Once this process has been completed, spray the outer surface as it builds up.

Results Achieved

This trial validated the efficacy of MICROBE-LIFT® technology. Manure was removed and composted demonstrating faster stabilization. Once the manure was removed, the barns treated new manure periodically significantly reducing odors and quickly stabilizing the manure for use as fertilizer.

For more information on MICROBE-LIFT® Technology contact
Ecological Laboratories Inc.
www.EcologicalLabs.com
CS11303

Ammonia Reduction & Reduced Beetle Larvae with MICROBE-LIFT® Technology in Poultry Composting

Location: **Experimental Farm, Honduras**

Background: Lazarus & Lazarus, a technology-based construction firm in Honduras, contacted a distributor of Ecological Laboratories to explore technology to improve their poultry litter processing. Ecological Laboratories' technologists devised a test protocol using MICROBE-LIFT® technology conducted at an experimental poultry farm. This farm is utilized to evaluate new technology to optimize efficiency of operations for poultry farms.

Objective: The objective of this trial was to determine if this technology could:

- Reduce ammonia to create a healthier environment for birds and workers
- Decrease the incidence of beetle larvae in the broiler bedding
- Accelerate the composting process and produce a higher quality fertilizer.

Results achieved: This trial was evaluated by the farm manager, Daniel Martinez, and Daniel Irias, the technical representative from Lazarus & Lazarus. The results are tabulated as follows:

Incidence of Beetle Larvae	Presence of larva actively proliferating.	Presence of larvae significantly lower than control	Intensive visual evaluation in one square meter
Concentration of airborne ammonia	≥10 ppm	5 ppm	Indicator tape for NH4OH
Human appreciation of ammonia odor	High concentration on the human perception	Very low concentration on the human reception	Personal qualitative appreciation
Composting Process	High moisture, very low composting development	Low moisture, significantly higher composting process	Observation of the physical condition of the bedding

Based on the parameters listed above, the broiler bedding trial achieved the following results:

- MICROBE-LIFT® technology worked as expected, lowering the ammonia in the air both quantitatively and qualitatively. It significantly reduced odor noted by human perception and by air measurement showing the recommended 5ppm concentration inside the warehouse.
- There was a significant decrease in the amount of moisture and also a significant acceleration of the composting process.
- The incidence of the beetle larvae was significantly reduced; this was a secondary experiment of discovery that was tested based on previous experience reducing infestations in other applications. While MICROBE-LIFT® technology is not sold as an insecticide, it appears to change conditions that discourage their growth.

All objectives of the program were successfully achieved.

For more information on MICROBE-LIFT® Technology contact

Ecological Laboratories Inc.
www.EcologicalLabs.com

CS11304

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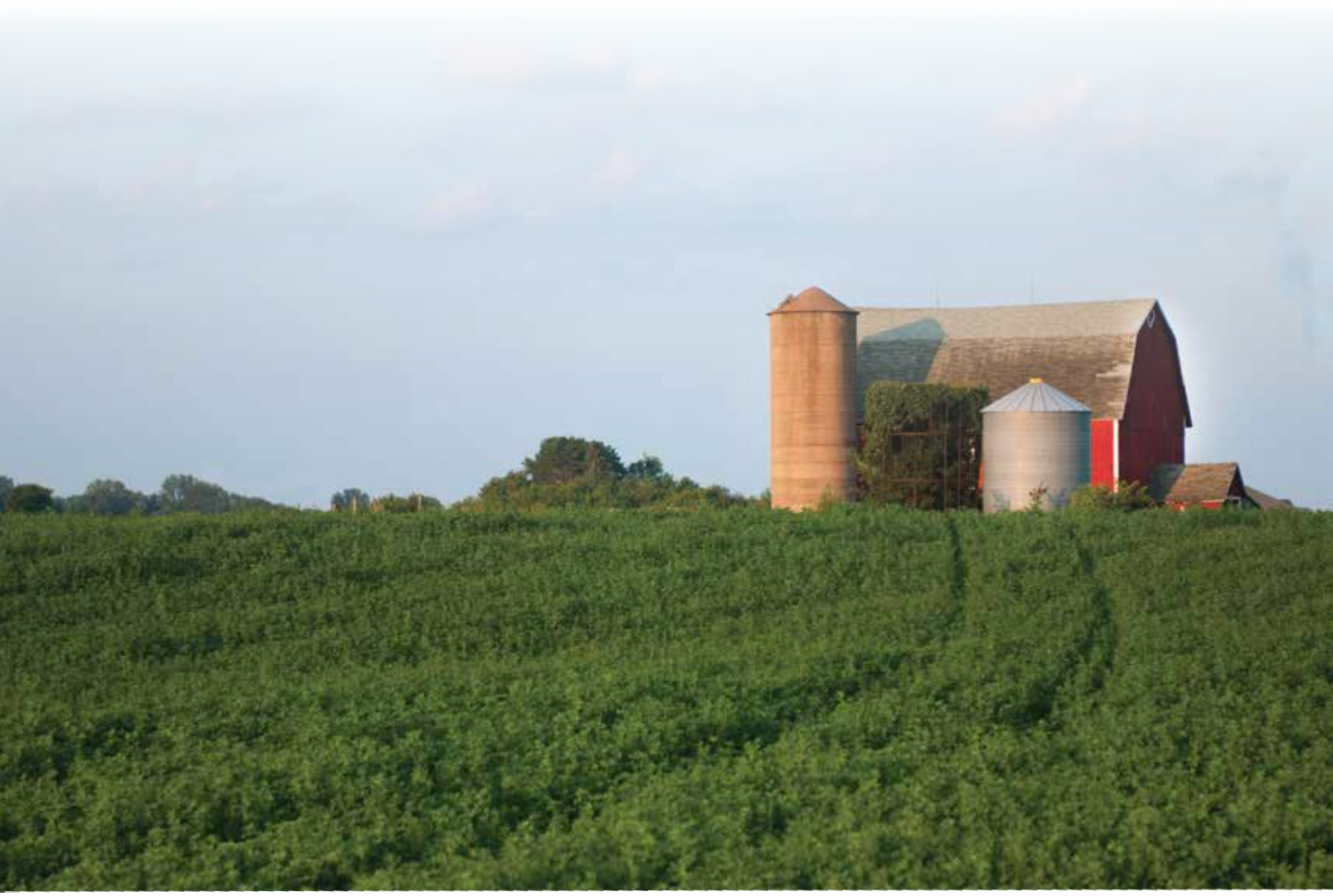
AGRICULTURE - MANURE MANAGEMENT

11400 Technical Essays and Testimonials



For more information on MICROBE-LIFT® Technology contact

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Three Brothers Farms L.L.C. Testimonial

Three Brothers farm
626 190th Street
Ogden, Iowa 50212

My name is Ben Hollingshead;

I am a Co-owner of Three Brothers Farms L.L.C. We operate a 4800 head wean to finish hog barn for Cargill Pork in central Iowa.

MICROBE-LIFT/HOG & MICROBE-LIFT/SA manure treatment

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 and 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 the aerobic and facultative bacteria that are critical for the health of the ENTIRE pit.

When we started we used their purge application to jump start our imbalanced pit. Within a few weeks of the application we noticed a difference in the appearance and smell of our pits.

However the true deal maker was when we pumped the pits in the spring after 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.

Sincerely
Ben Hollingshead
Three Brothers Farms L.L.C.

For more information on MICROBE-LIFT® Technology contact
Ecological Laboratories Inc.
www.EcologicalLabs.com
T11401

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MICROBE-LIFT® Products & McClellan Farms Inc. Testimonial

August 14, 2011
To: Douglas Dent
Ecological Laboratories, Inc.

MICROBE-LIFT Products & McClellan Farms Inc

I just wanted to follow up with you about the conversation we had a few weeks ago regarding the use of the MICROBE-LIFT bacteria products that I have been using for several years now (about 5 years now).

To refresh your memory, I use a combination of the regular MICROBE-LIFT/HOG bacteria as well as the MICROBE-LIFT/SA (Sludge Away) products in the facilities I own and operate with my family.

McClellan Farms Inc. consists of two 2100-head finishing operations and one 8800-head nursery operation here in Bradford County Pennsylvania. The three buildings combined give us close to 2.5 million gallons of manure to manage each year.

Odor reduction in barn and field: I believe the reason we got started on the MICROBE-LIFT product was the potential to reduce odor from manure applied to the land, as well as the possible reduction of gases being exhausted from ventilation fans. Like anything else I wasn't sure what to expect from the product, especially because of the relative lower cost than other products on the market claiming to do the same, but cost much more money! Well Doug, not only have we noticed a major improvement in the odor reduction from the manure we land apply, I truly feel 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 that 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!

Manure quality and fertilizer value: As I stated, when we began the MICROBE-LIFT program the reduction of odors were the main focus. But I have been extremely pleased to report that reducing the odor has only been a small piece of the positive experiences we have had using the product. Other positive results have been the consistent flow of manure from the first load to the last load hauled. The consistent flow is very important for several reasons as follows. If your flow is consistent through the pump to the tank then your manure content is very liquefied. If your manure is liquefied then your manure storage space is being completely utilized in an efficient capacity.

Liquefied manure also translates into the elimination of the nasty crust on the top of your manure level that is an open door for pests to run on and those horrible insects to nest and multiply!

The only drawback 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 due to a better liquid consistency. The more consistent manure will also allow a farmer 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 do believe that I could go on about how pleased I am with your product and how I truly believe that it has also had a positive effect on the overall production of the pigs we are responsible for growing for CVFF but that may start to bore you or others who may read this?

The bottom line is this. The MICROBE-LIFT product has the ingredients to positively effect the manure management of a facility. But, like anything else we do if you don't follow the program set up for your facility you probably won't get the results you should, or shall I say that your pigs and your help, and your neighbors, and your crops deserve!

I firmly believe that since I have started using the MICROBE-LIFT product that it has allowed me to create a much more positive atmosphere for anyone/thing involved directly or indirectly with our facilities. I would be glad to answer any questions or share any information that anyone may have regarding this product.

Thanks Doug for sharing your knowledge with me and getting me involved with your Microbe-Lift product!

Sincerely,

Matthew L. McClellan

For more information on MICROBE-LIFT® Technology contact
Ecological Laboratories Inc.
www.EcologicalLabs.com
T11402

Swartz Family Farm L.L.C. MICROBE-LIFT®/HOG Testimonial

Delbert & Deron Swartz

115 Delmar Lane
Thompsontown, PA 17094
717-463-4097- Fax
717-463-3466- Home
717-363-6844- Delbert cell

August 15, 2011

Swartz Family Farm is located near Thompsontown, Pa. 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 800,000 gallons.

MICROBE-LIFT/HOG

We have used Microbe-Lift Hog for approximately 9 to 10 years.

Prior to the product's use we had surface crusting which resulted in a fly problem. We have seen improvement in less crusting and lower fly population which results in better herd health with 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 we believe there is much less odor in the barn, but have 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 the product use in the pit results in better nitrogen utilization by the crops.

I have heard other producers say it is just another expense in these challenging times but I believe it is a good tool in the overall management of the barn. I would recommend MICROBE-LIFT/ HOG to other farmers.

Delbert Swartz

For more information on MICROBE-LIFT® Technology contact
Ecological Laboratories Inc.
www.EcologicalLabs.com
T11403

AQUACULTURE

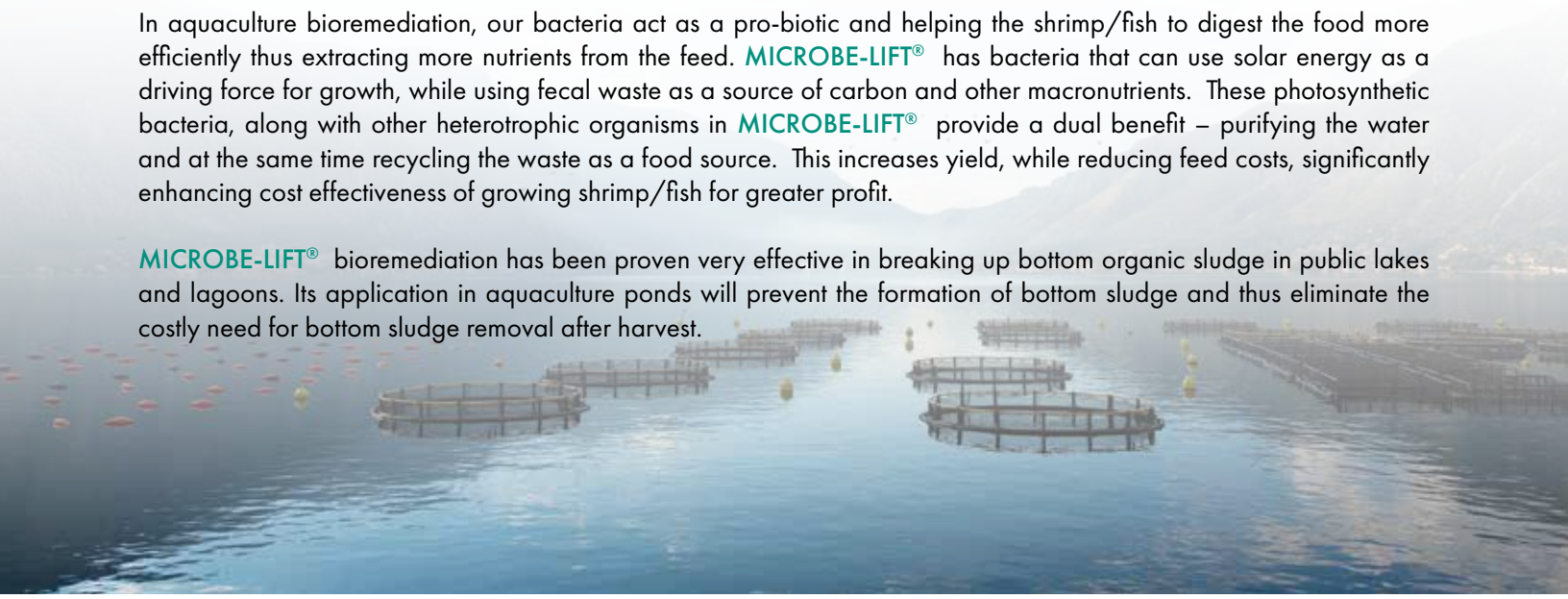
Ecological Laboratories' dedication is to solve environmental problems in a way that is compatible with natural processes and does not damage the environment in other ways. Ecological Laboratories' MICROBE-LIFT® line of products represents the most environmentally compatible approach to handling common aquaculture problems. The reason for this is simple. All waste, particularly organic waste, must be recycled in nature in some way to continually replenish the critical building blocks of life. In nature, waste is re-cycled by bacteria, and fungi. Ecological Laboratories' MICROBE-LIFT® formulations are bacterial products, some of which may also contain enzymes and/or vital nutrients to accelerate this natural process. The products contain nothing that is harmful to man, wildlife, aquatic life or the environment.

Shrimp and/or fish fecal matter, as well as leftover feed, pollutes the pond water, contributing to high nitrate and organic waste. The polluted water results in hyper-eutrophication with large quantities of decaying dead algae and organic waste from fish and/or shrimp excretion creating a layer of organic waste known as bottom sludge. The pond's ecological balance will be significantly stressed when the sludge builds up reducing the water volume. This is very critical for shrimp culture, as bottom sludge can shorten the effective grow-out period from 6 to 4 months, resulting in very small shrimp at harvest. Many shrimp ponds are experiencing extremely high mortality beyond 4 months due to the accumulation of bottom sludge. As an example, Tiger prawns only grow to about 12 grams in size when harvested at 4 months, but can increase to 35 grams when harvested at 6 months, which then commands more than two times the market price for these larger prawns.

MICROBE-LIFT® contains a full spectrum of bacteria, including aerobic, facultative, anaerobic, chemotropic and photosynthetic species. The micro-organisms in MICROBE-LIFT® are non-toxic and non-pathogenic, safe and non-harmful to humans, animals, plants and all types of AQUACULTURE.

In aquaculture bioremediation, our bacteria act as a pro-biotic and helping the shrimp/fish to digest the food more efficiently thus extracting more nutrients from the feed. MICROBE-LIFT® has bacteria that can use solar energy as a driving force for growth, while using fecal waste as a source of carbon and other macronutrients. These photosynthetic bacteria, along with other heterotrophic organisms in MICROBE-LIFT® provide a dual benefit – purifying the water and at the same time recycling the waste as a food source. This increases yield, while reducing feed costs, significantly enhancing cost effectiveness of growing shrimp/fish for greater profit.

MICROBE-LIFT® bioremediation has been proven very effective in breaking up bottom organic sludge in public lakes and lagoons. Its application in aquaculture ponds will prevent the formation of bottom sludge and thus eliminate the costly need for bottom sludge removal after harvest.



For more information on MICROBE-LIFT® Technology contact
Ecological Laboratories Inc.
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CS12000

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AQUACULTURE - FARMING

12100 AQUACULTURE FARMING

For more information on MICROBE-LIFT® Technology contact

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Determining The Performance Of Microbe-Lift® In Shrimp Aquaculture In India

ECOLOGICAL ASIA

INTRODUCTION

High density commercial aquaculture farming of Tiger Prawn, pacific white prawn (Vannami), Tilapia or Basa Shrimp and/or fish fecal matter, as well as leftover feed, pollutes the water in Aquaculture ponds, contributing to high nitrate and organic waste. The polluted water results in hypereutrophication with large quantities of decaying dead algae and organic waste from fish and/or shrimp excretion creating a thick layer of organic waste known as bottom sludge. The pond's ecological balance will be significantly disturbed when the sludge builds up reducing the water volume. This is very critical for shrimp culture, as bottom sludge can shorten the effective grow-out period, resulting in very small size shrimp at harvest. The formation of sludge can also end up in disease for the shrimps thus losing the entire harvest at times. Many shrimp ponds are experiencing extremely high mortality beyond 4 months due to the accumulation of bottom sludge. As an example, Tiger prawns only grow to about 12 to 15 grams in size when harvested at 4 months, but can increase to 30 to 35 grams when harvested at 6 months, which then commands a premium price which can be even more than two times the market price.

M/s EnviroAquaria International, the Exclusive India Distributor of **Ecological Laboratories Inc**, USA ,in collaboration with Dr Manoj Sharma of Mayank Aquaculture Private Limited conducted a pilot trial in their Aquaculture farm at Surat in Gujarat State, India during the period April to August 2013 using MICROBE-LIFT® technology, a worldwide used and time tested product for Aquaculture, a product of **Ecological Laboratories Inc**, USA, which is a consortium of microbes for Pond treatment.

OBJECTIVES

The Shrimp Farms in Surat had been using locally cultured probiotics (Bacteria) for pond treatment in their Aquaculture ponds and had been achieving satisfactory performance in water quality and shrimp yield as informed by Dr Manoj Sharma. However these probiotics/bacteria are not capable of eliminating/reducing sludge formation, a major issue faced by the farmers after the harvesting since the sludge is to be removed mechanically, which involves huge expenditure apart from the time required in doing the same and the delay in starting the next farming/crop.

MICROBE-LIFT® technology is a consortium of microbes unlike the locally available Probiotics which contains only few beneficial bacteria. Hence the local product is having a lower price in comparison to MICROBE-LIFT® the price of which perhaps may be felt costly to use.

Determining the Performance of Microbe-Lift® in Shrimp Aquaculture in India

The main objective of the trial was to establish the commercial benefits in using MICROBE-LIFT® which not only gives higher yields but also helps in achieving better size of the shrimp which are in greater demand for export. While using MICROBE-LIFT® , sludge formation is nil or negligibly small and hence there is no need of removing the sludge after the harvest to make the pond ready for the next season. This reduces the additional and unwanted expenditure and also saves time. The consortium of bacteria in MICROBE-LIFT® technology not only takes care of the advantages as mentioned above but also avoids the possibilities of disease and mortality. It also permits for higher stocking of the shrimp. Thus, by using MICROBE-LIFT®, the farmer gains in multiple folds and the cost of the material becomes negligibly small in comparison.

Key objective of the trial was to evaluate the effectiveness of MICROBE-LIFT® in the following segments.

- Maintaining the ecological balance of your ponds by reducing organic waste and eliminating bottom sludge
- Reducing pathogenic bacteria and diseases through Pro-Biotic effect
- Increasing growth rate & reducing mortality
- Achieving larger prawn at harvest, commanding much higher market price
- Allowing for a higher density and lower mortality resulting in higher yield
- Reducing feed conversion ratio (FCR)- saving on feed cost
- Reducing the rate of water changes- providing for a clean environment
- Eliminating bad odor in the water, avoiding a soil smell in fish and prawns

ABOUT MICROBE-LIFT® technology

MICROBE-LIFT® formulation contains a full consortium of bacteria, including aerobic, facultative, anaerobic, chemotropic and photosynthetic species. The micro-organisms in MICROBE-LIFT® are non-toxic and non-pathogenic, safe and non-harmful to humans, animals, plants and all types of aqua culture.

MICROBE-LIFT® is made up of various types of bacterial species that have been cultivated for compatibility, reproduction and synergistic growth, delivered in an active adult state. These are natural and not genetically modified. When MICROBE-LIFT® is added to a polluted area, the bacteria immediately revive themselves and begin to feed on the organic waste. In aquaculture bioremediation, MICROBE-LIFT® act as a pro-biotic and helping the shrimp/fish to digest the food more efficiently thus extracting more nutrients from the feed. These photosynthetic bacteria, along with other heterotrophic organisms in MICROBE-LIFT® results in the following:

1. Purifying the water and at the same time recycling the waste as a food source.
2. Increasing the yield while reducing feed costs, thus significantly enhancing the cost effectiveness of growing shrimp/fish resulting in greater profit.
3. Maintaining the required bloom of water favourable for the fishes to grow.
4. Elimination of algae formation.
5. Elimination of sludge formation.

Dr Manoj Sharma & Mr NK Menon at farm site

TRIAL PROCEDURE

Two tiger prawn ponds and four vannamei shrimp ponds were treated with MICROBE-LIFT® from April to July 2013 based on the manufacturer's dosing recommendation. Two of the vannamei ponds were with more stocking than the farm's standard practice of about 100,000 stocking per pond for a hectare size with a water depth of 1.5 mts. The remaining non-treated pond serves as control during the trial. Comparisons were made with the performance as per past farming/harvest treatment.

The standard parameters such as NH_3, pH, DO, salinity, water colour and soil quality were regularly checked and measured as per farm standard.

Manufacturer's dosing recommendation for a 1 hectare pond is as follows:-

Week No.	Dosing	Remarks
2 or 3	1 gallon	Avoid dosing in wk 1
4 to 10	0.75 gal / wks	May do 0.5 gallon per week
12 to 20	1.5 gal /2 wks	May do 1 gallon per 2 week

TRIAL RESULTS

The actual dosing and various parameter measurements for the 6 ponds are tabulated in appendix 1.
The shrimp harvest was done from 1st week of Aug 2013 onwards.
The water quality of both Vannami and Tiger ponds were found to be of good quality. The sludge formation was nil/negligible.
Dr Sharma is extremely happy with the trial results. All the time he was perhaps under the impression that it is yet another probiotic. However the results from the trial ponds compelled him to conclude that MICROBE-LIFT® is not yet another simple probiotic. The results according to Dr Manoj Sharma are praiseworthy with respect to the following:

1) Yield is very good.
2) No increase in mortality despite more stocking density.
3) There is no sludge at all
4) Absolutely no smell from the pond after draining the entire water while harvesting.
5) Above all the size of the shrimp is very big, both Vannamie and Tiger. (32 gms and above per shrimp)
6) The taste of the shrimp is very good.
7) The colour of the Vannami shrimps are found to golden brown, which otherwise is more or less white in colour.

Mr Menon of EnviroAquaria at the farm during harvest

Tiger prawn at harvest

Vannamei Shrimp at harvest

Determining the Performance of Microbe-Lift® in Shrimp Aquaculture in India

Trial pond

Control Pond

Sludge after harvest in all control ponds

Trial pond after harvest – no sludge

Bottom of treated pond – No sludge

Several farmers whose stock density varies from 30 to 50 per sq m is now using MICROBE-LIFT® and found the product is very exceptional in performance.

Note:-
This trial was conducted at Dr Sharmar's farm where stock density is relatively low compare to other Asian countries. A product launch at Surat was carried out where more than 150 shrimp farmers attended.

For more information on MICROBE-LIFT® Technology contact

Ecological Laboratories Inc.
www.EcologicalLabs.com
CS12101

MICROBE-LIFT® Technology Helps Maintain High Quality Water in Prawn Hatchery in Malaysia

Location: **Fajar Prawn Hatchery, Manjung, Perak State, Malaysia**

Background: Fajar Prawn Hatchery is a 20-tank fry hatchery, which is located in the middle of Manjung District, Perak State, Malaysia. Since 2000, they hatch only White Shrimp fry. The hatchery operator Mr. Tan Kim Bak said he buys the Nauplius (see figure 2) from another company and hatches to post larvae stage and then sells to shrimp farmers.

Mr. Tan Kim Bak had been using a competitive aquaculture bacterial product for the shrimp hatchery, specifically Bacillus Plus II from Thailand. After he was approached by an international partner of Ecological Laboratories Inc., he agreed to run a comparative test between MICROBE-LIFT® technology and the competitive product.

Objective: The objective was to maintain cleaner water for healthier fry for improved growth and subsequent transfer and restocking.

Fig. 1: *Shows the facility and typical fry tank.*

Application:

MICROBE-LIFT® Formulation	
Inoculation	25ml for 4500 liter of water
2nd dosing : (7 days):	25ml for 9000 liter of water
TOTAL:	**50 ml of MICROBE-LIFT® Formulation**

BACILLUS PLUS II	
Inoculation	2 g for 9000 liter of water
2nd application (3 days):	2 g for 9000 liter of water
3rd application (3 days):	2 g for 9000 liter of water
4th application (3 days):	2 g for 9000 liter of water
5th application (3 days):	2 g for 9000 liter of water
TOTAL:	**10 g of Bacillus Plus II**

Fig. 2: *Products were applied according to manufacturer's dosage recommendation.*

Two tanks were each inoculated with 1.5 million Nauplius (shrimp larvae) on 20th March 2.

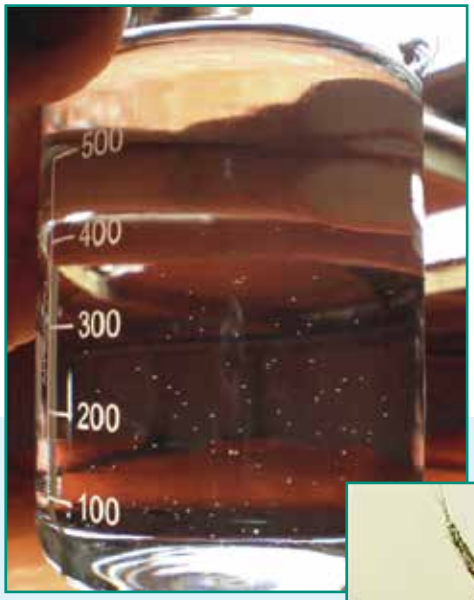
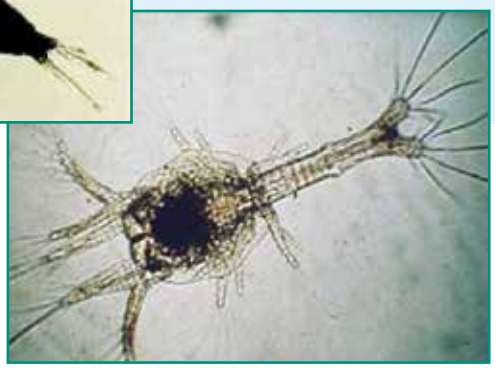


Fig. 3: *The sample shown on the left is a sample of the tank 2 hours after seeding with Nauplius, before the addition of MICROBE-LIFT® Formulation or the competitive product.*

Fig. 4: *The picture below (left) is a close up of a Nauplius under the microscope.*

Fig. 5: *Below right is a picture of the zoeal stage.*



The water remains very clear in appearance initially and after the inoculation with Nauplius.

As the larvae start to eat and grow and produce different larval stages the water will become cloudy and waste will start to settle. In the zoeal stages, swimming is accomplished with the first and second antennae, as in the naupliar stage, but these are now aided by the well-developed first and second maxillipeds. The swimming stroke is slower than that of the nauplii, the movement appears less jerky.

Characteristic of the zoeae is their continuous feeding. The culturist can judge how well the zoeae are feeding by the contractions of the digestive tract and the presence of a long trail of feces. Active feeding and a continued prompt response to a light source are indications of healthy zoeae. Towards the end of the last zoeal substage, the body becomes slightly flexed.

Fig.6: *Before first dosing culture had developed some cloudiness.*

Two tanks were each inoculated with 1.5 million Nauplius (shrimp larvae) on 20th March 2. The picture above shows the protozoeal after four days of growth with much cloudier water. The first dose of MICROBE-LIFT® Formulation (25 mls for 4500-liter hatchery tank) is added on 24 March 2009 according to manufacturer's recommendation. The competitive product is not added to its test tank for another 3 days on 27 March.

Fig. 7: *At the second dosing the larvae are at the mysis stage and the water is starting to clear.*

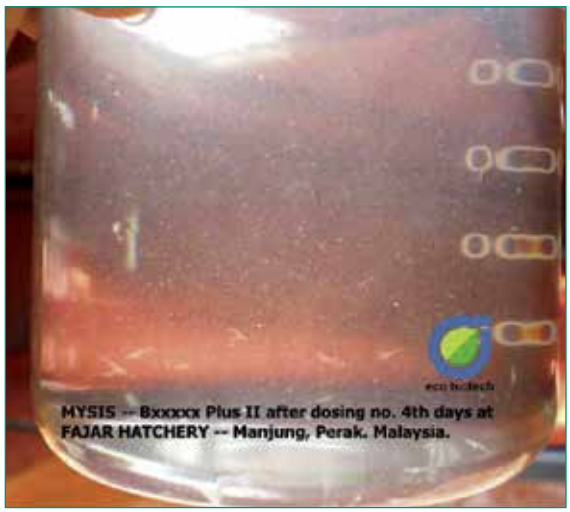


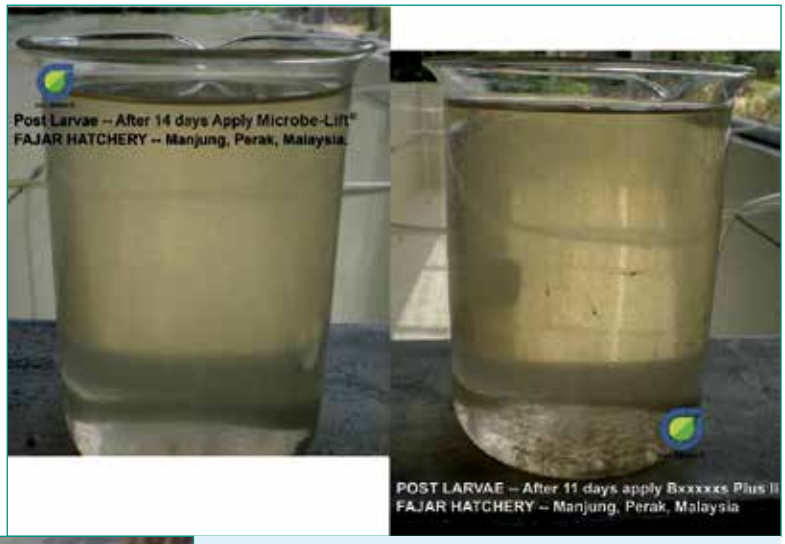
Fig. 8: *Water from competitive product tank shows turbidity & particulates.*

The picture at left shows the competitive tank sample, which is much more turbid four days after dosing.

At **Day 14** with the competitive product there is substantially more particulate suspended material and increased build-up fecal solids (dropped to the bottom in this sample) indicating poor degradation of excess food and waste.

At **Day 17** the MICROBE-LIFT® Formulation sample remains clearer than the competitive sample indicating cleaner water and a better environment for larvae development. There were also more larvae in the tank treated with the MICROBE-LIFT® Formulation.

Mr. Tan Kim Bak was pleased with the results preferring to use the Formulation.



He was also pleased that, based on past results Ecological Laboratories, Inc. has experienced, his larvae will show improved viability when shipped and transplanted to new tanks.

For more information on MICROBE-LIFT® Technology contact

Ecological Laboratories Inc.

www.EcologicalLabs.com

CS 12103

MICROBE-LIFT® Technology Increases Yield & Size of Shrimp

Location: **Mississippi Gulf Coast, Community College**

Background:

The increase in popularity of freshwater shrimp (Macrobrachium Rosenbergii) production has prompted researchers to develop better and more efficient production methods. The current production methods are sufficient to justify the growing of freshwater shrimp. However, to stay competitive long term in the market place, producers will have to increase yields and reduce costs. The small and medium size growers cannot compete with current production costs. Globalization will continue to put downward pressure on market prices, so production costs must be reduced and efficiency improved in order for the farmer to maintain profitability.

The aquaculture instructors at Mississippi Gulf Coast Community College in Southeastern United States found that products used in aquaculture applications for improved water quality also may increase growth and survival of shrimp.

Objective:

Through an agreement with Global Seafood Technology's Aquaculture Department, Ecological Laboratories for MICROBE-LIFT® technology, and Mississippi Gulf Coast Community College Aquaculture Department, a decision was made to evaluate the microbial product in the production of Macrobrachium rosenbergii. The microbial product MICROBE-LIFT® Formulation was used.

Global Seafood Technology supplied juvenile shrimp to stock two ponds for the study, Ecological Laboratories, Inc. supplied the product MICROBE-LIFT® to be used in one pond, and Mississippi Gulf Coast Community College Aquaculture Department supplied the ponds, feed, and labor.

The purpose of the study was to see if shrimp production could be improved using the MICROBE-LIFT® Formulation. Two ponds were used in the study and both ponds were stocked with juvenile freshwater shrimp. One pond was treated with MICROBE-LIFT® Formulation in accordance with the manufacturer's recommendations, while a second pond was kept as a control. Dissolved oxygen and temperature were measured once per day, and pH, alkalinity and hardness were measured once per week using industry standard methods. Shrimp were sampled periodically by seine and feed rates were adjusted using sample results. Both ponds received continuous aeration using Aerolator brand surface aerators and were stopped only when students entered the ponds for sampling.

MICROBE-LIFT® Technology Increases Yield & Size of Shrimp

Stocking:

Two 0.10-acre (0.04 hectare) ponds (MGCCC #4 and #5) were stocked with juvenile prawns (Macrobrachiun rosenbergii) on June 21, 2001. Prawns with an average weight of .10 grams were stocked at a rate of 2,150 per pond (21,500 per acre). Pond #4 received MICROBE-LIFT® treatment, and Pond #5 did not. Each pond had a volume of 142,718 gallons (539,474 liters).

Feeding:

Feeding began in both ponds on June 24, 2001, three days after stocking. Both ponds were fed #2 Rangen Trout Starter at a rate of 1 lb. (0.45 kg) per pond every other day. This feed rate was chosen not only to feed the shrimp but to also build up a food base for the MICROBE-LIFT® bacteria that were to be introduced into pond #4. On July 4, 2001, feed type was changed to Burris Shrimp Crumbles, and the feed rate was changed to 1 lb. per day. The feed rate was changed again on August 20, 2001 based on shrimp samples. Pond #4 was fed 2.7 lbs. (1.22 kg) of Burris Shrimp Crumbles per day, and Pond #5 was fed 3.1 lbs. (1.41 kg) of Burris Shrimp Crumbles per day. Feed rates were determined by utilizing "Freshwater Prawns Pond Production & Grow Out" from Mississippi State University. Feeding was done daily except in a few instances when the weather made feeding dangerous. Half feed rates were fed on 8/23/01, 9/4/01 and 9/2/01 due to heavy rains and thunderstorms and neither pond was fed on 9/1/01 and 9/2/01 due to loss of electrical power to the aerators. Dissolved oxygen did not reach dangerous levels, and no shrimp losses were observed. On August 24, 2001 feed type was changed to Burris Shrimp Grow-out Pellets but feeding continued at the same rate. The feed rate was changed to 4.5 lbs. (2.04 kg) per day in Pond #5 and 3.6 lbs. (1.63 kg) per day in Pond #4 on September 13, 2001 and continued at this rate until harvest. Feeding was discontinued two days prior to harvest.

Water Quality:

Aerators were operated continuously to prevent dissolved oxygen problems. The aeration also helped distribute and suspend microbes and organic material. The aerators were turned off briefly for shrimp sampling and other work details around the ponds. As noted above, aerators were off for two days, 9/01/01 and 9/02/021 due to electrical problems. Aerators were off briefly in Pond #4 on 9/27/01 and 9/30/01 due to electrical problems, but these were quickly remedied. Dissolved oxygen and temperature readings were taken every day in both ponds. Pond #4 had average dissolved oxygen of 8.53 for the growing season. The lowest dissolved oxygen was 5.41 and the highest dissolved oxygen of the growing season was 13.59. The average temperature for the growing season in pond #4 was 28.10º Celsius. The lowest temperature was 20.6º Celsius, and the highest was 32.9º Celsius. Pond #5 had average dissolved oxygen of 7.94 for the growing season. The lowest dissolved oxygen was 3.96, and the highest was 13.60. The average temperature for the growing season in pond #5 was 27.55º Celsius. The lowest temperature recorded was 20.4º Celsius, and the highest was 32.4º Celsius. The growing season for the shrimp was from 6/21/01 to 10/23/01 for a total of 125 days.

Alkalinity, pH and hardness were measured once per week. The average pH reading for pond #4 was 7.84, and pond #5 had an average pH reading of 7.89. There was no problem with alkalinity or hardness in either pond. The average alkalinity for pond #4 was 91.28 and for pond #5 was 74.14. Pond #4 had an average hardness of 9.57, and pond #5 had 10.07.

The water quality parameters that were observed during this grow-out period are typical for south Mississippi.

The first cold front of the season came through on September 24, 2001. At this time, both ponds were flushed with warm (33º Celsius) well water whenever pond temperature reached 20º Celsius or lower. This was done to both to extend the growing season and to pick a scheduled time for the shrimp harvest.

MICROBE-LIFT® Technology Increases Yield & Size of Shrimp

MICROBE-LIFT® Technology

MICROBE-LIFT® is a bio-augmentation liquid product that is produced by **Ecological Laboratories Inc**. The product is used to help with water quality problems. This purpose of this trial was to determine if the product would improve water quality and produce an alternative food source for pond raised freshwater shrimp.

Pond #4 was treated with MICROBE-LIFT® at the manufacturers recommended rates. Treatment took place 26 days after stocking and 22 days after first feeding. MICROBE-LIFT® was applied to the pond by spreading i t over as much of the surface as possible. On June 16, 2001, 3.5 gallons (13.23 liters) of MICROBE-LIFT® were added to pond #4. Subsequently, 1 gallon (3.78 liters) of MICROBE-LIFT® was applied to pond #4 on 6/24/01, 6/31/01, 7/8/01 and 7/15/01. On 9/14/01 the amount was reduced to 1 quart (0.94 liters).

Results achieved:

Both ponds were first seined for a partial harvest and then were pumped down and hand harvested to completion.

Pond #5 was pumped down half way and then seined during the day. That evening the pond was pumped down the rest of the way and hand harvested. A representative sample of shrimp was counted and weighed to determine the average individual shrimp weight. The sample had a total count of 389 and weighed 19.3 lbs. (8.75 kg), which calculates to .049 lb. (0.022 kg) weight per shrimp. It was determined that the shrimp harvested were 20 count (20 shrimp per pound). The total harvest weight from pond #5 was 101.07 lbs. (45.85 kg), and the survival rate was 94%.

Pond #4 was harvested in the same matter. The pond was pumped down half way and seined and then pumped down the rest of the way and hand harvested. A representative sample of 317 shrimp was collected. The weight of the 317 shrimp was 19.28 lbs. (8.75 kg) producing an average shrimp weight of .06 lbs. (0.027 kg) or 16 count (16 shrimp per pound). The total harvest weight from pond #4 was 118.14 lbs. (53.59 kg), and the survival rate for the pond was 91.5%.

Conclusion:

Water quality parameters were monitored to assure average or better than average water quality. Pond #4 had average dissolved oxygen of 8.53, average temperature of 28.10º Celsius, average pH of 7.84, average alkalinity of 91.28 and an average hardness of 9.57. Pond #5 had average dissolved oxygen of 7.94, average temperature of 27.55º Celsius, average pH of 7.89, average alkalinity of 74.14 and an average hardness of 10.07. These water quality parameters are typical for aquaculture ponds in South Mississippi.

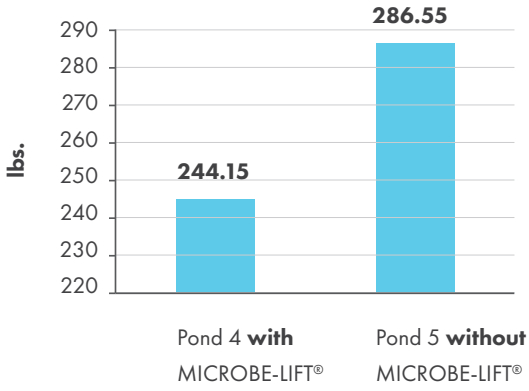
MICROBE-LIFT® Formulation was added only to pond #4. A total of 5.75 gallons (21.74 liters) of MICROBE-LIFT® were used. This was the manufacturer's recommended rate to inoculate the estimated 142,718 gallons (539,474 liters) of water contained in pond #4. Pond #5 was harvested 125 days after stocking, and the shrimp that were harvested were 20 count. The total weight harvested out of the 0.10-acre pond was 101.07 lbs. (45.85 kg), which equates to 1010.7 lbs. (450.85 kg) per acre, and the survival rate was 94%. Pond #4 was harvested 126

days after stocking, and the shrimp from pond #4 were larger at 16 count. Total harvest from pond #4 was 118.14 lbs. (53.59 kg), which equates to 1181.4 lbs. (535.90 kg) per acre, and the survival rate was 91.5%. Pond #4, which was treated with MICROBE-LIFT®, had a survival rate of 2.5% less than pond #5 but produced 17.07 lbs. (7.74 kg) which equates to 170.7 lbs. (77.40 kg) per acre more than pond #5 on 42.4 lbs. (19.23 kg) which equates to 424 lbs. (192.30 kg) per acre less feed. The feed conversion for shrimp in pond #4 was 2.06 to 1 and 2.8 to 1 in pond #5.

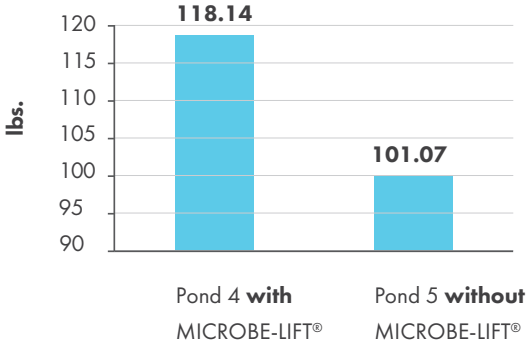
The results of this study strongly indicate that MICROBE-LIFT® may increase total production and average size of pond-raised shrimp while improving feed conversion and reducing production costs.

Further research by a research institution would be justified by the results of this study.

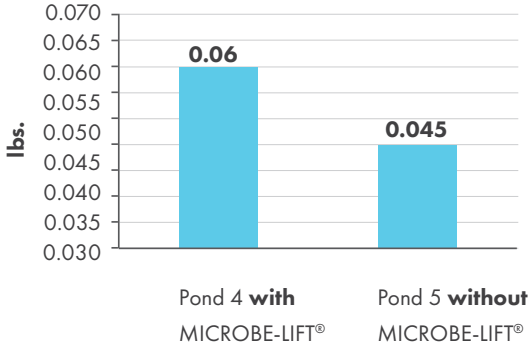
Total Feed Consumption



Total Shrimp Production



Average Weight of Shrimp



Benefits of MICROBE-LIFT®

Total Shrimp Production	+17.4%
Total Feed Consumption	-14.4%
Total Weight of Shrimp	+22.4%

For more information on MICROBE-LIFT® Technology contact

Ecological Laboratories Inc.
www.EcologicalLabs.com

CS12104

12200 OTHER AQUACULTURE

12202 MICROBE-LIFT® Increases Sea Bass Hatchery Fry Survival Providing 100% Increase in Yield

12202 MICROBE-LIFT® Technology Increases Survival of Ornamental Fish During Shipping and Transfer

For more information on MICROBE-LIFT® Technology contact

Ecological Laboratories Inc.
www.EcologicalLabs.com

MICROBE-LIFT® Increases Sea Bass Hatchery Fry Survival Providing 100% Increase in Yield

Location: **Marine Life Aquaculture Farm, Singapore**

Background:

Marine Life Aquaculture Pte. Ltd. (MLA) is a high tech food fish hatchery located in Pasir Ris, Singapore. The company's core business consists of the hatching and breeding of sea bass, thread fin, grouper, and other fish fry for commercial aquaculture farms in Singapore and surrounding countries.

Mr. Tan Kay Heok, the Chief Technical Officer of MLA has developed great expertise in the hatchery of commercial food fish. The farm has been using various innovative technologies to maintain food water quality in their hatchery tanks.

Objective:

Dr. Lim Lian Chuan, an expert in ornamental and food fish breeding and packing introduced MICROBE-LIFT® to MLA in December 2010 when they decided to test the technology in their sea bass tanks for potential improvement of yield and survival rate of fry.

Three 20 M3 breeding tanks (tank 1, 2 & 3) were each stocked with 200,000 AVA sea bass eggs on 6 Dec 2010 after the tanks had been cleaned and sterilized with Remedor Aquatic (RA) and UV light which is their normal process to prepare the environment prior to stocking.

During the breeding period a rotifer and artemia diet was fed to the fry in all three tanks. Tanks 2 & 3 were maintained using the bath system that included daily exchange of 30% of the culture water, replacing backwater and seawater. Tank 1 was maintained by dosing with MICROBE-LIFT® . Because the trial tanks did not have biofilters or other filter media the dosage applied was higher than the standard recommendation by the manufacturer, **Ecological Laboratories Inc.** In addition, due to lack of filtration in any of these tanks, the fish manure and food waste were regularly siphoned off manually.

MICROBE-LIFT® was added to tank as follows:

Dosage Schedule	Dosage
Day 1 (12/06/2010	100 ml
Day 2	200 ml
Day 3	300 ml
Day 4	400 ml
Day 5	500 ml
Day 6	500 ml
Day 7	400 ml
Day 8 to 11	no dosage
Day 12	500 ml
Day 13	400 ml
Day 14 (12/19/2010)	400 ml

Fig. 1: *Dosage rates considerably higher than standard dosage rates were required to compensate for lack of the normal filter system in these tanks. Normally, the filters provide a surface for substantial fixed film growth of these strains.*

MICROBE-LIFT® Increases Sea Bass Hatchery Fry Survival Providing 100% Increase in Yield

Results Achieved: During the trial, Mr. Tan found that ammonia levels in tank 1 were much lower compared to the control tanks while the water exhibited much higher DO levels when using MICROBE-LIFT®. As a result the water in tank 1 was less frequently changed and at a much lower volume compared to the control tanks. Despite the reduced frequency and volume of water changes, less sludge formed at the bottom of the tank reducing the need for siphoning tank 1.

Fig. 1: *Yield of fry per tank demonstrates 100% increase in yield in the* MICROBE-LIFT® *treated tank.*

The table below depicts the number of try transferred from the tanks to a nursery on day 17 (Dec 22, 2010). Using MICROBE-LIFT® has doubled the number of fry compared to the control tanks.

Trial Tanks	Number of Fry	Survival Rate
Tank 1	50,000	25%
Tank 2	25,000	12.5%
Tank 3	30,000	15%

Treatment with MICROBE-LIFT® increased the fry survival rate to double the yield of fry making it an excellent investment. In addition, since less water recycling was required less labor was required during the hatching process. Mr. Tan was so pleased with the results, that he incorporated the use of MICROBE-LIFT® in the standard operating procedure of the hatchery.

For more information on MICROBE-LIFT® Technology contact

Ecological Laboratories Inc.

www.EcologicalLabs.com

CS12201

MICROBE-LIFT® Technology Increases Survival of Ornamental Fish During Shipping and Transfer

Location: **Ecological-Asia, Singapore**

Background: Exporters and trans-shippers of ornamental fish have always faced the problem of maintaining fish health and well being as fish are shipped around the globe in plastic bags.

During transport, the water in these closed containers may become oxygen-depleted asphyxiating the fish or it may accumulate excessive carbon dioxide reducing pH to toxic levels. Metabolic activity may lead to elevated ammonia levels sufficient to damage or kill fish. As the containers become more densely packed in an effort to save shipping costs, the greater the risk of injury or mortality.

Fortunately, some products have been developed to help maintain a healthier aquatic environment during containment and transfer.

Objective: A study was conducted to test several products versus a non-treated control in an effort to validate a cost-effective solution to improve conditions for increased fish viability. MICROBE-LIFT® technology was tested against another leading product designated "Product K" and both were compared to a non-treated control.

MICROBE-LIFT®/Ammonia Remover contains a patented molecule ClorAm-X, previously found in Product K, which was commonly used by trans-shippers. MICROBE-LIFT®/Ammonia Remover is a non-toxic product that is able to remove ammonia, chorine, and chloramines from water in all types of fish and aquatic invertebrate cultures. This product can be used for the following applications:

- Condition new water for aquariums, tanks, ponds, and live haul containers.
- Condition water after or during water additions.
- To condition an aquarium for addition of new plants, invertebrates, fish or amphibians.
- Treatment of live haul containers for increased viability during shipment of fish, amphibians, or aquatic invertebrates.

MICROBE-LIFT®/Special Blend contains a mix of proprietary bacterial strains that help degrade organic waste, lower ammonia level, and biologically reduce nitrates, hence reducing the need for water changes in aquariums and transport containers. It allows new tanks to cycle immediately and is 100% chemical-free. Basically, it provides a complete, favorable ecosystem in a bottle.

This test was conducted on 25 April 2009 using four bags each containing 55 unpurged Dwarf Gouramis (Colisa lalia) in approximately 1.8 liters of water. The bags were treated as specified below, sealed, and kept at room temperature for 48 hours after which water samples were taken and compared.

Bag	Treatment	Dosage
#1	MICROBE-LIFT®/Ammonia Remover	1 ml
#2	MICROBE-LIFT®/Special Blend	1 ml
#3	Product K	1 ml
#4	No additive control	None

***Fig. 1**: Table above defines the treatments used.*

***Fig. 2**: Picture on left shows the preparation of test bags.*

Results Achieved:

In order to compare water quality, after 48 hours a sample was taken from each bag and examined. The sample from the control bag (#4) was very dark due to the feces of the unpurged fish. Fish activity in the control bag was very limited. The water quality in the bag treated with Product K (#3) was similar to the control. In both bags treated with MICROBE-LIFT® products (#1&2) the water was much cleaner with only traces of feces and there was significantly more fish activity compared to that in the other treatments. Unfortunately, due to equipment malfunction it was not possible to get ammonia assays. (See pictures below).

***Fig. 3:** Samples of water at 48 hours shows very dark, feces contaminated water in the control (far left), and dark water in the PK treated product (middle left), while the ML treated samples are much cleaner.*

After taking the water samples, the fish were transferred to tanks with fresh water. The fish in ML treated bags resumed normal activity quickly while the fish in the PK treated bag required an additional 8 hours to regain full activity. The fish from the control bag failed to fully reactivate with most fish remaining on the surface gasping for air or at the bottom of the tank with little activity.

Fig. 4: *When fish were transferred to fresh water, the ML treated fish in the two tanks on the left were more active and ready to eat. Those in the Product K treated tank (middle right) recovered after an additional 8 hours but those from the control bag showed toxicity and died within 72 hours.*

The fish in the tanks were fed at 53 hours. The ML treated fish started feeding immediately while the Product K treated fish started feeding about 30 minutes later. The control fish did not feed. At 72 hours the fish were examined again. All the fish in the control tank had died while those in the other tanks remained active, with no signs of stress, and they were feeding normally.

The tanks were then checked for mortality data. The ML treated tanks again fared best with significantly increased survival rates. The PK-treated fish showed a mortality rate of 7% which is higher than the 0-2% mortality for ML treated fish but much better than the 100% mortality of the control.

Additive	Dead/Total	% Mortality
MICROBE-LIFT®/Ammonia Remover	1/55	2%
MICROBE-LIFT®/Special Blend	0/55	0%
Product K	4/55	7%
No additive control	55/55	100%

Fig. 5: *After 72 hours all control fish were dead indicating that it is necessary to use a water conditioner when shipping live fish.* MICROBE-LIFT® *provided superior results to Product K.*

This test indicated that, above all, it is necessary to use a water conditioner to sustain viability when shipping live fish. MICROBE-LIFT®/Special Blend and MICROBE-LIFT®/Ammonia Remover were both superior to Product K in maintaining water quality and associated fish viability. The water was obviously cleaner in both the bags treated with MICROBE-LIFT® products while the water in the Product K treated bag appeared more similar to the control.

While the fish from the bag treated with Product K eventually recovered when they were released from the bag into fresh water, they were sluggish and did not respond to food immediately as did the fish in the bags treated with the MICROBE-LIFT®/Special Blend and MICROBE-LIFT®/Ammonia Remover. Both the MICROBE-LIFT®/Special Blend and MICROBE-LIFT®/Ammonia Remover treated fish were much healthier as evidenced by their continual activity and, unlike the Product K treated fish, they showed willingness to eat as soon as they were transferred to clean water.

All fish in the control appeared to die of ammonia poisoning. This test should be repeated to accurately test the ammonia level.

For more information on MICROBE-LIFT® Technology contact

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CS12202

12300 PUBLICATIONS

12301 Determining the Effects of Bioaugmentation in Yield and Feed Consumption in Freshwater Shrimp

Determining the Effects of Bioaugmentation in Yield and Feed Consumption in Freshwater Shrimp

Abstract

Based on qualitative studies performed in Taiwan that demonstrated increased yield by weight of Tiger prawns grown in commercial shrimp ponds to which a bioaugmentation product had been added, a quantitative study was undertaken to determine statistically the improved yield, if any, on Macrobrachium rosenbergii. Feed was also monitored to determine biomass conversion efficiencies.

On June 21, 2001 two 1/10 acre ponds were each stocked with 2,150 freshwater shrimp with an average weight of 0.10 gram. Each pond had an estimated volume of 142,718 gallons. The shrimp were fed a manufactured high protein trout diet of 5 lbs. for the first ten (10) days and then switched to a manufactured shrimp diet for the rest of the grow-out season. Pond #4 was fed a total of 244.15 lbs. of feed, while pond #5 was fed a total of 286.55 lbs. of feed. A commercially available bacterial formulation was added only to pond #4 to treat the water and see if it could act as an alternative natural source of food for freshwater shrimp. A total of 5 ¾ gallons of culture were used. (This was the manufacturer recommended rate to inoculate the estimated volume in Pond #4.) used.

Pond #5 was harvested 125 days after stocking. The shrimp that were harvested were 20 count. The total weight harvested out of the 10' acre pond was 101.07 lbs. (1010.7 lbs. per acre). Survival rate was 94%. Pond #4 was harvested 126 days after stocking. The shrimp from pond #4 were 16 count. Total harvest from pond # 4 was 118.14 lbs. (ii k~1 .4 lbs. per acre). The survival rate was 91.5%. Pond #4 which was treated with the bacterial formulation had a survival rate of 2.5% less than pond #5, but produced 17.07 lbs. (170.7 lbs. per acre) more than pond #5 on 42.4 lbs. (424 lbs. per acre) less feed. The feed conversion for shrimp in pond #4 was 2.06 to 1 and 2.8 to 1 in pond #5.

These results strongly indicate that bioaugmentation may increase total production and average size of pond raised shrimp while improving food conversion and reducing production costs.

Introduction

With the increased popularity in freshwater shrimp (Macrobrachium rosenbergii) production, researchers are looking for better production methods. The current production methods are good enough to justify the growing of freshwater shrimp, but for farmers the pond is 101.07 lbs. (1010.7 lbs. per acre). To stay competitive in the market place they will have to increase yields and reduce production costs. On average, current niche markets are paying from $5.00 US to as much as $12.00 US per pound for freshwater shrimp. Once the majority of the niche markets are filled the shrimp will need to compete on an open shrimp market where prices average about $2.75 a pound (pond bank). The price at $2.75 a pound may be justified by large production farms but not for the small farmer. The only way for the small farmers to compete will be by improving production methods.

Determining the Effects of Bioaugmentation in Yield and Feed Consumption in Freshwater Shrimp

Based on qualitative studies performed in Taiwan that demonstrated increased yield by weight of Tiger prawns grown in commercial shrimp ponds to which a bioaugmentation product had been added, a quantitative study was undertaken to determine statistically the improved yield, if any, on Macrobrachium rosenbergii grown with the same bioaugmentation product. Feed was also monitored to determine biomass conversion efficiencies.
Through an agreement with Global Seafood Technology's Aquaculture Department, the bioaugmentation product producer (Ecological Laboratories, Inc.), and Mississippi Gulf Coast Community College Aquaculture Department a decision was made to evaluate the bioaugmentation product in the production of Macrobrachium rosenbergii.

Materials and Methods

Global Seafood Technology supplied Juvenile shrimp to stock two ponds for the study. Ecological Laboratories supplied the product the Bioaugmentation Product MICROBE-LIFT® to be used in one pond. Mississippi Gulf Coast Community College Aquaculture Department supplied ponds, feed and labor.

The purpose of the study was see if shrimp production could be enhanced using the Bioaugmentation Product MICROBE-LIFT®, to see if further research was warranted, and to provide students with experience in conducting aquaculture research.

Two ponds were used in the study. Both ponds were stocked with juvenile freshwater shrimp. One pond was treated with the bioaugmentation product, according to the manufacturer's recommendations while a second pond was kept as a control. Dissolved oxygen and temperature were measured once per day and pH, alkalinity, and hardness was measured once per week, using industry standard methods. Shrimp were sampled periodically by seine and feed rates were adjusted using sampling results. Both ponds received continuous aeration, using Aerolator brand surface aerators. Aerators were only stopped when students entered the ponds for sampling.

Stocking

Two 1/10 acre ponds (MGJCCC #4 and #5) were stocked with juvenile prawns (Macrobrachium rosenbergii) on June 21, 2001. Prawns with an average weight of .10 grams were stocked at a rate of 2,150 per pond (21.500 per acre). Pond #4 received the Bioaugmentation Product MICROBE-LIFT® treatment, while pond #5 did not; each pond had a volume of 142,718 gallons.

Feeding

Feeding began in both ponds on June 24, 2001, three days after stocking. Both ponds were fed ~2 Rangen trout starter at a rate of 1 lb. per pond every other day. This feed rate was chosen not only to feed the shrimp but to also build up a food base for the microbes that were to be introduced into pond #4. Both ponds were to be treated as close to the same as possible. On July 4, 2001 feed type was changed to Burns Shrimp Crumbles and feed rate was changed to 1 lb. per day. Feed rate was changed again on August 20, 2001, based on shrimp samples. Pond #4 was fed 2.7 lbs. of Burns Shrimp Crumbles per day. Pond #5 was fed 3.1 lbs. of Burns Shrimp Crumbles per day. Feed rates were determined by utilizing "Freshwater Prawns Pond Production & Grow Out", from Mississippi State University. Feeding was done daily, except in a few instances where weather made feeding dangerous. Half feed rates were fed on 8/23/01, 9/4/01 and 9/17/0l due to heavy rains and thunderstorms. Neither pond

was fed on 9/1/01 nor 9/2/01 due to loss of electrical power to the aerators. Dissolved oxygen did not fall to a dangerous level, and no shrimp losses were observed. On August 24, 2001 feed type was changed to Burris Shrimp grow-out pellets, but feeding continued at the same rates as before. Feed rate was changed to 4.5 lbs. per day (Pond #5) and 3.6 lbs. per day (Pond #4) on September 13, 2001 and continued at this rate until harvest. Feeding was discontinued two days prior to harvest.

Water Quality

Aerators were operated continuously to prevent dissolved oxygen problems. The aeration also helped to distribute and suspend microbes and organic material. The aerators were turned off briefly for shrimp sampling and other work details around ponds. As noted above, aerators were off for two days 9/01/01 and 9/02/01, due to electrical problems. Aerators were off briefly in Pond #4 on 9/27/02 and 9/30/01 due to electrical problems but these were quickly remedied.

Dissolved oxygen and temperature were taken every day in both ponds. Pond #4 had average dissolved oxygen of 8.53 for the growing season. The lowest dissolved oxygen was 5.41 ppm and the highest dissolved oxygen of the growing season in was 13.59. The average temperature for the growing season in pond #4 was 28.10 Celsius. The lowest temperature was 20.6 Celsius and the highest was 32.9 Celsius. Pond #5 had average dissolved oxygen of 7.94 ppm for the growing season. The lowest dissolved oxygen was 3.96 and the highest was 13.60. The average temperature for the growing season in pond #5 was 27.55 Celsius. The lowest temperature recorded was 20.4 Celsius and the highest was 32.4. The growing season for the shrimp was from 6/21/01 to 10/23/01 a total of 125 days.

Alkalinity, pH, and hardness were measured once per week. The pH was low during most of the growing season, a common problem for aquaculture ponds in South Mississippi. An attempt was made to correct the low pH problem with the addition of 50 lbs. of agricultural lime to both Pond #4 and #5. This was done at the beginning of the shrimp-growing season on 7/2/01. It was found later at the end of the growing season that the bench pH meter that was being used to measure the pH would not calibrate correctly although it was very consistent in its readings.

The pH meter readings were compared to chemical pH tests several times and the differences were very consistent, averaging 1.3 higher on the chemical tests. The average pH reading for pond #4 with the bench meter was 6.54, which meant that the actual pH was 7.84. Pond #5 had an average pH reading of 6.59, with the actual pH being 7.89.

There was a problem with alkalinity or hardness in both ponds. The average alkalinity for pond #4 was 91.28 and 74.14 for pond #5. Pond #4 had an average hardness of 9.57 with an average of 10.07 for pond #5. The water quality parameters that were observed during this grow-out period are typical for south Mississippi. The first cold front of the fall season came through on September 24, 2001. After this, both ponds were flushed with warm (33 Celsius) well water whenever pond temperature reached 20 degree Celsius or lower. This was done to both to extend the growing season and to pick a scheduled time for the shrimp harvest.

Determining the Effects of Bioaugmentation in Yield and Feed Consumption in Freshwater Shrimp

Bioaugmentation Product

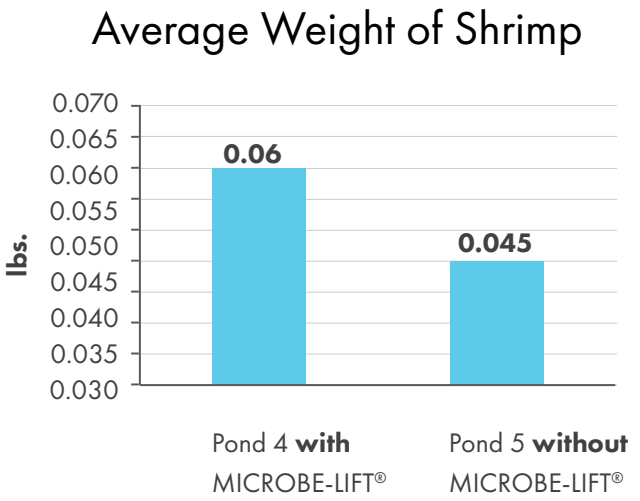
The bioaugmentation product is a liquid product that is produced by Ecological Laboratories of Lynbrook, NY in their manufacturing facility in Cape Coral, FL. The product is used to help with water quality problems. This research was designed to determine if this product would improve water quality and produce an alternative food source for pond raised freshwater shrimp.

Pond #4 was treated with the bioaugmentation product at the manufacturer's recommended rates. Treatment took place 26 days after stocking and 22 days after first feeding. The bioaugmentation product was applied to the pond by spreading it over as much of the surface as possible. On June 16, 2001 three gallons of the bioaugmentation product was added to pond #4. On the following dates 1/2 gallon of the bioaugmentation product was applied to pond #4: 6/24/01, 6/31/01, 7/8/01, and 7/15/01. On 9/14/01 the dosage amount was reduced to 1 quart.

Results

Both ponds were first seined for a partial harvest and then were pumped down and hand harvested to completion.

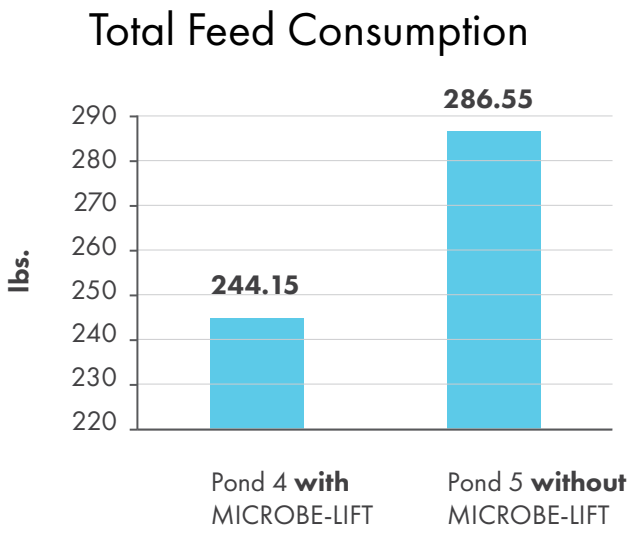
Pond #5 was pumped down half way and then seined during the day. That evening the pond was pumped down the rest of the way and hand harvested. A representative sample of shrimp was counted (389) and weighed (19.3 lbs.) to determine the average individual shrimp weight of .049 lbs. It was determined that the shrimp harvested were 20 count (20 shrimp to the pound). The total pounds of shrimp that were harvested from pond #5 were 101.07 lbs. The survival rate was determined to be 94%.



Conclusions

Earlier qualitative studies had assumed that the increase in shrimp yield, mostly due to increased size, was based mostly on improving the water quality of the shrimp ponds. The quantitative study suggests that there may also be other factors associated with the bioaugmentation product since the increased yield was realized with a reduction in feed use. There are two potential explanations for this. First, the bacteria may be acting as a probiotic and helping the shrimp to digest the food more efficiently thus extracting more nutrients from the feed.

Second, the bioaugmentation product contains photosynthesis bacteria and heterotrophs that can use solar energy as a driving force for growth and the shrimp waste as a source of carbon and other macronutrients. These photosynthetic bacteria, along with other heterotrophic organisms in the bioaugmentation product, may be providing a beneficial feed supplement for the shrimp providing a dual benefit – purifying the water and at the same time providing a food source to supplement the added feed. Increasing the yield while reducing feed costs may significantly enhance the economics of growing shrimp for lower price markets.



Future Studies

A follow-up study was conducted to determine the impact of putting a solid growth substrate to provide a surface to which the bacteria in the bioaugmentation product could attach. The study, recently conducted, showed an additional 66.67% improvement over the results achieved with bioaugmentation alone demonstrating that this could enhance the benefits of the bioaugmentation product. This further improves the potential of using this technology to make freshwater shrimp farming profitable in lower cost markets.

Acknowledgements

The authors wish to acknowledge the contributions of high school and post secondary aquaculture students who performed much of the routine care, water quality lab work, harvesting and processing of shrimp from this study.

Mark J. Krupka
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WASTEWATER TREATMENT

MICROBE-LIFT® bio-technology products are the most preferred bacterial products for improving wastewater treatment processes. With unparalleled capabilities to breakdown waste, reduce toxic and corrosive gases, and significantly reduce sludge. Wastewater operators and managers experience superior results from the efficiencies and related improvement in system stabilities regarding the reduction of COD, BOD, TSS, & Fats-Oils-Grease (FOG). Elimination of odor associated with the generation of hydrogen sulfide and ammonia is a significant benefit when using MICROBE-LIFT®. MICROBE-LIFT® is also effective in-situ for the remediation of pollution caused by hydrocarbons. Proven economic benefits have been experienced via the utilization of MICROBE-LIFT® technology and it's abilities to reduce the cost of sludge handling, while improving system maintenance by reducing hydrogen sulfide, and other corrosives. MICROBE-LIFT® significantly reduces costs, increases operational efficiency, and assists in the achievement of regulatory compliance.

The unique consortium of microbes in MICROBE-LIFT® combine with indigenous populations to provide a bio-system that enhances the natural elemental cycles responsible for processing wastewater in a wide variety of systems. MICROBE-LIFT® enhances biomass efficiency and stability in wastewater treatment systems with bio-technology designed to breakdown, oxidize and remove difficult to degrade waste.

With over 40 years of experience, MICROBE-LIFT® is manufactured in the U.S. by **Ecological Laboratories**, Cape Coral, Florida.

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CS13000

Made in the USA

13100 MUNICIPAL WASTEWATER CASE STUDIES

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MICROBE-LIFT® Technology Reduces BOD, COD, and TSS and Helps Lower H_2S at Kibbutz

Location: **Kibbutz Yagur, Haifa, Israel**

Background:

A field study was conducted in cooperation with Dr. R. Armon and Dr. F. Orshansky at the Center of Research in Environmental Engineering in Technion, Haifa 3200, Israel February 23 to May 17, 1994.

Kibbutz Yagur has a population of approximately 1400 people who live in a communal settlement. The kibbutz has several mid-size industries including an aluminum can factory and produces many agricultural crops including cotton and corn. The kibbutz grows cows for dairy products. The cow manure is digested anaerobically. Human and farm wastes are both transferred to three ponds for treatment. The first pond is an anaerobic sediment pond. The final water is used for agricultural irrigation. The data on each pond is illustrated in the diagram below:

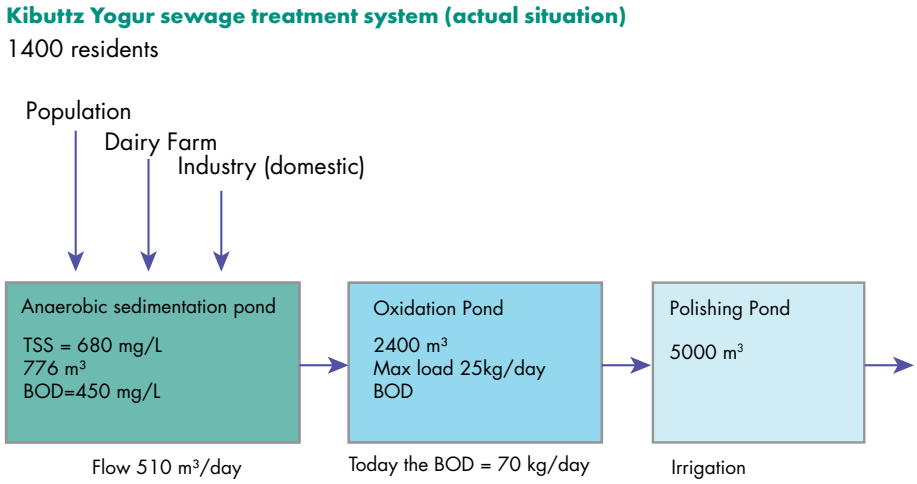

Fig. 1: *Schematic of Kibbutz Yagur's treatment system. Hydraulic retention time in the oxidation pond runs 5.2 days in summer and 2.6 days in winter.*

Objective:

During hot weather the anaerobic digester and sometimes the oxidation pond emit foul odors as a result of anaerobic fermentation. The oxidation pond was chosen for the study because it had an intermediate load and the goal was to utilize MICROBE-LIFT® to improve degradation of BOD, COD, TSS, and H_2S.

To establish control parameters, the oxidation pond effluent was tested for two months prior to the application of product. Analyses were performed according to Standard Methods Manual (1992).

The dosage schedule included an initial 15-gallon purge on April 5th followed by 1.5 gallons per week for four weeks. Thereafter, for an additional three weeks, there was no further addition of product.

MICROBE-LIFT® Technology Reduces BOD, COD, and TSS and Helps Lower H_2S at Kibbutz

Results Achieved: Drs. Armon and Orshansky concluded that MICROBE-LIFT® technology met the product goals. It reduces BOD, COD, TSS and, to some extent, H_2S. They believed that all parameters indicated that the dosage should have been maintained at a higher level to achieve optimal results based on the high organic loading and short retention time. They suggested that in each application the optimal dosage should be determined, or at least adjusted, experimentally.

However, in accordance with observations above, and depicted in the following graphs, they stated that they "were able to recommend MICROBE-LIFT® as a product intended to improve water and wastewater quality."

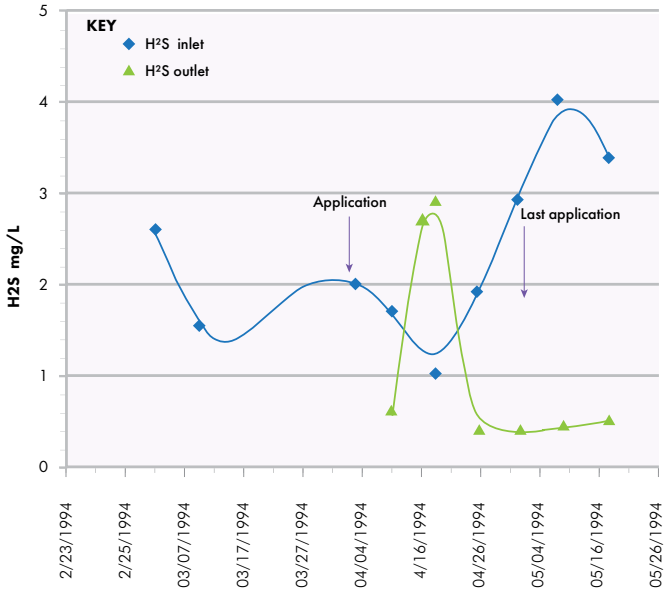

Fig.1: *H^2S data before and after product application.*

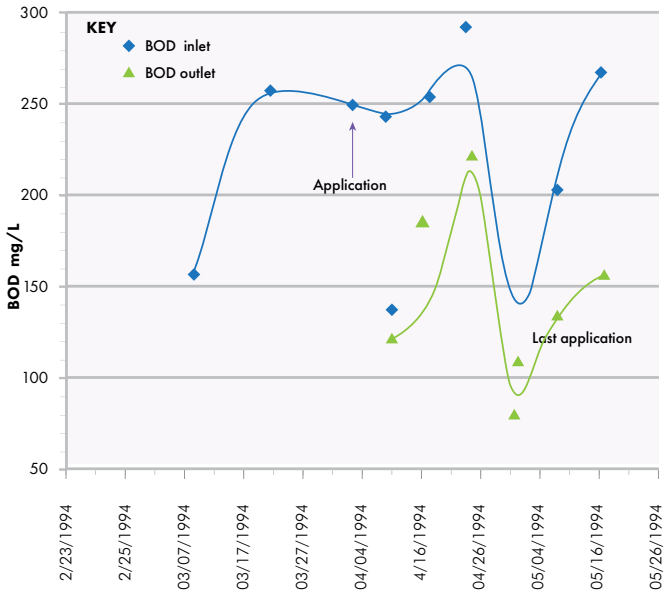

Fig. 2: *BOD results inlet versus outlet prior, during, and after product application.*

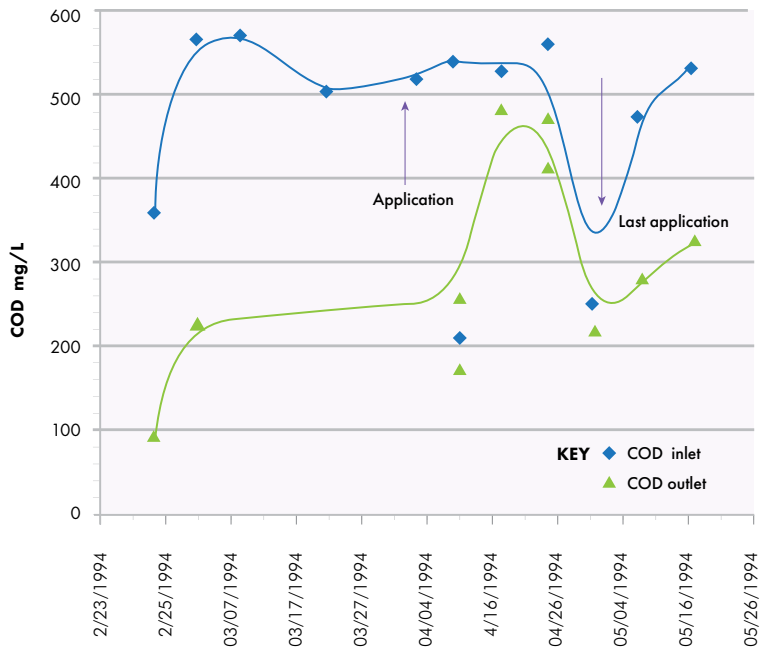

Fig. 3: *COD results prior, during, and after product application.*

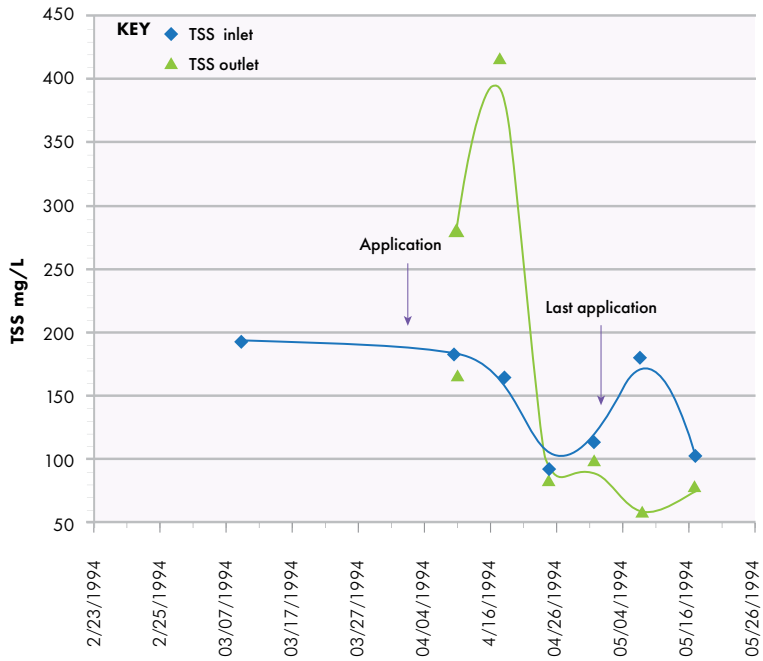

Fig. 4: *TSS results of influent and effluent prior, during, and after the trial.*

For more information on MICROBE-LIFT® Technology contact

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CS13101

Bioaugmentation with MICROBE-LIFT® Technology Remediates Polluted Drainage Retention Pond in Penang, Malaysia

Location: **Penang, Malaysia**

Background: S-10 is a flood mitigation river water holding pond in Penang, Malaysia. Drain water from Georgetown is channeled into this 150M x 85m x 2m deep retention pond before being discharged into the sea. Excess water in the pond is either drained into the sea during low tide by opening the tidal gate or through mechanical pumping when sea level is higher than the pond water level. The retention pond prevents ingress of salty seawater into Georgetown and allows free flow of surface drain water during heavy rain that coincides with high sea water level.

Fig. 1: *Picture of S10 flood mitigation holding pond in Penang.*

Fig. 2 *Additional pictures of the pond and drainage system*

Fig. 2 & 3: *Additional pictures of the pond and drainage system.*

This drainage allows discharge of both ground surface water during heavy rain and discharge of wastewater including domestic sewerage and wastewater from commercial and industrial operations. Discharge of untreated grey water forms the bulk of the water flowing into the pond on dry days. The influent water pollution level is significantly diluted during heavy rain. Influent BOD ranges from 40 mg/l to 250 mg/l and COD has a low value of 100 mg/l to as high as nearly 1,000 mg/l. The influent water also carries a very high concentration of suspended solids and floating debris. Most of the floating debris is trapped at the grit chamber just before the pond entrance and is physically removed on a regular basis. There is a high concentration of suspended solids that have settled into the pond as bottom sludge.

The pond has accumulated a bottom sludge layer exceeding a half-meter in only a year of operation. If left untreated, the pond would be fully filled with bottom sludge within a few years and would be incapable of fulfilling its intended purpose as a flood mitigation pond. In addition to the sludge problem, extreme malodor emanating from the pond has affected nearby residences and has become a significant problem for the Jabatan Pengairan Dan Aliran Negeri (JPS). JPS has also expressed interest in reducing pollution to below Standard B before discharging into the sea to prevent harm to marine life. Standard B specifies BOD <50 mg/l and COD <100 mg/l.

The pond has an estimated volume of 25,000 m^3. On dry days, the grey water from Georgetown forms the bulk of the influent water. The estimated flow rate is 5,000 m^3 per day. This gives an average of five days retention time, which is ideal for biological treatment. The flow rate during heavy rain is not known; it is estimated at several times that of the normal dry day flow rate. The water in the pond can be completely replaced after a few days of heavy rain.

Bioaugmentation with MICROBE-LIFT® Technology Remediates Polluted Drainage Retention Pond in Penang, Malaysia

Objective

A bioaugmentation treatment program was developed to remove bottom solids and improve degradation of the waste organics. MICROBE-LIFT® technology, was recommended. MICROBE-LIFT® is a highly active liquid bioculture developed and manufactured by Ecological Laboratories Inc, USA. MICROBE-LIFT® contains a wide range of microorganisms elected for proven degradation capabilities targeting difficult to degrade organic waste components.

According to plan, treatment was conducted from the 29th of August 2005 to the 5th of March in 2006. A 10 ppm inoculation was performed on day one, a day affected by heavy rain immediately after inoculation. This was followed by an 8 ppm dose three days later followed by five additional doses of 4.5 ppm in the first month. Maintenance doses of less than 2 ppm, 12 gallons per week, were applied for the remaining period of treatment. Since retention time is limited due to increased rainfall and biodegradation can be enhanced by aeration, BioAktiv, an all natural mineral compound for oxygenation was added weekly to support MICROBE-LIFT® technology's stimulating enhanced degradation rates.

Results Achieved:

The first result noted within the initial month of treatment was the significant reduction in malodors experienced by workers and nearby residences. The bad odor was essentially eliminated throughout the treatment period in the pond area, with the exception of malodors near the influent to the pond on water that had not yet been treated. The S-10 MICROBE-LIFT® Bioremediation Project was showcased at the National Environment Seminar on 14-16 Dec. 2005, as organized by the JPS in Penang. Delegates invited to the site on 15 Dec 2005 confirmed that odor was no longer noticeable around the pond. Only from the incoming, untreated water were malodors noted.

As another indication of improved treatment, water samples of the pond also showed higher transparency (less turbidity) than in the past.

Water samples at the influent point of the pond and the effluent point near the discharge tidal gate were taken twice a month to monitor water parameters. BOD, COD, TSS, and total NH_4 were measured. The sludge thickness was also measured on the day of inoculation followed by three more measurements during the treatment period. Sludge thickness was measured by means of a sludge judge, a transparent glass tube inserted into the pond until it contacted the hard bottom.

The tube is then closed and brought to the surface where the captured column of sludge can be measured. An independent lab conducted the water sampling and analysis. The six-month treatment results are tabulated on the next page:

Bioaugmentation with MICROBE-LIFT® Technology Remediates Polluted Drainage Retention Pond in Penang, Malaysia

JPS Penang Retention Pond Project

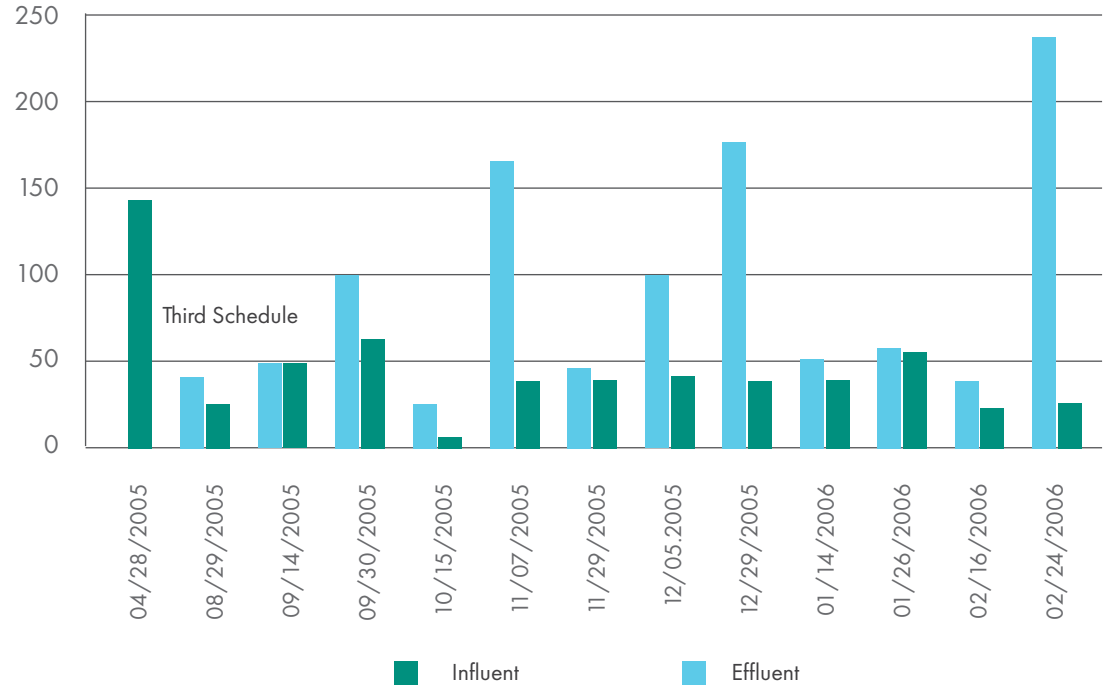
Water Parameter Measurements

Day	Date	Influent (at pump hose outlet)				Effluent (at discharge outlet)			
		BOD mg/l	COD mg/l	TSS mg/l	NH_2 mg/l	BOD mg/l	COD mg/l	TSS mg/l	NH_2 mg/l
	04/28					142	522	196	11.4
1	08/29	42	162	34	11.4	23	98	26	12.2
16	09/14	49	189	45	12.2	48	185	45	20.2
32	09/30	98	383	180	1.9	63	431	52	11.2
47	10/15	28	113	59	11.7	7	42	44	12.2
70	11/07	167	571	113	18.6	39	256	125	13
92	11/29	45	178	34	2.1	39	196	42	11.6
98	12/05	100	408	77	11.4	43	187	18	11.7
122	12/29	178	695	20927	20.4	40	167	51	9
138	01/14	52	197	71	15.4	39	161	56	14.4
150	01/26	59	279	70	15.6	56	223	41	15.6
171	02/16	39	158	50	20.6	22	86	41	13.6
179	02/24	235	975	598	17.4	24	95	37	8.6

Fig. 1: *This table shows actual data from the test period April 2005 through February 2006. Note the high effluent levels of BOD, COD, and TSS prior to treatment that were never reached again during treatment.*

Fig. 2: *The dramatic differences between influent BOD and the effluent levels show the treatment achieved through bioaugmentation. Note that treatment substantially improves after the first two months after the microbes have had a chance to establish themselves.*

Influent versus Effluent BOD



Influent versus Effluent COD

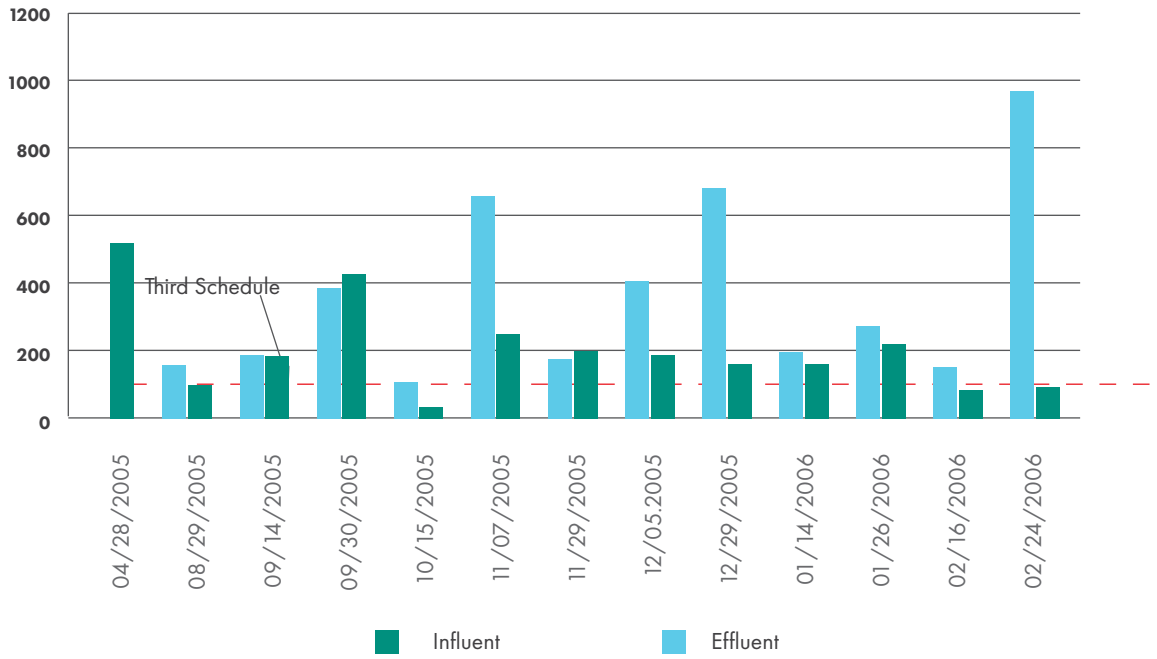


Fig. 3: *Consistent with the BOD data, COD results validate improvement in treatment. Data from the first two months represents a baseline prior to treatment, while the data thereafter shows substantially increased treatment based on greater differences between influent and effluent levels.*

The most significant change between influent and effluent water parameters occur after the first two months of treatment. This effect is typically seen in bioaugmentation applications, as the microbes inoculated require time to grow and establish themselves within the ecosystem. Significant water parameter improvement is observed starting in mid-October 2005. The data would not show much improvement during periods of heavy rainfall when influent water pollution levels are low. It was also noted that the water in the pond forms a circular motion when large volumes of water were discharged through the tidal gate or was being pumped out. The influent and effluent water was well mixed by this circular motion. As such, the water in the pond became more homogeneous and shows less difference between influent and effluent water samples. This factor explains the apparent non-performance of water parameters on 29 Nov 2005 and January 2006.

The bottom sludge continued to be reduced throughout the treatment period, and was practically eliminated by Feb 2006.

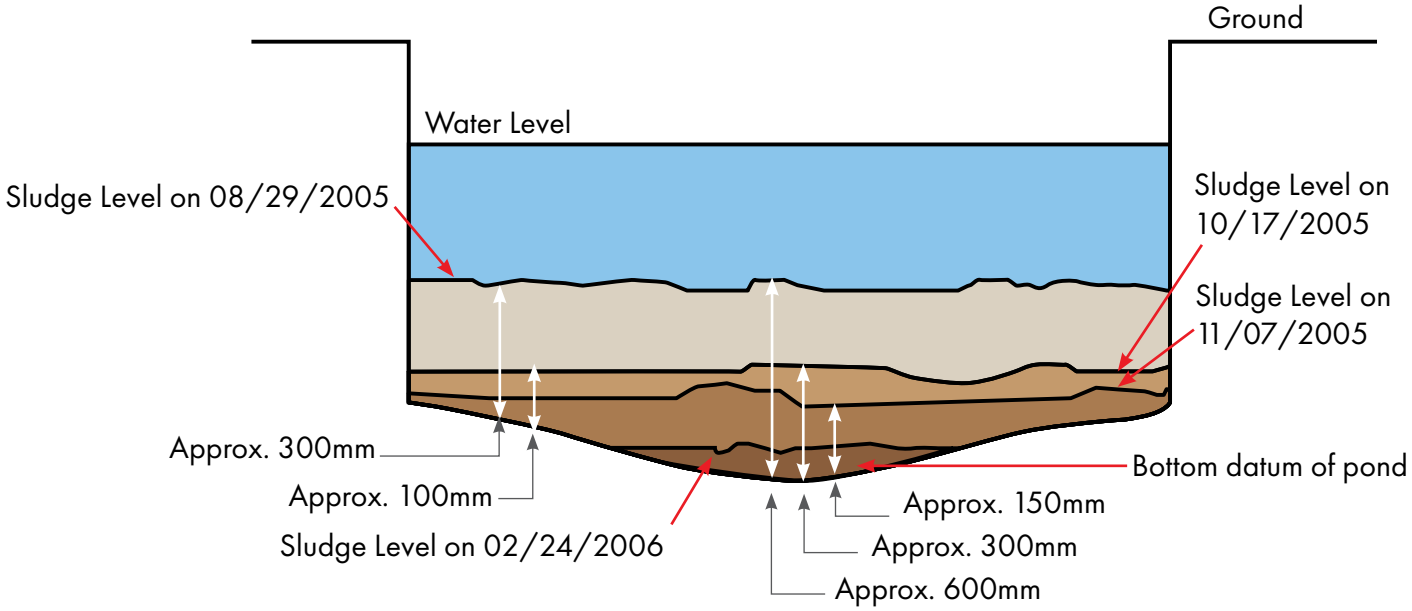
Average Sludge Level

Date	Side of Pond (mm)	Center of Pond (mm)
08/29/2005	300	600
10/17/2005	100	300
11/07/2005	80	150
02/24/2006	0	45

Fig.4: *This chart shows removal of accumulated sludge deposits ranging from a remarkable 93% to 100%*

Schematic Presentation of Sludge Thickness During the Treatment Period

Fig. 5: *This is a visual schematic of the reduction of bottom solids by the bioaugmentation program. A tremendous volume of sludge was virtually eliminated by biological degradation.*



The breaking up of bottom organic sludge often contributes to increasing amount of pollutants in the water as seen in the water parameters during the first two months of treatment.

It is important to note that as these bottom solids are degraded they are first broken down into smaller, soluble components that add to the water parameters of BOD, COD, and TSS until they too are degraded. This is another factor seen in the water parameters during the first two months. As the bottom sludge is reduced we expect to see faster improvement in the influent vs. effluent water parameters. This is clearly reflected in the effluent water parameters taken on 24 Feb. 2006 where the discharge of BOD, COD, and TSS now meet the Standard B regulatory requirement despite the pond experiencing the
highest pollutant input load during the entire treatment period.

Based on comparing the initial benchmark sludge measurement with the most recent measurement made on 24 Feb 2006, an estimated 6,000 m^3 of sludge has been degraded by MICROBE-LIFT® technology's environmentally friendly bioremediation process. Based on RM 80 per m^3 of dredging and dumping cost, the biological sludge removal saved the Board over half a million ringgitt, making it a very cost effective solution. And in addition, MICROBE-LIFT® technology eliminated the bad odor in the surrounding area of the pond and improved the quality of the water before discharge to the sea.

In this trial, led by Goh Kwang Beng of MICROBE-LIFT® ASIA and Oakwell Engineering Ltd of Singapore, MICROBE-LIFT® achieved results well beyond JPS's initial targets of odor control and water quality improvement. MICROBE-LIFT® technology improved the water quality to obtain parameters better than the required Standard B, effectively eliminated the odor problem, and achieved sludge reduction far exceeding expectations. This sludge reduction has restored the pond to its intended function.

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CS13103

Bioaugmentation with MICROBE-LIFT® Technology Reduces Sludge Production by over 25%

Location: **Bath Regional Wastewater Treatment Plant, Zeeland, Holland**

Background: The Bath WWS is a regional facility that covers many small communities over a large area serviced by a network of domestic sewage collection conduits. Total Population Equivalent (PE) of 537.000 is pumped to this central facility on the coast of Southern Zeeland. The facility is a well designed and operated wastewater treatment plant. The basic design brings the domestic sewage to a gross filter and then into a collection diverter that separates the flow into 4 trains. In each of the trains, the first tank is a covered primary (facultative) receiver, covered with thick floating Styrofoam sheets to lower odor emissions. From here it flows into an aeration tank system, and then onto large settling clarifier. After this point, the flow is dewatered and the pressed cake is further processed in anaerobic chambers.

Objective: The system was operating well, but the plant had periodic odor issues and they wanted to lower sludge handling costs. MICROBE-LIFT® Technology Products were recommended for a 12-week trial period and a monitoring schedule was recommended that would determine the effect of treatment.

Results Achieved

As the tracking data shows on the next page, bio-augmentation with MICROBE-LIFT® was able to improve the general performance of the facility as well as to significantly reduce sludge generation and the associated handling costs.

The trial collected data for six weeks prior to treatment and compared this to twelve weeks when MICROBE-LIFT® formulations were applied. MICROBE-LIFT® bio-augmentation products were able to improve the general performance of the facility and, over time, this treatment will certainly improve upon plant performance even further without any danger of disruption. Qualitatively, the issue of odor was resolved. The most important benefit was the reduction of sludge handling costs by 27.8% percent.

The actual treatment data follows:

MICROBE-LIFT®/ Treatment - Tracking Data

Removal Percentage Rate

WEEK	CZV COD	BZV BOD	NKi-N Nitrogen	NH4-N Ammonia	Ntot-N Total N	TZV D.O.	Ptot-P Total P	O.B.	Sludge Percentages	
Pre-treatment									Indamprest	Removal
16	87.3	95.3	96.8	98.7	83.7	90.9	63.8	91.2	0.7	52.8
17	85.4	96.1	96.5	99.0	80.7	90.5	63.0	90.9	1.1	53.3
18	68.4	96.0	91.5	96.7	67.5	82.7	30.9	92.7	0.9	54.1
19	76.9	95.8	95.3	98.3	83.4	86.9	72.0	92.3	1.0	53.3
20	82.8	95.7	96.0	98.9	82.1	88.6	70.5	91.8	0.8	50.4
21	88.1	96.1	96.7	99.1	85.1	90.2	53.0	92.1	1.1	53.7
Average	**81.3**	**95.9**	**95.5**	**98.5**	**80.4**	**88.3**	**58.9**	**91.8**	**0.9**	**52.9**

MICROBE-LIFT®/ Treatment - 6 Weeks

22	91.3	97.2	96.0	99.8	88.6	93.3	60.8	94.5	0.9	54.8
23	94.5	98.0	97.1	99.7	89.3	95.7	67.8	97.6	0.7	56.4
24	93.3	97.7	98.3	99.7	90.1	95.4	70.9	95.9	0.8	57.3
25	91.8	98.3	98.3	99.9	90.3	95.8	72.3	94.8	0.7	57.9
26	94.3	99.1	98.0	99.8	89.8	96.8	73.9	95.7	0.6	60.1
27	95.1	98.2	98.8	99.7	90.2	97.1	74.4	98.1	0.6	61.3
Average	**93.4**	**98.1**	**97.7**	**99.8**	**89.7**	**95.7**	**70.0**	**96.1**	**0.7**	**57.9**

MICROBE-LIFT®/ Treatment - (6 through 12 Weeks)

28	94.6	98.3	99.8	99.9	90.2	95.5	73.2	96.2	0.6	61.3
29	95.2	98.6	98.9	99.7	89.8	96.9	74.0	97.8	0.6	61.9
30	95.5	98.8	98.3	99.6	91.4	97.3	75.1	96.9	0.6	61.8
31	94.7	98.0	98.5	99.8	92.3	97.4	75.3	97.9	0.6	63.2
32	95.1	98.3	99.1	99.9	90.7	96.0	73.8	96.7	0.5	64.1
33	94.9	99.1	99.3	99.6	91.9	97.3	74.2	98.2	0.7	64.4
Average	**95.0**	**98.5**	**99.0**	**99.8**	**91.1**	**96.7**	**74.3**	**97.3**	**0.7**	**62.8**
Percent Improvement	16.9	2.7	3.7	1.1	13.3	9.5	26.1	6.0	33.3	21.0

Since most activated sludge plants spend approximately half of their operating costs on sludge handling and disposal, a 28% reduction in these costs is a major benefit to the bottom line.

For more information on MICROBE-LIFT® Technology contact

Ecological Laboratories Inc.

www.EcologicalLabs.com

CS13105

Well-Operated Municipal Plant Achieves $130,000 Cost Savings from Microbe-Lift® Technology in Deutsch-Wagram, Austria

Location: **Deutsch-Wagram Municipal Treatment Plant, Austria**

Background: The sewage treatment plant of the borough Deutsch-Wagram is situated in the south west of the settlement on the left shore of the Rußbach and has been in operation since 1969. The drainage area is 350 hectares and the degradation performance is more than 90% based on mechanical, chemical and biological treatment. The waste water entering the sewage work at the supply tank is lifted up with screw pumps to the level of the sewage work and passes through a bar screen. A mechanical scraper removes coarse matter from the waste water. Then, the wastewater flows through the circular degritter where granular components are separated. Through a distributor structure the mechanical pre-cleaned wastewater enters the activated sludge tank with a capacity of 1440 m^3. The biological treatment is carried out by the activated sludge process. To cover the oxygen demand, air is supplied with cage rotor aerators into the wastewater. In the secondary settling tank, with a capacity of 2.300 m^3, the sludge settles down and is separated from the wastewater, treated biologically, then discharged to the receiving water (Rußbach). Through a siphon pipe the settled sludge enters the sludge recycling pump station. With screw pumps the sludge is pumped back into the activated sludge tank.

The quantity of water for a population equivalent of 8.200 is treated in the activated sludge tank, designed for a population equivalent of 6.000. The chemical cleaning is carried out with the addition of iron salts to precipitate phosphorous from the wastewater and is removed with the excess sludge from the process. Nitrates can be removed (denitrification) with high efficiency from the wastewater when operated with that objective. The sludge is thickened in the sludge storage tank and the sludge liquor pumped back into the supply tank. The thickened sludge either can be directly used in agriculture or the produced sludge granulate is scattered on the fields after de-watering with a sludge press.

Objective: The plant is operated by an O&M firm from the Netherlands. Located close to a residential area, the plant had regular problems with odors and oil & grease buildup in the head-works and aeration basins despite achieving better than 95% reduction for BOD and TSS. In addition, the plant was expending a significant portion of its operating budget for sludge handling and disposal.

A bioaugmentation program was implemented in 1998 for a period of one year to determine if the bioaugmentation program could consistently reduce the amount of sludge generated in the plant. Improving odors and oil and grease breakdown were secondary objectives but were not considered to be enough on their own to justify the cost of product treatment, approximately US $30,000/ year.

Fig.1: *Wastewater Plant at Deutsch-Wagram*

Deutsch Wagram

Dosages:

Table 1. Average of some main parameters from the annual report of 1997

parameter	average / year	unit	degradation eff.
Waste water / d	1320	m^3/Tag	-
Sludge volume	810,2	ml/l	-
$BSB_{5:}$ supply	286,3	mg/l	-
BSB_5: discharge	5,4	mg/l	98,0 %
CSB: supply	574,5	mg/l	-
CSB: discharge	39,1	mg/l	92,5 %
NH_4-N: supply	47,5	mg/l	-
NH_4-N: discharge	1,4	mg/l	97,0 %
NO_3-N: supply	33,2	mg/l	-
NO_3-N: discharge	4,8	mg/l	85,5 %
PO_4-P: supply	5,6	mg/l	-
PO_4-P : discharge	0,5	mg/l	91,4 %

Fig. 2: Average values of some main effluent parameters from the annual report of 1997.

Dosage Schedule for MICROBE-LIFT® Technology in the Sewage Work of Deutsch-Wagram:

Dosages were recommended based on loading (COD; BOD5, resp. hydraulic loading) degradation efficiency, problem zones and working capacity.

Before initial inoculation, 2 gallons of MICROBE-LIFT® formulation were applied in the pump station, supply tank, and secondary settling tank. The addition was carried out either by direct applying or spraying in a dilution of 1:10 to 1:50 with water in a water can.

Initial treatment, start on 1st April

April 1998, ¼ gallon was applied on the floating layer and the sidewalls of the supply tank near the pump screw in a dilution of 1:10 with water. 4 gallons were applied into the activated sludge tank. On the floating layer of the secondary settling tank ¾ of a gallon was sprayed in a dilution of 1:10.

On April 2.1998, at 3 a.m. 1 gallon was added at the pump station.

Dosage schedule:

1 US gallon = 1 bottle = 3,7853 liter		gallons per month
Initial:	6 gallons	
Next four weeks (once per week):	1,5 gallon	6
Maintenance (once per week):	1 gallon	2

Deutsch Wagram

Dosages

Next four weeks once per week:

9.4.1998	1 gallon was added into the activated sludge tank
17.4.1998	1 gallon was added into the activated sludge tank
23.4.1998	1 gallon was added into the activated sludge tank
30.4.1998.1	1 gallon was added into the activated sludge tank

Maintenance once per week:

8.5.1998	½ gallon was added into the activated sludge tank
13.5.1998	½ gallon was added into the activated sludge tank
20.5.1998	½ gallon was added into the activated sludge tank
28.5.1998.1	½ gallon was added into the activated sludge tank
6.8.1998	½ gallon

If required (based on seasonally high flow rates) at the pump station, into the supply tank and into the secondary settling tank MICROBE-LIFT®/IND is applied additionally.

Results Achieved

After collecting one full year's worth of data, it was determined that for the year, under slightly higher flow and organic loading, that the plant had generated 34% less sludge for handling and disposal, reducing the cost for chemical treatment as well as for transportation and disposal.

Additional benefits included improved solids settling characteristics as reflected by the SVI, reduction of the odors from the plant and a significant reduction in the oil & grease buildup.

Table 2. Sludge pressing results:

	without	with MICROBE-LIFT®/IND
	24.7.98-1.8.98;	9.12.-17.12.98

Duration of pressing	volume of raw sludge	TS - of press-cake %	press-cake t
28.7.-1.8.97	2083 m3	26	270,18
24.7.-1.8.98	1330 m3	31	178,12
- 2 day -	753 m3	+ 19 absolute	- 92,06
1.12.-10.12.97	2065 m3	25	208,41
9.12.-17.12.98	1529 m3	27	194,46
- 1 day	-536 m3	+ 8 absolute	-13,95

Fig. 3: *This chart shows a comparison of the duration of pressing and the volume of sludge when treated with AquaClean vs. without treatment.*

Deutsch Wagram

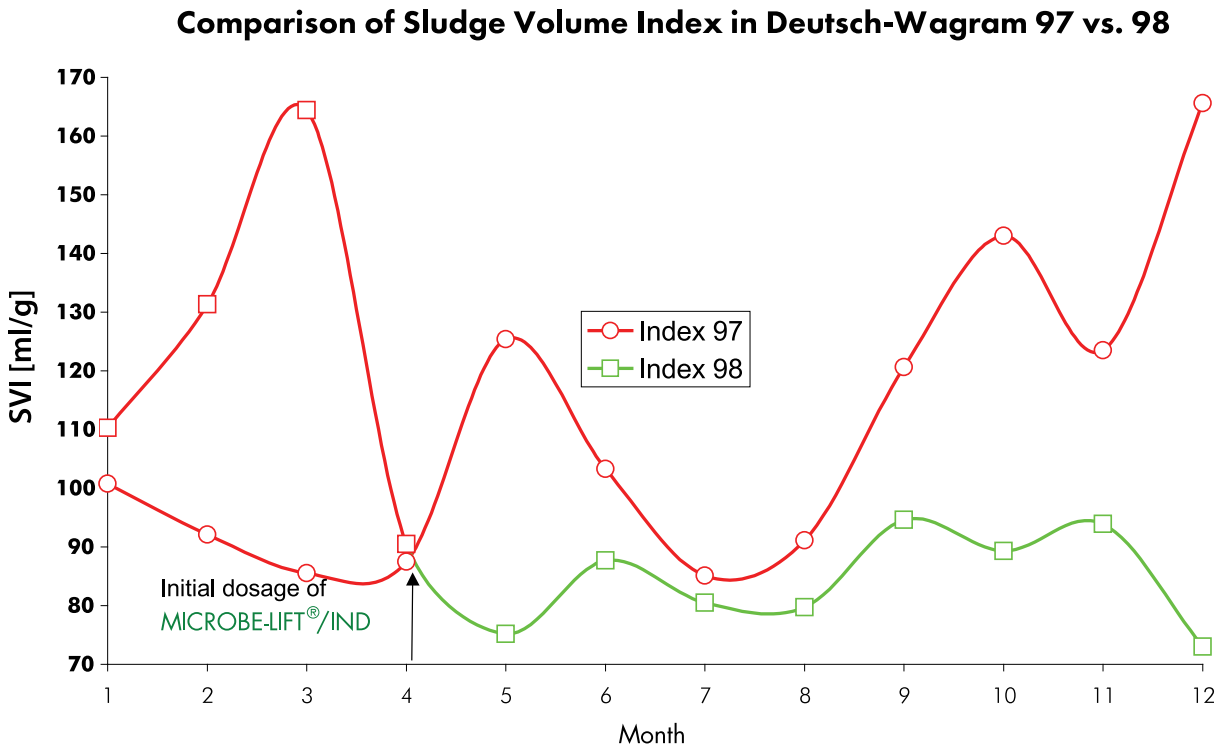


Fig 4: *SVI Data from Deutsch-Wagram*

Sludge handling and disposal costs were reduced by US $160,000 resulting in a net operating cost savings of US $130,000.

For more information on MICROBE-LIFT® Technology contact
Ecological Laboratories Inc.
www.EcologicalLabs.com
CS13107

Municipal Lagoon Treatment Efficacy Was Restored in LaCosta, Uruguay with MICROBE-LIFT® Technology

Location: **La Costa, Uruguay**

Background: This municipal lagoon receives 240,000 litres of domestic sewage per day. Treatment efficacy had been reduced to the point that the town was having difficulty meeting discharge parameters and malodors and the presence of insects such as flies and mosquitoes were causing complaints from the local community.

Objective: Ecological Labs developed a treatment program using of MICROBE-LIFT®/IND. A total dosage rate of 322 litres was applied over a period of six weeks.

Results achieved: Dramatic results in surface scum were seen by the third week as all waste parameters started to improve. At the end of the six-week treatment the water had been purified 85% and was certified for use in farm irrigation. The pH had been raised to 7.2 and the Biochemical Oxygen Demand (BOD) was reduced from 480-ppm initial concentration to 130 ppm after treatment, a reduction of 73%. All noxious odors were eliminated, as was the presence of insects.

Week 1

Week 2

Fig. 1: *The pond has a layer of scum that is starting to break-up. Clear patches are evident after two weeks of treatment using MICROBE-LIFT® technology*

Week 3

Week 4

Week 5

Week 6

Fig. 2: *The above pictures show the progression of improvement and the efficacy of treatment with* MICROBE-LIFT® technology. *Surface scum was eliminated and effluent quality improved sufficiently to be used for farm irrigation.*

For more information on MICROBE-LIFT® Technology contact
Ecological Laboratories Inc.
www.EcologicalLabs.com
CS13108

An Average Reduction In Sludge of Approximately 20% Was Observed at Zutphen Plant in the Netherlands

Location: **Zutphen Municipality Netherlands**

Background: Zutphen is a medium sized activated sludge system treating an average of 6,600 M^3 of wastewater per day. The plant comprises two parallel trains with segregated recycle lines so that a side-by-side comparison could be conducted.

Fig. 1: *This picture shows the parallel aerated basins side by side. Since these trains have segregated recycle lines they can be treated separately and the sludge from each train can be evaluated and compared.*

MICROBE-LIFT® is **Ecological Laboratories'** core wastewater technology.

Based on the successful sludge reduction experience in municipal wastewater treatment plants, Zutphen worked with **Ecological Laboratories** to plan a trial in their plant.

Objective: In March 2006 the City of Zutphen initiated a 120-day trial augmentation program. Their goal was to increase biological treatment reducing the yield of sludge. Two products were applied to Train AT2, MICROBE-LIFT® technology and a natural organic compound known to potentiate the sludge reduction capabilities of MICROBE-LIFT® technology in past applications. Train AT1 was left unseeded as a control. The design of the plant was ideal for testing since each train handled their sludge independent of the others.

Results Achieved: Within 60 days, an average reduction in sludge of approximately 20% was observed from the treated train with a maximum reduction of 26% observed late in the latter part of the 60-day period. Between the 60th and 90th day of the trial some settling instability was observed as was typically observed in the transition from cold weather to warm weather operation. Once through the transition the plant quickly stabilized and again a sludge reduction was observed in the treated train, but for this time period was in the 12% to 16 % range. Upon further evaluation of the data and process, it was determined that there was some comingling of the supernatant from the digestors, leading to an inadvertent low-level seeding of the control train. While the differential between the seeded and "control" trains had been reduced, a comparison to historical sludge production numbers indicated that both trains were generating on the order of 20% reduction, despite higher hydraulic and organic loadings in 2006.

Zutphen Sludge Reduction Trial

Sludge Wasted (Kg)

	AT1	AT2	Average	Average/Day
Q1: 1 Jan to 13 March	250,597	252,883	251,740	3496
Q2: 14 March to16 July	319.136	319,136	319,136	2574
			% Reduction	**26.4%**

Fig. 2: Sludge reduction efficiency improvement during trial exceeds 26%. This was achieved in spite of dramatically increased BOD & TSS loading.

Another typical measure of sludge production is the yield coefficient, which is measured by the equation:

$$\frac{\text{Solids Processed} - \text{Cum Solids inf (kg)}}{\text{Cum BOD inf} - \text{Cum BOD eff}}$$

The calculated yield coefficient for the trial period is 22.4% lower than for the period immediately before the trial in 2006 and 36.1% lower than the yield coefficient for the same period in 2005. (Actual data available)

These impressive results validate the potential sludge reduction benefit of bioaugmentation even when applied to a very well operated system. Since sludge treatment and handling accounts for approximately 50% of the overall cost of wastewater treatment, reduction in sludge volume is a very cost effective benefit.

For more information on MICROBE-LIFT® Technology contact
Ecological Laboratories Inc.
www.EcologicalLabs.com
CS13109

MICROBE-LIFT® Technology Improves Efficiency of Anaerobic Digesters in Columbia - Preventing Costly Expansion

Location: **Empresas Publicas, Columbia**

Background: **Ecological Laboratories Inc.** was contacted by Empresas Publicas to determine if bioaugmentation with MICROBE-LIFT® technology could assist in the operation of their anaerobic digesters.

The facility consisted of two anaerobic digesters of 7,900 M^3 each. The average flow rate was 1.8 M^3 per second giving an average hydraulic retention time (HRT) of 21 days. The VSS reduction being achieved prior to the bioaugmentation program was approximately 30% for both reactors.

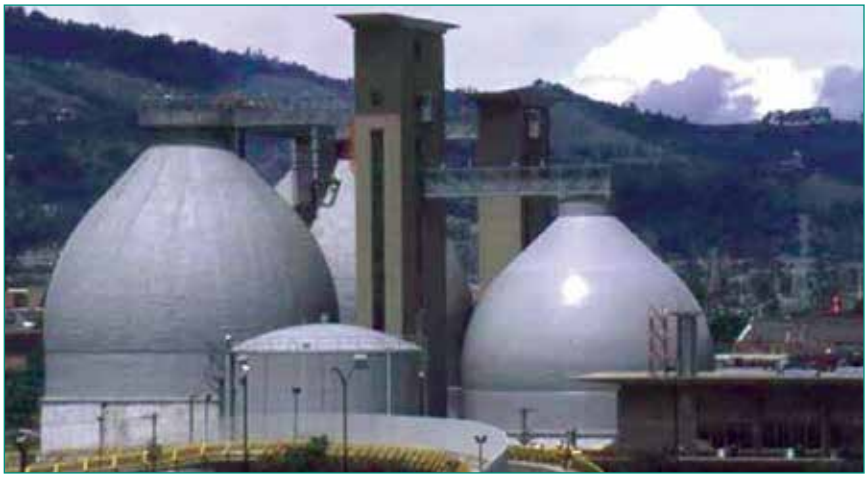


Fig.1: *Anaerobic digesters at Empresas Publicas*

Objective: The objective of the program was to reduce odors associated with the operation of their anaerobic digesters and improve VSS reduction.

After thorough evaluation of their system, a plan was developed using MICROBE-LIFT® technology. On the first day, the reactors were dosed at a rate of 12 mg/l based on the volume of the reactors. Thereafter, a weekly dose of 4 mg/l was applied for the next four weeks, followed by a 1.5 mg/l weekly maintenance dose.

Results Achieved: Six weeks after the initial dosage, VSS reduction had been increased to 37% versus a target of 50%. This improvement allowed the plant to handle the existing load without the immediate addition of a third reactor.

The plant also achieved significant reduction in odors in and around the plant.

For more information on MICROBE-LIFT® Technology contact
Ecological Laboratories Inc.
www.EcologicalLabs.com
CS13110

Made in the USA

Bioaugmentation Reduces Sludge Production 20% Allowing Digester to Handle Increased Load in Hod Hasharon, Israel

Location: **City of Hod Hasharon, Israel**

Background: Hod Hasheron's municipal waste treatment system includes anaerobic digesters utilized to reduce sludge volume before disposal. Average daily flow into the plant is approximately 25,000 M^3/day. The overall performance efficiency of the plant is excellent.

Objective: Based on results achieved in the anaerobic digestors at Pusan and Empresas Publicas, the Operations Staff at Hod Hasharon made a decision to determine if similar results could be achieved in their plant. Unlike the other plants, Hod Hasharon was also interested in whether or not an increase in biogas production could be realized since they recovered the gas for use as a fuel source.

Results Achieved: After the first three months of treatment with MICROBE-LIFT® technology, results were compared to historical values from the previous 15 month operating period. In spite of a 1.8% increase in loading to the plant based on a hydraulic and organic basis, the amount of sludge that was removed from the plant was reduced by 18% with a concurrent increase in biogas of 11.3%.

The following chart shows the actual data developed by the city.

Table 4: Operating Data from Hod Hasharon

BIO-GAS	Solids Vs WAS	SOLIDS Tons	% SOLIDS	Dry Sludge	Sewage in m3	RAS m3	WAS m3	
126635	0.42%	139	16.20%	858	796800	255870	32745	1/28/2004
106633	0.45%	129	16.60%	775.5	738833	243050	28593	2/28/2004
115413	0.44%	141	16.10%	874.5	774194	212910	32289	3/28/2004
112470	0.32%	118	15.60%	759	746850	238970	37522	4/28/2004
111817	0.42%	156	14.80%	1056	756214	230610	36870	5/28/2004
119430	0.34%	125	13.50%	924	730080	218740	36847	6/28/2004
159154	0.37%	122	14.20%	858	644940	193520	32969	7/28/2004
131719	0.46%	164	15.50%	1056	695370	212240	35870	8/28/2004
150030	0.38%	136	14.70%	924	677590	213870	35351	9/28/2004
147219	0.41%	153	15.00%	1023	730670	231090	37845	10/28/2004
138930	0.51%	151	15.80%	957	602680	182340	29630	11/28/2004
140585	0.45%	154	16.10%	957	742290	265340	34018	12/28/2004
140864	0.46%	144	15.60%	924	715640	332910	31392	1/28/2005
131488	0.39%	132	16.00%	825	755250	345860	33830	2/28/2005
142383	0.33%	141	15.30%	924	706748	365820	42207	3/28/2005
139350	0.29%	143	18.90%	759	763127	329610	49042	4/28/2005
151032	0.27%	146	19.20%	759	724080	324160	53732	5/28/2005
144330	0.31%	152	20.90%	726	715070	305420	48967	6/28/2005
								7/28/2005
								8/28/2005
								9/28/2005
								10/28/2005

Fig. 1: *Operating data from Hod Hasharon shows the drop in dry sludge and the increase in biogas.*

This data represents good correlation between the reduction in VSS and the increase in biogas production, making it reasonable to assume that the increase in biogas production is a result of the improved VSS reduction efficiency.

Typically with effective bioaugmentation programs, results may continue to improve as the microorganisms become better established in the population. Current treatment, during the summer of 2006, has obtained even better results in the effluent properties of TSS and BOD with sludge reduction over 20%. The plant has also experienced a significant reduction in odor.

MICROBE-LIFT® technology has consistently shown benefit in anaerobic sludge reactors for sludge reduction and odor control

For more information on MICROBE-LIFT® Technology contact
Ecological Laboratories Inc.
www.EcologicalLabs.com
CS13111

Bioaugmentation Remediates Heavy Organic Loading in Municipal Oxidation Pond in Drakenstein, South Africa

Location: **Drakenstein Municipality, Western Cape Province, South Africa**

Background:

The primary influent pond is in a series of seven oxidation and maturation ponds serving the municipality of Drakenstein, S. Africa. This system was designed to allow the final maturation pond to be a polishing pond for nitrification to allow effluent of suitable quality to be discharged to the river. However, due to the high level of incoming organics the initial ponds are not effective enough to allow the system to work as designed. The key to this system is to improve treatment in the initial influent pond to a level that allows efficacy in the remaining system.

Drakenstein Municipality was approached in mid-October 2009, with a request to participate in a field trial for the bioremediation of wastewater/sewerage effluent. The municipality offered Pond #1 at the Gouda sewerage oxidation and maturation pond site. This site was deemed ideal for the trial, as the two influent ponds (Pond #1 and Pond #2), are practically the same in size and conditions. Pond #1, being the primary influent pond, had higher average values for Chemical Oxygen Demand (COD) and Suspended Solids (SS).

Objective:

The water conditions in Pond #1 were found to be above the Department of Water Affairs (DWAF) limits on both the COD and SS for the "discharge of wastewater into a water resource (1999)". The 7-year average and August 2009 water parameters, taken from the municipal laboratory results are given in the table below. These parameters give the starting point for the remediation.

PARAMETER	7 YEAR AVERAGE	AUGUST 2009	DWAF LIMIT
COD	410	388	75
SS	78	177	25
pH	8.6	7.8	5.5 - 9.5

Fig. 1: *Data on organic loading in pond #1 prior to treatment.*

The goal of a successful field trial is to reduce the pH, COD and SS values being equal to or lower than the DWAF limits and/or remediation of the water to the point where the water is able to support the natural aquatic flora and fauna associated with a settling dam.

In order to keep the field study true to conditions generally found in the Southern African arena, no special or proprietary equipment was used in the application of the bioremediation product. The product was poured by hand standing on the edge of the dam. As a boat was available for the initial inoculation, product was poured from the boat as it was tracked diagonally across the dam.

The dosing regime for the MICROBE-LIFT® products is shown in the table below. Dosage is shown in gallons. The MICROBE-LIFT® formulation was added at the calculated standard dosage for a volume of effluent equal to 2000 m^3

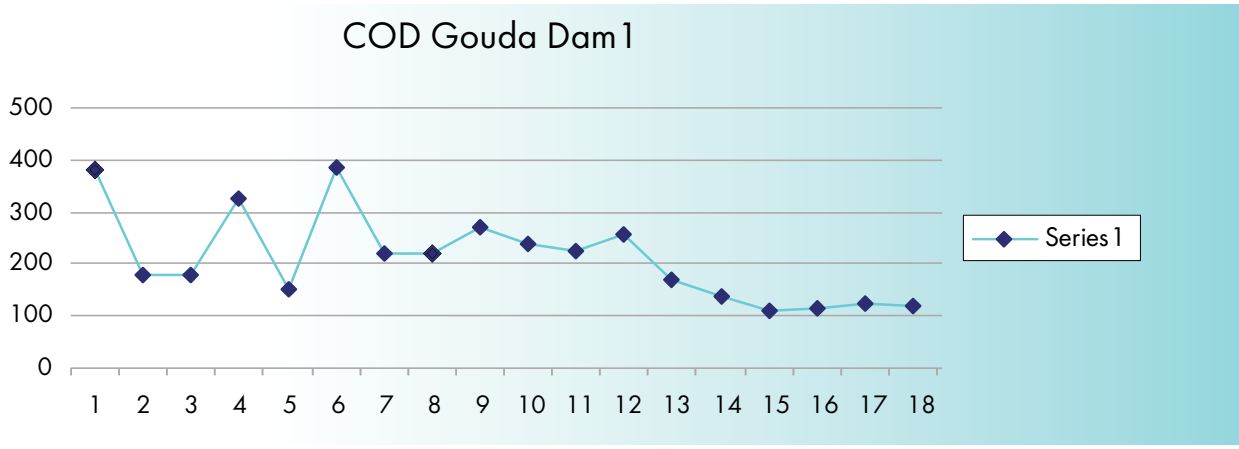
PRODUCT	WEEK 1	WEEKS 2 - 5	WEEKS 6 - 27	ADDITIONAL
	Inoculation 12/10/2009	per week	per week	For 2 weeks 05/02/2010
MICROBE-LIFT® #1	16	8	2	
MICROBE-LIFT® #2				3

Fig.2: *This chart represents the dosage schedule for the field trial. During the trial it was decided to add another MICROBE-LIFT® product, for two weeks to assist in degrading bottom solids.*

Samples were drawn from the same area as those drawn for the municipal samples. This sampling area on the southern side of the dam, 10m from the southeast corner, provides a small concrete platform where hand samples may be gathered. Duplicate samples were taken on a weekly basis, or more often if deemed necessary. The sample was collected in sterile 1-liter sample bottles with sealable lids. Once the sample was taken the lid was sealed and the sample packed into a polyurethane cooler to keep the sample temperature stable. Sealed samples were delivered to the laboratory for analysis.

Results Achieved:

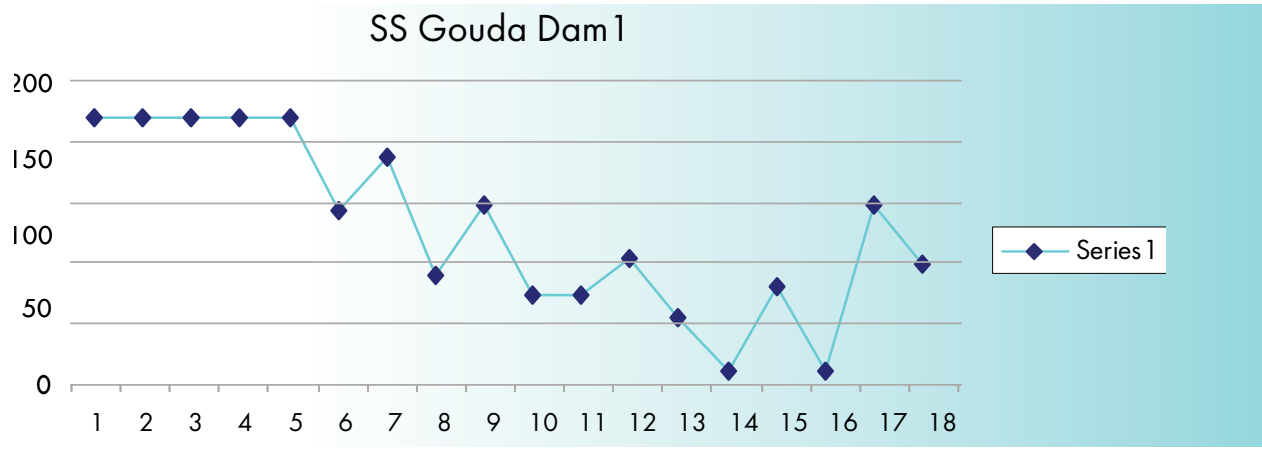
The following graph shows the COD (chemical oxygen demand) data in pond #1for the 18 weeks of the trial:



The results show the downward trend of the COD and SS values, these being the two main indicators of water quality. The pH value measured was well within limits at all times during the trial.

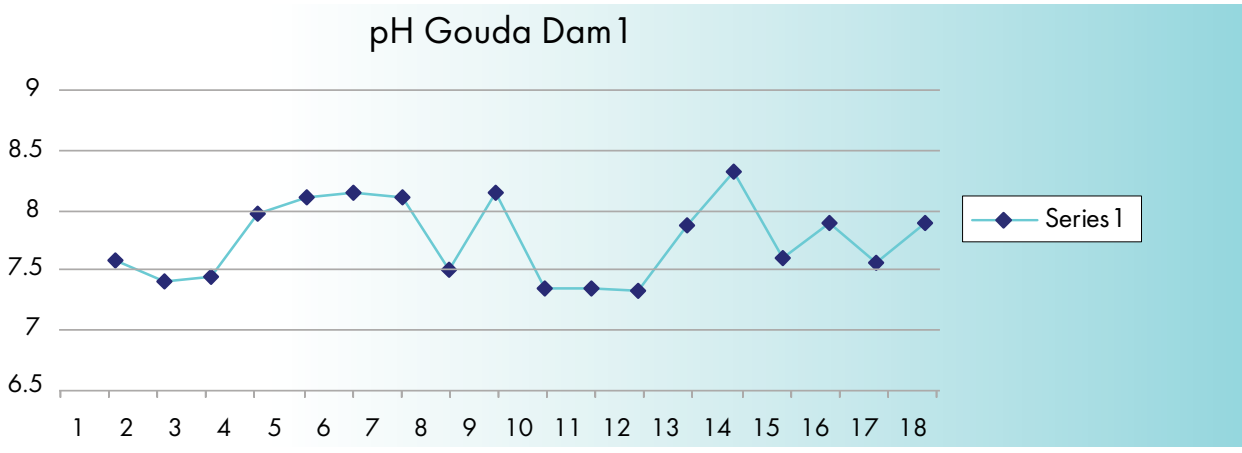
The overall downward trend of COD is due to the ongoing oxidation of organics and inorganics present in the water plus the corresponding suspended solids released to the water as the solids in the benthic sludge layer are solubilized. This trend will continue until the benthic sludge layer is removed and a steady state between influent and effluent from the pond is achieved. It is estimated that this value will reach DWAF limits by week 22 and can be accelerated with the application of a second MICROBE-LIFT product if required. The spikes seen at weeks 4 and 6 are due to the release of soluble organics from the benthic sludge layer, due to the population growth of the bacterial consortium.
The decline shown from week 12 to 18 is due to the addition of 6 gallons of MICROBE-LIFT SA over weeks 11, 13 and 16 to accelerate the solubilization of the sludge layer. Further application of the second product is required to reduce the COD value to below 75 mg/l.

Suspended solid (SS) data for the trial period are provided below:



The overall downward trend of the SS value is due to the ongoing solubilization of organics present in the benthic sludge layer and the corresponding release of soluble organics suspended in the water. The spikes seen at weeks 7, 9, 12, 15 and 17 are due to the release of soluble organics and inorganics from the benthic sludge layer, due to the addition of MICROBE-LIFT SA. This product is specifically formulated for the biological oxidation of slow-to-degrade organic solids. Once a steady state of oxidation is reached between influent and effluent this value will remain substantially below the DWAF limit of 25 mg/l.

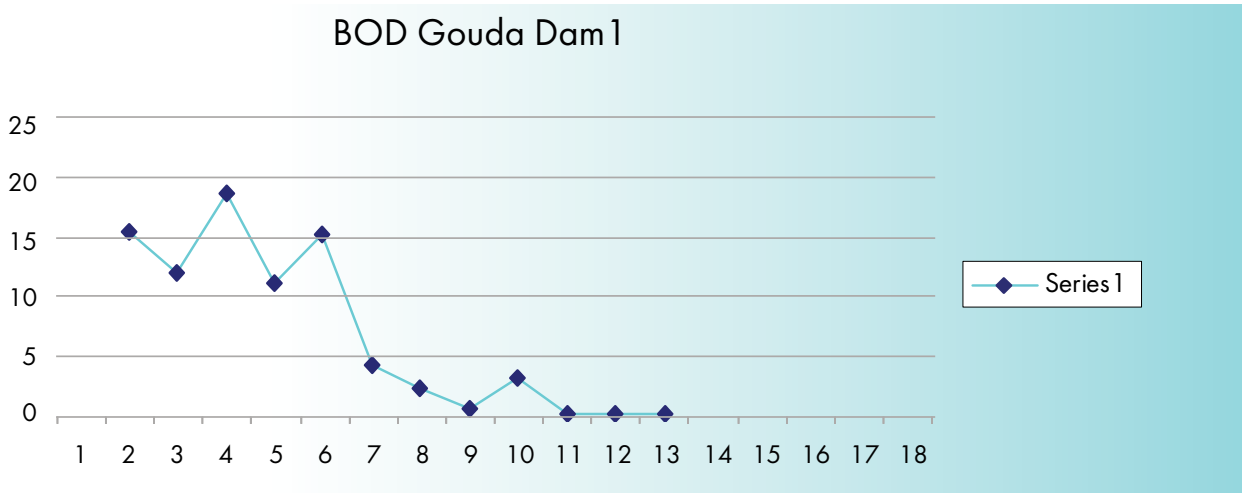
pH remained in the 7.5 to 8.5 range throughout the trial as shown in the graph that follows:



Throughout the trial, the pH varies from 7.5 to 8.5.

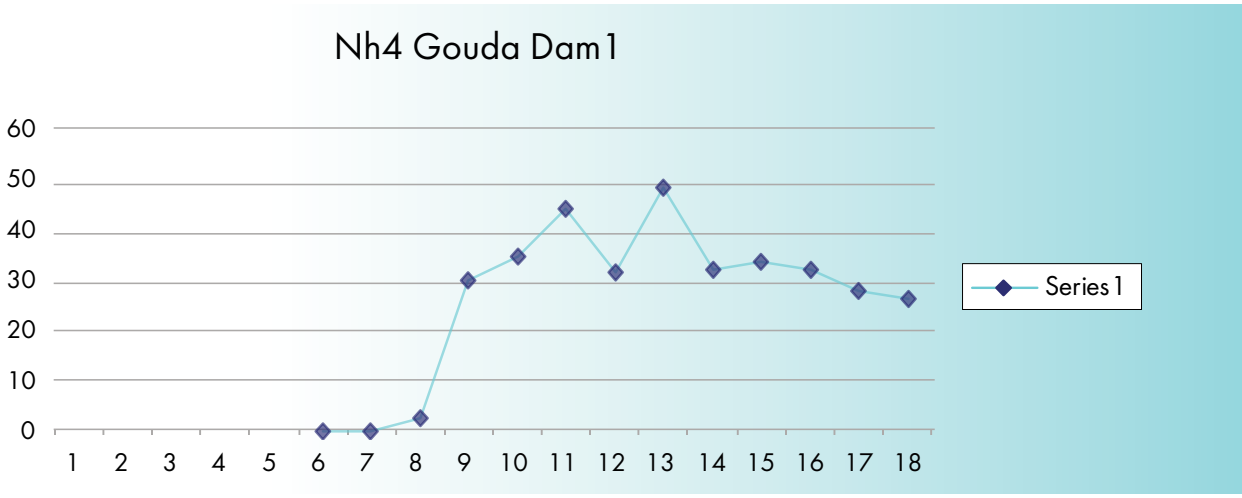
The pH has remained well within DWAF limits for the 18 weeks of this trial. This value is not expected to change by any great amount in future. The small variations seen are usually due to the breakdown of organic acids that lower the pH. In the anaerobic conditions in the benthic zone it is not uncommon for the formation of these organic acids by acetogens.

BOD (Biological oxygen demand) levels are indicative of the biodegradable portion of the waste. The excellent reduction of BOD shows the efficacy of the bioaugmentation program.



As can be seen from the graph, the majority of organics present in the pond were solubilized and oxidized between weeks 6 and 13. The sampling and analysis for BOD was discontinued after a 3-week steady state was incurred. The spikes seen at weeks 4, 6 and 10 are due to the population growth in the bacterial consortium after dosing. The COD and SS values tend to lag the BOD trend by approximately 2 weeks, this is due to the action of the bacterial consortium on the more easily oxidized organics as opposed to the more difficult to solubilize organic sludge.

Ammonia (NH4) elevates as sludge containing nitrogenous compounds is broken down.



As the breakdown of organic sludge solids in the benthic layer throws ammonia into the water phase, they will be removed over time by heterotrophic uptake or through natural nitrification and denitrification. During nitrification ammonia is converted to nitrate and then into nitrogen gas and released. The ammonia is expected to drop to the 0.1 to 0.2 ppm range as the COD value is dropped to below 75mg/l.

Significant events

As can be seen from the graphs, after the initial inoculation of the MICROBE-LIFT product in week 1, the bacterial consortium growth peaked in week 3. From this peak the organic/inorganic sludge layer in the benthic zone began to be solubilized. As dosage continued further peaks were experienced with each dosing until week 10, by which time the BOD had normalized. The COD, however, remained stubbornly in excess of 200 mg/l. In order to assist the reduction of the COD value, MICROBE-LIFT SA was added in weeks 11, 13 and 16. The addition of SA then provided the catalyst for COD reduction as the insoluble components of the benthic sludge layer were solubilized and freed for oxidation. Due to the large sludge component deposited over years, this value will reduce below the 100 mg/l as the final sludge layer is oxidized.

It is interesting to note that the natural aquatic fauna returned to the pond in week 13, where a population explosion of Daphnia, Platana and other aquatic life appeared. This aquatic life is still present in the pond and the possible introduction of fish is being investigated.

Conclusions:

Using the calculated dosage rates, bioremediation of the pond was achieved in 13 weeks. This was a week longer than the original estimation of 12 weeks. Bioremediation has dropped the BOD, SS and COD and led to the appearance of natural fauna in week 13. Interestingly the fauna appeared at the peak of the ammonium cycle, where it is shown that ammonium is not harmful to certain fauna at the pH levels experienced.

In March 2010, Gouda began a rehabilitation process for the ponds and piping, which resulted in the ponds being pumped to very low levels. The low levels exposed inaccessible areas of the ponds and have given new insight into the COD value seeming to stabilize at approximately 100 mg/l. Significant sludge deposits were exposed in the corners of the pond. These deposits were not picked up in sludge sampling due to their placement. It is clear that the mid and lateral-mid sections of the pond have been cleared of sludge and the remaining corner pockets are responsible for the COD plateau at 100 mg/l. With the ongoing dosage of the SA product these deposits will be oxidized and the COD and NH4+ values will drop to below the DWAF limits.

The Following Benefits Accrued From This Field Trial:

- Due to the oxidation of pollutants, the wastewater and effluent can be brought to within DWAF limits for release into receiving waters in approximately 12 weeks. This figure may be manipulated by the addition or subtraction of product quantities.
- This bioremediation takes place in situ with NO additional mechanical intervention, therefore no capital investment in plant expansion, machinery, or energy is required.
- This bioremediation takes place in situ with NO chemical or enzyme intervention; therefore no additional pollutants are introduced.
- Odors are eliminated within approximately one week after initial inoculation of product.

- The action of the bacteria consortium has as an additional beneficial side effect. Due to the reduction of odor, there was a reduction of the mosquito and fly population.
- As the sludge is oxidized the current extremely expensive cyclical dredging of ponds is reduced to an absolute minimum, if required at all.
- The contamination of groundwater is also remediated over time, as the anaerobic constituents of the bacteria consortium will permeate the soils with the pond water, thereby reducing the need for re-lining of ponds.
- As a result of treatment, the pond is in a state where fauna such as indigenous fish or others may be introduced. With a small investment in facilities, the area could be used for public recreation such as picnics, angling, bird watching etc.

For more information on MICROBE-LIFT® Technology contact
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CS13113

California City Reduces Lift Station Maintenance with MICROBE-LIFT® Technology

Location: **Kerman, CA, USA**

Background:

A city of 14,000, Kerman is located 15 miles West of Fresno, CA. As the business and commercial center for Fresno County, this city was cited as one of the fastest growing cities in central California with 150% growth since 1990. Typically, fast population growth puts a strain on local services and the town's sewer maintenance was no exception.

Kerman's collection system is relatively new with approximately seven years of service to date. It consists of 25 grease traps in the city leading to 2 lift stations. The lift stations empty into five ponds before reaching a final 48 MG pond that is utilized to irrigate silage crops.

Objective:

The grease traps and lift stations were plagued with rapid grease build-up requiring expensive and time-consuming pumping and disposal of grease in most locations.

The wastewater manager stated that he had worked for the city of Kerman for 15 years and although he had "tried everything" he had never seen a technology that worked to clear the grease.

Ecological Laboratories' technical staff developed a program to treat the system with MICROBE-LIFT®/IND beginning with the two final lift stations. The first station was 10 X 15 X 35 feet deep with an auger to keep the fluid mixed. The second was 8 X 20X 30 ft deep. At the time of treatment there was a grease layer 2-3 feet thick covering the width of the station and extending over three-fourths of its length. The grease was physically removed from the well prior to initiation of treatment.

Initially both the wastewater and collection wells were each dosed once with 3 gallons of MICROBE-LIFT®/IND. Thereafter 1 gallon was added to the collection pit daily for four days. Starting on the fifth day, the system was maintained on a dosage of 1/2 gallon per week.

Results Achieved:

The results of treatment with MICROBE-LIFT®/IND were dramatic as depicted by the pictures below. Before treatment on February 8, 2012 the lift station pictured below was heavily impacted with grease and scum.

Fig. 1: *With the grate open, a 2 - 3 foot grease layer is evident prior to treatment.*

Fig. 2 & 3: *These pictures show a side view with gate open and a top view with gate closed.*

Fig. 4: *May 18, 2012 after three months of treatment, the grease cap has not returned.*

Fig. 5 & 6 *These pictures further demonstrate the lack of new buildup of the grease cap when seen from a side view and through the grate from the top.*

After three months with only the maintenance dose of ½ gallon per day being applied, the grease layer has not returned.

The MICROBE-LIFT® program was considered to be such a success that the wastewater manager is budgeting for the treatment program to be expanded to include all grease traps in the city system plus the sewer plant head-works.

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CS13114

Bioaugmentation with MICROBE-LIFT® Technology Reduces Sludge Production 20% Allowing Digester to Handle Increased Load

Location: **City of Busan (formerly Pusan), South Korea**

Background: Busan is the second largest metropolis in South Korea. With a population of 3.6 million, it is second in size only to Seoul. With rapid urban development the city of Busan was continually challenged with increasing wastewater treatment demand. The city's anaerobic digester was only functioning at 70% of design efficiency based on volatile suspended solids (VSS) reduction.

Objective: In 1999, Ecological Laboratories was approached by the City of Pusan in Korea about the use of one of it's bacterial products to improve the efficiency of it's anaerobic digestors, which were functioning at 70% of design efficiency based on volatile suspended solids (VSS) reduction. While a version of the product had been used in septic tanks, primarily an anaerobic environment, with good success, the product had not been applied to commercial size anaerobic digestors.

Pilot studies were conducted in 5,000-liter pilot reactors that remained from the original design work on the digestors. With encouraging results achieved in the pilot trials, field trials were later pursued.

MICROBE-LIFT®/IND Application Program

Day	Tank 1	Tank 2	Tank 3	Tank 4	Total
1	6 gal.	4 gal.	3 gal.	4 gal.	17 gal.
4	6 gal	4 gal.	3 gal.	4 gal.	17 gal.
7	3 gal.	2 gal.	1.5 gal.	2 gal.	8.5 gal.
10	3 gal.	2 gal.	1.5 gal.	2 gal.	8.5 gal.
13	3 gal.	2 gal.	1.5 gal.	2 gal.	8.5 gal.
16	3 gal.	2 gal.	.5 gal.	2 gal.	8.5 gal.
19	3 gal.	2 gal.	1.5 gal.	2 gal.	8.5 gal.
22	3 gal.	2 gal.	1.5 gal.	2 gal.	8.5 gal.
25	3 gal.	2 gal.	1.5 gal.	2 gal.	8.5 gal.
28	3 gal.	2 gal.	1.5 gal.	2 gal.	8.5 gal.
31	3 gal.	2 gal.	1.5 gal.	2 gal.	8.5 gal.
34	3 gal.	2 gal.	1.5 gal.	2 gal.	8.5 gal.
Maintenance (2x/wk)					
	1.5 gal.	1 gal.	0.5 gal.	1 gal.	

Total first 37 days = 127 1/2 gallons
Annual Maintenance = 416 gallons

Fig. 1: *This table provides the dosage schedule for the Busan field trial. The annual maintenance rate is 416 gallons.*

Results achieved: Within 90 days the VSS reduction went from 70% of design efficiency to 130% of design efficiency. The plant has continued to use the product with the exception of one year during which an alternate product from a Japanese supplier was used and the plant efficiency returned to the 70% VSS reduction efficiency observed prior to the bioaugmentation with MICROBE-LIFT®/IND. The following year when the MICROBE-LIFT®/IND was again added, the digestors again resumed the 130% VSS reduction observed the first time with the MICROBE-LIFT®/IND.

Fig. 2: *Harbor in Busan, South Korea*

For more information on MICROBE-LIFT® Technology contact

Ecological Laboratories Inc.

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CS13115

Shoal Lake Lagoon Treatment with MICROBE-LIFT® Technology Ensures Rapid Start-up in Spring After Winter Freeze

Location: **Shoal Lake, Western Manitoba, Canada**

Background: Shoal Lake is a small town of less than 1,000 people in western Manitoba. The wastewater generated by the town is treated in a series of three aerated facultative lagoons to lower key pollutant discharge parameters prior to discharge to the lake. The lagoons are in series and referred to as Cell #1, #2, and #3. Cells #1 and #2 are both 49 years old with a surface area of 5 acres and a depth of 6 feet with an approximate volume of 10 million gallons (MG). Cell #3 has been in service for 26 years and is 7 acres by 6 feet deep with an approximate volume of 14 MG. Normal inflow into the series of lagoons is approximately 0.22 million gallons per day (MGD). There is an estimated 2 feet of sludge in each lagoon. This sludge build-up reduces the working volume of the lagoons and the hydraulic retention time (HRT) of the system by about 30%.

Before the winter weather arrives, the lagoons are pumped down so that water can be collected during the winter months when no water is discharged. When the warmer weather arrives in the spring, water is discharged to the lake from the 3rd Cell after the water has been shown to be below discharge limits. The city's permit requires that the following parameters be met before discharge: BOD <30 mg/L; fecal coliform count <200 per 100 mLs. of sample based on the MPN Index; total coliform <1,500 per mL of sample based on the MPN Index; and total phosphate <1.0 mg/L. The lagoons also must keep offensive odors minimized.

Fig. 1: *Shoal Lake and lagoon system*

Since the biological activity slows down dramatically while the load is continually fed to the system over the winter months, it is desirable that the biological activity increases as quickly as possible in the spring to take advantage of the time frame when ambient temperatures are warm enough to effect adequate treatment.

Objective: In 2012, the city made the decision to evaluate a biological additive that would increase the biological activity quickly to achieve high levels of treatment as soon as possible. Samples for key operating parameters commonly monitored for wastewater discharge were taken monthly to effectively monitor the system efficiency. These included: BOD, COD, TSS, TKN, ammonia, nitrite, nitrate, total and reactive phosphorous, and total and fecal coliform counts. The additive evaluated was MICROBE-LIFT® formulation, produced by Ecological Laboratories, Inc. in Cape Coral, FL and supplied by Gerald Wiebe and Associates, of Manitoba. This product has been used successfully worldwide to improve the efficiency of biological systems, including lagoon systems, producing a high quality effluent and at the same time reducing odors, and breaking down organic sludge that has built up on the bottom of the lagoon resulting in significant overall cost savings.

CELL 1

Limited historical data on this system was available. More comprehensive monitoring was performed this year in order to better evaluate the impact of the bioaugmentation program. Performance of the individual Cells was monitored. The primary wastewater monitoring parameters for Cell #1 can be found in Figure 2.

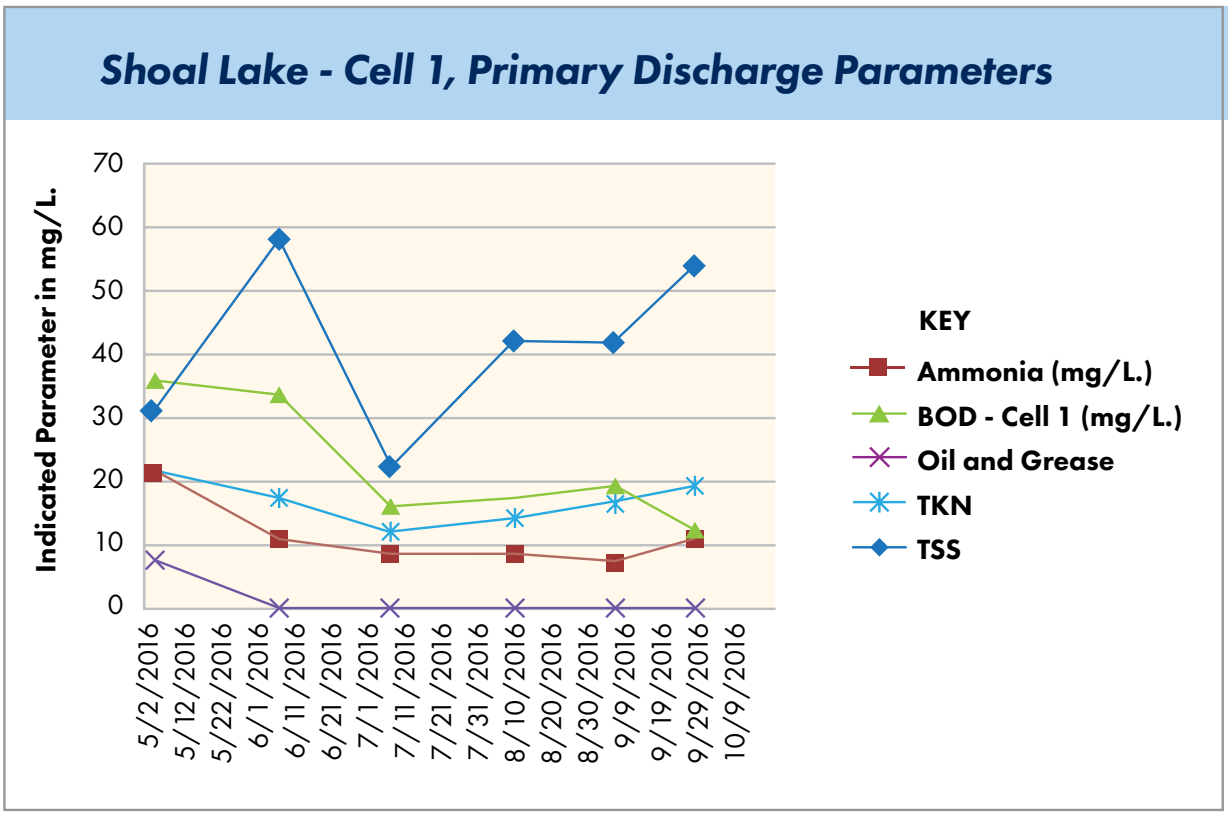

Fig.2: *Operating results for Shoal Lake Cell #1.*

The most dramatic drop was observed in BOD from the May through July time frame, with a total reduction of over 50% to below 20 mg/L. Similar results were observed with ammonia, TKN, and oil & grease. The only parameter, which increased was the TSS, which is to be expected as the bacterial population grows to handle the organic load. However, once their source of substrate was depleted, or stabilized, a drop in the TSS was observed in July. A later increase in TSS was likely due to the bacteria beginning to digest the accumulated organic solids in the lagoon bottom as a food source.

The nutrient analyses for Cell #1, which appear in Figure 3, show negligible levels of nitrites and nitrates throughout. It is possible that the primary mechanism for ammonia reduction, this early in the application, is a result of heterotrophic uptake of ammonia as a source of nitrogen for Cell synthesis. This is supported by the initial increase in TSS. Reactive phosphorous was also reduced, and again the probable mechanism is heterotrophic uptake to meet phosphorous requirements of the bacterial growth. The slight increase in total phosphorous is likely due to breakdown of biological solids on the bottom of the lagoon, but it should not be as great a concern since the non-reactive fraction of the phosphorous is less likely to create water quality issues like algae blooms.

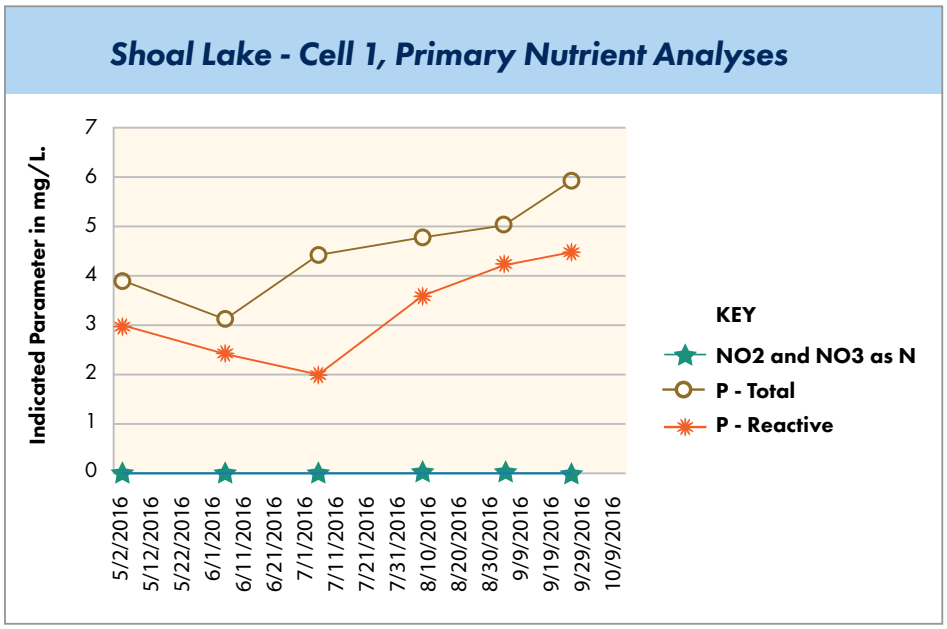

Fig. 3: *Shoal Lake Cell #1 Nutrient Data*

Total and fecal coliform numbers vary. The total coliform numbers generally increase as the temperature rises and more biological activity is observed. In general, the application of MICROBE-LIFT® technology will typically result in significantly reduced fecal coliform counts. It is possible, depending on the test methods used, that certain organisms in the MICROBE-LIFT® technology can generate a false positive for a time, but can be confirmed as not coliforms through additional testing. Since these numbers are observed in Cell #1 these numbers are not as great a concern since this water is not discharged directly to the lake, but goes to Cell #2.

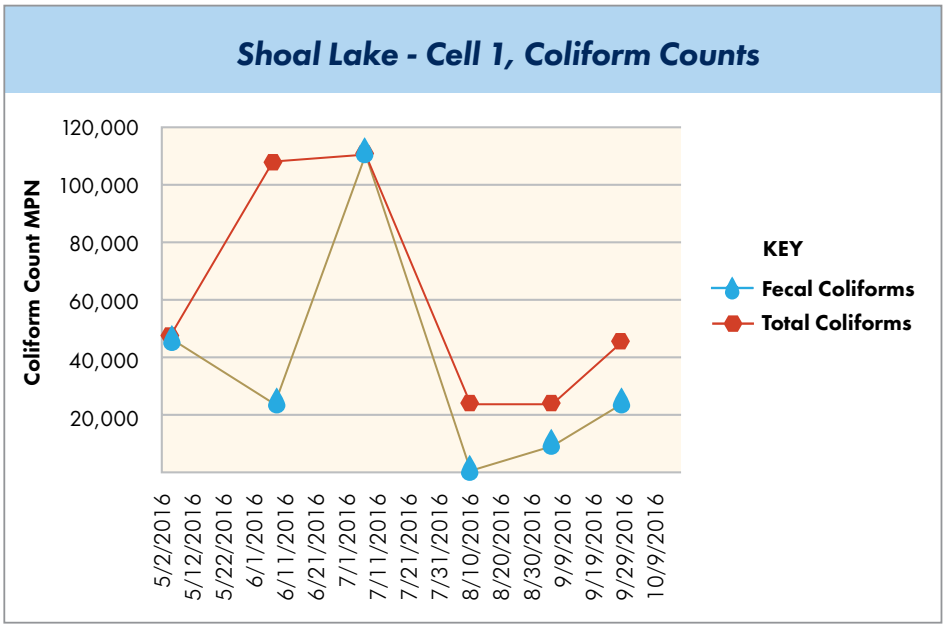

Fig. 4: *Shoal Lake, Cell #1 Coliform Data*

CELL 2

Proceeding to the primary discharge data in Cell #2 (Figure 5), all parameters with the exception of BOD have been reduced significantly. The BOD has risen slightly, and this is something that has been observed in many lagoon applications worldwide. This increase is due to the breakdown of solids that have accumulated on the bottom of the lagoon once the soluble organics have been lowered significantly. In documented cases, it has been demonstrated that from 1" to 3" of organic solids, which have accumulated on the bottom of a lagoon, can be digested per month. This usually results in substantial savings in dredging costs.

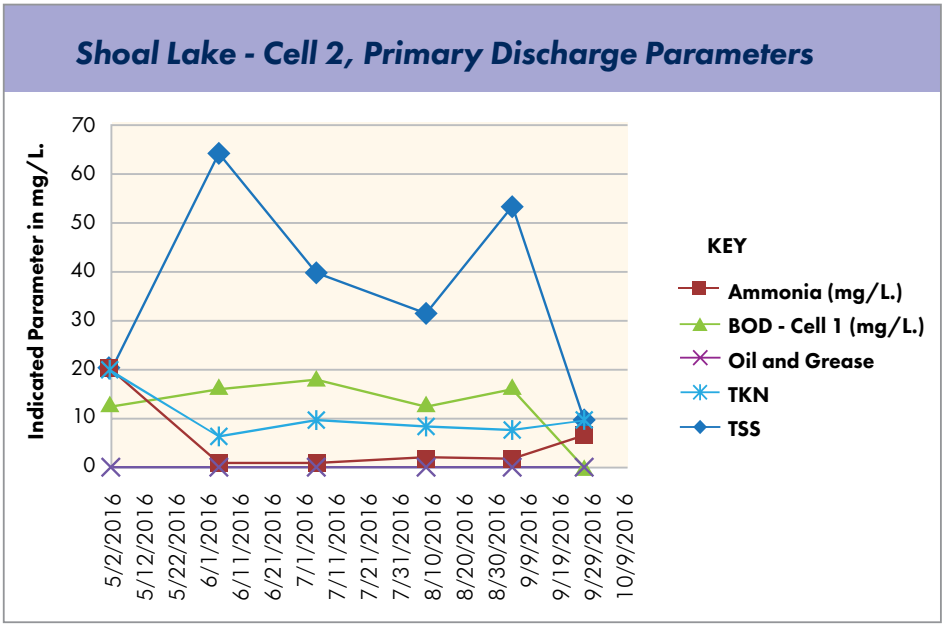

Fig. 5: *Operational results for Shoal Lake Cell #2*

Nutrient levels (Figure 6) show that nitrite and nitrate levels continue to be very low. Total and reactive phosphorous are somewhat higher but the more important reactive phosphorous being reduced to almost 1/0 mg/L. There will be less heterotrophic uptake of nutrients as the organics are reduced as a result of removal in Cell #1.

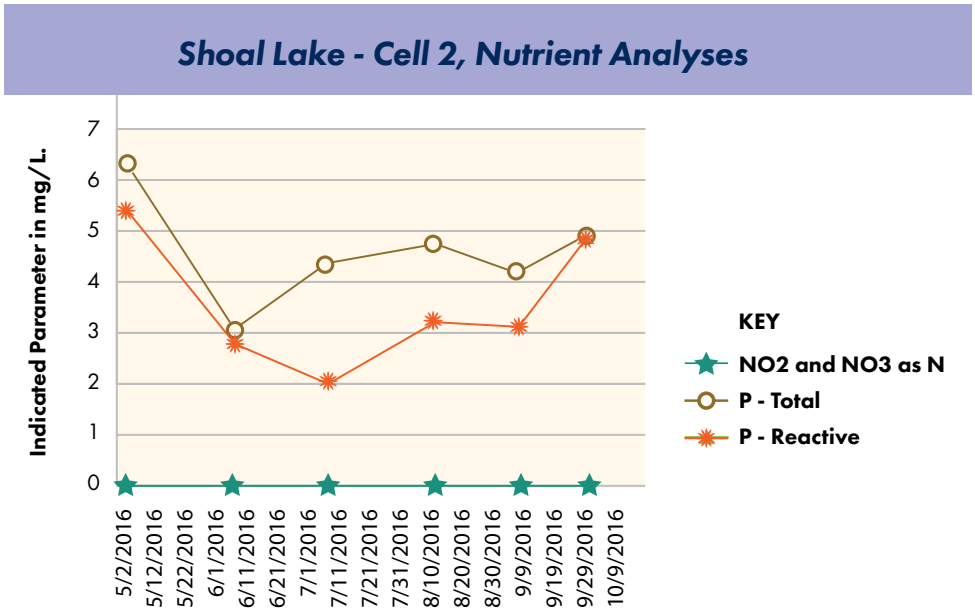

Fig. 6: *Shoal Lake Cell #2, nutrient data*

Coliform numbers for Cell #2 are much lower, as the populations in the MICROBE-LIFT® formulation compete with the naturally occurring coliforms for available nutrients. The increase in total coliform count in July may again be attributable to some false positive reading of certain organisms in the MICROBE-LIFT® formulation due to their versatile metabolic capabilities.

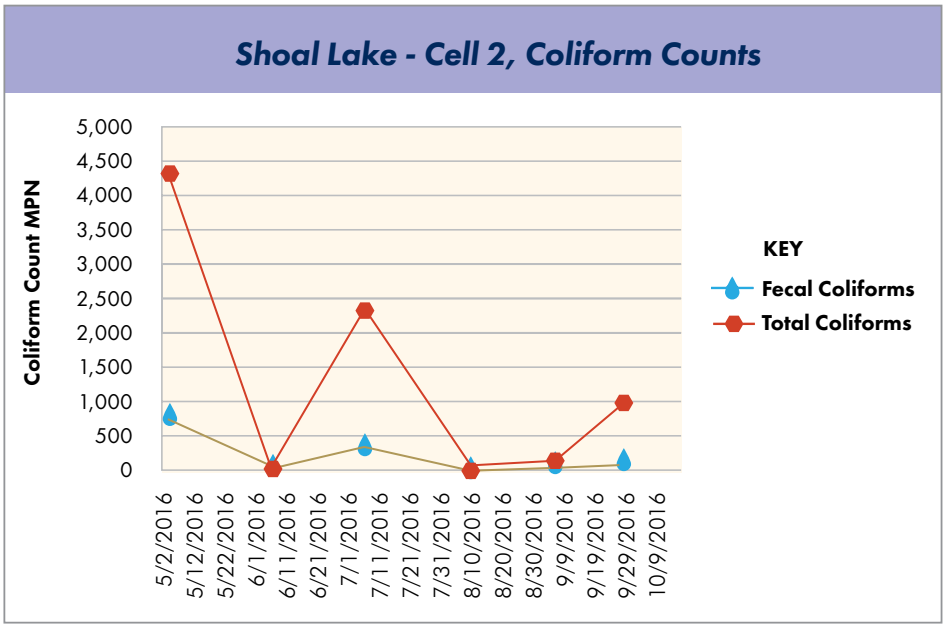

Fig. 7: *Shoal Lake #2 Cell coliform counts.*

CELL 3

In Cell #3 the primary discharge levels have been reduced, with the exception of TSS. All permitted discharge parameters have been reduced to below allowable discharge limits for most bodies of water. Our experience shows that most lakes will have background levels below what is observed here. Again, there is a slight rise in TSS values, as the beneficial bacteria multiply in the process of breaking down the organic pollutants. Eventually, the equilibrium levels of organics will be reduced to a level where the bacteria will go into endogenous respiration and the TSS levels will drop.

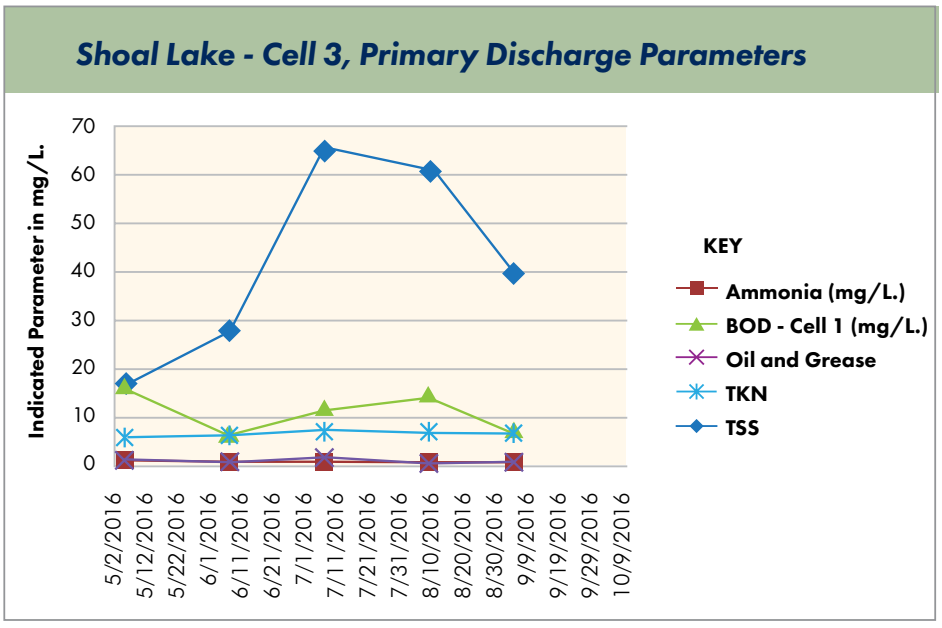

Fig. 8: *Shoal Lake Cell #3 performance data.*

There were no detectable results for nitrite and nitrate reported for Cell #3. The reactive phosphorous levels did decline but then rose slightly, while total phosphorous levels remained mostly unchanged. Fecal coliform levels in Cell #2 were 4 per 100 mls. Total coliform reading remained somewhat higher, but was still at a relatively low level for a natural body of water and is well within permit limits.

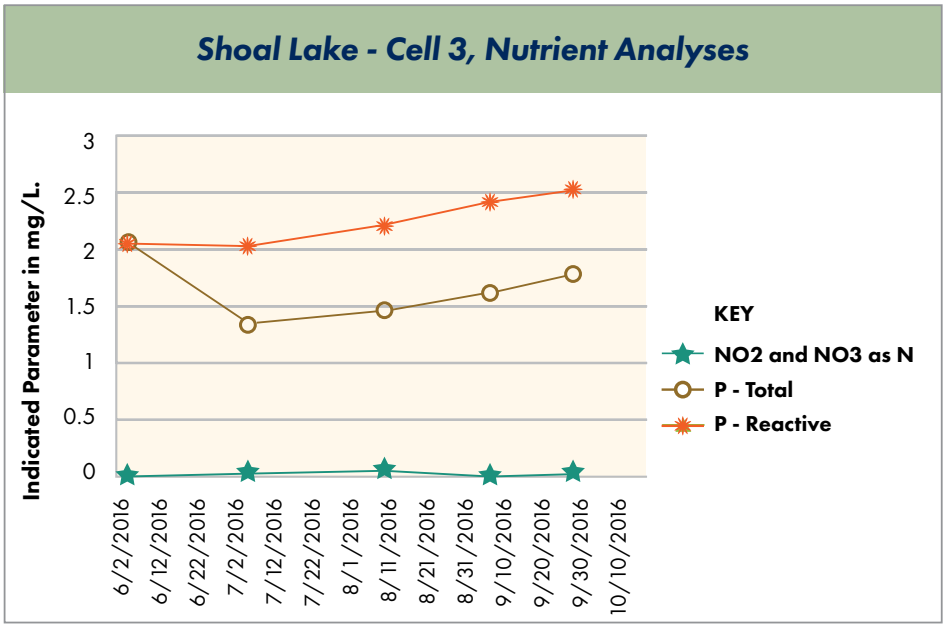

Fig. 9: *Shoal Lake Cell #3 nutrient analysis shows adequate levels.*

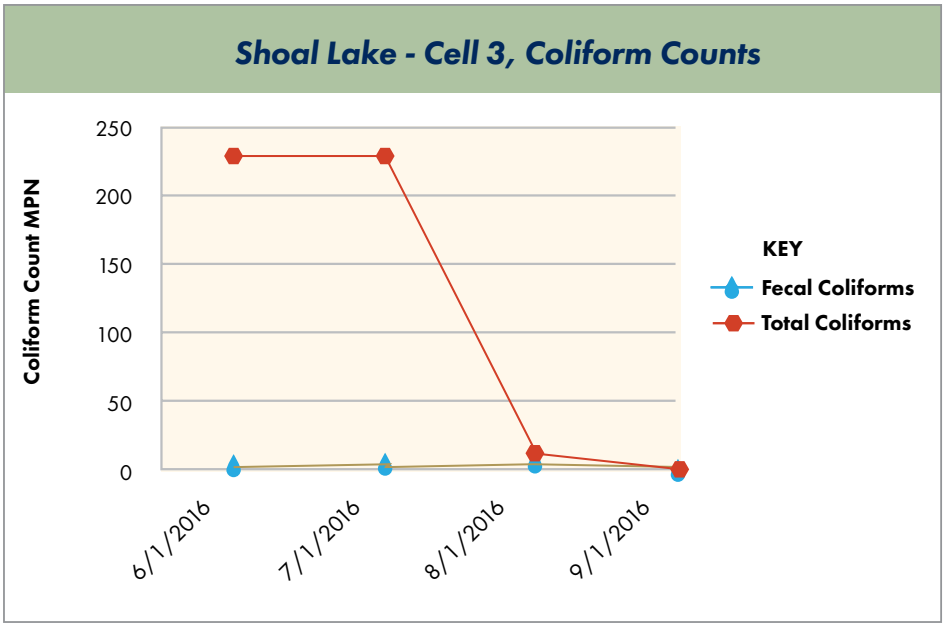

Fig. 10: *Shell Lake Cell #3 coliform data.*

Total Findings:

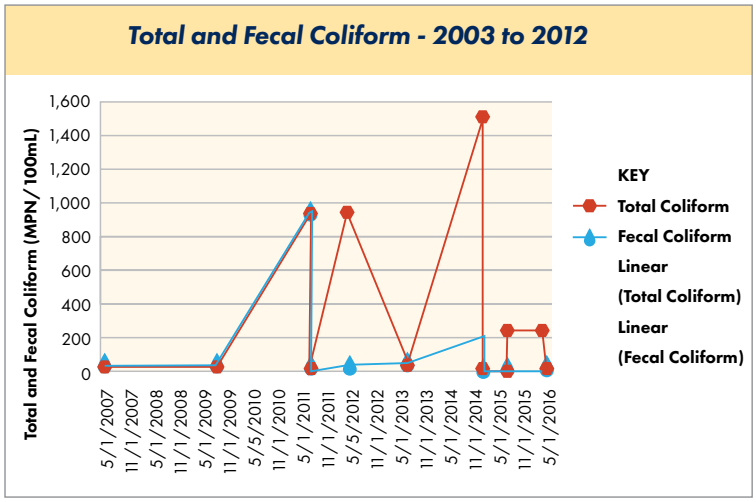

Fig. 11: *Total phosphorus readings compared for 2011 and 2012.*

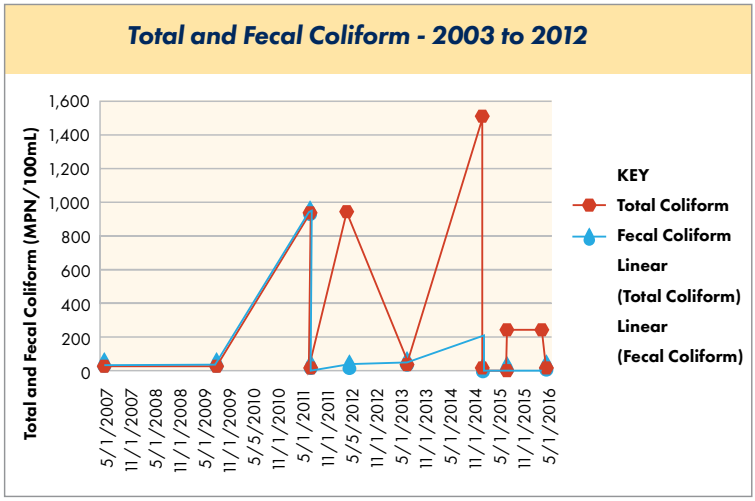

Fig. 12: *Total and Fecal Coliform Counts with projected trend lines.*

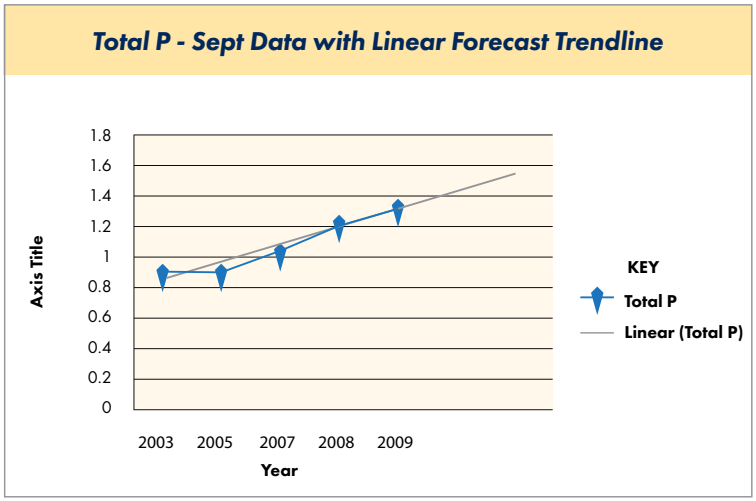

Fig. 13: *Historical September total phosphorous readings from 2003 through 2009 with projected trend lines.*

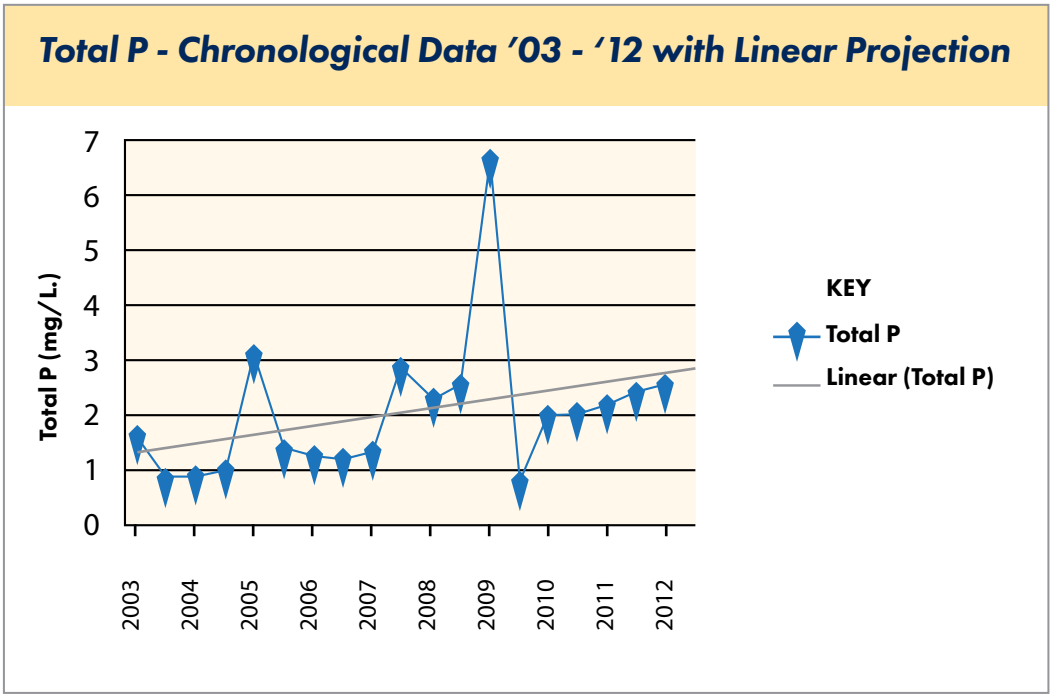

Fig. 14: *Chronological sequence of all total phosphate readings for Cell #3 from 2003 through 2012 with Linear Projection line*

Conclusions:

While comparisons of historical performance were limited, for certain parameters comparisons were made for performance data from 2012 relative to that of 2011. In addition, total phosphate data and coliform data trends were evaluated for all years for which data was available from 2003 to 2012. All significant discharge parameters were reduced over the monitoring period evaluated. As would be expected, there is some variability in the data from month to month and Cell to Cell. However, trends across the board for BOD, ammonia, TKN, O&G, nitrate-nitrite, are down. TSS values increased during monitoring, and, as pointed out earlier, this is to be expected due to increases in the biological activity and growth of the bacteria on the organics.

While slightly higher total phosphate values were observed, the historical values for total phosphate showed that there has been an increasing trend since 2003, possibly due to accumulation of bottom solids and release of phosphorous from the solids as they break down. During the trial period the phosphate levels were stable and did not exhibit the fluctuations observed in historical monitoring periods.

In the historical data presented, there was one occasion where the discharge limits for both total and fecal coliforms were exceeded, and there were marked fluctuations in readings. Compared to historical values, the coliform data observed during the trial period were much more stable and in a range where the values were substantially below discharge requirements, making an excursion very unlikely.

While only subjective qualitative observations were made regarding odor, the control of which is mandated in the permit, the general consensus was that odors were reduced and no complaints regarding odors were reported.

Recommendations:

The analytical results recorded during the bioaugmentation trial indicate that better system efficiency and stability has been observed and we propose continuing the program in 2013. This will provide further data with respect to the improvements in efficiency and stability.

Based on observations in other lagoon systems, in the future it would be helpful to monitor bottom solids levels to determine what level of solids breakdown we are achieving. It was estimated that there are two feet of sludge in all three lagoons. Additional loading from sludge breakdown effects many of the monitoring parameters. Considering the impact that the breakdown of organic solids has on the water monitoring parameters like soluble BOD, COD, ammonia, nitrates and phosphates would help get a better picture of the impact of bioaugmentation on treatment.

Sludge data would also provide even more economic justification for the program as in many cases bioaugmentation with MICROBE-LIFT® technology has saved municipalities hundreds of thousands of dollars on dredging costs by biodegrading these solids and reducing the frequency of, or eliminating the need for, dredging.

For more information on MICROBE-LIFT® Technology contact
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CS13116

MICROBE-LIFT® Technology Speeds Compost Processing & Reduces Odor while Producing Higher Quality Compost

Location: **Enviro Grind Ltd, Pettigo Co., Donegal, United Kingdom**

Background: Situated in South Donegal, Enviro Grind is a waste recycling company that has diversified into the reprocessing of organic waste streams. Enviro Grind operates an ABP Category 3 approved in-vessel composting facility and takes in feedstock including catering industry waste, pre and post food processing waste, fish and shellfish processing waste, some sludge material and green/garden waste.

Odor is often a problem in composting, but with the diversity of feedstock this was reaching a level where even the odor control technology employed on-site was ineffective. Recent growth in business had meant that the plant was also operating at full capacity and any change to the process was going to result in significant investment. Finally, being an ABP Category 3 site, any change to the process must not have a negative impact on the temperature profile of the process.

Objective: In an effort to reduce odor being generated, Enviro Grind initiated a trial of MICROBE-LIFT® core technology. Enviro Grind applied the recommended dosage of bacteria directly to the incoming waste. With a broad spectrum of bacteria being introduced at the start of the process, the aim was expanded to not only reduce the odor, but also speed up the process to reduce the strain on capacity.

Results achieved: Within the first six weeks of the program the performance was reviewed and due to the obvious odor reduction, Enviro Grind agreed to continue use for a prolonged period. After a year of use the results are clear:

- Odors are significantly reduced.
- Organic breakdown is improved.
- The operation process has been stabilized.
- The compost is dryer, and, as a result, screening is easier.
- All of the above have led to an increase in capacity.

Most importantly, all this has been achieved without any negative impacts on the process, or output, that could affect the ABP Category 3 status.

Martin Eves, Managing Director of Enviro Grind comments: "The addition of the MICROBE-LIFT® technology product has removed inconsistencies from the active composting phase, thus reducing processing time and improving the quality of compost produced". For more information on Enviro Grind Ltd, visit www.envirogrindltd.com or call +353 7198 61772.

For more information on MICROBE-LIFT® Technology contact
Ecological Laboratories Inc.
www.EcologicalLabs.com
CS13117

Made in the USA

Odor & Solids Reduction at Wastewater Treatment Plant on Resort Island in Southeast Georgia

Location: **WWTP on Resort Island in Southeast Georgia**

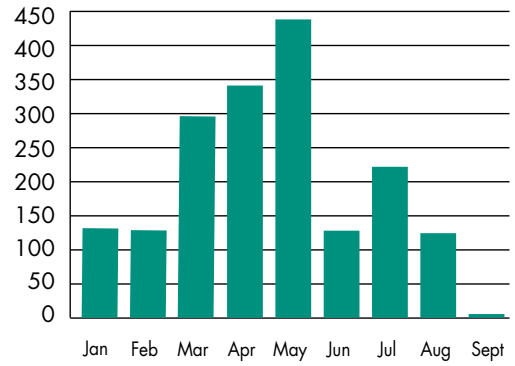
Problem: A WWTP in Southeast Georgia located on a resort island has a 3 million gallon per day flow. The WWTP was experiencing major odor problems at the head of the plant, as well as poor digestion and settling of bio-solids in the SBR's and aerobic digesters. The odors were primarily H_2S and were the source of numerous complaints from the residents living in the vicinity of the WWTP. The plant was hauling and disposing an average of 125 to 150 tons of bio-solids per month at a cost of approximately $60 per ton, which equates to $7,500 to $9,000 total average hauling/disposal charges per month.

Solution: MICROBE-LIFT®/IND was added to the influent of the wastewater stream approximately 100 yards before the head of the plant. The product was added at a rate of 3-4 PPM of the daily flow (3 million gallons). Odors were immediately reduced at the head of the plant. Within 2 days the plant operator began to see a significant reduction in solids in the SBR's as well as the digesters.

The WWTP was treated for a period of 30 days at a rate of 3-4 PPM. The plant operator also added 2.5 gallons of product directly into the digesters each day.

Results: During the first month of treatment the odors being generated at the head of the plant were dramatically reduced. No odor complaints from the residents were received during first month of application. The total waste solids for the 30-day period were reduced from an average of 125 tons to 4 tons (96.8% reduction). The plant saved $7,260 in hauling/disposal expense during the month. The improvement in overall plant operation also allowed for fewer man-hours being needed to run the plant.

Municipal WWTP Bio-Solids Tons Waste



MICROBE-LIFT®/IND feed at a rate pf 3 PPM during the month of September. Saved WWTP $7,000 in hauling and disposal fees.

For more information on MICROBE-LIFT® Technology contact

Ecological Laboratories Inc.
www.EcologicalLabs.com

CS13118

Made in the USA

Sludge Reduction & Cost Savings at Sequential Batch Reactor Plant in Southern Pennsylvania

Location: **SBR Plant in Southern Pennsylvania**

A 0.5 mgd SBR plant in southern Pennsylvania uses **MICROBE-LIFT®**/IND and **MICROBE-LIFT®**/OC and achieves the following improvements:

1. Maximizes throughput from aerobic digester to sludge press. If the digester gets full, they cannot remove waste solids from the SBR basins.
2. Reduces foaming in aerobic digester so blowers do not have to be turned off
3. Reduces filter press downtime for cloth washing
4. Decreases time and manpower requirements for the above-mentioned cleaning
5. Reduces chemical costs for filter press
6. Improves the effectiveness of UV disinfection
7. Makes it possible for primary contributors to increase their discharge flow to the WWTP facility
8. Makes it possible to operate plant at lower MLSS thus reducing foaming and filamentous
9. Better decant is possible in winter due to no frozen foam on decant trough
10. Net savings of over $2,000 per month

Background

Plant personnel wanted to lower operational costs if possible but maintain good effluent quality. Also, foaming was a problem throughout the system. Aerobic digester blowers often had to be turned off due to excessive foaming, so the aerobic digesters, in effect, became anaerobic digesters. This resulted in the production of solids that settled poorly and were difficult to dewater and in the generation of filamentous bacteria. Foaming at the surface of the two SBR basins was not only unsightly, but it was a breeding ground for filamentous bacteria, and, when foam froze during winter months, decant trough function was impaired.

Initial evaluation of **MICROBE-LIFT®**/IND and **MICROBE-LIFT®**/OC had the following **objectives:**

A. Improve B.O.D. removal to reduce foaming organics
B. Reduce the quantity of sludge generated
C. Improve solids settleability and dewaterability
D. Improve plate-and-frame filter press performance, while lowering flocculation-aid chemical usage
E. Reduce operational costs

Results: Before and After Comparisons

I. Aerobic digester blowers often had to be turned off because high levels of foam were generated and even overflowed the tank. An unavoidable consequence of this was that within minutes, anaerobic conditions would develop within the aerobic digester. This not only encouraged filamentous growth, but also resulted in significant solids deterioration. Solids in such a case do not settle well and are difficult (and expensive) to dewater.

IND and OC were added to the digester and within days **foaming was dramatically reduced** and blowers could be left on as per design specs.

II. Loading and flow conditions were the same before and after treatment with IND and OC began. Along the same lines, the average number of gallons of sludge waste per day from the two SBR basins did not change significantly. These factors are significant.

> In the 12 months before treatment began, an average of 27,810 gpd total was waste.
> In the first 12 months after treatment started, daily average wasting was 27,572 gpd.
> This is a difference of only 238 gpd. Therefore, the performance improvements **and cost savings achieved was NOT due simply to fewer gallons per day being waste.**

III. Since it had been observed that **foaming** was much more severe **on the SBR basins** at higher mixed liquor concentrations, there was incentive to reduce MLSS—but without decreasing plant performance or effluent quality. Specifically, they did not want to affect nitrification.

> In the 12 months before treatment began, average MLSS (of both basins) was 2,843 mg/lit.
> In the first 12 months after treatment began, average MLSS was 2,580 mg/lit, **down 263.**
> (Update: MLSS's can now be carried as low as 2000—and with improved performance.)

At these lower mixed liquors, foaming was appreciably reduced, protozoal population was "younger," and biological floc settled (and dewatered) better.

IV. With new cloths, the **plate-and-frame filter press** could get 90 runs/cycles/dumps between washings. Washing the cloths is an unpleasant, manpower intensive, ergonomically unfriendly task—not to mention that cake quality deteriorates as you get closer to the limit of the runs.

Except with new cloths, the average number of runs between washes was 32. After treatment with IND and OC began, **average number of days between washings went up to 110.** Press cake was higher quality as well. Better removal/degradation of fats, oil, and grease by the microorganism in IND and OC is the primary reason press performance is improved.

V. Sludge cake is transported to landfill where it **is weighed.**

Average monthly weight of this sludge cake **before** treatment with IND and OC:

155.4 Tons/month

Average monthly weight **after** treatment began:

60.2 Tons/month

This represents a 61.3% reduction in the amount of sludge cake disposed of per month on average

VI. Aluminum chlorhydrate (coagulant) cost reductions:

Before treatment: **15,648 gallons used in 6 months**
After treatment: **10,876 gallons** used in the corresponding 6 months

This represents a **30.5% reduction** and very considerable **cost savings** at $4.33 per gallon. **($21,000.00)**

VII. A UV array is used at this plant for **disinfection** of final effluent. The higher the transmittance of UV rays, **the better** the disinfection.

Before treatment: average transmittance was **23%**
After treatment: average transmittance was into the **mid 40%** range, a near doubling.

VIII. The above-mentioned improvement in UV transmittance made it possible for the WWTP to **lift** the **cap on the leachate flow** it received from the local landfill when necessary (after heavy rains, e.g.).

Before treatment: **35,000 gpd 6 days a week** was the limit on the landfill leachate flow
After treatment: **50,000 gpd 7 days per week if necessary**

Note: The landfill leachate has a tint to it. This was the original reason for the daily cap on flow from the landfill. Please note that the improved UV transmittances reported in Point VII above occurred even in light of the increased flows from the landfill reported in Point VIII.

IX. Net savings for this 0.5 gpd plant was an average of **$2,200 per month**, excluding reductions in manpower costs (for press fabric washings). Dosage of **MICROBE-LIFT®** /IND is 3 gallons per week. Dosage of **MICROBE-LIFT®** /OC is also 3 gallons per week. Addition point was directly into the aerobic digester for 3 months to seed it, then to the headworks thereafter.

For more information on MICROBE-LIFT® Technology contact
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Laboratory Testing: Microbe-Lift® Technology's Efficacy Improving Gas Capture in Biofilters in Seoul, Korea

Location: **This testing was conducted at LG Twin Towers, Seoul, Korea**

Background: MICROBE-LIFT®/HOG was designed for use in manure pits where it has been used successfully for over thirty years. One of the major benefits provided by this technology is substantial reduction in sulfur-containing odors.

Objective: Based on years of successful treatment controlling sulfide odors, the goal of this testing was to determine the potential for utilizing MICROBE-LIFT® technology in biofilters to improve removal of sulfur-containing odors in a wide variety of applications.
LG set up testing in their biofilters units as specified in the following charts:

Condition	Temperature: 30 Degrees C Pressure: 760 mm
Bio-Filter Reactor	Microorganism: **MICROBE-LIFT®**/HOG Bio Filter: Fiber Bio-Filter Thickness: 10 Cm Reactor Diameter: 3.2 Cm Reactor Size: 8.04 Cm^2 Reactor Volume: 80.4 Cm^3 HRT: 10.49
Input Gas Conc	GAS: DMS **(Di Methyl Mercaptan)** Inlet Conc.: 140 - ppm Flow Speed: 0.95 cm/s Flow Rate: 460 Cm^3/min
Output Gas Conc.	Temperature: 30 Degrees C Outlet Conc.: 0 - 1 ppm

Fig. 1: *This test was set up to determine the potential degradation of methyl mercaptan.*

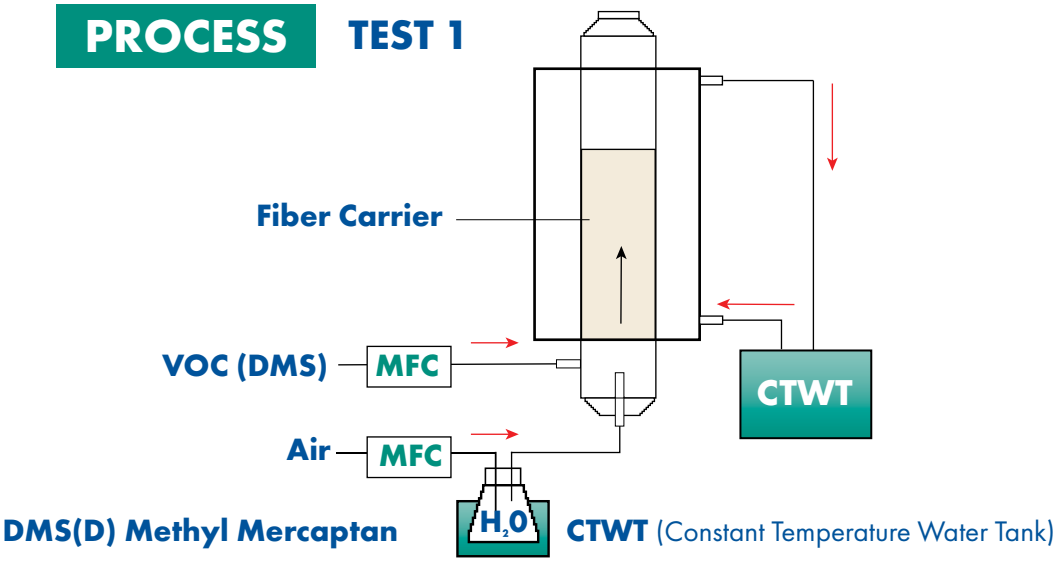

Fig. 2: *This schematic shows the design of the experiment whereby gas was passed through the filter along with humidified, temperature controlled air. Exhaust was recycled establishing a given reaction time.*

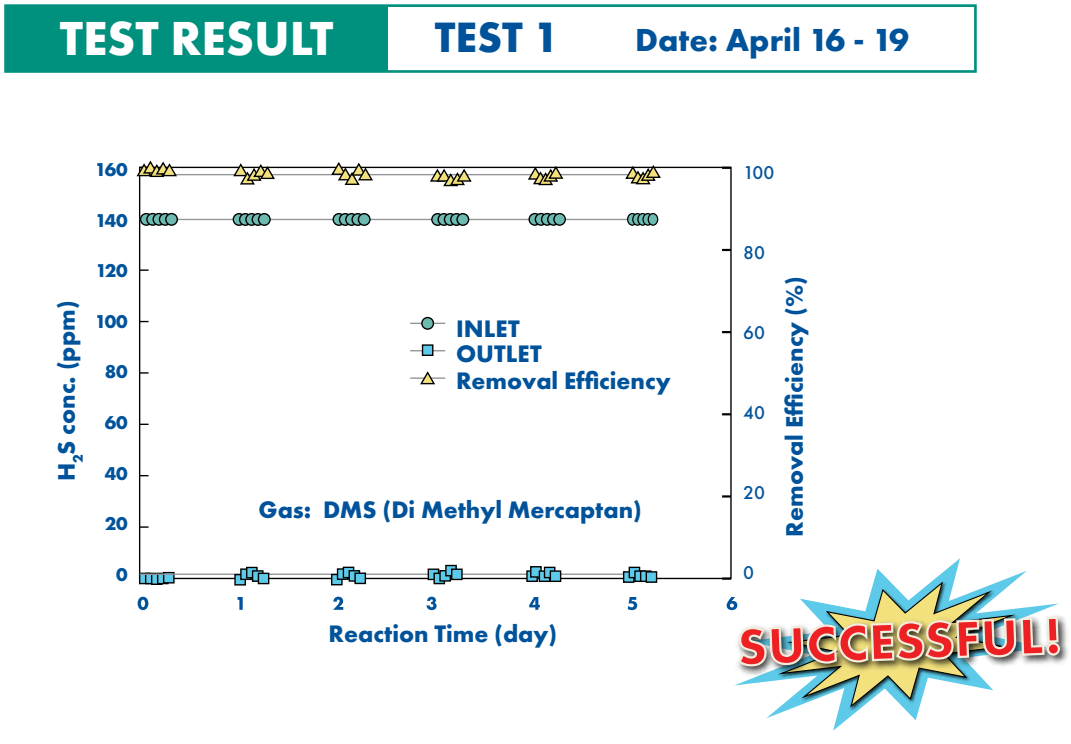

Fig. 3: *This test was considered successful with close to 100% removal of the odor causing gas with as little as one day reaction time.*

Condition	Temperature: 30 Degrees C Pressure: 760 mm
Bio-Filter Reactor	Microorganism: **MICROBE-LIFT®**/HOG Bio Filter: **MICROBE-LIFT®** Filter Thickness: 10 Cm Reactor Diameter:10 Cm Reactor Size: 78.5 Cm^2 Reactor Volume: 785 Cm^3 HRT: 11.785
Input Gas Conc	GAS: H_2S Inlet Conc.: 140 - 600 ppm Flow Speed: 0.85 cm/s Flow Rate: 4,000 Cm^3/min
Output Gas Conc.	Temperature: 30 Degrees C Outlet Conc.: 0 - 30 ppm

Fig. 4: *This test utilized* MICROBE-LIFT® *biofilters with* MICROBE-LIFT® */HOG to degrade* H_2S.

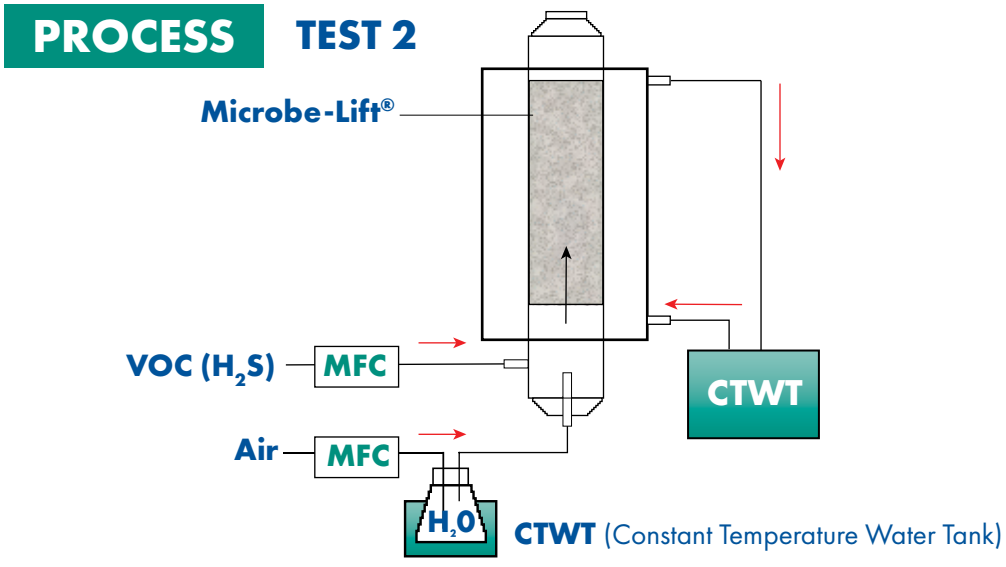

Fig.5: *The test format was the same as the first test except different pacing material* MICROBE-LIFT® *was used.*

TEST RESULT	TEST 2	Date: April 16 - 19

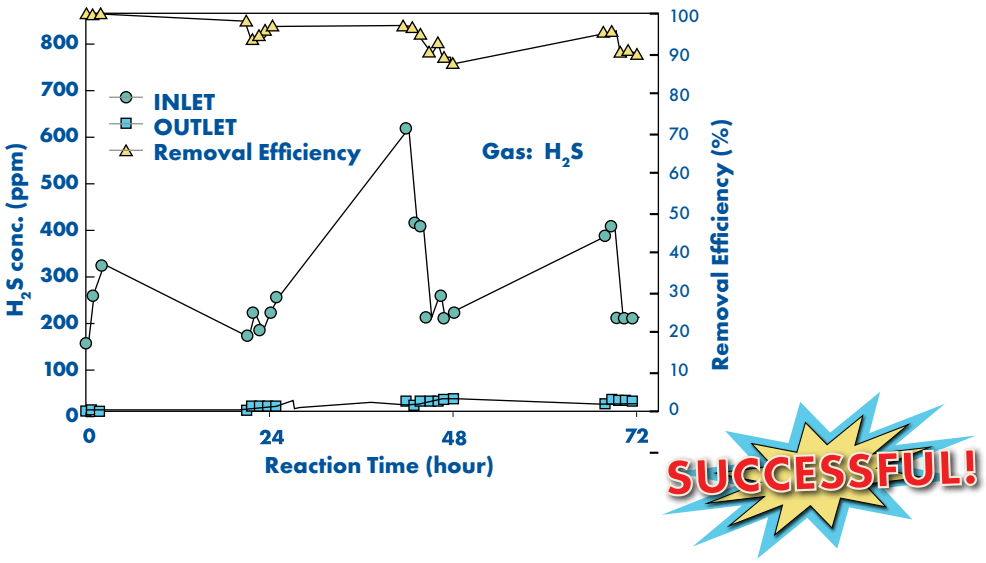

Fig. 6: *Again results were successful with control of H_2S ranging from 75% to 90%.*

Condition	Temperature: 30 Degrees C Pressure: 760 mm
Bio-Filter Reactor	Microorganism: **MICROBE-LIFT®**/HOG Bio Filter: Fiber Bio-Filter Thickness: 11 Cm Reactor Diameter: 5.3 Cm Reactor Size: 22.06 Cm^2 Reactor Volume: 242.7 Cm^3 HRT: 4.8 sec
Input Gas Conc	GAS: **Styrene Monomer** Inlet Conc.: 400 - 500 ppm Flow Speed: 10 cm/s Flow Rate: 3.000 Cm^3/min
Output Gas Conc.	Temperature: 30 Degrees C Outlet Conc.:25 - 28 ppm

Fig. 7: *The third test attempted to degrade styrene monomer with a fiber-based biofilter.*

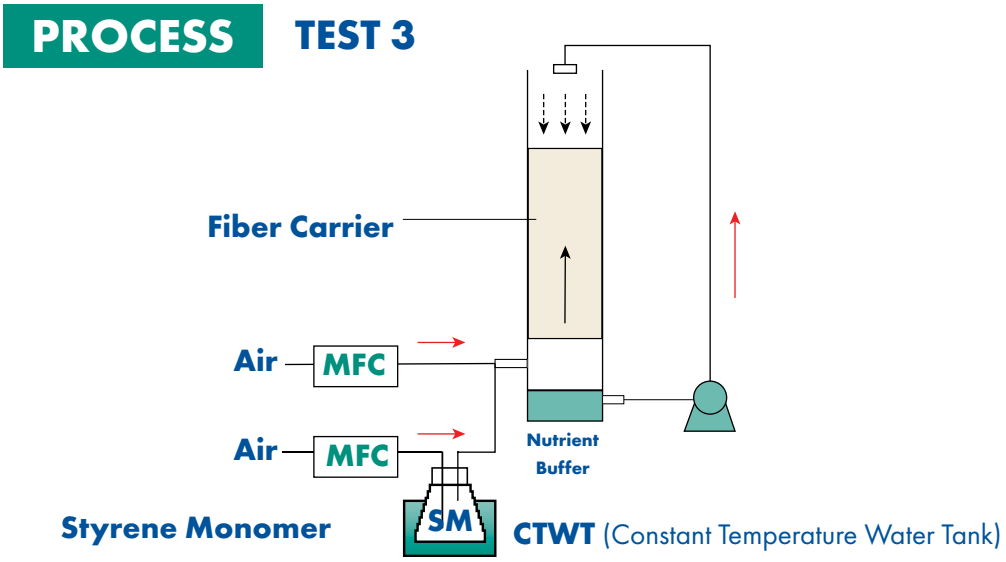

Fig. 8: *In this case a nutrient buffer was added*

TEST RESULT **TEST 3** **Date: April 20 - 26**

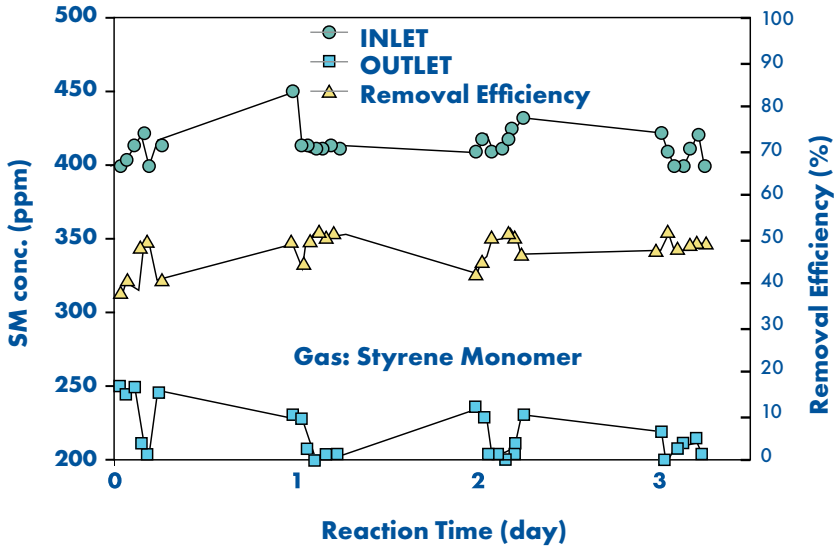

Fig. 9: *MICROBE-LIFT did not degrade the styrene monomer under the conditions supplied.*

Results Achieved:

MICROBE-LIFT®/HOG successfully degraded the mercaptan and H_2S in the LG designed biofilters. This testing supports the use of MICROBE-LIFT® technology in biofilters. It also confirms its efficacy in controlling these gases in manure applications.

MICROBE-LIFT®/HOG did not show any degradation of the styrene monomer in the conditions of the test. While it may be possible to improve performance under different conditions, this test did not show any potential for the use of MICROBE-LIFT® in these biofilters. However, the negative result for the styrene monomer can be utilized as a negative control supporting the positive effects of test #1 and test #2.

For more information on MICROBE-LIFT® Technology contact

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TE13201

"Successful Applications of Bioaugmentation for Reducing Sludge Output from Biological Wastewater Treatment Plants and Anaerobic Digestors"

Author: **Mark J. Krupka, Ecological Laboratories, Inc.**

Abstract:

One of the major costs associated with the operation of biological wastewater treatment is the handling and disposal of sludges generated primarily in the conversion of soluble organics as measured by BOD/COD into either carbon dioxide (aerobic) or methane (anaerobic), water and bacterial cells. Often times the sludge generated in either of these processes may be subsequently treated in a digestor to reduce the volatile suspended solids (VSS) volume for disposal. Bioaugmentation with certain microbial consortia has been shown to lower the generation of solids in both aerobic and anaerobic wastewater processes by reducing the yield coefficient (y), as well as enhancing the efficiency of digestors designed to reduce the volume of solids for disposal.

This paper will detail the use of MICROBE-LIFT®/IND, a liquid microbial product, which has been shown to reduce the generation of sludge in: aerobic biological wastewater systems in Austria and Holland; and, to improve the efficiency of anaerobic digestors in Korea, Israel and Colombia. Sludge reduction ranged from 15% to almost 40% and was observed in all applications. In some cases, the improved system efficiency allowed the system to handle additional loadings without physical expansion; while generating significant savings in handling, chemical usage and disposal costs over and above the cost for bioaugmentation. In addition to presenting the statistical data this paper will also propose biochemical mechanisms for how these results are achieved through an analysis of the biochemical processes involved in all of these systems.

Keywords: Aerobic biological treatment, anaerobic biological treatment, anaerobic digestor, bioaugmentation, sludge handling and disposal costs, and sludge reduction.

Background:

Since the development of the activated sludge process, suspended growth biological wastewater treatment systems have become the predominant form of secondary treatment for removal of dissolved organics. The primary reason for this is that these systems are generally the most economical way to treat large quantities of polluted water with respect to organic removal.

In aerobic biological processes, the dissolved organics are converted to carbon dioxide, water and bacterial cells according to the following equation:

BOD + N + P + O2 ---------- CO2 + H2O + Cells

Or, in anaerobic processes:

BOD or cells ---------- CH4 + H2S + H2O + N + P + cells

The excess cells that are produced are primarily what comprise the waste sludge, which must be disposed. Many processes have been developed that are designed to reduce the amount of sludge for disposal through breakdown or digestion of the sludge and increasing the dry solid weight of the sludge to further lower the volume of sludge for disposal. Very little attention has been paid to the potential for manipulation of the biomass characteristics to reduce the amount of sludge produced to begin with or to improve the efficiency of digestors.

Pilot studies were conducted in 5,000-liter pilot reactors that remained from the original design work on the digestors. With encouraging results achieved in the pilot trials, field trials were later pursued. Based on successful results at Pusan similar field trials were run in Colombia and at the Hod Hasharon, as well as the Jerusalem Wastewater Plants in Israel. In another application of the product at Deutsch Wagram in Austria, a bioaugmentation program was conducted in 1998 to reduce odors, improve breakdown of oil & grease, and reduce the amount of waste sludge generated at the plant. Based on the success at Deutsch Wagram a trial was undertaken at the municipal wastewater plant in Zutphen, the Netherlands.

City of Pusan

In the pilot trials for the City of Pusan, a 20% improvement was observed in the reduction in VSS. Based on these results, the full-scale reactors were augmented as follows:

MICROBE-LIFT®/IND Application Program

Day	Tank 1	Tank 2	Tank 3	Tank 4	Total
1	6 gal.	4 gal.	3 gal.	4 gal.	17 gal.
4	6 gal	4 gal.	3 gal.	4 gal.	17 gal.
7	3 gal.	2 gal.	1.5 gal.	2 gal.	8.5 gal.
10	3 gal.	2 gal.	1.5 gal.	2 gal.	8.5 gal.
13	3 gal.	2 gal.	1.5 gal.	2 gal.	8.5 gal.
16	3 gal.	2 gal.	.5 gal.	2 gal.	8.5 gal.
19	3 gal.	2 gal.	1.5 gal.	2 gal.	8.5 gal.
22	3 gal.	2 gal.	1.5 gal.	2 gal.	8.5 gal.
25	3 gal.	2 gal.	1.5 gal.	2 gal.	8.5 gal.
28	3 gal.	2 gal.	1.5 gal.	2 gal.	8.5 gal.
31	3 gal.	2 gal.	1.5 gal.	2 gal.	8.5 gal.
34	3 gal.	2 gal.	1.5 gal.	2 gal.	8.5 gal.
Maintenance					
(2x/wk)	1.5 gal.	1 gal.	0.5 gal.	1 gal.	

Total first 37 days = 127 1/2 gallons
Annual Maintenance = 416 gallons

Results Achieved

Within 90 days the VSS reduction went from 70% of design efficiency to 130% of design efficiency. The plant has continued to use the product with the exception of one year during which an alternate product from a Japanese supplier was used and the plant efficiency returned to the 70% VSS reduction efficiency observed prior to the bioaugmentation with MICROBE-LIFT®/IND. The following year when the MICROBE-LIFT®/IND was again added, the digestors again resumed the 130% VSS reduction observed the first time with the MICROBE-LIFT®/IND.

Background:

Deutsch Wagram

The waste water entering the sewage work at the supply tank is lifted up with screw pumps to the level of the sewage work and passes through a bar screen. A mechanical scraper removes coarse matter removed from the waste water. Then, the wastewater flows through the circular degritter where granular components are separated. Through a distributor structure the mechanical pre-cleaned waste water enters the activated sludge tank with a capacity of 1440 m^3. The biological treatment is carried out by the activated sludge process. To cover the oxygen demand, air is supplied with cage rotor aerators into the waste water. In the secondary settling tank, with a capacity of 2.300 m^3, the sludge settles down and is separated from the wastewater, treated biologically, then discharged to the receiving water (Rußbach). Through a siphon pipe the settled sludge enters the sludge recycling pump station. With screw pumps the sludge is pumped back into the activated sludge tank.

The quantity of water for a population equivalent of 8.200 is treated in the activated sludge tank, designed for a population equivalent of 6.000. The chemical cleaning is carried out with the addition of iron salts to precipitate phosphorous from the wastewater and is removed with the excess sludge from the process. Nitrates can be removed (denitrification) with high efficiency from the wastewater when operated with that objective. The sludge is thickened in the sludge storage tank and the sludge liquor pumped back into the supply tank. The thickened sludge either can be directly used in agriculture or the produced sludge granulate is scattered on the fields after de-watering with a sludge press.

The plant is operated by an O&M firm from the Netherlands. Located close to a residential area, the plant had regular problems with odors and oil & grease buildup in the head-works and aeration basins despite achieving better than 95% reduction for BOD and TSS. In addition, the plant was expending a significant portion of its operating budget for sludge handling and disposal.

A bioaugmentation program was implemented in 1998 for a period of one year to determine if the bioaugmentation program could consistently reduce the amount of sludge generated in the plant. Improving odors and oil and grease breakdown were secondary objectives but were not considered to be enough on their own to justify the cost of product treatment, approximately US $30,000/ year.

Fig.1: *Wastewater Plant at Deutsch-Wagram*

Deutsch Wagram

Dosages:

Table 1. Average of some main parameters from the annual report of 1997

parameter	average / year	unit	degradation eff.
Waste water /d	1320	m^3/Tag	-
Sludge volume	810,2	ml/l	-
$BSB_{5:}$ supply	286,3	mg/l	-
BSB_5: discharge	5,4	mg/l	98,0 %
CSB: supply	574,5	mg/l	-
CSB: discharge	39,1	mg/l	92,5 %
NH_4-N: supply	47,5	mg/l	-
NH_4-N: discharge	1,4	mg/l	97,0 %
NO_3-N: supply	33,2	mg/l	-
NO_3-N: discharge	4,8	mg/l	85,5 %
PO_4-P: supply	5,6	mg/l	-
PO_4-P : discharge	0,5	mg/l	91,4 %

Dosage Schedule for MICROBE-LIFT®/IND in the Sewage Work of Deutsch-Wagram:

Dosages were recommended based on loading (COD; BOD5, resp. hydraulic loading) degradation efficiency, problem zones and working capacity.

Dosage schedule for the sewage works of Deutsch-Wagram was developed based on the use of given parameters from operation readings.

Dosage schedule:

1 US gallon = 1 bottle = 3,7853 liter		gallons per month
Initial:	6 gallons	
Next four weeks (once per week):	1.5 gallon	6
Maintenance (once per week):	1 gallon	2

Before initial inoculation, 2 gallons of MICROBE-LIFT®/IND were applied in the pump station, supply tank, and secondary settling tank. The addition was carried out either by direct applying or spraying in a dilution of 1:10 to 1:50 with water in a water can.

Initial treatment, start on 1st April

April 1998, ¼ gallon was applied on the floating layer and the sidewalls of the supply tank near the pump screw in a dilution of 1:10 with water. 4 gallons were applied into the activated sludge tank. On the floating layer of the secondary settling tank ¾ of a gallon was sprayed in a dilution of 1:10.

On April 2, 1998, at 3 a.m. 1 gallon was added at the pump station.

Deutsch Wagram

Dosages:

Next four weeks once per week:

9.4.1998	1 gallon was added into the activated sludge tank
17.4.1998	1 gallon was added into the activated sludge tank
23.4.1998	1 gallon was added into the activated sludge tank
30.4.1998.1	1 gallon was added into the activated sludge tank

Maintenance once per week:

8.5.1998	½ gallon was added into the activated sludge tank
13.5.1998	½ gallon was added into the activated sludge tank
20.5.1998	½ gallon was added into the activated sludge tank
28.5.1998.1	½ gallon was added into the activated sludge tank
6.8.1998	½ gallon

If required (based on seasonally high flow rates) at the pump station, into the supply tank and into the secondary settling tank MICROBE-LIFT®/IND is applied additional.

After collecting one full year's worth of data, it was determined that for the year, under slightly higher flow and organic loading, that the plant had generated 34% less sludge for handling and disposal, reducing the cost for chemical treatment as well as for transportation and disposal. Additional benefits included improved solids settling characteristics as reflected by the SVI, reduction of the odors from the plant and a significant reduction in the oil & grease buildup.

Results:

Table 2. Sludge pressing results: without 24.7.98-1.8.98; with MICROBE-LIFT®/IND 9.12.-17.12.98

Duration of pressing	volume of raw sludge	TS - of press-cake %	press-cake t
28.7.-1.8.97	2083 m^3	26	270,18
24.7.-1.8.98	1330 m^3	31	178,12
- 2 day -	753 m^3	+ 19 absolute	- 92,06
1.12.-10.12.97	2065 m^3	25	208,41
9.12.-17.12.98	1529 m^3	27	194,46
- 1 day	-536 m^3	+ 8 absolute	-13,95

Deutsch Wagram

Results:

Comparison of Sludge Volume Index in Deutsch-Wagram 97 vs. 98

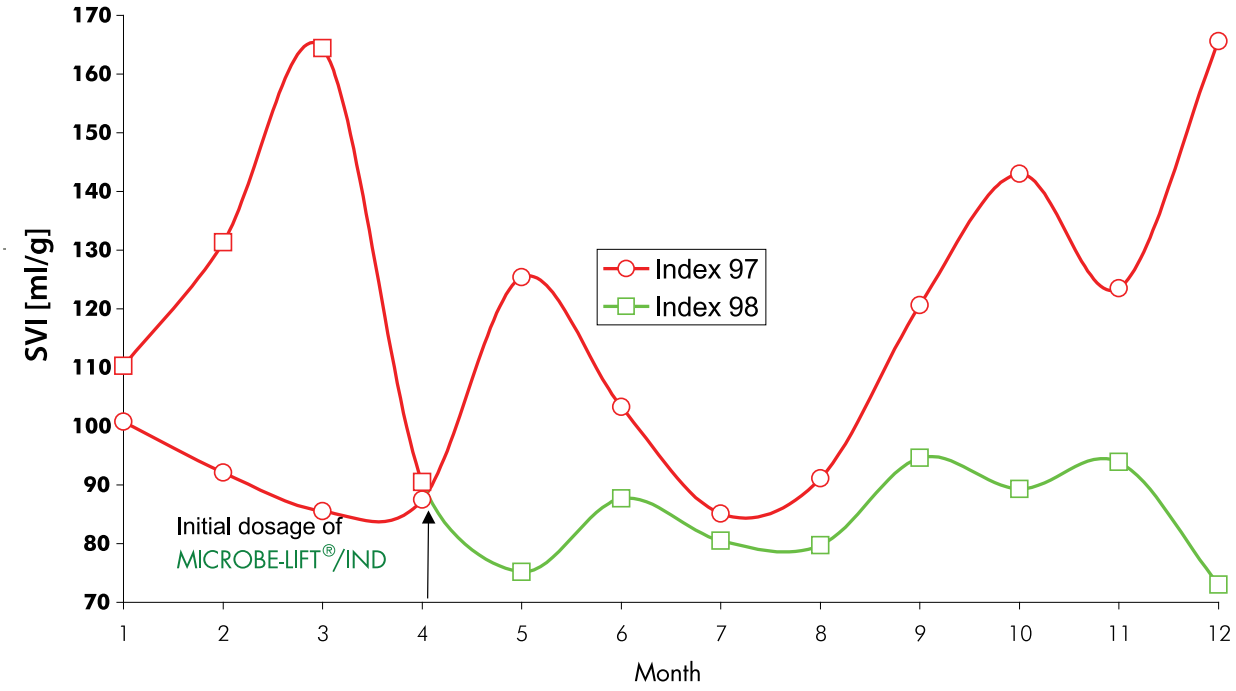

Fig.2: *SVI Data from Deutsch-Wagram*

Sludge handling and disposal costs were reduced by US $160,000 resulting in a net operating cost savings of US $130,000.

Zutphen

Background:

In March, 2006 the City of Zutphen in the Netherlands initiated a 120-day trial augmentation program. Zutphen is a medium sized activated sludge system treating an average of 6,600 M^3 of waste water per day. The plant comprises two parallel trains with segregated recycle lines so that a side-by-side comparison could be conducted. Two products were applied to Train AT2, MICROBE-LIFT®/IND and a natural organic compound found in other applications to potentiate the sludge reduction capabilities of MICROBE-LIFT®/IND Train AT1 was left unseeded as a control.

Results:

Within 60 days, an average reduction in sludge of approximately 20% was observed from the treated train with a maximum reduction of 26% observed late in the latter part of the 60 day period. Between the 60th and 90th day of the trial some settling instability was observed as was typically observed in the transition from cold weather to warm weather operation. Once through the transition the plant quickly stabilized and again a sludge reduction was observed in the treated train, but for this time period was in the 12% to 16 % range. Upon further evaluation of the data and process, it was determined that there was some commingling of the supernatant from the digestors, leading to an inadvertent low-level seed of the control train. While the differential between the seeded and "control" trains had been reduced, a comparison to historical sludge production numbers indicated that both trains were generating on the order of 20% reduction, despite higher hydraulic and organic loadings in 2006.

Table 3: Sludge Reduction Efficiencies at Zutphen

	Zutphen Sludge Reduction Trial Sludge Wasted (Kg)			
	AT1	**AT2**	**Average**	**Average/day**
1 Jan to 13 March	250,597	252,883	251,740	3496
14 March to 16 July	319,136	319,136	319,136	2574
	% Reduction	26.4%		

Colombia

Background:

Ecological Laboratories' Representative in South America was contacted by Empresas Publicas to see if it might be possible to reduce the odors associated with the operation of their anaerobic digestors and also improve the VSS reduction. The facility consisted of two anaerobic digestors of 7,900 M3 each. The average flow rate was 1.8 M3 per second giving an average HRT of 21 days. The VSS reduction being achieved prior to the addition of MICROBE-LIFT®/IND was approximately 30% for both reactors.

Results:

The reactors were dosed at rate of 12 mg/L based on the volume of the reactors on the first day followed by dosages of 4 mg/L once per week for the next four weeks and then 1.5 mg/L once per week thereafter on a maintenance basis. Six weeks after the initial dosage VSS reduction had been increased to 37% vs a target of 50% reduction with significant reductions in odors in and around the plant. The improvement allowed the plant to handle the existing load without the immediate addition of a third reactor.

Hod Hasharon - Israel

Background:

The City of Hod Hasharon operates an activated sludge system with anaerobic digestors to reduce the sludge volume before disposal. Average daily flow into the plant is approximately 25,000 M^3/day. Overall performance efficiency of the plant is excellent. Based on results achieved in the anaerobic digestors at Pusan and Empresas Publicas, the Operations Staff at Hod Hasharon made a decision to see if similar results could be achieved in their plant. Unlike the other plants, Hod Hasharon was also interested in whether or not an increase in biogas production could be realized since they recovered the gas and used as a fuel source.

Results:

Compared to historical values from the previous 15 month operating period, during for the first three months of product treatment, with a 1.8% increase in loading to the plant based on a hydraulic and organic basis, the amount of sludge removed from the plant was reduced by 18% with a concurrent increase in biogas of 11.3%. There is a fairly good correlation between the reduction in VSS and the increase in biogas production, making it reasonable to assume that the increase in biogas production is a result of the improved VSS reduction efficiency.

Current treatment, during the summer of 2006, has obtained even better results in the effluent properties of TSS, BOD etc. with sludge reduction over 20%, along with a significant reduction in odor.

Table 4: Operating Data from Hod Hasharon

BIO-GAS	Solids Vs WAS	SOLIDS Tons	% SOLIDS	Dry Sludge	Sewage in m3	RAS m3	WAS m3	
126635	0.42%	139	16.20%	858	796800	255870	32745	1/28/2004
106633	0.45%	129	16.60%	775.5	738833	243050	28593	2/28/2004
115413	0.44%	141	16.10%	874.5	774194	212910	32289	3/28/2004
112470	0.32%	118	15.60%	759	746850	238970	37522	4/28/2004
111817	0.42%	156	14.80%	1056	756214	230610	36870	5/28/2004
119430	0.34%	125	13.50%	924	730080	218740	36847	6/28/2004
159154	0.37%	122	14.20%	858	644940	193520	32969	7/28/2004
131719	0.46%	164	15.50%	1056	695370	212240	35870	8/28/2004
150030	0.38%	136	14.70%	924	677590	213870	35351	9/28/2004
147219	0.41%	153	15.00%	1023	730670	231090	37845	10/28/2004
138930	0.51%	151	15.80%	957	602680	182340	29630	11/28/2004
140585	0.45%	154	16.10%	957	742290	265340	34018	12/28/2004
140864	0.46%	144	15.60%	924	715640	332910	31392	1/28/2005
131488	0.39%	132	16.00%	825	755250	345860	33830	2/28/2005
142383	0.33%	141	15.30%	924	706748	365820	42207	3/28/2005
139350	0.29%	143	18.90%	759	763127	329610	49042	4/28/2005
151032	0.27%	146	19.20%	759	724080	324160	53732	5/28/2005
144330	0.31%	152	20.90%	726	715070	305420	48967	6/28/2005
								7/28/2005
								8/28/2005
								9/28/2005
								10/28/2005

Conclusion: Hypothetical Mechanisms for Observed Reduction in Sludge Generation

When growing microorganisms in an aqueous organic medium the carbon contained in the organics can end up being incorporated into new biomass (heterotrophic uptake), cell byproducts such as biopolymers or enzymes, or carbon dioxide. In fermentation technology, it is not uncommon to improve yields of fermentation products, which can be byproducts of bacterial metabolism, such as xanthan gum or biomass such as yeast, through manipulation of the process or the biomass itself. There are numerous examples of this in the production of antibiotics and enzymes. Typically, if the biomass is the desired end product, the system whether a batch or continuous fermentation is operated at a high F/M ratio, which maximizes the yield of cells since the cells are in log growth more of the time. This is consistent with Monod Kinetics, which suggests that growth rate increases with increasing substrate concentration until it reaches a point where the population cannot grow any faster dues to limitations such as mass transport or inhibition.

At the other end of the spectrum, when the cells operate in a substrate poor environment, the majority of substrate is used to satisfy the cell maintenance energy and there is little left over for new cell synthesis. This phenomenon is utilized in the process design for extended aeration systems, which produce less sludge but typically at a higher energy cost.

Until now, there have been few documented cases of sludge reduction through bioaugmentation but based on the example of the fermentation industry, there was always reasons to believe that sludge reduction was possible through biomass manipulation. Initial observations of sludge reduction were made serendipitously during programs in which bioaugmentation was used to enhance the reduction of refractory organics or enhance the overall efficiency of the systems with respect to organic removal efficiencies normally on the basis of BOD or COD reduction.

In most cases, some percentage of organic removal efficiency was achieved resulting in an equilibrium concentration of organics equivalent to that of the effluent in most suspended growth systems, especially those operating as CSTRs. Just as biomass in a fermentation would show lower yields of biomass when operated in a substrate poor environment, so does the biomass in a suspended growth system operating at a lower equilibrium F/M resulting in a lower yield coefficient for the system.

It also appears possible through bioaugmentation, along with the addition of natural supplements containing humic acids, that we can also enhance the cell digestion process.

We have certainly demonstrated the effectiveness and market potentials in our European trials for odor control and sludge reduction at municipal wastewater treatment facilities. We are in the final stages, and we are confident of the out-come, and therefore will be in a position to capitalize on these successful trials by mid-year. Projecting the business opportunity based on sludge reduction in the European domestic sewage market alone, our near-term target would be to take our success in Holland to the balance of Western Europe, and then expand to Eastern Europe, Asia, the Middle-East, and Central and South America. Similar business could be possible in urban areas (municipal treatment plants) in your market, or on a smaller scale in village septic lagoons and aeration ponds.

For more information on MICROBE-LIFT® Technology contact
Ecological Laboratories Inc.
www.EcologicalLabs.com
TE13202

INDUSTRIAL WASTEWATER TREATMENT

For more information on MICROBE-LIFT® Technology contact

Ecological Laboratories Inc.
www.EcologicalLabs.com
14000

Made in the USA

WASTEWATER TREATMENT - INDUSTRIAL

14100 PULP & PAPER

14101 Hydrogen Sulfide Reduction and Corrosion Control - Industrial/Municipal Application at Stone Container in Savannah, Georgia

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Hydrogen Sulfide Reduction and Corrosion Control - Industrial/Municipal Application at Stone Container in Savannah, Georgia

Location: **Stone Container (Pulp/Paper Mill) - Savannah Plant, located within the city limits of Port Wentworth, Georgia.**

Problem: The plant is tied into the municipal wastewater treatment system. The plant had been in operation for several years and complaints from the city residents and government officials had been escalating because of the extremely unpleasant odors that were being emitted by the plant. Residents living near the plant began to complain about discoloration of window blinds and shades. Many reports of headaches and sore eyes began to surface. A determination was made that the high levels of hydrogen sulfide being emitted by the plant, either directly into the air due to an inadequate air scrubber systems, or as a result of effluent discharge into the wastewater sewer system, was the major cause of the yellowing effect on the blinds and shades as well as the source for the offensive odors in the air which could be associated with the high level of reported headaches and sore eyes.

The City of Port Wentworth also began to experience chronic problems with sewer line blowouts and corrosion in the City's sewer system began advancing at an alarming rate. The blowouts were usually located within the vicinity of forced mains downstream of the plant. Corrosion was calculated as high as 30.86% annually in some locations. These problems were being caused by crown corrosion which could be traced back to high concentration of hydrogen sulfide in the sewer system. Leaching hydrogen sulfide into the concrete was causing rapid deterioration of the City's system. Again, the source of the problem was traced back to Stone Container.

In 1995, Port Wentworth government officials began pressuring Stone Container management to find a solution to the problems being created by the plant.

Solution: **Ecological Laboratories**, in association with ChemStone, Inc., was awarded a contract to reduce the hydrogen sulfide emission and control sewer corrosion in May of 1995.

MICROBE-LIFT®/IND was applied into the sewer system via metering pumps at strategic locations on the Stone Container site as well as sites located throughout the City. Levels of initial application were determined by the hydrogen sulfide levels and the maximum daily effluent flow rate at the site. The metering stations were located "up-line" from problem areas where unacceptable levels of hydrogen sulfide were being emitted.

For example, one lift station in the plant was consistently generating H_2S reading above 50 PPM. The maximum daily flow rate at this lift station was estimated at slightly over 1 million gallons per day. The metering station for treatment of this lift station was located approximately 200 yards "up-line" from the lift station at a manhole. The H_2S reading the day before treatment began was 62 PPM. MICROBE-LIFT®/IND was applied at a rate of 50 PPM of the maximum

daily flow rate for the first day of treatment. The H_2S reading the following day was 12 PPM at the station. The application of MICROBE-LIFT®/IND was then reduced daily until the final daily "maintenance" application reached 12 PPM, or 12 gallons per day. A total of four metering stations were eventually set up at the plant and in the City.

MICROBE-LIFT®/IND was also injected into the circulation water of the air scrubber system at the plant. The daily application was set at 25 PPM. Tests in the gas stream showed a reduction of hydrogen sulfide by 76%.

Corrosion tests were conducted at ten selected sites in the sewer system over a three-year period. The introduction of MICROBE-LIFT®/IND over the three-year period produced dramatic improvements in lowering corrosion levels. By significantly reducing the H_2S in the system, MICROBE-LIFT®/IND had also virtually eliminated the crown corrosion caused by leaching hydrogen sulfide. Over the three-year test period, corrosion levels at the ten sites were reduced by an average of 87.5%, from 19.2% annually before treatment to 2.4% annually at the end of the test period.

Conclusion:

Over the course of this three year study, the MICROBE-LIFT®/IND produced dramatic improvements in the air quality at the Stone Container Plant, as well as the air quality in Port Wentworth. Complaints from the City's residents and government officials ceased. The expensive repairs to City sewer system were greatly reduced.

For more information on MICROBE-LIFT® Technology contact

Ecological Laboratories Inc.
www.EcologicalLabs.com

CS14101

WASTEWATER TREATMENT - INDUSTRIAL

14200 PETROLEUM REFINERIES & SOIL REMEDIATON CASE STUDIES AND TESTIMONIALS

14201	A Major Oil Company in Hong Kong Remediates Subsurface Hydrocarbon Contamination with MICROBE-LIFT® Technology
14203	Successful in Situ Remediation of Hydrocarbon Contaminated Soils in South Africa
14204	MICROBE-LIFT® Technology Cleans Up Petroleum Lagoon in Israel
T14205	Effectiveness of MICROBE-LIFT®Bacteria Mixture in Bioremediation of Petroleum Contaminated Soils at Mostardi-Platt Plant
T14206	Compliance Environmental Confirms PCB Transformer Oil Degradation in Bioremediation Test
14207	MICROBE-LIFT® Technology Helps Remediate TPH Contaminated Soils in Georgia and Tennessee

For more information on MICROBE-LIFT® Technology contact

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CS14200

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A Major Oil Company in Hong Kong Remediates Subsurface Hydrocarbon Contamination with MICROBE-LIFT® Technology

Location: **Oil Transportation & Transfer Site, Hong Kong**

Background: **Ecological Laboratories** has addressed wastewater technology internationally for over ten years. In that time they have remediated a variety of petroleum contaminated sites including oil production ponds in Venezuela for GEBetz, containment ponds in Israel, and sites in the Dominican Republic and throughout Asia. In this case, a major oil company, who chooses to remain anonymous, had detected contaminated soil under a concrete slab at an oil transportation and transfer site. The oil had seeped into the ground to a depth of two meters.

Objective: To avoid further mobilization, it was imperative to remove the oil by the most cost effective, least disruptive technology available. Working with their local agent, Ecological Laboratories developed a remediation plan using MICROBE-LIFT® technology.

Because in-situ treatment generally requires support engineering, it is important to first confirm that the hydrocarbon can be degraded by the inoculant and that the site does not contain additional toxicity that would inhibit biological activity. Therefore, a benchtop remediation trial was run using a soil bio-slurry inoculated with a MICROBE-LIFT® formulation.

This MICROBE-LIFT® formulation was applied to a slurry containing contaminated soil in a tank. Dry weight of material was 10-15%, pH 7-9, TPH content at 3-5%. The TPH was not diesel based, but made up of linear hydrocarbon chains between C12 and C20. The boiling point is between 200 and 250 C in the gas chromatographic analysis (C10-C40) giving the following splitting in mg/kg dm:

Hydrocarbon Fraction C10-C40 mg/kg Ds 43,400
Hydrocarbon Fraction C10-C12 mg/kg Ds 875
Hydrocarbon Fraction C12-C16 mg/kg Ds 21,375
Hydrocarbon Fraction C16-C20 mg/kg Ds 6,750
Hydrocarbon Fraction C20-C24 mg/kg Ds 2,475
Hydrocarbon Fraction C24-C28 mg/kg Ds 800
Hydrocarbon Fraction C28-C32 mg/kg Ds 400
Hydrocarbon Fraction C32-C36 mg/kg Ds 460
Hydrocarbon Fraction C36-C40 mg/kg Ds 300

The test tank contained +/- 600 liters in a slurry (+/- 75 kg waste+ 525 kg water). Nitrate was added to assure that proper C:N:P ratio for biological degradation was present. The slurry was re-circulated in order to provide adequate mixing. The initial test was run for 28 days. Each 7 days the slurry was sampled in order to follow the TPH content and the biodegradation.

A Major Oil Company in Hong Kong Remediates Subsurface Hydrocarbon Contamination with MICROBE-LIFT® Technology

Solution:

After three weeks the MICROBE-LIFT® formulation had reduced the petroleum by 71%.

MICROBE-LIFT® had readily degraded the contaminating TPH and there was no toxicity present that would prevent a successful remediation. The results of the study are shown below:

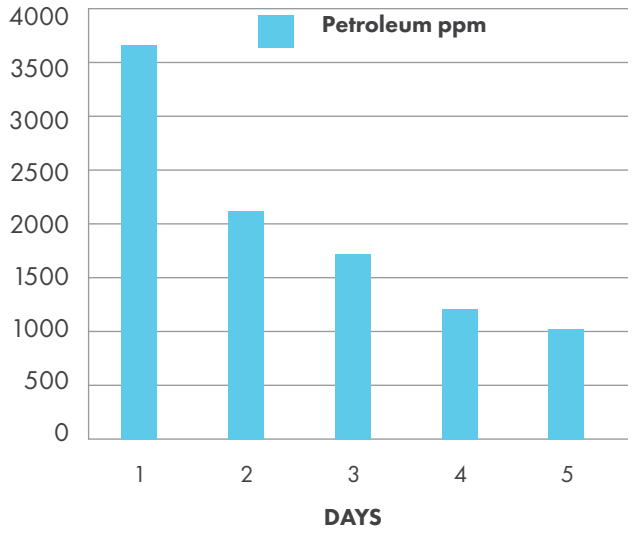


Fig. 1: *This graph shows the result of the bench top remediation with an initial concentration of 35-40,000 ppm of hydrocarbons C10 to C40 being reduced by 71% in one week*

Results Achieved:

The in–situ treatment was initiated. After drilling a test hole of two to three meters, a gradient-flow analysis was conducted. Diluted MICROBE-LIFT® was applied through injection holes and recycled through extraction holes downgrade to get the same results in the field. The site was successfully remediated. In our experience, all applications for in-situ remediation tend to be site specific depending on other contaminants present and engineering required providing adequate contact, but in general most land treatment plans require the following:

- Inoculation with capable consortium of microbes (pretesting recommended)
- Provision of the necessary nutrients (adjust C:N:P ratio)
- pH and moisture adjustment as necessary
- Assurance of contact between microbes and pollutants:
  1. Land farm surface pollution - work remediation ingredients into soil or
  2. Subsurface soils - provision of an engineered system, often pump and treat, to assure contact
- In some cases, a solubilizing agent such as a lipophilic surfactant may be recommended to increase surface contact.

Effective bioremediation is always the most cost effective solution for elimination of hydrocarbon contamination and it is widely used by industry globally. Ecological Laboratories' MICROBE-LIFT® technology, is a highly effective solution to hydrocarbon pollution when used with proper, site-specific application.

For more information on MICROBE-LIFT® Technology contact

Ecological Laboratories Inc.
www.EcologicalLabs.com
CS14201

Successful In Situ Remediation of Hydrocarbon Contaminated Soils in South Africa

Location: PepsiCo Frito-Lay Simba Isando, Gauteng, South Africa

Background: Use of the vehicle workshop area at the Frito-Lay Simba Isando plant was discontinued due to outsourcing of the distribution chain. An area in front of the wash bay borderedby the workshop and boundary walls had been heavily contaminated by hydrocarbon.This contamination was a mix of petroleum (PRO) and diesel (DRO) range organics and covered a surface area of approximately 300 square metres. The contamination occurred in three main areas, these being DRO in approximately 30 square metres under the removed diesel tank, a mix of DRO and PRO in approximately 120 square metres in front of the wash bay and an area of approximately 90 square metres of tar macadam covered soil. The wash bay area was contaminated with a mixture of petroleum, diesel,oils, alkanes and kerosenes. During initial sampling the average depth of contamination was found to be 150 mm below the surface, a target depth of remediation was set at 250 mm below the surface. In order to re-use this ground the company requested they 2000 mg/kg. This value was chosen based on the fact that the site was industrial and would not readily be used for agriculture or human occupation in the foreseeable future. Another factor affecting this target is that the Department of Water Affairs and Forestry (DWAF) had in the past recommended the use of a similar target for hydrocarbons in an industrial area (Snyman 1996). The area was completely enclosed by concrete walls on three sides and a brick workshop on the remaining side. Thus, in-situ bioremediation was the preferred method providing the following benefits:

- No expensive removal and replacement of the walls was needed,
- No removal and transfer of the contaminated soil would be required.
- No addi tional treatment system was required.
- No suitable dumping site with associated transfer and fees would have to be utilized.

Objective:

Due to environmental audits there was a need to bioremediate the soil in as short a time span as possible with a 12-week time span allocated. To create the most favorable conditions for a successful bioremediation of hydrocarbons in soil, a number of factors needed to be considered:

1. Product specifically manufactured for the bioremediation of hydrocarbons would be needed. MICROBE-LIFT® technology in the USA were selected based on proven efficacy and exceptional technical backup available from the producers of the product, **Ecological Laboratories**, based in Florida USA.

2. The soil needed to be regularly tilled to the depth of the contamination in order to aerate the soil providing the most suitable conditions for the growth of the bacterial colonies.

3. The Carbon:Nitrogen:Phosphate (C:N:P) ratio of the soil was tested and modified as necessary to provide optimal nutrient conditions for growth of the amended bacteria.

4. The soil was kept damp, but not saturated, to provide the most suitable environment for bacterial growth. Due to the limited time and budget available this was achieved with a manually set flow rate of water as opposed to control via measured moisture content.

5. The bioremediation products were dosed in a regular regime to provide a continuous replenishment of the bacterial consortium to the area being treated thus building the most effective bacterial population for the oxidation of the hydrocarbon compounds.

The above conditions were satisfied using the following method. Prior to the delivery of hardware and product, initial soil samples were taken as a baseline for the bioremediation and to ascertain the C:N:P ratio. An independent laboratory was used to analyse the soil samples. Two sampling areas were determined to provide an average value of contaminated soil and a control sample of uncontaminated soil. The soil samples were taken by extracting a plug of soil which was then placed in a sample jar, inverted and kept at constant temperature in a polystyrene container until delivered to the laboratory.

The soil was then tilled to a depth of 250 mm.

The initial values for the C:N:P ratio were given as 100:4:1 rounding to the nearest whole number. This value was deemed to be close enough to the required values of 100:5:1; therefore no fertilizer was added.

An irrigation system comprising 25 mm irrigation pipe was laid. This consisted of a delivery trunk main pipe running along the west wall for 0.10 metres. This trunk main was fed via a 1 kW water pump fed by a 60-litre drum. The drum was replenished from the water main using a regulator valve to maintain a constant volume of water in the drum. Five branch pipes were laid 2 metres apart, running at right angles from the trunk main eastwards across the contaminated area. Each 30 metre branch pipe was connected to the trunk via a tee piece and regulating valve. 360-degree irrigation spinners were fixed at 2 metre intervals along each branch pipe. This layout created an effective grid system of 2 metre squares fed from each irrigation spinner. The required flow rate of water was then manually set using the regulator valves.

Once the required flow rate was confirmed by monitoring the soil moisture content for two days, ½ kg of MICROBE-LIFT® formulation was spread evenly over the soil. This dosage of MICROBE-LIFT® formulation was repeated every 2 days from the inoculation date.

In order to dose the MICROBE-LIFT® formulation,12 litres of MICROBE-LIFT® formulation as an inoculation dose was poured into the 60 litre drum feeding the pump. The mains water inflow to the drum created sufficient turbulence to mix the product with the water. This mixed product was then pumped into the irrigation system and evenly distributed via the 360 degree spinners. A quantity of spare spinners was kept available for replacement of blocked spinners. These were replaced as and when required. A MICROBE-LIFT® formulation dosage of 4 litres was then repeated every 2 days from the inoculation date.

This dosing schedule ran for 44 days from 15 May 2010 to 28 July 2010. The total product utilized was 47kg of MICROBE-LIFT® formulation.

The soil was then tilled to 250 mm once every two weeks.

Results achieved: The table below gives the results of the laboratory analysis:

Date	TPH mg/kg Series 1	TPH mg/kg Series 2	% Reduction In contaminated soil
13th May 2010	17630	151	
8th June 2010	16012	701	9.2
9th July 2010	1684	402	89.5
28th July 2010	1681	1433	89.5

Fig. 1: *Series one is the contaminated soil while series 2 refers to soil not considered contaminated.*

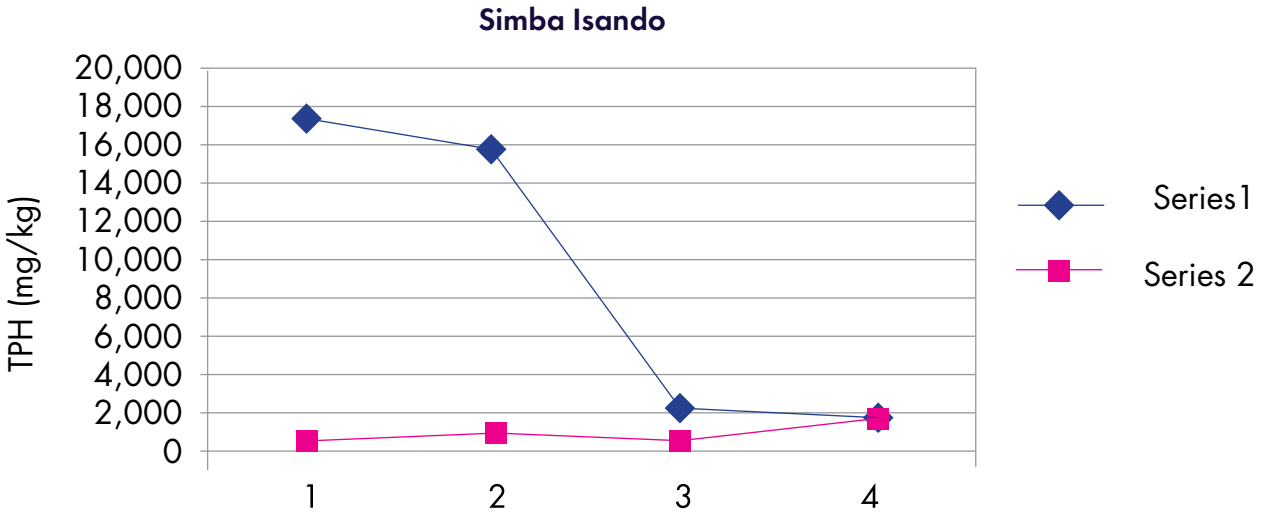


Fig. 2: *Shows the data represented graphically.*

Series 1 indicates that the contamination was reduced from an initial TPH value of 17630 mg/kg to 16012 mg/kg. This reduction occurred in the initial 3 weeks after inoculation indicating that the bacterial consortium from the MICROBE-LIFT® formulation has begun to take hold and multiply in the soil. The growth of the consortium reaches a peak in this period and begins to stabilize to a point where the bacterial colony has grown to a level where the colony/nutrient source is balanced and maximum oxidation of the hydrocarbons is in progress.

This oxidation process continues at this level for a period of 4 weeks until the nutrient content supplied by the hydrocarbons has been depleted to the point where the bacterial colony begins to die off in relation to the nutrient source.

During the final 3 weeks of the remediation the bacterial colony has once again reached equilibrium with the nutrient source, however at a much lower level. This is the expected outcome of the natural bell curve growth of organisms in the presence of a finite nutrient source.

Series 2 shows a small upward trend in the TPH value reaching approximately the same level of TPH value given by series 2. This upward trend is due to the action of the water/product mix creating an osmotic effect in the soil where some of the hydrocarbon contamination is spread throughout the treatment area. It is shown in the results that the target TPH value of 2000 mg/kg was reached and exceeded in 10 weeks with the final value being 1681 mg/kg. This is seen to be a reduction of 89.5%.

Conclusions: Despite the short time frame given for the bioremediation, the MICROBE-LIFT® formulation succeeded in remediating the hydrocarbon contamination. The required result of reducing the contamination to an acceptable level of 2000 mg/kg TPH was reached in 10 weeks, being 2 weeks shorter than the requested duration.

In short, **Ecological Laboratories** achieved a successful bioremediation using the method as proposed. MICROBE-LIFT® technology has proven its ability to degrade hydrocarbons in the DRO and PRO range.

For more information on MICROBE-LIFT® Technology contact
Ecological Laboratories Inc.
www.EcologicalLabs.com
CS14203

MICROBE-LIFT® Technology Cleans Up Petroleum Lagoon in Israel

Location: **Oil Company, Jordon Valley, Israel**

Background: Crude petroleum that had been collected from a transport spill was collected and deposited in a 100,000-gallon containment lagoon in the Jordan Valley, with the expectation that the petroleum would biodegrade over time.

Objective: After several months with little or no degradation observed, alternatives were evaluated to accelerate the petroleum breakdown. A recommendation was made to use bioremediation. After evaluating different microbial additives, **Ecological Laboratories** was contacted. **Ecological Laboratories** had utilized MICROBE-LIFT® technology very successfully in numerous petroleum clean-up applications.

Since the lagoon also contained municipal sewage there was adequate nitrogen and phosphorous present to provide the required nutrients for the petroleum degradation. In addition to the MICROBE-LIFT® formulation, FDG, a lipophilic surfactant, was applied to help solubilize the petroleum to make it more readily available to the microbes.

Fig. 1: *The lagoon was not a pretty sight with oil scum over the entire surface.*

Fig. 2: *A close-up picture shows the extent of the oil and scum in the lagoon.*

After inspection and evaluation of the lagoon, **Ecological Laboratories** developed a treatment plan as follows:

Day 1:	Add 300 mls. FDG (lipophilic surfactant) Plus 600 mls. MICROBE-LIFT® formulation
Every three days thereafter:	Add 70 ml FDG & 150 mls. MICROBE-LIFT® formulation

Fig.3*: Treatments were mixed with water and sprayed over the surface of the lagoon to provide maximum contact with the surface oil.*

Results:

After treatment, the water was dramatically cleaner with no visible oil scum on the surface.

The primary parameter for monitoring the crude petroleum breakdown was Total Petroleum Hydrocarbons (TPH). Other parameters tracked were Biological Oxygen Demand (BOD), Chemical Oxygen Demand (COD), Soluble COD, and Total Suspended Solids (TSS). Results from the outside lab testing of these parameters are shown below:

Initial, Pre-trial data (mg/l)				
BOD	COD	Soluble COD	TSS/TPH	TPH
1,900	12,900	268	55,427	25,000
After three weeks of treatment (mg/l)				
BOD	COD	Soluble COD	TSS/TPH	TPH
568	4,900	268	1,750	2,915
Percent removal in 3 weeks				
70%	62%		97%	88%

After three weeks of treatment, a reduction of almost 90% of the TPH was observed. While 60-70% reductions in BOD and COD were observed. The BOD numbers were likely artificially low due to the lack of the seed's acclimation to petroleum, which is known to inhibit microbial activity. Soluble COD did not change, due to that fact that as soluble COD is broken down more is solubilized by a combination of the added surfactant as well as biosurfactants produced by the bacteria. Generally, after all of the non-solubilized petroleum is solubilized and broken down, the soluble COD will drop to non-detectable levels.

Based on the three-week analytical data and physical observations, no further analytical testing was performed to save added cost as no more petroleum was observed in the lagoon. The initiation of the degradation had been confirmed.

This was another highly successful application for the degradation of petroleum oil.

For more information on MICROBE-LIFT® Technology contact
Ecological Laboratories Inc.
www.EcologicalLabs.com
CS14204

Effectiveness of Microbe-Lift® Bacteria Mixture in Bioremediation of Petroleum Contaminated Soils at Mostardi-Platt Plant

January 4, 1993

Ecological Laboratories, Inc.
P.O. Box 132
Freeport, New York 11520

Attention: Mr. Barry Richter, President

Gentlemen:

Effectiveness of Microbe-Lift Bacteria Mixture in Bioremediation of Petroleum Contaminated Soils

MOSTARDI-PLATT ASSOCIATES, INC. (MPA) has prepared this letter to inform you of the preliminary results of a controlled experiment involving the full-scale field application of Microbe-Lift for remediation of petroleum contaminated soils. In this experiment, four relatively uniform soil cells, with volumes of approximately 30,000 cubic feet each, were to be remediated by bioremediation. The contamination involved was a heavy fraction of petroleum.

Three of the four cells have been treated using an application technique developed by MPA that incorporates the Microbe-Lift bacteria mixture, and the remaining cell was left in its natural state as an experimental control. No nutrients or enzymes were introduced to any of the four cells. The systems have since been closely monitored for indications of microbial decomposition of the petroleum product present in the soils. Data collected during the first two months of activity indicate a 78% increase in biodegradation of petroleum in the cells treated with Microbe-Lift, over the untreated cell. MPA will continue this experiment and inform you of the progress achieved using your product.

Sincerely,
MOSTARDI-PLATT ASSOCIATES, INC.

Douglas M. Waring

Douglas M. Waring
Environmental Engineer

DMW/bit

Compliance Environmental Confirms PCB Transformer Oil Degradation in Bioremediation Test

COMPLIANCE ENVIRONMENTAL, INC.
45. N. Fairfiled Drive, Dover, Delaware, 19901 Phone.fax: 302-697-0681

May 5, 1995

Mr. Barry Richter
Ecological Laboratories, Inc.
P.O. Box 132
Freeport, New York 11520-0132

Re: Transformer Oil Test Project

Dear Mr. Richter:

We would like to thank you for allowing us to include your product, Microbe-Lift, in our bioremediation test project. Microbe-Lift was used along with several other products to investigate the oil degradation process of non PCB transformer oil.

We found that Microbe-Lift could be an effective alternative for transformer oil clean-up projects. Our tests of Microbe-Lift indicated that it possibly contributed to the reduced amount of Total Petroleum Hydrocarbons (TPH) present in our samples.

Thank you for your interest in the project. Please feel free to contact me if you have any questions or concerns.

Sincerely,

COMPLIANCE ENVIRONMENTAL, INC.

Valentino, P. DeRocili, CHMM
Senior Environmental Manager

MICROBE-LIFT® Technology Helps Remediate TPH Contaminated Soils in Georgia and Tennessee

Location: **PCS Nitrogen, Georgia & Tennessee Sites**

Background: PCS Nitrogen, a business unit of Potash Corporation of Saskatchewan, is one of the largest producers of nitrogen worldwide. It produces nitrogen fertilizers and feed ingredients from three manufacturing facilities in the US and one in Trinidad. When they experienced heavy contamination of soils with hydrocarbon and TPH compounds at two of their facilities, they utilized Ecological Laboratories' MICROBE-LIFT® technology to remediate these sites.

Objective: During 2005, 2006, and 2007, **Ecological Laboratories** supplied PCS MICROBE-LIFT®, MICROBE-LIFT® /IND, and MICROBE-LIFT®/SA to be used with nutrient management to enhance and speed the remediation process targeting the removal of the petroleum compounds.

The bioremediation at two sites, in Georgia and Tennessee, included land farming with monthly bioaugmentation application, followed up by wet lay up over colder winter months with the application of microbial treatment.

Results Achieved: These bioremediation programs resulted in site recoveries with dramatic reductions in priority pollutants and TPH. At one site the wet lay up period for three months over the colder period resulted in the reduction of 17 inches of contaminated soil and a corresponding reduction in pollutants, a surprising efficacy considering the low temperature of treatment. It is postulated that the photosynthetic strains in MICROBE-LIFT® provide a substantial advantage in soil remediations.

The following pictures show the dramatic improvement at the Tennessee site:

Fig. 1: *These pictures show the site before the beginning of treatment*

Fig 3: *Excavation to ready the site for land farming shows the extent of contamination.*

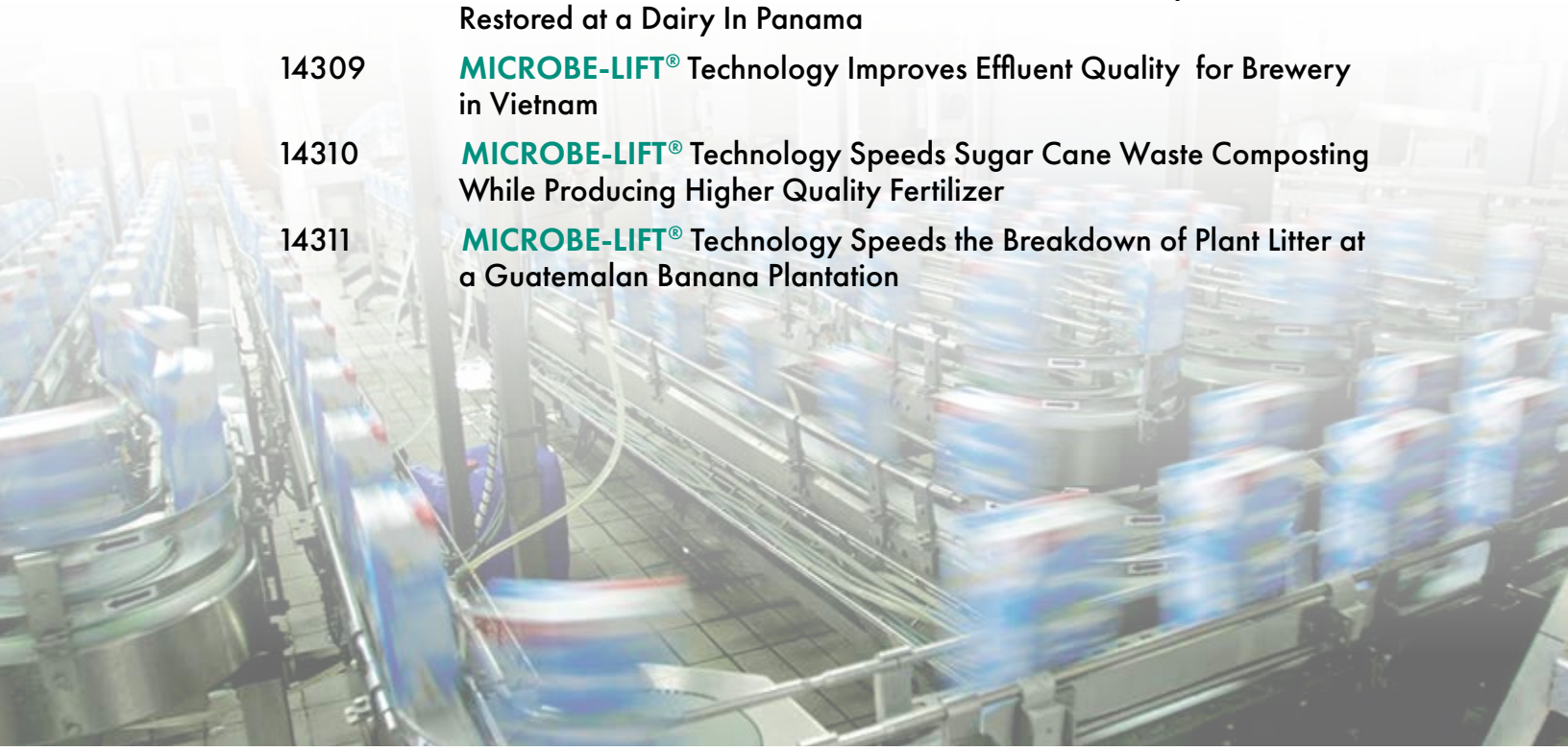
Fig. 4: *This picture shows the site after successful remediation.*

The dramatic "after treatment" picture above confirms the efficacy of MICROBE-LIFT®'s photosynthetic consortium in remediating petroleum contaminated soil, and in this case, efficacy in spite of low temperatures.

For more information on MICROBE-LIFT® Technology contact
Ecological Laboratories Inc.
www.EcologicalLabs.com
CS14207

WASTEWATER TREATMENT - INDUSTRIAL

14300 FOOD PROCESSING



For more information on MICROBE-LIFT® Technology contact
Ecological Laboratories Inc.
www.EcologicalLabs.com

Made in the USA

Poultry Slaughterhouse in Karak, Jordan Achieves Compliance with MICROBE-LIFT® Technology

Location: **National Poultry Slaughter House, Karak, Jordon**

Background: A 200,000 to 270,000 GPD wastewater treatment plant was experiencing difficulty meeting its effluent discharge limits.
This facility consisted of:
a) Collection tank (60 M^3)
b) Aeration tank (7500M^3)
c) Clarifier tank (1600 M^3)
d) Sludge collection tank (130 M^3)

Wastewater flows from the production area to the collection tank by gravity. It is then pumped up to the aeration tank and thereafter pumped to the clarifier.

Objective: There were three main objectives for the program as follows:

1) Reduce the effluent parameters as to meet permit limits as follows (fig 1):

Parameter	Prior to MICROBE-LIFT®	Permit limit
COD mg/l	4211	150
BOD mg/ml	2725	50
TSS mg/ml	1276	50
FOG mg/ml	612	5
PO4 mg/ml	71	5
NH4 mg/ml	310	5

Fig. 1: *This table indicates plant performance relative to permit limits prior to treatment.*

2) Eliminate the malodors from the sludge tank and the effluent.

3) Remove a 65 cm thick floating layer on the sludge tank.

A dosage plan for a 120-day program was developed using MICROBE-LIFT® technology, produced by **Ecological Laboratories, Inc.** Treatment was implemented on May 16, 2001. The results were monitored and tabulated.

Results Achieved: All waste parameters started to improve immediately after treatment as outlined below (fig. 2 & 3):

Date	COD	BOD	TSS	FOG	PO_4	NH_4
1/17/01	2710	1496	610	173	97	100
2/21/01	3210	1445	702	230	83	214
2/25/01	3891	2023	909	490	80	270
4/25/01	4011	2407	1070	501	80	293
5/16/01	4122	2725	1276	612	71	310
6/16/01	1618	779	760	367	48	187
7/03/01	630	275	311	5.3	3.6	120
9/09/01	293	46	153	1.1	0.3	13
9/16/01	107	12	64	0.3	0.1	2

Fig 2*: The table demonstrates effective reduction of waste parameters.*

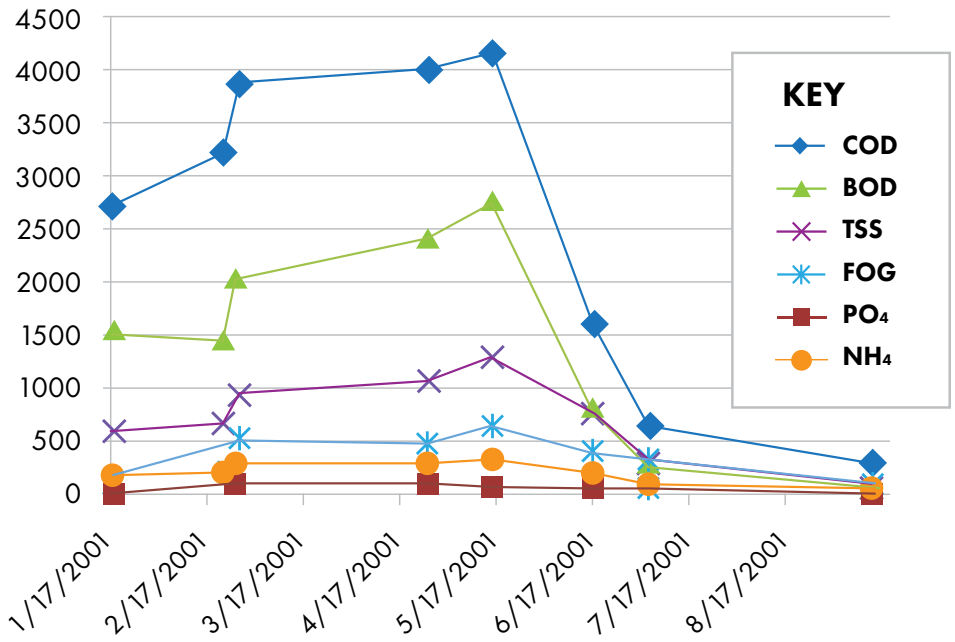


Fig. 3: *Graphic representation of the data shows dramatic improvement in wastewater effluent quality after the application of* MICROBE-LIFT® *on May 16.*

One week after the start of treatment, the bad smell was barely traceable, and as of the 28th of May (12 days after treatment) and throughout the entire duration of the treatment, no malodor was observed.

One month after the start of treatment, the color of the effluent turned to a pink color for two weeks and returned to clear color thereafter. This change of color is evidence of growth of MICROBE-LIFT® formulation's highly active purple bacteria growing in the first four weeks when there was a high concentration of hydrogen sulfide in both the aeration and sludge tank.

The floating layer of the sludge tank virtually disappeared within two months as evidenced in the following table.

Date	16/5	16/6	3/7	9/9 1	6/9
Thickness (cm)	65	32	0.5	00	00

Fig. 4: *Indicates rapid removal of floating sludge on sludge tank.*

Treatment with MICROBE-LIFT® technology was effective in reducing all wastewater parameters to meet the limits set forth. All parameters were reduced by 90-100% compared to prior levels.

For more information on MICROBE-LIFT® Technology contact
Ecological Laboratories Inc.
www.EcologicalLabs.com
CS14301

Egg Processor in Belgium Achieves COD Compliance & Reduces Odor with MICROBE-LIFT® Technology

Location: **Dion Vandewiele N.V., Zulte, Belgium**

Background:

Dion Vandewiele N.V. has engaged in the production of pasteurized liquid egg products since 1937. Between 3 and 4 million eggs are broken daily, 5 days a week, to produce egg-white, egg-yolk, and some mixed egg products for a total to 900- 1000 tons of end products per week.

The wastewater treatment plant was built 10 years ago and designed for 3 million egg-breaking capacity. At up to 4 million eggs per day, the system is over capacity. The key environmental problems include bad odor (mainly caused by hydrogen sulfide from rotten eggs), sludge build-up, and the inability to meet effluent COD permit levels. Their effluent was not in compliance with government standards.

The system was designed as follows:

1) **Collection tank, which allows for chemical treatment:** This is a 10,000 liter tank with influent flow of 150-170 cbm (million m3/day), ranges in pH from 2-13, and COD concentrations from 5,000-35,000 mg/l. This waste contains 1-2% of egg plus cleaning chemicals (caustic, detergents, and nitric acid) and disinfecting chemicals (peroxide). Sulfuric acid used in the collection tank to neutralize the caustic (>333 liters/day) provides a second source of sulfur. System upsets occur when excess sludge is cycled back into this tank or a high spillage of eggs comes from the pasteurization units, where a blend of egg and water is passed through and wasted until the correct pasteurization temperature is achieved.

2) **Aerated basin:**
A small, aerated basin (which is covered to contain odors) receives 150-170 cbm/day from the collection tank. It has one surface aerator and is maintained at a pH of 7.6 to 8.2.

3) **Large aeration basin:**
The waste from the small aerated basin is discharged to a much larger 3200 cbm aeration basin. With an average retention time of 20 days, this basin has three surface aerators to suck waste from the bottom and spray into the air for aeration. During long-lasting warm periods, the surface may form a crust. If this crust breaks the odor is intolerable.

The egg plant works a five-day week. At the beginning of the week, the waste level in this aerated basin is at 3.5 meters (the minimum level at which the aerators can operate). By the end of the week, the waste depth approaches 5 meters, the maximum depth. 9-10 cbm per hour of wastewater are discharged to the flotation unit.

4) **The flotation unit:**
This unit sends 5-7 cbm per hour of water to the pond and 3-4 cbm per hour to sludge storage. Flocculation is accomplished by "polyelectrolytes" which keep the sludge (approximately 1/3 of volume) on the surface.

5a) Sludge storage tank:

This tank has a capacity of 700 cbm with aeration carpets installed on the bottom of the tank for further digestion. Solids content of this sludge is about 3%.

5b) Pond:

The water phase of the effluent from the aeration basin is discharged to the pond. This pond of 225 cbm contains a smaller 75 cbm Reed Pond and a checkpoint for controlling release based on COD. The COD should not exceed 125 mg/l.

The sludge tank is the area with the most critical problems. As long as the sludge does not exceed half of the capacity of the tank, the existing carpet aerators are sufficient to feed the existing microbial population. However, when the sludge volume increases over half the capacity the tank goes septic with a sulfide odor that permeates the whole neighborhood. It is much more difficult to dispose of septic sludge often requiring decanting and incineration at a much higher cost.

Dion Vandewiele N.V. turned to Ecological Laboratories Inc, for their MICROBE-LIFT® wastewater technology. After fully evaluating the system, Ecological Laboratories' technical staff developed a treatment plan designed to achieve the following:

- Remove a major source of hydrogen sulfide ($H2^S$)
- Convert sulfide into elemental sulfur and then to sulfate (no odor)
- Improve biodegradation with a lower yield reducing the formation of sludge by 30-60%
- Clear pond of surface solids and consistently reduce the COD below 125 mg/l in the final effluent.

The treatment plan calls for the dosage schedule of MICROBE-LIFT® wastewater technology listed in the following chart:

Day	Small Aeration	Basin Aeration Basin	Sludge Storage Tank	Pond
		INOCULATION SCHEDULE		
1	5,0 gal	12 gal	6 gal	2.0 gal
		FIRST MONTH SCHEDULE		
7	2.5 gal	6 gal	4 gal	1.5 gal
14	2.5 gal	6 gal	4 gal	1.5 gal
21	2.5 gal	6 gal	4 gal	1.5 gal
28	2.5 gal	6 gal	4 gal	1.5 gal
		MAINTENANCE DOSAGE		
weekly	1.0 gal	2 gal	1 gal	1.0 gal

Note: If there is an extra toxic load of egg products, due to an incident in production, the system is already equipped to handle this and will prevent destabilization. However, it is recommended to use an additional dosage of MICROBE-LIFT® in response to such upsets to ensure stabilization.

In addition to MICROBE-LIFT® an additional product, MICROBE-LIFT®/OX is added to the sludge storage tank at least for the first two months of treatment to help provide enough oxygen to optimize the

action of the MICROBE-LIFT® technology. MICROBE-LIFT®/OX should also be added in conjunction with MICROBE-LIFT® if sludge storage exceeds its 50% capacity, since the air beds only produce enough oxygen to support 50% capacity of the basin. To apply OX, it should be slurried in a ratio of 1 kg OX to 3-4 liters of water prior to addltion.

Recommended dosage of OX to the storage tank along with MICROBE-LIFT®:

Day 1 – 175 kg
Day 2 – 175 kg
Day 28 – 175 kg
Maintenance – 50 kg bi -weekly

Results Achieved: The treatment plan was implemented in middle of May 2001. At this time the neighborhood was complaining about very bad odor and the plant owner was being threatened with plant closure.

Odor	COD influent mg/l	COD effluent mg/l	Visual Apperance of Effluent
Day 1: Very bad odor at small aeration basin & sludge storage polluted the entire neighborhood. (Most of the floating particles were skimmed off)	21,600	245	Cloudy water and a lot of coagulated particles in pond and in reed pond, hindering the growth of the reed.
Day 15: Bad odor was significantly reduced and limited to the small aeration basin and sludge storage tank	16,240	93	The water was becoming clearer.
Day 30: No odor observed in the small basin and only a small occasional odor-wave at the sludge storage tank.	15,400	70	Clear water in the pond down to the bottom (one meter deep)
Day 45: No odors detectible	16,500	70	Clear water

By day 15 the effluent was becoming clearer, the odor was reduced, and the effluent met the required COD parameter. By day 30, clear water was evident down to the bottom of the pond indicated the solids were being reduced.

The goals of the program were met:

1. No detectable odors remained
2. The effluent was clear water with reduced turbidity and solids
3. Effluent COD met specified permit limit

This plant will continue to observe trends particularly based on production and maintenance issues and will respond with increased dosages of MICROBE-LIFT® as necessary to maintain treatment excellence. With the resolution of odor problems and COD compliance the plant was no longer concerned about potential shut down.

For more information on MICROBE-LIFT® Technology contact

Ecological Laboratories Inc.
www.EcologicalLabs.com
CS14302

MICROBE-LIFT® Technology Eliminates the Need for Capital Investment at a Rendering Plant in Guatamala

Location: **ARECA's Frisa Rendering Plant, Palin, Guatemala**

Background:

The facility is a rendering plant, utilizing a limited waste water system. The basic design has a cooling tower, from which the water passes through a grease trap and then into an aeration tower. The water is then discharged into a series of three small lagoons, with a retention time that is calculated to be between 10 and 15 days based on a system volume of 110,000 gallons in the tanks and lagoons and the flow which was believed to vary between 6,857and 11,428 gallons per day.

Objective:

This plant contacted the technical representative at **Ecological Laboratories Inc.** to determine if bioaugmentation could lower the effluent COD to avoid the need to expand their system. The local regulations had targeted a 50% reduction by 2014 and an additional 50% reduction by 2024 for every facility in the river basin.

After thorough evaluation of their system, **Ecological Laboratories Inc.** developed a treatment plan using MICROBE-LIFT®/IND as follows:

Location	Volume Gallons	Week #1 Gal/week	Weeks #2-4 Gal/week	Maintenance Gal/week
Aerator #1	10 m^3	2	1	½
Lagoon #1	120 m^3	2	1	½
Lagoon #2	120 m^3	1	½	½
Lagoon #3	120 m^3	1	½	½
Total	370 m^3	6	3	2

Results Achieved:

From the initial application of MICROBE-LIFT®/IND, the effluent COD was reduced by 74% while the effluent BOD was reduced by 86%. (See chart below)

Parameter	Influent	Effluent (April 1)	Effluent (June 6)
COD mg/l	6,290	1,420	363
BOD mg/l	5,700	1,140	164
Improvement		74%	86%

Based on the first 5 weeks of the plan, treatment with MICROBE-LIFT®/IND was able to meet the 2024 goals without any further capital investment, while eliminating odor and significantly reducing flies.

Fig. 1: *These pictures taken on 5/22/09 (above) and 7/1/09 (below) show the condition of the three lagoons after treatment compared to during treatment. Note the condition of the lagoons improve from the first to the third lagoon in the series.*

Ecological Laboratories, Inc. also recommended that by constructing a simple block wall one meter high to increase the lagoon depths, they could increase the retention time to provide an anticipated effluent discharge below 100 mg/l COD and 50 mg/l BOD.

For more information on MICROBE-LIFT® Technology contact
Ecological Laboratories Inc.
www.EcologicalLabs.com
CS14303

Cheese Factory Optimizes Treatment System and Resolves Odor Problem with MICROBE-LIFT® Technology

Location: **Cheese Factory, Ohio**

Background: A small cheese factory with an activated sludge system was experiencing high levels of sulfide and mercaptan odors, high solids that clogged sand filters, and poor settling in their clarifier. All these problems were signs of inadequate treatment efficiency. Their 10,000-gallon daily flow was discharged to a 140,000-gallon aerobic digester, which then decanted to a clarifier where significant polymer addition was required to achieve settling.

Objective: This factory had experienced numerous odor complaints and their clogged sand filters required ever-increasing maintenance. They were having difficulty meeting discharge limits and were well aware that their system was not providing effective or cost-efficient treatment. MICROBE-LIFT®/IND was the prescribed treatment.

Results Achieved: Based on the recommendation of Ecological Laboratories' technical staff, a shock dose of MICROBE-LIFT®/IND was added to all tanks in the system. As a result, sulfide and mercaptan odors were reduced by an estimated 95-100% in 24 hours. The air system was then changed to provide more dissolved oxygen to the aeration tanks. MICROBE-LIFT®/IND in the aeration tanks resulted in clearer water and improved settling in the clarifier. Use of polymer in clarifier to achieve settling was completely suspended resulting in substantial cost savings to the factory.

This plant maintains treatment efficacy using a low maintenance dose of MICROBE-LIFT®/IND which effectively maintains reduced odors, low TSS, and efficient settling in the clarifier. The cost of treatment is more than covered by the elimination of the use of expensive polymers. Combined with reduced maintenance on the sand filters, this treatment provides a handsome return on investment.

For more information on MICROBE-LIFT® Technology contact

Ecological Laboratories Inc.
www.EcologicalLabs.com

CS14304

Made in the USA

Ohio Bakery Reduces FOG in Pretreatment Effluent with MICROBE-LIFT® Technology

Location: **Bakery , Ohio**

Background:

A major full service bakery in Northern Ohio has a pretreatment plant which discharges to the local village wastewater treatment plant. The average daily flow through this plant is 15,000 to 25,000 per day. Influent waste concentration ranges from 6,000 to 100,000 mg/l CBOD; average suspended solids is 6,000 mg/l; and FOG level ranges between 800 mg/l to 1,000 mg/l.

Objective:

The waste is treated aerobically in an activated sludge system consisting of two 50,000 gallon aerated tanks in series. The wastewater from the secondary tank is pumped onto a gravity belt with polymers being injected into the waste stream.

The municipality was requiring further reduction of effluent FOG since this causes sewer blockages requiring high maintenance costs.

The bakery needed a mechanism to improve the activity of their system to reduce FOG and organics. MICROBE-LIFT® was selected to enhance biological activity to improve degradation. MICROBE-LIFT® was added to the system with an initial charge of two gallons, followed by one quart per day added for a ten-day period. The maintenance dose was then reduced to one pint per day.

Results Achieved:

As a result of this treatment the second aeration tank took on a richer brown color and there was less grease as evidenced by the absence of the grease that used to collect on the paddles of the sludge thickener belt. The plant was able to reduce the usage of sludge-thickening polymer by 70%.

After treatment, the average effluent disharge to the local village POTW was reduced to an average CBOD of <200 mg/l, TSS of 200-400 mg/l, and an average FOG of 15 mg/l or less. Both the bakery and the municipality considered this treatment a dramatic success.

The novel consortium of bacteria in MICROBE-LIFT®/IND enhances microbial action to speed degradation of a wide range of waste organics including the residual hard-to-degrade long chain fatty acids typically measured as FOG. Typically the effects of treating FOG containing waste with MICROBE-LIFT® are quite dramatic.

For more information on MICROBE-LIFT® Technology contact
Ecological Laboratories Inc.
www.EcologicalLabs.com
CS14305

Made in the USA

New Alternative in the Treatment of Residual Wastewater at Coca Cola Bottling Plant in San Salvador

Location: **The Eco Plant of Nixapa Coca Cola, San Salvador**

Background: This Coca Cola bottling plant added a new bottling line that doubled its production that, in turn, doubled the organic loading to its activated sludge waste treatment plant.

This plant needed a quick solution to address increased treatment demand. They proceeded to make several source control changes in the facility to reduce organic loading but these changes were not sufficient to handle the demand and the average effluent COD remained over 2000 mg/l as opposed to a regulation guide of 450 mg/l.

Bioaugmentation with MICROBE-LIFT® technology was a logical solution. **Ecological Laboratories Inc.** is the developer and manufacturer of MICROBE-LIFT® technology.

Pryeasa SA de CV is the exclusive distributor of MICROBE-LIFT® in San Salvador. They provided the technical recommendation for addition of MICROBE-LIFT® to increase the biological degradation capacity of Coca Cola's waste treatment system.

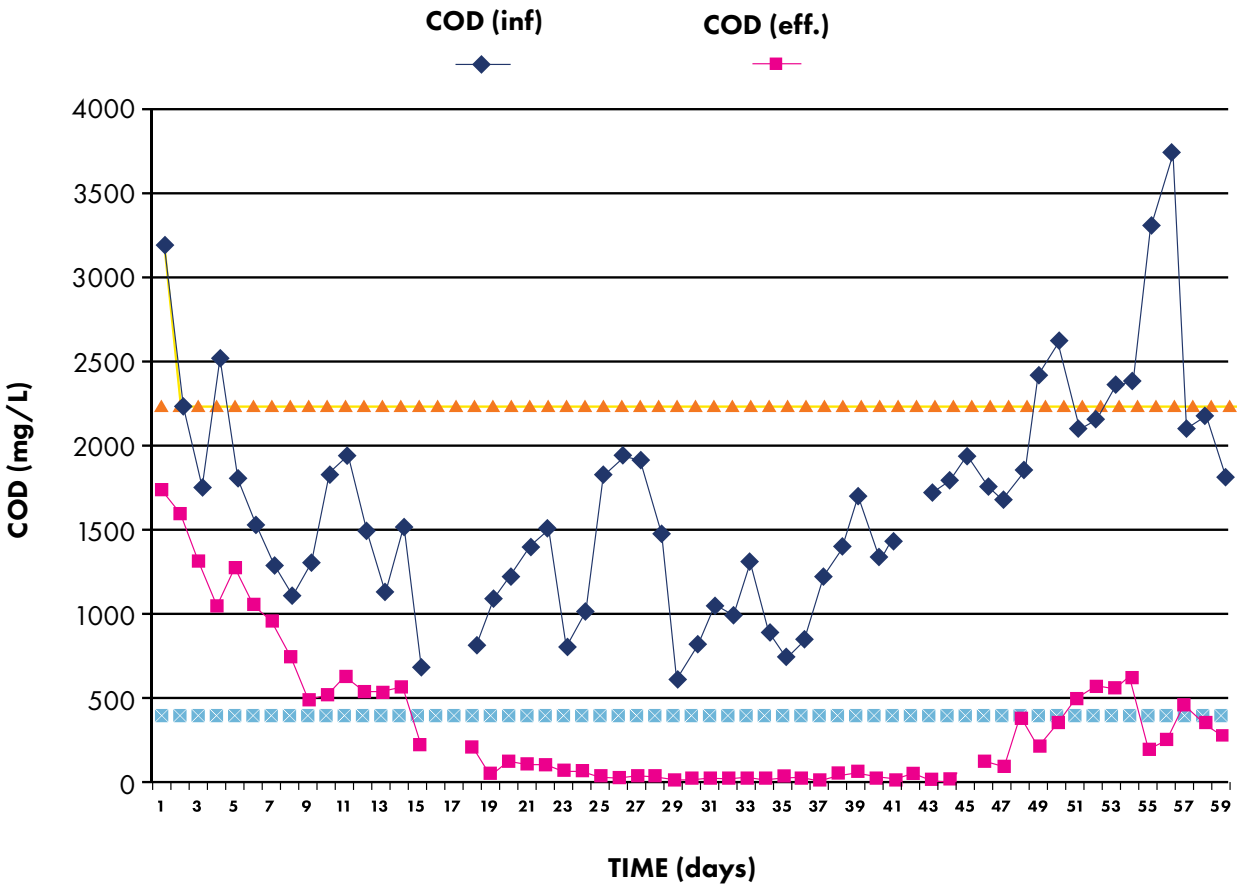
Results: Results were immediate. Dosage of MICROBE-LIFT® was introduced as recommended and within two weeks, the plant was operating within the regulation requirement. After three weeks the effluent was below 50 mg/l COD on a regular basis. Even when there was a spike in influent COD, MICROBE-LIFT® was able to bring the effluent back into compliance very quickly.

Ing. Danilo Juárez, Head of plant maintenance proclaims ,

"We have increased the efficiency of our activated sludge system to more than 90% with the use of MICROBE-LIFT®, in conjunction with a reduction of organic loading to the system as well as the application of a heavy weight flocculant. The efficiency levels now being attained have never before been achieved with the use of other bacterial products in our treatment process."

FIG. 1: *The Eco Plant of Nixapa Coca Cola has experienced much success with the utilization of the MICROBE-LIFT® bacteria. In the photograph is the gentleman in the white shirt, Ing. Danilo Juárez, Head of plant maintenance, and Ing. Roberto Calderón Avelar,, Director of PRYEASA de C.V., the exclusive representatives for MICROBE-LIFT® technology in El Salvador.*

New Alternative in the Treatment of Residual Wastewater at Coca Cola Bottling Plant in San Salvador



The Fig.1: *The chart above shows the COD level of the effluent versus the COD of the influent waste stream. The effluent COD is well below the required 450 mg/l (blue line) with the exception of an influent spike that is quickly recovered.*

Conclusion:

The plant management was very pleased with the performance of *MICROBE-LIFT® technology* in resolving their requirements and a testimonial of their satisfaction is on file.

For more information on MICROBE-LIFT® Technology contact

Ecological Laboratories Inc.

www.EcologicalLabs.com

CS14306

New England Apple Juice Processor Solves Odor Problems with MICROBE-LIFT® Technology

Location: **Apple Juice Processor, New England**

Background: A very large New England apple juice processor, located in a heavily populated area, was facing fines and possible shutdown if the factory was not able to reduce odors from its wastewater pre-treatment facility.

Objective: After investigating the potential of bioaugmentation technology to increase the efficacy of wastewater treatment, the processor turned to **Ecological Laboratories**' MICROBE-LIFT® technology to attempt to resolve their problem.

A shock treatment of 100 ppm MICROBE-LIFT® formulation was dosed to the 700,000 gallon aeration tanks on day one. The impact on odor was dramatic showing odor reduction within three hours. Thereafter, a declining dosage schedule was prescribed as follows:

Time	Dosage
Day 1	100 ppm
Day 2	50 ppm
Day 3	5 ppm
Day 4 & thereafter	5 ppm

Results Achieved: This plant avoided fines and possible shutdown after MICROBE-LIFT® resolved their odor problem in less than a week of treatment. The plant continues to use a maintenance dose to avoid future recurrence of odor problems.

For more information on MICROBE-LIFT® Technology contact
Ecological Laboratories Inc.
www.EcologicalLabs.com
CS14307

Made in the USA

Grease and Odors are Eliminated and the Treatment System is Restored at a Dairy In Panama

Location: **Refrescos Nacionales S.A. , Panama City, Panama**

Background: The grease traps and lagoon treatment system at this dairy beverage plant was severely overloaded with the high-organic dairy waste. Grease and other solids covered the surface of the lagoon and odors were intolerable, saturating clothing, and eliciting numerous complaints from surrounding neighborhoods. Biological treatment was poor as confirmed by microscopic exam that showed a high population of worms and solids that would not be present in an active biomass.

Fig. 1: *Shows the lagoon covered with surface scum.*

Objective: The facility wanted to eliminate the grease and surface scum that interfere with flow and aeration and improve waste treatment. They also wanted to eliminate the malodors that plagued workers and neighbors alike.

When contacted, Ecological Labs designed a treatment based on MICROBE-LIFT®/IND. This technology contains a highly active consortium of bacteria that rapidly eliminates grease and solids and restores energetic microbial action to lagoons. The program called for an initial dose of 4 gallons with two-gallon monthly maintenance doses.

Results Achieved: Within three weeks of the initial application, the oils and grease completely dissolved and the water changed color. Turtles that had not been present for years began to reappear.

Fig. 2: *At three weeks, the surface scum was eliminated.*

The MICROBE-LIFT® technical representative recommended modification of the system by reattachment of some unused grease traps that had previously been disconnected and to dig one additional trap.

After twelve weeks, the system was free of solids and odors. The traps were odor-free and the lagoon had no detectable presence of solids.

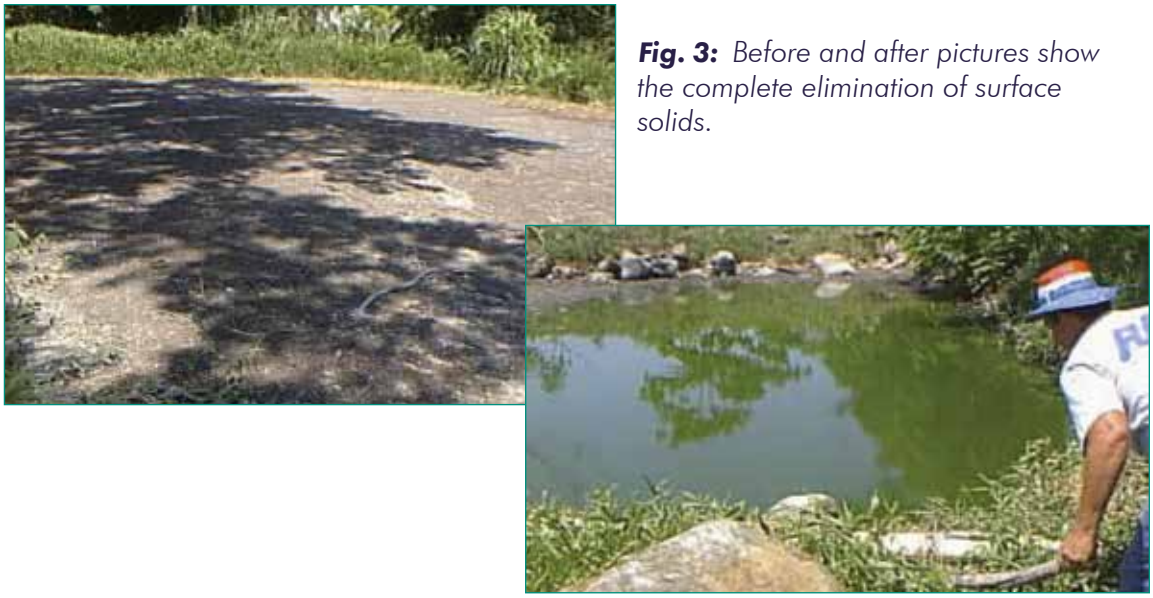


Fig. 3: *Before and after pictures show the complete elimination of surface solids.*

After treatment, no further odor complaints were received. The condition of the lagoon continued to improve. The undesirable insects such as flies and gnats, that had plagued the area prior to treatment, disappeared and turtles and other wildlife returned.

For more information on MICROBE-LIFT® Technology contact
Ecological Laboratories Inc.
www.EcologicalLabs.com
CS14308

MICROBE-LIFT® Technology Improves Effluent Quality for Brewery in Vietnam

Location: **Hatay Brewery, Vietnam**

Background:

Hatay Brewery is the producer of world-class beers such as Heineken, Tiger, Anchor and Bivina. It also distributes other beers and beverages such as Larue Export, Fosters, Amber and Orangina.

This brewery is one of the most modern, state of the art, automated breweries in south East Asia with an investment of 65 million USD in their facilities. Its equipment is of world class standard. The brew house, filtration and packaging operations use the latest industrial technology with a capacity of 56 million liters. Hatay Brewery also has sales offices and warehouses in Hanoi, Hai Phong, Vinh.

Hatay Brewery Ltd has long been known for not only its internationally acclaimed high quality beer brands but also for its contribution towards the development of Hatay province in particular and the community in general.

Objective:

With a concern for high environmental standards, this brewery contacted **Ecological Laboratories, Inc.** for MICROBE-LIFT® technology for wastewater treatment, for potential assistance in meeting effluent quality limits.

Fig. 1: *Initial evaluation of the wastewater shows water that is dark in color with sludge and some black solids floating on the surface.*

Fig. 2: *Solids are evident around the edges of the pond.*

The pictures above show the condition of the 150 M^3 monitoring pond at the brewery site on 2 February 04, prior to treatment. A very strong odor was evident.

Results Achieved:

The picture below shows the condition of the pond eight days later, on 10 February 04, after a daily dose of one gallon has been applied. The water had become much clearer, the odor had been greatly reduced, and the COD and TSS had been reduced significantly.

Fig. 3: *After only eight days of treatment, the water s much cleaner. Note the absence of the scum around the edge of the lagoon.*

The laboratory results confirm that the effluent is much cleaner with improvement of nearly 48% in COD degradation and 91% in TSS removal compared to results experienced prior to treatment. This is a very dramatic improvement.

Test Result:

No.	Date	Parameters		
		pH x	COD total Mg/L	TSS Mg/L
1	02/02/2004	7.81	164	74
2	02/04/2004	7.96	122	47
3	02/10/2004	7.97	86	7

Interestingly, this extremely positive result was obtained with a totally natural biological treatment without any additional chemicals added.

For more information on MICROBE-LIFT® Technology contact
Ecological Laboratories Inc.
www.EcologicalLabs.com
CS14309

MICROBE-LIFT® Technology Speeds Sugar Cane Waste Composting while Producing Higher Quality Fertilizer

Location: **Magdalena Sugar Plantation , Guatemala**

Background: On sugar plantations, cane waste solids called "cachaza" are produced as a by-product. This cachaza is separated from the sugar cane juice and composted for use as a fertilizer.

Magdalena Plantation produces 900 cubic meters of cachaza daily. Using a conveyor system they build 400 meter long windrow rows of cachaza each day and have space for 40 of these rows on site.

Fig. 1: *A large conveyor system was built to handle large volumes of cachaza filling dump trucks which will be used to build windrows.*

Fig. 2: *This picture depicts placement of the windrows.*

MICROBE-LIFT® Technology Speeds Sugar Cane Waste Composting while Producing Higher Quality Fertilizer

Based on numerous field applications, Ecological's core technology has shown benefits in increasing the efficacy of composting. Use of MICROBE-LIFT® core technology has been shown to:

- Shorten the time required to reach heap temperature
- Reduce time to stabilize the compost
- Reduce residual volume
- Improve screening properties
- Improve fertilizer value of the compost

Objective:

The plantation's management wanted to increase efficiency of composting in order to reduce labor and increase the capacity of their facility. A field trial was developed to assess the benefits of bioaugmentation with MICROBE-LIFT® core technology that had shown efficacy in numerous other compost applications.

Fig. 3 & 4: *The standard procedure of adding moisture to the cachaza before composting offered an ideal opportunity for seeding the cachaza with* MICROBE-LIFT®

Two identical sections of a row were set up whereby one was inoculated with MICROBE-LIFT® while the other represented an uninoculated control. The same volume of moisture was added to the cachaza in each row. Temperature and humidity of both rows were measured every week.

Fig. 5-7: *Temperature is recorded and samples taken for moisture analysis.*

Typically a tractor aerates the rows on a scheduled basis. This process was maintained on the regular schedule for both treated and control rows.

After the initial application at the factory, additional applications are made in the field. The first of the field application was performed after 10 days.

Fig. 8 & 9: *Each dose is sprayed on the row before the aerating tractor turns the row to mix, allow gases to escape, and oxygenate the cultures.*

Results Achieved:

The increased degradation of the treated windrow compared to the control is already very evident when the third application was performed 23 days later.

Fig. 10: *The difference in the rate of composting is very evident in the treated vs. the control rows by this time validating the increased degradation rate of* MICROBE-LIFT® *cultures.*

Faster composting reduced labor costs by reducing processing time. Since the cachaza that contained MICROBE-LIFT® was also being composted at a faster rate, it offered less resistance to the aerating tractor saving additional time and labor. This in turn resulted in less wear of tractor parts and less use of diesel fuel by the tractor. In addition, they noted a significant reduction in the flies in the area.

Since the microorganisms in MICROBE-LIFT® are growing in the cachaza, the residual microbes in the compost will have additional value in the fertilizer as these strains have demonstrated the capability to increase growth and yields in agriculture crop applications. Overall this trial was determined to be a success providing numerous benefits to the management of the sugar plantation.

For more information on MICROBE-LIFT® Technology contact

Ecological Laboratories Inc.

www.EcologicalLabs.com

CS14310

MICROBE-LIFT® Technology Speeds the Breakdown of Plant Litter at a Guatemalan Banana Plantation

Location: **Banana Plantation, Guatemala**

Background: Typical of most banana plantations, this operation left plant litter such as leaves and stalks on the floor of the banana stand in order to decompose and return nutrients to the soil to support new growth. However, it takes significant time for this litter to decompose or "compost" slowing the availability of needed nutrients.

Objective: Additional processing of the litter such as mechanical grinding to speed its breakdown was simply not cost effective, however, management considered the slow recovery of nutrients to be a limiting factor in the efficient growth of new crops.

While this was not a typical compost process, a program was developed to assess the ability of MICROBE-LIFT® core technology, to speed the breakdown of this litter. Based on the experimental design, MICROBE-LIFT® was applied at recommended dosage through the central irrigation system.

Fig. 1 &2: *After product was added to the irrigation water tank, it was sprayed through the plantation's irrigation system.*

Results Achieved: Within two months after treatment significantly improved composting of the ground litter had been achieved.

Fig. 3 & 4: *These pictures show dramatic improvement in the breakdown of the plant litter in only two months time.*

This trial was considered a success with more rapid breakdown of litter providing a means of increasing nutrient availability for faster growth of new crops.

In addition to providing faster restoration of nutrients, the microbes in **Ecological Lab's** core technology are known to increase plant growth, productivity, and disease resistance in agricultural crops. The growth of these microbes in the plant litter provides an added value fertilizer for the growth of new crops.

For more information on MICROBE-LIFT® Technology contact
Ecological Laboratories Inc.
www.EcologicalLabs.com
CS14311

WASTEWATER TREATMENT - INDUSTRIAL

14400 TEXTILE

14401 MICROBE-LIFT® Technology Helps Blue Jean Stone Washer Improve Effluent Quality

For more information on MICROBE-LIFT® Technology contact

Ecological Laboratories Inc.
www.EcologicalLabs.com

CS14400

Made in the USA

MICROBE-LIFT® Technology Helps Blue Jean Stone Washer Improve Effluent Quality

Location: Textile Company, Caribbean

Background: Ecological Laboratories Inc. had utilized MICROBE-LIFT® technology in several textile fabrication facilities in the Caribbean and South America with excellent success.

Objective: The major waste treatment challenges of textile manufacturers include degrading sizing chemicals and color elements. The operations in the Caribbean and South America generally use a series of lagoons to treat their waste.

In this particular system of lagoons, MICROBE-LIFT® was added to the first facultative lagoon along with the caustic soda and micronutrients that were normally added. The objective was to eliminate the strong indigo color as evidenced in the following pictures.

Fig. 1: *These pictures of the lagoons show extreme color in the water and surface scum.*

Fig. 2: *The effluent from the plant shows extreme level of indigo pigment in the wastewater.*

The dosage of MICROBE-LIFT® varied with changes in load and flow and MICROBE-LIFT® was added to the other lagoons in sequence at a decreasing rate. This system is very cost-effective as it does not require electrical aeration or pumps, and does not require advanced technical support of the operations. The wastewater is very colored with indigo dye that is being removed from the fabric during stone washing.

Results Achieved:

After treatment, the water is dramatically cleaner in color and the BOD has been reduced to 5 mg/l.

Fig. 3: *This picture shows a much cleaner lagoon after* MICROBE-LIFT® *treatment.*

Fig. 3: *The final effluent is dramatically cleaner showing clarity similar to that which you would expect to see in drinking water.*

The customer was very pleased that this extremely positive result was obtained with totally natural biological treatment that optimized the biological degradation of the waste. No polymers or other chemical treatments were required.

For more information on MICROBE-LIFT® Technology contact
Ecological Laboratories Inc.
www.EcologicalLabs.com
CS14401

WASTEWATER TREATMENT - INDUSTRIAL

14500 PALM OIL

14501 Palm Oil Mill Remediates Wastewater Treatment System with MICROBE-LIFT® Technology in Indonesia

14502 Palm Oil Mill Achieves Wastewater Effluent Goals in Sabah, Malaysia with MICROBE-LIFT® Technology

For more information on MICROBE-LIFT® Technology contact

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CS14500

Made in the USA

Palm Oil Mill Remediates Wastewater Treatment System with MICROBE-LIFT® Technology in Indonesia

Location: **PHG Nubika Jaya, Labuhan Batu, Indonesia**

Background: PHG Nubika Jaya is located in the regency of Labuhan Batu in the North Sumatra region. The manufacturing complex consists of 3 separate manufacturing entities including a palm oil mill that produces crude palm oil, a refinery plant, and an oleo-chemical facility. All the wastewater from these manufacturing facilities share the same effluent pond and, because of this, the quality standard of a POME has to meet the refinery and olechem standard. Hence this makes the project very unique and very challenging.

	Palm Oil Mill Max value (mg/l)	Refinery Max value (mg/l)	Olechemical Max value (mg/l)
BOD	100	75	
COD	350	250	160
TSS	250	60	100
FOG	25	5	10
Total Nirogen /Ammonia	50	na	10
Phosphate (PO_4)	na	2	5
pH	6 to 9	6 to 9	6 to 9
Max waste debit	2,5 m^3/ton cpo	0,5m^3/ton	4m^3/ton

Table 1: *Quality Standard set by the government.*

The daily flow rate of the effluent from the three plants is estimated at 80 m3/hr, and the plant operates at least 20 hours daily. The wastewater treatment system comprises a large pond system, with a few aerators in 2 of the ponds. The total holding volume of the eight-pond system is about 200,000m3. Therefore, the total hydraulic retention time is more than 100 days. The final effluent parameters are shown (table 2 on next page) and the effluent were of red terra cotta color and had a faint smell of ammonia.

Parameter	Average Parameter Jan - July 2010 mg/L	Government Quality Standard of POME Max. mg/L	Target 1 20 % drop on overall parameter mg/L	Target 1 40 % drop on overall parameter mg/L
BOD	151	100	120	90
COD	275	350	220	165
TSS	196	250	156	90
Ammonia	27	50	21	16
POG	9.9	5	8	6

Table 2: *This table provides effluent treatment parameters accomplished to date and specifies the target for improved treatment.*

Objective:

Ecological Laboratories, Inc. was asked to propose a program aimed at meeting the limits specified in table one.

Ecological Laboratories, Inc. proposed a treatment program whereby the ponds would be improved one at a time in sequence from the last pond back to the first pond. Treatment will solubilize collected oil and settled sludge causing an initial increase in organic loading. By treating one lagoon at a time, they will avoid dramatically over-loading the system which would result in deterioration of effluent quality.

Ecological Laboratories, Inc. recommended bioaugmentation based on MICROBE-LIFT®/IND. **Ecological Laboratories, Inc.** recommended inoculation of pond #8 only to kick-start the bioremediation process. In addition, they proposed the construction of a plug flow bioreactor equipped with biomedia and aeration to help achieve the rate of degradation required with the limited 5-8 hours of retention time provided. The new installation is considered pond #9. The following table indicates the targets for the initial application of MICROBE-LIFT®/IND :

Parameter	Average Parameter Jan - July 2010 mg/L	Government Quality Standard of POME Max. mg/L	Target 1 20 % drop on overall parameter mg/L	Target 1 40 % drop on overall parameter mg/L
BOD	151	100	120	90
COD	275	350	220	165
TSS	196	250	156	90
Ammonia	27	50	21	16
POG	9.9	5	8	6

Table 3*: The initial goal was to drop effluent parameters by 20%.*

Results Achieved: The inoculation of MICROBE-LIFT®/IND was performed on Feb 10th, 2010 by the staff of Nubika Jaya supervised by Ecological Laboratoires, Inc and Planet Biru Indonesia. Product was dosed into both pond #8 and pond #9.

A total of two months supply was applied at the following dosage rates:

Day	Date	Dosing (gallons)
Day 1	02/10/2011 Thursday	150
Week 1	02/17/2011 Thursday	64
Week 2	02/24/2011 Thursday	64
Week 2	03/03/2011 Thursday	64
Week 4	03/10/2011 Thursday	64
Week 5	03/17/2011 Thursday	18
Week 6	03/24/2011 Thursday	18
Week 7	03/31/2011 Thursday	18
Week 8	04/07/2011 Thursday	18

Table 4: *Dosage schedule for* MICROBE-LIFT®/IND *in pond #8.*

Week	Day	Date	Inlet Sector	Biomedia Sector	Diffuse Sector	Total
Week 1	1	02/15/2011 Wednesday	1	4	1	6
	3	02/18/2011 Saturday	4	2	0	6
Week 2	6	02/22/2011 Tuesday	2	0	0	2
	10	02/26/2011 Saturday	1	1	0	2
Week 3	13	03/01/2011 Tuesday	2	0	0	2
	17	03/05/2011 Saturday	1	1	0	2
Week 3	20	03/08/2011 Tuesday	2	0	0	2
	24	03/12/2011 Saturday	1	1	0	2
Week 5	27	03/15/2011 Tuesday	2	0	0	2
	31	03/19/2011 Saturday	1	1	0	2
Week 6	34	03/22/2011 Tuesday	2	0	0	2
	38	03/26/2011 Saturday	1	1	0	2
Week 7	41	03/29/2011 Tuesday	2	0	0	2
	45	04/02/2011 Saturday	1	1	0	2
Week 8	48	04/05/2011 Tuesday	1	0	0	1
					Total	37

Table 5: *Dosage schedule for* MICROBE-LIFT®/IND *to pond #9. Note this is a higher rate of inoculation because of shorter retention time.*

Fig. 1: *Inoculation of* MICROBE-LIFT®/IND *by the Nubika Jaya team was made from a boat to assure adequate distribution.*

Two weeks after the first application of MICROBE-LIFT®/IND in pond #8, there was bubbling in the pond indicating a tremendous amount of anaerobic activity as the new microbes become established in the pond.

Fig. 2: *Shows bubbling starting 10 days after inoculation in February in pond #8.*

Fig. 3: *Depicts dramatic bubbling in March, evidence of substantially increased biological activity.*

Apart from the bubbling activity noted at pond #8, the water quality had improved in pond #9. When the water sample was collected on March 27th there was hardly any odor from the final effluent, a substantial change from before treatment. The color of the effluent had also improved turning into a brown tea color after only one month after initial dosing.

Fig. 4*: Color of effluent before treatment was a medium, turbid brown.*

Fig. 5*: After treatment water was a clear, tan color.*

In addition to the improvement in appearance and smell, the water parameters had improved to reach and exceed the level 1 targets specfiied. The table below shows an average 30% drop in all parameters in March compared to the average prior data collected in 2010.

	Average Prior	Target #1	March Result
TSS mg/l	196	156.8	145
Ammonia mg/l	27.11714	21.69371	15.4
BOD mg/l	151.2	120.96	112.4
COD mg/l	275.7629	220.6103	203.77
Nitrogen mg/l	34.545	27.636	19.36
FOG mg/l	9.9	7.92	7.5

Fig. 6: *All parameters were reduced dramatically ranging from 26% to 43%.*

The following graph showcases the actual result. The treatment performed better than expected in the first month:

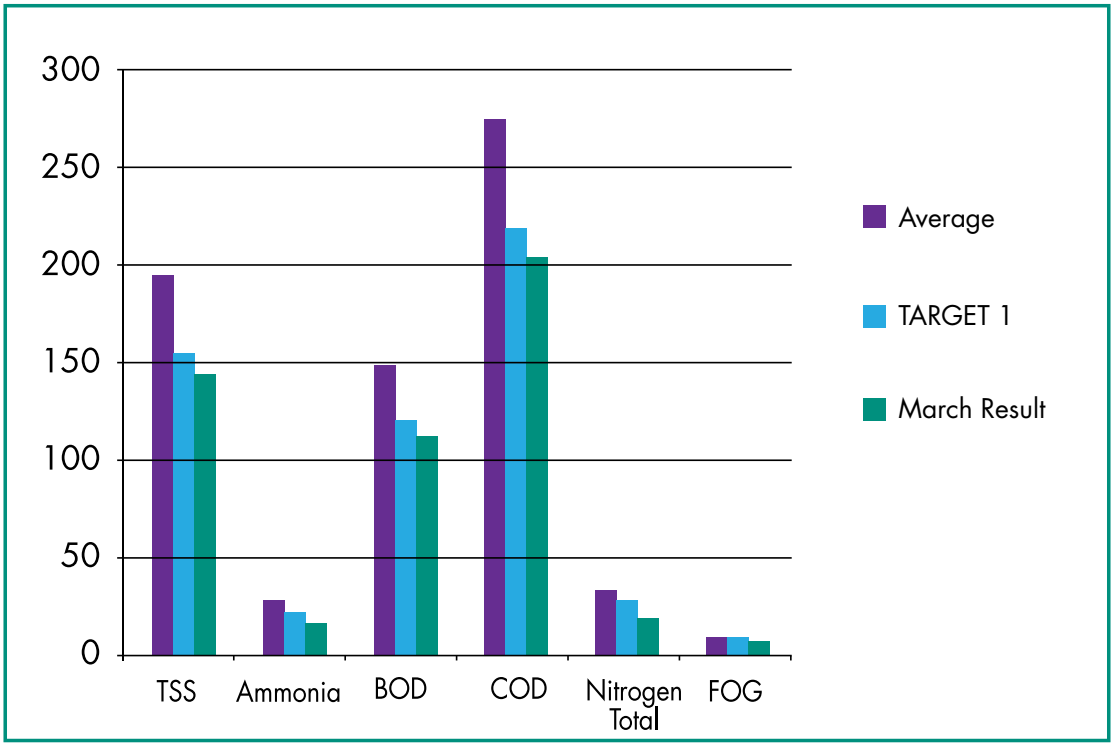

Fig.7: *Performance of* MICROBE-LIFT® *on the final effluent parameters shows consistent, significant improvement in treatment.*

Conclusion and recommmendation: The inoculation of MICROBE-LIFT®/IND has been proven successful at both pond #8 and pond #9. The action was dramatically evident with the bubbling of pond #8 which showed the digestion of bottom sludge and waste organics. There was also a change in color and the removal of odor in the final pond.

The overall water quality improved on an average >30% compared to first trimester 2010 averages. It is believed that the system will further improve the effluent quality once it reaches optimum level in another 1-2 months.

We recommended continuing the maintenance dosage of 15 gallons MICROBE-LIFT® weekly at pond #8 for another month to optimize activity in this pond before commencing stage 2 to restore pond #7. Continue to dose and aerate pond #9 at one gallon, twice a week to maintain bioreactor functionality. This is important in order to maintain efficacy of treatment once restoration of pond #7 commences.

For more information on MICROBE-LIFT® Technology contact
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www.EcologicalLabs.com
CS14501

Palm Oil Mill Achieves Wastewater Effluent Goals in Sabah, Malaysia with MICROBE-LIFT® Technology

Location: **Palm Oil Mill, Sabah, Malaysia**

Background: This palm oil mill was having difficulty meeting effluent requirements due to build-up of sludge in its treatment lagoons. This mill was under pressure from the government to meet effluent requirements and from the surrounding area residents to eliminate tremendous malodor emanating from the lagoon system. This company was aware of the substantial cost of dredging the lagoon and was looking for a more cost-effective solution.

Fig. 1: This picture shows the final effluent lagoon completely impacted with sludge actually forming islands visible from the surface (7 July, 2007).

Objective: **Ecological Laboratories, Inc.** was contacted and asked if bioremediation could offer a solution to eliminate the sludge and restore the treatment capacity of the lagoon.

Ecological Laboratories, Inc. responded to the challenge and developed a highly ambitious treatment program based on the MICROBE-LIFT® microbial technology supported by an oxygenating chemical BioAktiv. The object was to remediate the final effluent pond first and then treat preceding ponds one a time until the entire system was treated. By treating one lagoon at a time, they could avoid a massive treatment overload that would be caused by solubilizing too much sludge organics at one time. By treating lagoons one at a time, they would be able to maintain higher quality effluent while removing the collected sludge. As sludge is removed, the ponds effectively increase their volume capacity and associated treatment efficiency providing cleaner effluent on a long-term basis.

	Microbe-Lift	BioAktiv
Initial inoculation 11 Nov, 2007	50 gallons	30 kg
Next 4 weeks	15 gallons/week	10 Kg/week
Thereafter	10 gallons/month	12 kg/month

Fig. 2: *Dosage schedule of recommended treatment.*

Results Achieved: The pond showed dramatic improvement after only four months of treatment.

Fig. 3: *The same pond as shown in figure 1 after four months of treatment shows that the "islands" have been removed and the water is much less turbid (23 October 2007).*

Based on denitrification activity, the pond showed bubbling throughout. The effluent BOD levels dropped 42% from 208 mg/l to 120 mg/l in spite of the added soluble organics released as the sludge layer was degraded. The smell dropped dramatically. The local community was extremely happy and the government regulators were very impressed offering to inform other mills of the potential of this treatment.

For more information on MICROBE-LIFT® Technology contact
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CS14502

WASTEWATER TREATMENT - INDUSTRIAL

14600 CHEMICAL

For more information on MICROBE-LIFT® Technology contact

Ecological Laboratories Inc.

www.EcologicalLabs.com

14600

Major Paint Manufacturer Utilizes MICROBE-LIFT® Technology to Effectively Resolve Odor Problem

Location: **Glidden Company, Div of SCM Corp. Huron, OH**

Background: Glidden, America's third largest paint company had been experiencing odor problems in their 2 MG lagoon system during the warm summer months at their Ohio plant. With warmer temperatures and high manufacturing level, the system would tend to go anaerobic releasing noxious odors that upset the local community.

Objective: MICROBE-LIFT® formulation was added to the lagoon in an effort to control odor while maintaining efficient waste degradation. The waste stream contained largely coatings and resins.

Results Achieved: An evaluation of the waste treatment system was made and laboratory tests were recommended to determine the toxicity and biodegradability of the waste and sufficiency of nutrients present. Results follow:

Laboratory	No.M286-2-1		
pH	7.16 S.U.	**Sulfide(H_2S)**	1.00mg/l
TNFLT(SS)	39940.00 mg/l	**COD**	38.00 mg/l
Ammonia as N	53.21 mg/l	**Total Chromium**	284.00 mg/l
T. Phosphorus	3.27 mg/l	**Lead**	78.00 mg/l
COD	18380.00 mg/l	**Nickel**	96.00 ug/l

With no serious toxicity problems present and ample nutrients, the waste was subjected to a treatability study by an outside lab to confirm that MICROBE-LIFT® technology could degrade the waste.

Ecological Laboratories' technical representative proposed a treatment plan for MICROBE-LIFT® technology. Initially the dosage prescribed was not sufficient to solve the odor problem. The technical representative worked with Glidden personnel to alter the dosage rate after which the odor problem was completely resolved. Once the proper dosage rate was applied, the septic odor was eliminated.

Paint Manufacturer Utilizes MICROBE-LIFT®/IND to Effectively Resolve Odor Problem

	TREATED AT 5 PPM			TREATED @ 10 PPM			UNTREATED		
	COD	**TSS**	**H_2S**	**COD**	**TSS**	**H_2S**	**COD**	**TSS**	**H_2S**
01/10/1996	18380	39940	116.0	18380	39940	116.0	18380	39940	116.0
01/14/1996	2680	18423	---	3010	1150	---	17440	34820	132.0
01/20/1996	1938	14050	1.21	1011	7000	0.79	16978	28690	151.0
% Reduction	**89.5%**	**54.8%**	**9%**	**94.5%**	**82.5%**	**99.3%**	**7.6%**	**28.2%**	**-30%**

Fig. 1: *This chart demonstrates that the waste was readily degradable by* MICROBE-LIFT® technology.

Ecological Laboratories' technical representative proposed a treatment plan using MICROBE-LIFT® technology. Initially the dosage prescribed was not sufficient to solve the odor problem. The technical representative worked with Glidden personnel to alter the dosage rate after which the odor problem was completely resolved.

Once the proper dosage rate was applied, the septic odor was eliminated within a day. Using a smaller maintenance dose, the system was maintained odor-free for the remainder of the season.

Mr. C. Hoffer, the Glidden Environmental Coordinator, was pleased with the resolution of his challenge by MICROBE-LIFT® Technology and recommends this technology to others. (Testimonial available)

For more information on MICROBE-LIFT® Technology contact
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www.EcologicalLabs.com
CS14601

Polymer Manufacturer in Texas Utilizes MICROBE-LIFT® Technology to Improve Effluent Quality

Location: **Polymer Manufacturer, Texas**

Background: A water-soluble polymer manufacturer was having difficulty with an activated sludge treatment system that failed to meet permit limits. The treatment system was designed with an initial flocculation phase, whereby the pH was adjusted to 12 or above, followed by an anaerobic treatment phase, which discharged to a typical aerobic activated sludge treatment process.

Objective: The facility was under pressure to improve the efficiency of treatment in the activated sludge system to meet effluent NPDES limits including COD, BOD, and TSS.

After a complete evaluation of the system, **Ecological Laboratories** technical staff determined that high phenolics in the waste stream, often exceeding 30 mg/l in the aerated basin, was inhibiting microbial treatment. Variation in the form of phenol shocks in the influent provided continual disruptions in both the anaerobic and aerobic systems.

Bioaugmentation with MICROBE-LIFT® technology, a consortium of strains capable of effectively degrading phenolic wastes, was the obvious solution. A program was developed including an initial dosage of 5 ppm dosed into the aerobic digester followed by a 1-ppm daily maintenance dosage.

Results Achieved: The following chart indicates the improvement in effluent quality two weeks after initiation of treatment. The results will continue to improve as the bacteria become more acclimated to the specific waste stream, again showing the cost-effectiveness of the use of bioaugmentation.

Effluent Data	Before	After	Percent Improvement
pH	8.35	7.66	
Alkalinity	5300		
NH_3(N)	33.93	1.28	96%
PO_4 (P)	14.76		
BOD	2689	148	94%
COD	4833	545	89%
TSS	824	128	84%
Cd	0.82		
T. Chromium	0.16		
Copper	0.44		
H_2S	9.60		

Fig.1: *This chart shows a dramatic increase in treatment efficiency based on the introduction of the consortium of strains in* MICROBE-LIFT® technology. *All data is reported in mg/l with the exception of pH.*

Through the bioaugmentation program and some diversion of flow, control was achieved even when the influent concentration of phenol was over 100 mg/l.

In addition, the anaerobic digester had also been disrupted because of toxic conditions. The dosing of MICROBE-LIFT® formulation directly into the primary digester was able to bring the digester back on line much faster than it would recover otherwise.

The use of MICROBE-LIFT® formulation in municipal anaerobic digesters is a well-established beneficial practice. Solids balancing of an anaerobic digester is the primary method of affecting control over these systems. Often this balance is difficult to maintain, especially with the aging and undersized systems and heavily increased solids loading we experience today. Anaerobic digesters handling industrial waste are even more difficult to balance. In this case, heavy metals provide additional toxicity. Application of MICROBE-LIFT® formulation to these systems has demonstrated its ability to quickly restore proper operating parameters, showing increased gas production and overall solids removal efficiency. Although MICROBE-LIFT® technology is sensitive to metal toxicity, the effective use of this bacterial augmentation can overcome these toxic conditions especially if the heavy metal toxicity is cyclical.

The excellent efficiency of MICROBE-LIFT® bacteria to oxidize hydrocarbons makes it particularly effective against complex organic compounds that end up in the digester. In addition, MICROBE-LIFT® technology's affinity for hydrogen sulfide oxidation makes it beneficial in controlling odor problems always associated with malfunctioning anaerobic digester systems.

For more information on MICROBE-LIFT® Technology contact
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www.EcologicalLabs.com
CS14602

MICROBE-LIFT® Technology Helps Pharmaceutical Plant in Saudi Arabia Avoid Shutdown

Location: **Al-Hayat Pharmaceutical Manufacturing Company, Jeddah, Saudi Arabia**

Background:

Al-Hayat Pharmaceutical is an old manufacturing facility that was built in 1972. This company produces the following range of products:

(1) Antibiotics: (syrup & tablet) including Ciprofloxacin (broad-spectrum) Clindamycin (gram-positive) Ampicillin (broad spectrum)
(2) Anti-diarrheal product (syrup) a product that contains "Neomycin", a broad spectrum anti-biotic
(3) Dextrose and Saline solutions.

When the plant was constructed in 1972, there was no plan for a wastewater treatment plant. All industrial wastewater was piped out into the city-draining network directly. Almost 30 years later, new regulations required that the wastewater be pre-treated on site before it is allowed to go through the city drainage system. At that point, it was decided to construct a 500 M^3 collection tank, which allows 4.1 days of retention time. The hope was to allow for some of the residuals of antibiotics to precipitate in the bottom of the tank, and cleaner effluent could then be piped to the city drainage system but the system proved unsatisfactory.

On January 10, 2006, a final closure warning letter from the local authorities was received by the top management of Al-Hayat Pharmaceutical stating "Treat your water within the next 60 days or you will be shut down". Two days later, after considering options, the plant maintenance manager, engineer Khalid Al-Hanbali called Nahhas World Business Center for assistance. Nahhas is a distributor for Ecological Laboratories Inc's MICROBE-LIFT® wastewater treatment technology.

Objective:

This plant was given effluent parameters that they must meet to avoid plant shut down. Nahhas agreed to work with Al-Hayat Pharmaceutical to attempt to meet those parameters. Initial Actions Taken:

1. Two samples from influent and effluent were collected and sent to the lab for analysis for COD, BOD, TSS, NO3, and PO4. Results are listed below.

Parameter	Influent	Effluent
COD	45,600 mg/Lt	46,811 mg/Lt
BOD	28,412 mg/Lt	28,315 mg/Lt
TSS	13,490 mg/Lt	8,920 mg/Lt
N-T	0.9 mg/Lt	0.9 mg/Lt
PO_4	62.5 mg/Lt	62.5 mg/Lt

***Fig**.1: Initial results show very poor treatment.*

2. Another sample from influent was taken to Nahhas' in-house lab to determine if the waste will support bacterial growth and what DO level is required. The initial sample showed no bacterial growth. As DO was added to achieve 10 mg/l a bacterial count of 3 million/ml was achieved which was adequate for a start. It was determined that there were insufficient nutrients in the wastewater so nutrients, mainly urea nitrogen, also had to be added.

3. A plan was devised to divide the 500 M collection tank into a four-stage treatment facility to include the following: a 50 M collection tank, followed by a 50 M3 primary clarifier, to a 350 M3 aeration tank, and a 50 M3 secondary clarifier. The daily flow was known to be 120 M3/day.
4. Discussions with local authorities resulted in the extension of their warning period from 60 to 120 days.

The following treatment plan was developed:

Aerators were installed on both the collection and aeration tank resulting in a DO Level of 10 mg/L in both tanks.

A dosage schedule for applying MICROBE--LIFT/IND (ML/IND) was devised as follows:

Day1: Apply 2 gallons ML/IND to the collection tank and 9 gallons ML/IND to the aeration tank. Add 40 kg of urea to the aeration tank and 10 kg of urea to the collection tank.

Days 2, 3, 4, 5 & 6 (daily): Apply 0.5 gallon ML/IND to the collection tank and 2.25 gallons ML/IND to the aeration tank. Add 5 kg urea to the collection tank and 20 kg of urea to the aeration tank.

Every 3 days X 10 times: Apply 1 gallon of ML/IND to the collection tank and 5 gallons of ML/IND to the aeration tank. Add 10 kg urea in the collection tank and 40 kg to the aeration tank.

Maintenance Treatment Plan (weekly):

Apply 1 gallon ML/IND to the collection tank and 3 gallons ML/IND to the collection tank. Add 10 kg urea in the collection tank and 40 kg urea in the aeration tank.

Results Achieved:

Effluent parameters were monitored throughout the treatment program with the goal of meeting the following effluent limits:

COD	1500 mg/l
BOD	500 mg/l
TSS	50 mg/l
Ammonia	5 mg/l (added later)

Significant improvement was seen in the first 30 days of treatment.

Parameter	Starting Effluent	30 days after ML	60 days	90 days	120 days
COD	46,811	31015	15,321	2,701	1200
BOD	28,315	11,326	3,237	1001	480
TSS	8,920	3,121	1007	452	117
Ammonia	---	720	412	201	70

Fig.2: *Results of effluent monitoring shows substantial reductions in all parameters.*

The parameter targets to be achieved were:

The program was successful in achieving the COD and BOD targets in 120 days. Although TSS was still in violation, the plant was allowed to continue and an average of 50 mg/l TSS was achieved in the next 60 days without any extra intervention.

Ammonia was not part of the initial defined parameters. But since it presented as a potential concern during the treatment process, it was added as an additional goal. The ammonia reached a plateau and did not continue to drop. It was decided to reduce urea input and adjust the aeration system to allow a short period of time for denitrification. The aeration system now injects air at 10 mg/l for 120 minutes and stops for 40 minutes, during which time denitrification kicks in. Nitrification in the aerobic phase converts ammonia to nitrate, which is then converted to nitrogen gas during denitrification. Nitrogen gas is returned to the atmosphere eliminating it from the system. Utilizing this process, the ammonia concentration was contained at 5-10 mg/l.

Based on bioaugmentation with MICROBE-LIFT® and the associated system modifications recommended by **Ecological Laboratories, Inc** technical team, this plant avoided shutdown.

For more information on MICROBE-LIFT® Technology contact
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14603

14700 OTHER WASTE TREATMENT APPLICATIONS

For more information on MICROBE-LIFT® Technology contact

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CS14700

MICROBE-LIFT® Technology Reduced Hydrogen Sulfide Odor in Rock Quarry by a Dramatic 86%

Location: **Limestone Rock Quarry**

Background: A seventy-year-old rock quarry was receiving numerous complaints from local businesses concerning odors being generated by the quarry. This quarry was producing H_2S levels as high as 154 ppm. Attempts had been made to mask the odors with fragrances but the effects had been minimal at best.

Objective: Anxious for a solution, the management agreed to test the efficacy of MICROBE-LIFT® technology, **Ecological Laboratoraies, Inc.** developed a test protocol that recommended dosing product into the second retention basin, a pond with a capacity of 25,000 gallons and daily flow rate of approximately 500,000 gallons per day. The basin was initially charged with a 25-gallon shock dose of MICROBE-LIFT® formulation. A metering pump was then installed and a daily application rate of 25 gallons per day was applied.

Results Achieved: Within 24 hours of the initial application of MICROBE-LIFT®, the H_2S levels were reduced from 154 ppm to 22 ppm for a dramatic 86% reduction. The complaints from local businesses ceased. Pleased with the efficacy of MICROBE-LIFT®, the quarry management continues to apply MICROBE-LIFT® on a daily basis.

For more information on MICROBE-LIFT® Technology contact
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CS14701

Made in the USA

Reduction of Odor at Municipal Unitary Enterprise "Vodokanal", Podolsk, Russia

Location: **Municipal Unitary Enterprise "Vodokanal", Podolsk, Russia**

Date of the report: December 1st, 2015
Date of the test:October 22, 23, November 13,14, 2015.

Background: On pilot tests of biological preparations MICROBE-LIFT®/IND and MICROBE-LIFT®/SA at sludge dewatering department in wastewater treatment plants.

The Purpose of the Test:

1. To check the technical capabilities and operating capacity of metering unit for bio-preparation at the sludge dewatering department provided by BTA Group Ltd.
2. To evaluate the bio-preparations MICROBE-LIFT®/IND and MICROBE-LIFT®/SA application efficiency to remove the characteristic odor of sewage sludge (cake) after separation on centrifuge and in its place of storage. Selection of optimum operating dosages of biological preparations MICROBE-LIFT®/IND and MICROBE-LIFT®/SA.
3. To evaluate the possible removal of the characteristic odor of sewage sludge at the sludge dewatering department room using the working solution of biological preparations MICROBE-LIFT®/IND and SA spraying method.
4. To determine the preferred specific consumption of biological preparations MICROBE-LIFT®/IND and SA mixture and to process sludge in ratio - liter / m^3 (a mixture of biological preparations, rather than its solution).

Original data

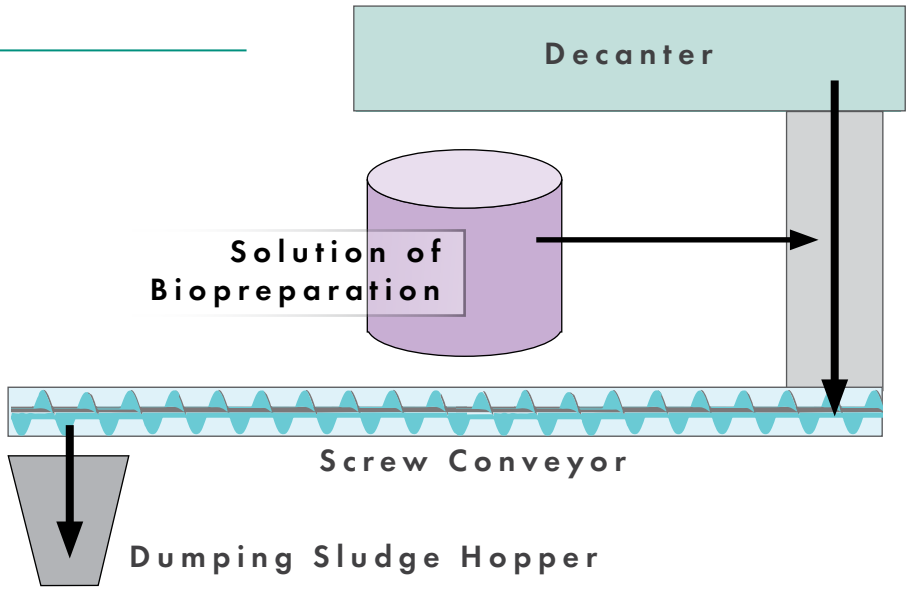
Type of initial sludge: a mixture of raw sludge from primary settlers and compacted surplus activated sludge (in the current working ratio).
Equipment: Screw conveyor and the decanter (centrifuge) for sludge dewatering Flott weg C4E-4/454 HTS, preparation metering unit.

Test procedure

Industrial tests of biological preparation MICROBE-LIFT®/IND and MICROBE-LIFT®/SA

- Bio-preparations MICROBE-LIFT®/IND and MICROBE-LIFT®/SA were mixed in a ratio of 1:1. Further, by diluting the resulting mixture in non-chlorinated water, the solutions of the following concentrations 3.5% and 2% were prepared. Solutions were prepared in a polyethylene tank in a total volume of 200 liters each.
- The solution was fed to the conveyor by the metering pump in a volume of 7,5 l per 2.65 m cake/h
- The total volume of solution used is ~ 600 liters, including biological preparations in concentration of 3.5% - 200 liters and with biological preparations in concentration of 2% - 400 liters;
- The total volume of processed cake - 212 m^3;

Test pattern is shown:



Test results are shown in Table:

Concentration of the mixture of biopreparations in solution. %	**3.5 %**	**2 %**
Bio-preparation rate l/m3 wastewater treatment	0.1	0,06
Odor at the outlet of the conveyor in the hopper compartment	Imperceptible 0 point	Too faint 1 point
Odor near to the storage site in 20 days	Too faint 1 point	Faint 2 points
Odor in the department within the period of biopreparations application	Too faint 1 point	Faint 2 points

In addition to the above results, it was indicated that after spraying a solution of bio-preparations in the sludge dewatering department room (total volume of 10 liters of the solution to the entire area of the department), the intensity of the characteristic odor of sludge in this room has been significantly reduced.

It should also be noted that storage of dewatered sewage sludge (cake) stored and processed by biological preparations was made under the weather conditions, characterized by high humidity with precipitation and average air temperature from + 2 to + 7 during a day and at night to -2 . The effectiveness (aftereffects) of the biological preparations MICROBE-LIFT®/IND and MICROBE-LIFT®/SA at lower ambient temperatures below + 4 and air access restriction (including due to high humidity), as a rule, is reduced. Under the conditions of dry and warm weather, the effectiveness (aftereffects) of the biological preparations in the stockpiled sludge (cake) is significantly higher (this, in particular, is evidenced by the experience of making similar tests with the processing of dewatered sewage sludge (cake) on Shchelkovo inter-district treatment plants in July 2015).

Reduction of Odor at Municipal Unitary Enterprise "Vodokanal", Podolsk

Summary:

Based on the industrial tests, all tested solutions of mixture of biological preparations MICROBE-LIFT®/IND and MICROBE-LIFT®/SA showed strong results in the removal of odor from the resulting sludge.

The most preferred specific consumption of mixture of biological preparations MICROBE-LIFT®/IND and MICROBE-LIFT®/SA for sludge treatment should be regarded as the ratio of 0.1 liter / m^3 (a mixture of biological preparations rather than its solution).

It is advisable to periodically process the plant premises by spraying the solution of biological preparations

Conclusions:

The solution of biological preparations such as MICROBE-LIFT®/IND and MICROBE-LIFT®/SA in a ratio of 1/1, in the total concentration of 3.5% may be recommended to reduce the intensity of the characteristic odor of the cake at the mechanical dewatering department room in order to prevent the spread (blocking) of the odor during transportation and storage of dewatered sewage sludge.

It is advisable to enter the cake processing procedure using the solution of bio-preparations MICROBE-LIFT®/IND and MICROBE-LIFT®/SA to the Rules and Procedures of the sludge dewatering department.

It is recommended to Company "BTA Group" to prepare a commercial offer for the MUE "Vodokanal" Podolsk for supply and use of preparations MICROBE-LIFT®/IND and MICROBE-LIFT®/SA with the following initial data:

- Hourly average volume of dewatered sludge (cake) formation- from 3.0 to 3.3 m3;
- Annual formation of dewatered sludge (cake) - 20 498 m3;
- Average moisture of formed sludge (cake) - 75.6%;
- The volume of dewatered sludge accumulated in the storage area - 29 227 m3.

For BTA Group Ltd. For MUE "Vodokanal" Podolsk
A.V.Vershinin
S.V.Kalinovski

For MUE "Vodokanal" Podolsk
Eryomina N.F.
Tokarev N.R.

The Report Is Approved by

A.A. Berezhinskiy
Director General
BTA Group Ltd.

M.V.Yavtushenko
Head of Wastewater Plants
MUE "Vodokanal" Podolsk

SEPTIC SYSTEM & INSTITUTIONAL WASTE TREATMENT

If properly maintained, a well-designed septic system will last for decades, however, if it is neglected, it can back up and clog which can result in an expensive excavation and even a complete replacement that could cost thousands of dollars.

The septic tank is the key component of the septic system. It serves as a settling basin where waste solids accumulate and gradually get broken down and solubilized by bacterial action. Some of the organic waste, also known as the organic fraction gets liquefied by natural bacterial decomposition, however, the rest of the waste accumulates in the bottom of the tank as a layer of sludge. A small percentage of the waste, mostly fats and oils, may float to the top of the tank to form a layer of semi-solid scum.

MicrobeLift is a proprietary formula of live bacteria effective in breaking down the organic fraction of sewage and wastewater. **MICROBE-LIFT®** is highly successful in maintaining septic tanks and systems in optimal conditions. By breaking down the solids quickly and effectively, **MICROBE-LIFT®** significantly reduces costly maintenance to the system which includes tank pumping and system backup. When used regularly, the septic system will function properly and avoid costly repair and/or replacement. MicrobeLift will remediate perculation problems in the drainage field soil and assure constant filtration back to the environment.

When added to the septic system, the bacteria in **MICROBE-LIFT®** accelerate the natural degradation process of the waste and maintain the system in good working order, free from clogging and backup. This can ultimately save the customer thousands of dollars in expensive maintenance and repair costs associated with a non-functioning system.

Unlike chemicals that are harmful to the environment, **MICROBE-LIFT®** is 100% natural and completely safe for the environment. The bacterial populations have been determined by repetitive plate count to be in excess of 350 million organisms per milliliter, making **MICROBE-LIFT®** one of the most concentrated and effective products on the market.

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CS15000

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15100 Septic Systems, Residential, & Institutional Systems, Portable Toilets

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15100

PRO-PUMP® /HC Removes Grease Balls from Large Grease & Septic Effluent Collection Tank

Location: **Whay Sanitation Company, Weems, VA**

Background: Whay Sanitation Company operates a large septic collection facility to break down septic and restaurant grease trap waste (30,000 gallons per day). They have been a PRO-PUMP® user for several years. Recently they developed a new program for PRO-PUMP®

Objective: Their septic waste receiving station consists of a 1000-gallon dump station and screen area with discharge to a 500-gallon distribution tank that distributes the waste to two 10,000-gallon biological tanks. The 500-gallon distribution tank had a continued problem with heavy grease accumulation on its surface with collection of large grease balls that Mr. Whay described as being the size of watermelons.

Based on recent results seen with PRO-PUMP® /HC in grease traps, Henry and his maintenance supervision decided to add one gallon of PRO-PUMP® /HC to the 500 gallon distribution tank to see what effect PRO-PUMP® /HC would have on the surface grease mat.

Results Achieved: The following day they inspected the tank and were amazed to find there were no more large grease balls or grease chunks. With the benefits they had witnessed they decided to add an additional gallon to the 500 gallon tank to determine what this effect would be.

Again, the following day they found the tanks completely grease free with no trace of surface grease in the waste receiving distribution tank. Henry advises that PRO-PUMP® 's performance is simply amazing.

He states, *"I have never seen anything work like PRO-PUMP® ".*

Based on MICROBE-LIFT® technology, PRO-PUMP® contains a proprietary consortium of microbial strains with highly effective long chain fatty acid degradation capability under aerobic and anaerobic conditions. No other product degrades grease and other organics as quickly or effectively as this vegetative consortium.

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PRO-PUMP® is the Key to Making On-Site Wastewater Systems Work for Florida Contractor

Location: Cocker Plumbing, Homestead, FL

Background: John Cocker operates Cocker Plumbing located in Homestead, Florida. John's business services commercial properties, food facilities, apartment complexes, and residential systems. John routinely provides service that includes the maintenance of facility effluent lines, grease traps and absorption fields (drain fields).

John was a past user of PRO-PUMP® and then switched to a competitive supplier (Bio-One) based on a relationship with the salesmen, lower cost and information that the product would out perform PRO-PUMP®. After comparing performance of the two products, John has returned to using PRO-PUMP®. John stated that during the period he used the competitive bio-product he saw no system benefits what-so-ever from the bio-formulation's use. He had used the competitive bio-product in the same applications and at the same feed rates as previously used with PRO-PUMP®.

Objective: John has numerous applications that are key to his company's success. With PRO-PUMP® he can save time on services, remediate failed drain field systems, and provide cost effective grease trap system maintenance.

Results Achieved: John advised that he successfully uses PRO-PUMP® to reduce his service time in system clean out and pump-out of both septic tanks and grease traps. He also uses PRO-PUMP® to assist in maintaining effluent flow to absorption field in commercial operations where the systems are organically and hydraulically overloaded. He applies PRO-PUMP® at the time of pumping, and again if the system requires service.

For example, John services a major BBQ facility with an effluent flow of 10,000 gallons/day. He modified the effluent treatment system that had consisted of a single 750/gal grease trap and 1,500 gallon septic tank, by adding three additional grease traps prior to the septic tank. The current system has a 750gal/ GT, 900gal/GT, 1,5000 gal/GT, 1,500/galGT and 1,500 septic tank, with effluent to an absorption field.

John adds one quart of PRO-PUMP® to each of the systems tanks every time he pumps the grease traps and septic tank. He advised that the use of PRO-PUMP® controls or eliminates the hard surface grease on all tanks, and eliminates or reduces the build up of grease balls and grease chunks. He claims that PRO-PUMP® makes a significant difference in the systems conditions at the time of service. (According to John, the competitive product used at the same rate in the same systems had no impact for solids or grease control.)

In another example, John services an eight-unit apartment complex in a low-income area outside Miami. A massive amount of solids and grease are contributed to the system by the 8 apartment buildings and its 40 inhabitants. The facility's on-site wastewater system is inadequate to handle the process waste as the system equipment consists of only one 2000-gallon septic tank and 800 feet of absorption field.

To remedy the system overload, John must pump the septic tank every three weeks to reduce surface solids and grease accumulations in the septic tank. Even with an aggressive pumping schedule, John believes that PRO-PUMP plays a key role in his ability to maintain the on-site wastewater system in working order. John applies two gallons of PRO-PUMP® following each pump-out. PRO-PUMP® reduces grease and solids build up in the 2000-gallon septic tank, and more importantly has reduced the effluent discharge water level at the tanks outlet, indicating improvement in field flow capabilities.

John is a firm believer in the benefits of PRO-PUMP®. It reduces solids accumulation in grease traps and septic tanks, improves septic field absorption, and provides labor savings on clean-outs. ***Welcome back John!***

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CS15102

Service Company Provides Absorption Field Recovery with PRO-PUMP®

Location: **Danny Miller Plumbing, Gulfport, MS**

Background: Mr. Danny Miller advised that his firm is often asked to help recover failed septic system absorption fields that have lost their flow resulting in surface seepage.

Objective: As an example, Danny Miller Plumbing was contacted by Mr. Jay Manett of Pass Christian, MS to resolve problems in his system.

When Danny inspected the on-site residential system he determined that the problems were the result of a failed leach field. Further inspection determined that the field was constructed of clam and oyster shells that were heavily fouled with organic sludge.

This old style absorption bed was about 50 years old and had lost the majority of flow capacity. The system media was fouled with heavy black sludge from top to bottom.

Danny advised that replacement of the failed absorption field was not an option due to the field's location and town regulations. In addition, a heavy chemical application could not be considered, as that would destroy the field's construction.

Based on his experience, Danny recommended recovering the absorption field using PRO-PUMP®. The septic tank was pumped and two gallons of PRO-PUMP® was added directly to the junction box. In addition one gallon was applied each week for the first three weeks.

Results Achieved: The absorption field recovered quite rapidly with improvements noted within 14 days and full flow was established within 90 days of treatment with PRO-PUMP®. The fields' clam and oyster shell media was fully restored to its original white color and flow capacity returned to full capacity. The process involved only the application of PRO-PUMP®; mechanical cleaning was not conducted and no chemicals were used to improve field conditions.
This customer continues to use PRO-PUMP® as recommended by Danny Miller to avoid future problems.
Danny advised that the application of PRO-PUMP® had recovered normal flow in all systems where he had applied PRO-PUMP® to treat problem drain-fields.

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Septic Supply Company Confirms that PRO-PUMP® Remediation Restores Drain Fields Every Time

Location: **Austin Septic Supply Company, Austin, TX**

Background: Austin Septic Supply has distributed PRO-PUMP®/HC and PRO-PUMP® products to its customers for over 10 years. They supply pumpers and excavators a full line of necessary materials to meet their service requirements.

Objective: The most serious and potentially expensive problem that occurs in a septic system is drain field failure where the septic field loses its ability to percolate wastewater and systems start oozing effluent on the ground and causing wastewater back-ups into the home.

Mr. Wayne Dolezal, the owner of Austin Septic Supply, has promoted the use of PRO-PUMP®/HC for drain field system recovery for several years with numerous successful applications. Wayne's customers attest that the product works every time they use it. Wayne has never experienced any reports of failure.

Results Achieved: Wayne supplies eleven septic service companies that rely on the use of PRO-PUMP®/HC for field recovery. The application for system recovery incorporates PRO-PUMP®/OX in combination with PRO-PUMP® at a rate of two gallons of PRO-PUMP® and two pounds of OX for each system recovery application. Systems are first serviced and pumped prior to product addition to the distribution or junction box, or discharge side of the septic tank.

Wayne recently had a satisfied homeowner stop to thank him for recommending PRO-PUMP® to her pumper. She advised that she had not been able to wash even one load without a system back-up and that had always been a wet spot on her lawn. Now, after her service company applied PRO-PUMP® remediation, she is able to do her laundry without problems as often as she wants and the wet spot is no longer there.

More recently, based on **Ecological Laboratories'** recommendation, Wayne now markets the new PRO-PUMP® Bio-remediation Kit, and has sold over 40 Kits within a short period of time. Wayne advised that his customers appreciated the market support the kit's design offers, as well as, the information the kit offers on why systems fail, how remediation works, and most importantly the kit's application instructions.

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PRO-PUMP® Drain Field Remediation Resolves Plugged Filter Bed and Helps Homeowner Complete the Sale of Her Home

Location: **County Side Service, Medina, OH**

Background: Homeowner Georgine Krudelback in Medina, OH had a neglected septic system that had started ponding. She contacted County Side Service to help her restore her system.

Objective: This homeowner needed to restore her system quickly so that it could pass inspection for the sale of her home.

Results Achieved: When County Side personnel inspected the system they determined that the system was not discharging. The filter bed was plugged causing ponding on the surface and in the yard. An aerator in the system was not functioning and a distinct foul odor was evident. A system in this condition makes it difficult to successfully sell a home.

To remediate the system, County Side Service first jetted all lines and pumped tanks empty. Then on May 23, 2003 they dosed one gallon of PRO-PUMP® into the septic tank and installed the PRO-PUMP® Bioremediation kit into the distribution box.

Less than 3 weeks later, on June 12, 2003, the water level had lowered enough to re-install the aerator motor.

The system continued to improve and less than a month later on July 7, 2003 the septic system passed inspection for the sale of the home. The homeowner, who had been concerned regarding a very expensive and lengthy rebuilding of her system, was extremely pleased with this fast, low-cost solution that allowed her to close on the sale of her property.

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Restaurant Uses PRO-PUMP® to Resolve Cesspool Capacity Problem

Location: **Restaurant, Cedarville, NJ**

Background: Mr. John Dino, owner of a restaurant in Cedarville, NJ, lost his restaurant to fire about 14 to 15 years ago when the building was burned to the ground. He rebuilt the facility and installed a complete new septic system consisting of a 500-gallon grease trap, a 1,500-gallon septic tank, distribution box, and four cesspools.

Objective: Robert Lore, Jr. of Lores Cesspool Service was contracted to maintain the restaurant's on-site wastewater system since it was put on-line. His service includes monthly pumping of the grease trap, and quarterly pumping of the septic tank. Several years ago Robert determined that the four cesspools were losing capacity and were getting full.

Results Achieved: To resolve the cesspool water capacity problem, Robert developed a remediation program. He placed valves on all discharge lines at the distribution box going to the cesspools. He closed all the valves except one, taking the remaining cesspools off-line for an extended period. Each 30 days he takes the active cesspool offline, treats the system with one gallon of PRO-PUMP® and puts a different cesspool in service. His monthly inspection of the system has determined that the cesspool placed in service is completely empty and carries the effluent water loading for the full 30 days without a problem. In addition, Robert treats the grease trap with 8 ounces of PRO-PUMP® Grease Trap Maintainer weekly.

Robert advises that this system modification and monthly use of PRO-PUMP® resolved the early cesspool drainage problem recovering an effective flow rate and has kept the commercial on-site absorption system in good working order for well over seven years. Robert strongly believes PRO-PUMP®/HC is a significant factor in maintaining cesspool flow for this commercial wastewater system.

Recently, Robert enhanced the system by installing a pump for PRO-PUMP® to expedite overall grease reduction and increase overall system performance allowing increased capacity.

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CS15106

PRO-PUMP® Improves Effectiveness and Efficiency for Sanitation Service Company

Location: **M&O Sanitation, Poughkeepsie, NY**

Background: Mr. Butch Cimorell, of M & O Sanitation Inc. is located in Poughkeepsie, NY. M&O Sanitation services commercial facilities, food facilities, and residential systems.

Butch has been a long-term user of PRO-PUMP® dating back 7 to 9 years. During this period he has experienced excellent results from PRO-PUMP® improving conditions in grease traps, septic systems and absorption fields.

Objective: Butch successfully uses PRO-PUMP® to reduce his service time in grease trap system clean out, and pump-outs, as well as to assist in maintaining effluent flow to absorption fields in commercial on-site systems.

For grease trap service, Butch adds from one quart to one gallon of PRO-PUMP® (based on system size and conditions) to each grease trap every time he pumps the trap. PRO-PUMP® controls or eliminates hard surface grease on the majority of grease traps as noted on his return service visit. He claims that PRO-PUMP® makes a significant difference in the systems' conditions at the time of service.

For on-site waste treatment systems, Butch has established a standard procedure for absorption system recovery that includes the application of PRO-PUMP®. Following system pumping and cleaning, they uncover and clean the distribution box; then they jet or Terri lift the system and add two gallons of PRO-PUMP® to the distribution box. Butch claims that PRO-PUMP® makes a significant difference in field recovery.

Results Achieved: Butch stated he has used several products over the years and believes PRO-PUMP® offers performance that is superior to the majority of the products he has evaluated.

In summary, Butch advised that PRO-PUMP® has proven to be effective in reducing grease and solids build up in grease traps, saves time on grease trap and septic tank cleaning, and improves efficacy of absorption fields.

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Successful Septic Service Business Relies on PRO-PUMP® to Help Resolve Customer Problems

Location: Swartout Construction Company, Boonville, NY

Background: Mr. Mark Swartout's company uses PRO-PUMP®in their septic business for system maintenance, as well as to resolve difficult absorption system drainage problems. To demonstrate his success with PRO-PUMP®/HC Mark submitted two case histories specific to the products performance in absorption flow recovery.

Objective: In one case, the William McLachian home in Eagle Bay NY, Mr. McLachian contacted Swartout Construction to resolve problems in his septic system and drain field. This home is located on a lake front property with a 1000-gallon septic tank and drain field. The field had failed and was ponding seepage water.

Mark inspected and evaluated the field's pooling. Based on Mark's past remediation success with PRO-PUMP®/HC he advised the owner that PRO-PUMP® offered a low cost alternative to system replacement. His recommendation was to use PRO-PUMP® as a first measure to resolve the problem.

The septic tank was pumped, the distribution box was uncovered and cleaned, and the drain field was jetted and vacuumed. One gallon of PRO-PUMP® was then added directly to the junction box, and one additional gallon was added to the septic tank. The customer was then advised to go easy on the system (watch and consider what goes down the drain) to assure long-term on-site system operation.

Results achieved: The absorption field recovered in approximately three weeks from date of treatment, and remains trouble free to date.

Objective: In another residential application, the Roy Hess home in Forestport, NY, the on site wastewater system consisted of a 1,000 gallon septic tank followed by a 6 X 6 dry well. The dry well had lost its absorption capacity and would no longer take water causing the entire system to fail.

Mark again developed a remediation program. The systems septic tank and dry well were pumped, and the dry well was washed down with a garden hose. The dry well was treated with two gallons of PRO-PUMP®/HC and one gallon was added to the septic tank.

Results achieved: The application of the three gallons of PRO-PUMP®/HC restored the dry well absorption flow capacity within four weeks from the date of treatment and has stayed problem free from the date of treatment. Mark has used PRO-PUMP®/HC for a number of years to resolve on site system problems, to include the recovery of failed absorption capacity in many applications similar to those listed above.

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Successful PRO-PUMP® Remediation Saves Customer from Having to Rebuild Septic System

Location: Ready Freddy Inc., Cedar City, UT

Background: Mr. John Tveit of Ready Freddy Inc. is a strong supporter of PRO-PUMP® having used PRO-PUMP® / HC for several years with excellent results. Applications include regular septic system maintenance after pump-out; grease trap applications to assist in the removal of hard grease caps (add one gallon, wait one week and pump), and for the recovery of flow in slow and failed absorption fields.

Objective: In a typical application John responded to a call for assistance from Mr. Gary D. Seaman in Kalispell, UT to resolve a reported septic system alarm problem. The home is a three-story construction located in a lake resort community, on the top of a hill with a decline to the waterfront. The on-site wastewater incorporates a 1000-gallon septic tank and a 500-gallon pump pit to transfer waste to the absorption field. The homeowner had reported alarm problems that result in the loss of power to the system waste effluent pump to the drain field.

The initial inspection of the system indicated a potential problem with the pump-pit electrical system, such as normal wire corrosion at the pump pit connections.

To determine the problem, the septic tank and pump pit were cleaned. In addition, a riser was installed on the septic tank, a filter installed on the septic effluent line, and the electrical connections replaced at the pump pit electrical box. Following the system corrections, it was determined the problem was with the pump's long cycle time that resulted in pump overheating. This would trip the electrical breaker shutting down the effluent pump. The transfer pump was requiring 45 minutes to lift the waste to the absorption field, and satisfy the low level pump shut off while the normal pump time should be approximately 7 minutes.

John determined that the excessive run time was due to reduced absorption field capacity, requiring a longer pump cycle time to transfer the pit waste to the absorption field.

Based on John's past experience with PRO-PUMP® in resolving absorption field flow problems, combined with the systems construction and location, John advised the homeowner that he recommended they first attempt flow recovery using PRO-PUMP® rather than system replacement.

Two gallons of PRO-PUMP® were added directly to the pump pit, one gallon to the septic tank, and one gallon each every week for two weeks.

Results Achieved: The absorption field recovery required three weeks to show dramatic results. The drain field flow was recovered and the pump cycle time was reduced from 45 minutes to 7 minutes. The problem was resolved with full flow restored to the absorption field.

The flow recovery process involved only the application of PRO-PUMP® . Mechanical cleaning was not conducted and no chemicals were used to improve field conditions.

The customer continues to use PRO-PUMP® once a year, as recommended by John. John claims that this was one of their most successful applications based on the system's location and specific problems.

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PRO-PUMP® Restores Impacted Drain Field Eliminating Back-ups

Location: A/1 Excavation Septic Service, Austin, MN

Background: Mr. Rusty Peck advises that his company has used PRO-PUMP® in their septic business for several years with good results. In addition to regular septic system maintenance, his company has successfully used PRO-PUMP® /HC to restore flow capacity to two failed residential absorption fields. The systems recovered with PRO-PUMP® /HC had lost water retention capacity and were leaching septic waters on the surface. A/1 Septic Service has determined PRO-PUMP® /HC has the capability to recover failed septic absorption fields.

Objective: In one case, Rusty's firm was contacted by Mr. Bruce Ulland of Austin, MN to resolve a problem with their septic system. Mr. Ulland advised that they could not wash their laundry without experiencing a system back-up. They needed assistance!

Upon inspection, Rusty determined that the absorption drainage system was constructed in tight clay soil and was heavily impacted with organic sludge. The owner was advised the problem was related to drain field failure. Further inspection indicated that flow recovery in the tight clay soil might be difficult to restore based on the field's design, location and clay structure.

Rusty evaluated the field's location, its tight clay environment and potential failure of a similar replacement field. Based on past remediation success with PRO-PUMP® /HC he advised the owner that PRO-PUMP® /HC offered a low cost alternative to system replacement. His recommendation was to use PRO-PUMP® /HC as a first measure to resolve the problem.

This recommendation is based on Rusty's past experience with absorption field recovery with PRO-PUMP®. Bioremediation with PRO-PUMP® is an excellent first measure prior to system replacement.

In this case, the septic tank was pumped, and one gallon of PRO-PUMP® was added directly to the junction box. In addition, one gallon was applied to the septic tank two weeks later.

Results achieved: The absorption field recovered rapidly with improvements noted after the first week (7 days), and full flow restored following the addition of the second gallon of PRO-PUMP® two weeks later in about 7 to 14 days following application. The field capacity was fully restored after several weeks. PRO-PUMP® 's high rate of organic degradation literally removed the organics that had impacted the drain field restoring percolation and free flow of liquid. This absorption system has remained trouble free for over 24 months.

The on-site wastewater system's flow was fully recovered by the application of PRO-PUMP® No mechanical cleaning of any kind was conducted, and no chemicals were used to improve field conditions.

The customer continues to use PRO-PUMP® from A/1 Excavation, as recommended by Rusty Peck. Rusty advised that due to the type of soil, this application was a tough challenge and remains their most dramatic result with PRO-PUMP® to date.

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CS15110

Drain Field Remediation Program Helps Two Homeowners Avoid Expensive Reconstructions with PRO-PUMP®

Location: **Homeowner Septic Systems, Patterson, NY**

Background: As leach fields start to fail due to soil impaction or poor drainage, owners often see water ponding on the surface of the field. This is generally an indication of the potential for more serious problems such as system back-ups, nutrient leaching, and malodors. In New York State, the State Dept. of Environmental Protectio n (DEP) closely monitors septic systems for potential nutrient leaching and will cite homeowners for failing systems, often requiring expensive renovations.

Objective: With two homes in Patterson, NY, the drain fields had started pooling and the owners needed to quickly remediate the systems before the state required more expensive resolutions. Learning of Ecological Laboratories bioremediation technology, they followed product recommendations and utilized a combination of PRO-PUMP® and PRO-PUMP®/OX to restore degradation to remove excess organics and restore soil activity and percolation.

Results Achieved: Jack Miller summarized his experience as follows:

"Last spring the septic field in the back of my property was ponding up badly. I used PRO-PUMP® and PRO-PUMP®/OX for the period of time and according the schedule supplied. I no longer have the problem and am satisfied it was the PRO-PUMP® products that made the difference."

Based on this success he recommended the product to a friend.Jack's friend, Peter Soumakis explains his results:

"I had a problem with my septic system. The fields were ponding up. A field agent for the New York State DEP observed the problem and I was sent a letter, which stated the problem had to be corrected. After I used PRO-PUMP® and PRO-PUMP® /OX, the DEP performed a followup test on my property and said it was satisfied that the problem had been corrected."

Both of these homeowners were extremely pleased to have resolved their problems quickly and cost effectively with PRO-PUMP® bioremediation technology.

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CS15111

Septic Tanks Cleaned & Drain Fields Remediated with PRO-PUMP® in Wasilla, Alaska

Location: **Wal-Mart, Wasilla, Alaska**

Background:

The Wasilla Wal-Mart in Mat-Su Valley, Alaska, north of Anchorage, had a 4000- gallon tank that failed in the first six months of business. Duane Neitzey, owner of the local septic service company, had his team clean the tank as well as possible but the front compartment was still half full of solid waste that was so solid "you could walk on and not make tracks".

Objective:

Mr. Neitzey then inoculated the tank with 2 gallons of PRO-PUMP® returned the system to service, and waited three weeks.

Results Achieved:

When Mr. Neitzey inspected the tank again after three weeks, PRO-PUMP® had liquefied the contents of the tank and they were able to easily clean the tank to the bottom. Thereafter, PRO-PUMP® was used regularly to help maintain the tank in good working order.

Mr. Neitzey's company has been using PRO-PUMP® bacterial products for about nine years in the Mat-Su Valley of Alaska.

"We use it to open drain fields that are plugged and not draining. We also use PRO-PUMP® for cleaning tanks that are not cleanable by mixing and back flushing. In addition, our service has returned hundreds of our customers' leach fields to work properly and cleaned up their tanks," says Duane Neitzey, who became a regular user of PRO-PUMP® .

For more information on MICROBE-LIFT® Technology contact

Ecological Laboratories Inc.

www.EcologicalLabs.com

CS15112

PRO-PUMP® Remediation Resolves Long-standing Problems with Homeowner's Septic Drain Field

Location: **Homeowner - Austin, TX**

Background: Marika Brown had a six-year-old septic system but she had experienced problems with it for "quite some time". They had experienced effluent seeping into their drain field, commonly called pooling, and had tried everything that had been recommended to fix the problem. Finally after adding 13 yards of loam to their yard, cleaning the tanks, and having the lines hydro-jetted without successfully resolving the problem they were unsure if there was any hope for the repair of their system.

Objective: Then they heard about the PRO-PUMP® drain field remediation system and ordered it through Austin Septic Supply. "Austin Septic Supply was kind enough to even do the installation for us. They put the bacteria into our tank and flushed it into the drain field" she stated. After several weeks the problem was resolved.

Results Achieved:

"It was with great joy that I realized that this treatment has solved our problems at last!" stated Marika. She has not seen or smelled seepage in over eight months after treatment which is *"an absolute relief"*.

For more information on MICROBE-LIFT® Technology contact
Ecological Laboratories Inc.
www.EcologicalLabs.com
CS15113

Made in the USA

MICROBE-LIFT® Technology Helps Commercial System Meet Discharge Permit Requirements

Location: **WS Treatment Service, Bridgeport, WV**

Background: James Honce, Jr. manages WS Treatment Service, a company that services wastewater treatment package plants and large-scale septic systems for commercial sites such as shopping malls.

Objective: One of their commercial accounts was having difficulty meeting their discharge requirements. **Ecological Laboratories'** (EL) technical staff recommended application of MICROBE-LIFT®/IND to increase biological degradation to lower effluent BOD, COD, and TSS to meet their permit limits. The system consisted of two 2000-gallon tanks in a package waste treatment system. The effluent from both tanks were monitored with initial results in January at 646 mg/l BOD and 944 mg/l COD for the first tank and 597 mg/l BOD and 662 mg/l COD for the second. The treatment plan called for addition of one gallon MICROBE-LIFT®/IND per day for several days followed by one gallon per week for a total of six weeks.

Results Achieved: After six weeks of treatment the effluents were assayed with BOD levels of 303 mg/l and 202 mg/l, results that met effluent permit limits. The COD level remained high, then requiring additional treatment of one quart per week to both tanks maintain BOD levels and further reduce COD. With the added product along with some minor change to the sand filter, the system successfully met permit limits.

In the words of James Honce,

> *"these products do what they are supposed to do. Whether it's improving activity in waste digesters, draining filters of standing water, or restoring seriously overloaded septic tanks. I have used them for years with excellent results."*

For more information on MICROBE-LIFT® Technology contact

Ecological Laboratories Inc.
www.EcologicalLabs.com

CS15114

WASTEWATER TREATMENT - INDUSTRIAL SEPTIC SYSTEM & INSTITUTIONAL WASTE

15200 Grease Trap Maintenance

For more information on MICROBE-LIFT® Technology contact

Ecological Laboratories Inc.
www.EcologicalLabs.com

CS15200

Made in the USA

Sprague Septic Finds PRO-PUMP® and Solves Difficult Grease Problem

Location: **Sprague Portable Toilet and Septic Service, Inc., Ladoga, IN**

Background: Bill Sprague had owned Sprague Portable Toilet and Septic Service Company for over 15 years. His success was based on personal relationships and excellent service.

Objective: When he encountered a grease trap that had a surface accumulation of about three feet in depth that could not be removed, Bill called **Ecological Laboratories.**

Doug Dent, VP of Sales, recommended that Bill mix two gallons of PRO-PUMP® with 5-10 gallons of water and apply directly to the surface of the grease cap covering the entire surface and allow PRO-PUMP® to work at the water and grease interface.

Results Achieved: Bill applied the recommended rate as instructed and checked the grease at the end of one week. While he noted some improvement, the trap was still difficult to pump. He was advised that he could add an additional gallon of PRO-PUMP® and give the process more time based on the severity of the problem.

The following week, Bill called to report that the heavy grease problem had been completely resolved and he was ordering more product for maintenance dosing.

Bill was extremely satisfied with the efficacy of PRO-PUMP® in resolving a very difficult situation.

For more information on MICROBE-LIFT® Technology contact
Ecological Laboratories Inc.
www.EcologicalLabs.com
CS15201

Taco John's Resolves Grease Trap Maintenance Problems with Microbe-Lift® Technology

Location: **Taco John's, West Fargo, ND**

Background: Taco John's is a family-friendly, fast food restaurant that serves its own unique brand of Mexican food. TJ's is the home of West-Mex® flavor. Like all restaurants they had challenges maintaining a well functioning grease trap system.

Objective: The restaurant called for service on a heavily impacted grease trap. Immediately the service technician recognized the need for more than cleaning. He knew that use of a highly effective microbial product could degrade a large amount of the grease reducing the loading on the grease trap. The accumulated grease had reduced the effective size of the separation chamber thereby reducing the quality of the effluent. The grease build-up obstructed the flow of the effluent stream.

Fig. 1: *"Before" treatment on 11/19/03 the grease trap was impacted with a thick grease cap.*

Numerous biotech companies produce microbial products to help digest grease, thus reducing its volume and helping to produce a cleaner effluent phase. Most products contain Bacillus spores that require time to germinate to become active.

Results Achieved:

MICROBE-LIFT® technology is the only product that has highly effective, stabilized vegetative strains that are active immediately upon application. These strains include organisms capable of rapid degradation of the typically slow-to-degrade long chain fatty acids that make up the bulk of the collected grease. And the organisms in this technology are highly effective in the anaerobic conditions of a grease trap environment. Unlike chemical treatments biological technology helps in the separation of residual grease rather than emulsifying it and passing it downstream. The microbes continue to grow in the grease trap system and any microbes transferred downstream in the effluent can only have a positive effect on the collection system.

The owners of West Fargo's Taco John agreed to test PRO-PUMP® a product that contains MICROBE-LIFT® technology from Ecological Laboratories. The PRO-PUMP® was delivered in a five-gallon pail and was set up on an automatic pumping system for reliable, continuous dosing. Each pail provides a full month's dosage.

Within a month of starting the program, the owners knew their system had been dramatically improved.

Fig. 2: *In less than a month after initiation of treatment, this picture taken on 12/11/03 shows the same grease trap with virtually no grease cap, a very dramatic change.*

The dramatic improvement convinced the owners to utilize PRO-PUMP® on a regular basis to maintain their system trouble-free. By eliminating grease trap system problems that so often plague restaurants, this Taco John's could concentrate on their business of providing excellence in West-Mex food.

For more information on MICROBE-LIFT® Technology contact

Ecological Laboratories Inc.

www.EcologicalLabs.com

CS15202

15300 Technical Essays & Testimonials

For more information on MICROBE-LIFT® Technology contact

Ecological Laboratories Inc.

www.EcologicalLabs.com

CS15300

Appotomax Man Using Products for 20 Years States No Other Product Works Like PRO-PUMP®

From: David Garrett
Sent: Thursday, August 11, 2005 12:20 PM
To: Doug Dent, VP Sales, Ecological Laboratories Inc.

Subject: Microbial based products

Dear Douglas;

It was good to talk to you this morning by phone. Thank you for taking the time to talk to me and provide information on your products.

I would like to let you know that for the past twenty years we have been using all kinds of products in our wastewater treatment plants and in our pump stations for the Town of Appomattox. I would also like to tell you your product is the "ONLY" product that works and works well in our system.

For the past three years now we have been only using your PRO-PUMP and PRO-PUMP HICount and I am here to tell you it works great for the Town of Appomattox .

We are also letting other Towns, Cities, and Counties know about your product and where they can go to get it.

We would also let you know that you have a great Distributor (Carrico - Dean Thompson) in Appomattox. He is a great distributor and he knows your product very well.

Again, it was good to talk to you.

David Garrett

Town Manager
Town of Appomattox, VA

Marika Brown States PRO-PUMP® Remediation Solves Long Standing Drainfield Problems

From: Marika Brown

Sent: Thursday, January 13, 2005 12:28 PM
To: DougEcoLab@msn.com
Subject: No Subject

Dear Doug,

It was a pleasure speaking to you yesterday. What wonderful success we have had with your PRO-PUMP remediation kit.

We have a 6-year-old septic system, but have had problems for quite some time. We have had effluent seeping to the top of our field and have done everything recommended to fix the problem. Finally after adding 13 yards of loam to our yard, cleaning the tanks and having our lines hydro-jetted, we were unsure if there was any hope for our system.

We then heard of your product and ordered it through Austin Septic Supply. They were kind enough to even do the installation for us and put the bacteria into our tank and flushed it into the septic field.

It is with great joy that I spoke to you yesterday and you confirmed what we have seen firsthand. Your product seems to have solved our problems at last!! We have not seen or smelled seepage on our field for over eight months, an absolute relief!!

We thank you for your wonderful product and work!

Sincerely,

Marika D. Brown
Austin, TX 78733

Neitzey Has Solved a Range of Problems in Alaska with PRO-PUMP®

From: Duane Neitzey
Sent: Wednesday, September 03, 2003 7:02 PM
To: Doug Dent, VP Sales, Ecological Laboratories Inc.

Subject: PRO-PUMP

Dear Doug,

We have been using Pro Pump Bacteria for about 9 years in the Mat-Su Valley, north of Anchorage, AK. We use it to open drain fields that are plugged and not draining. We also use it on tanks that are not cleanable by mixing & back flushing.

One example is the Wasilla Wal-Mart. The system had a 4000 gal. tank that failed in the first 6 months of business. We cleaned the tank as best we could, but the front compartment was still half full of waste so solid that you could walk on & not make tracks. So, we put in 2 gallons of PRO-PUMP & waited 3 weeks. After three weeks, PRO-PUMP had liquefied the contents & we were able to clean the tank to the bottom.

PRO-PUMP has returned hundreds of our customers' leach fields to proper working order & cleaned up their tanks.

Sincerely,

Duane Neitzey
A Two Septic
Palmer, AK

For more information on MICROBE-LIFT® Technology contact
Ecological Laboratories Inc.
www.EcologicalLabs.com
T15303

Made in the USA

POND & AQUARIUM

MICROBE-LIFT® is a name and a technology you can rely on for a clean, non-toxic stable pond environment "from spring startup to pond closing."

Perfect pond water conditions rely on the development of a balanced biological system consisting of two essential processes:

Waste-Degrading Biology: The development of these cultures in the pond and filter are essential to water quality.

Ammonia-Removing Biology: The development of these cultures in the pond and the pond's filter are also essential to prevent ammonia toxicity that will kill the fish.

This may sound easy but very often it becomes a time-consuming process that is difficult to achieve in many ponds. As an example, ammonia-removing nitrifying cultures are extremely slow to grow, requiring 18 hours for a single cell division, and are subject to many inhibitory factors. They also have a minimum requirement for100 to 150 ppm of KH (carbonate alkalinity) level at all times.

The use of **MICROBE-LIFT®** and its breakthrough pond care technology establishes ALL essential biological processes FAST, and assures stable operation all season long.

For more information on MICROBE-LIFT® Technology contact
Ecological Laboratories Inc.
www.EcologicalLabs.com

Made in the USA

POND AND AQUARIUM MAINTENANCE

16000 Ornamental Pond Maintenance

16001 Bioremediation Compensates for Inadequate Filtration of Ornamental Ponds at Macpherson Secondary School in Singapore

16002 MICROBE-LIFT® Recovers Landscaped Ponds at Sheraton Tower, Singapore

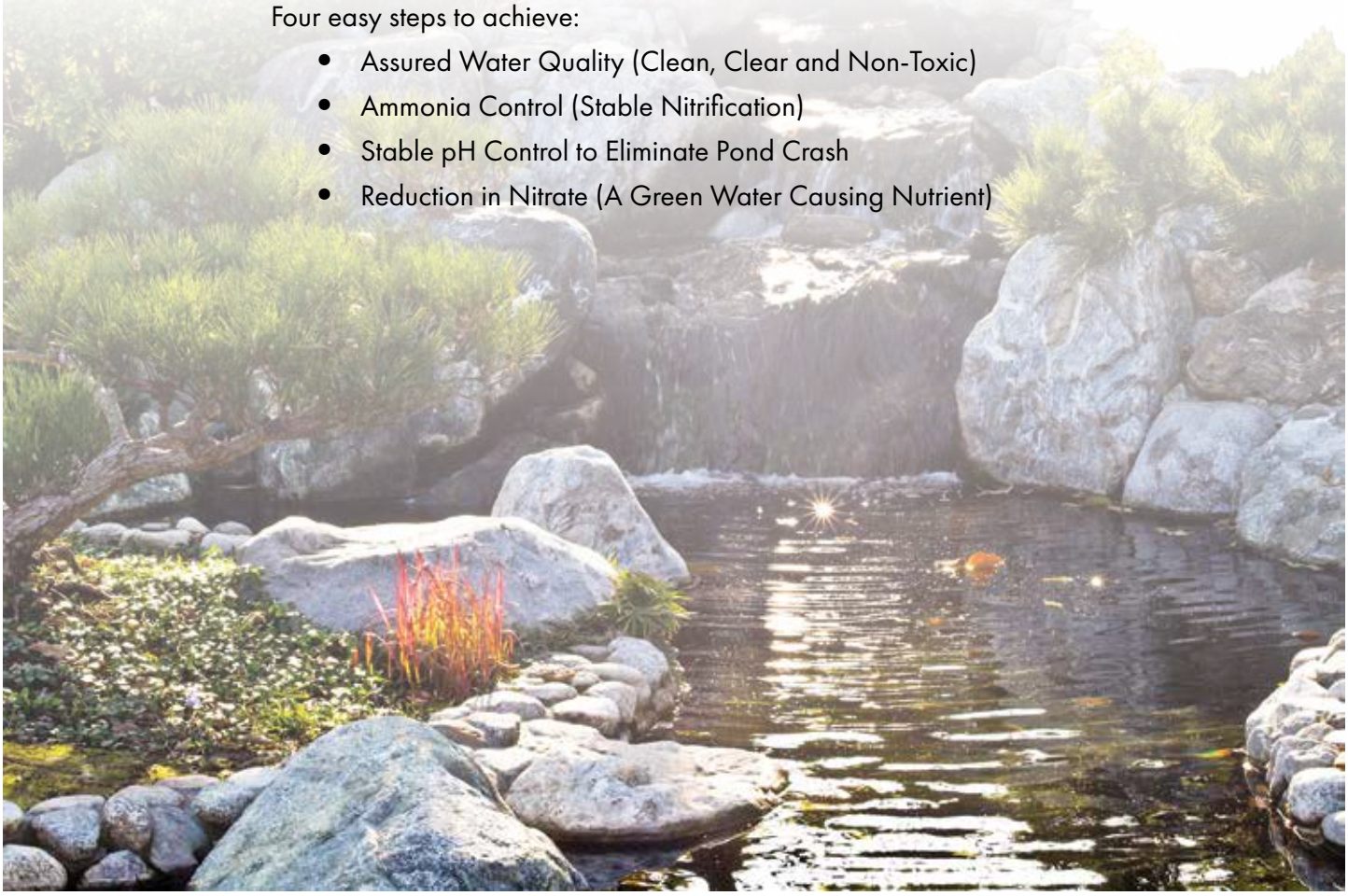
16003 Koi Pond Is Easily Maintained with MICROBE-LIFT® Technology in Toronto, Canada

A Non-Chemical Way to Reduce Maintenance and Mortality

It's as Simple as 1-2-3 + Test!

Four easy steps to achieve:

- Assured Water Quality (Clean, Clear and Non-Toxic)
- Ammonia Control (Stable Nitrification)
- Stable pH Control to Eliminate Pond Crash
- Reduction in Nitrate (A Green Water Causing Nutrient)



For more information on MICROBE-LIFT® Technology contact

Ecological Laboratories Inc.
www.EcologicalLabs.com

CS16000

Made in the USA

Bioremediation Compensates for Inadequate Filtration of Ornamental Ponds at Macpherson Secondary School in Singapore

Location: **Macpherson Secondary School, Singapore**

Background: Macpherson Secondary School has two outdoor ponds that form an L-shape on the roof top level. These ponds are home to many Japanese Koi and guppies. The treatment protocol included a portable mechanical filter and required regular water replacement. This protocol was not sufficient to maintain a healthy environment for the fish. The water was turbid with a foul fishy odor and, in one pond, the water was so murky that the fish were barely visible from the water surface.

In December 2008, Oakwell-Breen was engaged to rehabilitate the ponds. Oakwell-Breen is a service contractor working with **Ecological Labs Inc.** In spite of an industry standard of 33%, a space allowing only 10% turnover was available for biological filtration. The limited space allocated for a biological filter is generally not sufficient for effective biodegradation of the waste generated with the pond's fish density.

Objective: With the limitation on filtration capacity, which had proven to be inadequate, a plan was devised to provide the additional water cleaning capability of specialized microbes that can accelerate the biological digestion of the fecal material and unconsumed food that was polluting the ponds. MICROBE-LIFT® formulation was added.

Initially MICROBE-LIFT® formulation was inoculated at a high dosage followed by three moderate weekly doses. Thereafter, a very low maintenance dosage was used.

Results Achieved: Within two weeks of treatment, even the extremely turbid pond was transformed into a crystal clear, fresh smelling water pond with fish clearly visible.

Fig. 1: *Before treatment this pond was murky and had a foul fishy odor. The fish could not be seen.*

Fig. 2: *Three weeks after initial treatment, the same pond was fresh and clear with the fish clearly visible.*

Oakwell-Breen was able to successfully compensate for the lack of capacity of the filtration system with the addition of the MICROBE-LIFT® formulation. The cost-effective solution and the restored beauty of the ponds resulted in a very satisfied customer.

For more information on MICROBE-LIFT® Technology contact

Ecological Laboratories Inc.

www.EcologicalLabs.com

CS16001

MICROBE-LIFT® Recovers Landscaped Ponds at Sheraton Tower, Singapore

Location: **Sheraton Tower, Singapore**

Background:

The Sheraton Tower, an international hotel in Singapore maintains beautiful Koi ponds for their customer's enjoyment. The hotel had a large, landscaped pond with 100 m^3 (26,500 gal. of water, which was home to a large population of Japanese Koi. Although the pond was well aerated with two large artificial waterfalls, the system had only two small sand filters and no biological filter.

In the spring of 2005, the water in this large pond had become turbid and emitted a fishy odor. The water was so turbid that the fish could barely be seen at 300 millimeters (approx 12 inches) below the surface.

Fig.1: *The above picture clearly shows the murky water with the fish barely discernable.*

Objective:

Oakwell Engineering Limited was engaged to rehabilitate the pond. In May 2005. Well experienced in the capability of bioaugmentation to clarify water, Oakwell developed a program utilizing a MICROBE-LIFT®/PL with the inoculation schedule provided below. Results of the water quality monitoring program are provided as well.

Date	MICROBE-LIFT®/PL	BOD	COD	Turbidity
05/06/2005	5 gallons	30 mg/l	61 mg/l	8.84 NTU
05/13/2005	2 gallons			
05/20/2005	1 gallon	24mg/l	50 mg/l	17.8 NTU
06/02/2005	1 gallon			
06/07/2005	1 gallon	5 MG/L	15 mg/l	36.1 NTU
06/17/2005	0.5 gallons			

Fig.2: *Data shows an astounding 83% improvement in BOD and 75% drop in COD in only one month, yet the concurrent increase in turbidity was unexpected.*

Results Achieved:

The malodor disappeared within one week of MICROBE-LIFT®/PL inoculation and the water regained its clarity. Four weeks after inoculation, COD fell from 61 mg/l to 15 mg/l and BOD fell from 30 mg/l to 5 mg/l.

However, water turbidity increased from 8.84 NTU to 26.1 NTU. The ash content of suspended solids in the water sample taken on 20 May 2005 was 57.9%. It was concluded that the raised turbidity is due to the displacement of large amounts of non-biodegradable soil and fine sand particles accumulated over time and previously held in place at the bottom of the pond by waste sludge before MICROBE-LIFT®/PL treatment.

A complete mechanical cleaning of the pond was carried out in August 2005 with no further addition of MICROBE-LIFT®/PL. A small levee at the edge of the pond was constructed to prevent soil and fine sand particles from falling into the pond. Without the addition of MICROBE-LIFT®/PL, the water again returned to its turbid condition and began emanating a fishy odor within two weeks after fishes were reintroduced into the pond. An organic sludge was beginning to develop on concrete surfaces inside the pond.

MICROBE-LIFT®/PL was again used to remediate the water pollution problem. Two gallons were used as inoculation in mid September 2005, followed by a half gallon per week maintenance.

Fig.3: *Taken in October these pictures show the pond returned to its pristine state.*

MICROBE-LIFT®/PL treatment clarified the water and eliminated malodor approximately three weeks after inoculation. The water was very clear and the organic sludge build up disappeared by 18 October 2005, four weeks after inoculation. Our client was convinced that MICROBE-LIFT®/PL is effective in maintaining the pond without the need for bio-filters. Removal of the bio-filters provided significant operational savings eliminating both the capital cost and the maintenance expense of the bio-filters.

For more information on MICROBE-LIFT® Technology contact

Ecological Laboratories Inc.

www.EcologicalLabs.com

CS16002

Koi Pond Is Easily Maintained with Microbe-Lift® Technology in Toronto, Canada

Location: **Toronto, Canada**

Background: This pond enthusiast has maintained a residential pond with several large KOI through the harsh winters of Canada for seventeen years with the use of MICROBE-LIFT® technology.

Objective: As with all ornamental ponds clean water and healthy fish are the major objectives. It is important to accomplish this with minimal effort as the less time spent on maintenance the more time available for pure enjoyment for the hobbyist.

Results Achieved: This enthusiastic hobbyist reports having been able to maintain her 1000 gallon pond with minimal maintenance for over 17 years. In fact one of the original KOI is now 17 years old and as healthy as it was 17 years ago. She credits the health of this KOI with the use of MICROBE-LIFT® technology.

The more she uses the MICROBE-LIFT® formulation, the easier it is to maintain the pond. "This year the pond has been so easy to maintain. The string algae was flourishing in early June then it started to clump together and was easily removed". She uses an Oase filter and pump that only requires cleaning every two weeks. No sludge gathers and based on weekly testing the water parameters are perfect. There are two waterfalls, one for the skimmer and one from the filter.

Fig. 1: *This picture shows the beauty of the pond.*

She maintains four KOI and the pond remains pristine with very minimal maintenance. This hobbyist attributes the water quality and fish health in this beautiful pond to the use of MICROBE-LIFT®.

Fig. 2: *Four beautiful, large KOI enjoy a healthy, pristine environment.*

Discussion:

The difficulty of maintaining a KOI pond involves many factors and these are often compounded as fish grow larger and more fish are added to the aquatic system.

Concerns to address include but are not limited to:

- Achieving adequate biological breakdown and removal of slow-to-degrade fish food, fish waste, and organic matter from the environment such as leaves, grass clippings & wind blown dirt
- Achieving nitrification and assured ammonia control
- Monitoring and controlling nitrite, a toxic mid-stage product of the nitrification process
- Assuring adequate biology in pond and filter system to maintain a viable population of effective microbes once established.

"This year the pond has been so easy to maintain. The string algae was flourishing in early June then it started to clump together and was easily removed".

Benefits:

MICROBE-LIFT®/PL Benefits:

MICROBE-LIFT®/PL provides specialized microbes that speed the removal of slow and difficult-to-degrade compounds including fats, fatty acids and protein found in fish food that indigenous microbes often cannot breakdown and remove from the pond.

MICROBE-LIFT®/PL rapidly establishes essential microbes in filters and pond water improving filter and eco-systems performance that purifies water while reducing sludge build up and hydrogen sulfide production.

MICROBE-LIFT®/PL rapidly establishes essential microbes in filters and pond water improving filter and eco-systems performance that purifies water while reducing sludge build up and hydrogen sulfide production.

MICROBE-LIFT®/PL cultures achieve nitrate removal through a process termed denitrification. Highly active denitrification eliminates one of the essential elements for algae growth

The addition of MICROBE-LIFT®/PL to any pond system results in improved water quality, ammonia control, nitrate elimination, mortality reduction, and improved control of green water events.

Based on years of successful use, MICROBE-LIFT®/PL has a loyal following of pond enthusiasts who claim this product gives them the easiest, least time consuming maintenance for a beautiful pond that they now have time to enjoy.

For more information on MICROBE-LIFT® Technology contact

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CS16003

16100 PUBLICATIONS & TESTIMONIALS

P16101	"Keeping Algae Growth In Check" - Technical Paper by Mark J. Krupka, Vice-President & Technical Director at Ecological Laboratories, Inc.
T16102	MICROBE-LIFT® Technology Has Cult Following for Pond Treatment
T16103	Excellent Water Quality And Fish Health of 17 Year Old Koi Has Been Solely the Result of Using MICROBE-LIFT®/PL
T16104	MICROBE-LIFT® Sludge-Away Cleans Pond with Less Work for Garden Center in Lake City, PA

For more information on MICROBE-LIFT® Technology contact

Ecological Laboratories Inc.

www.EcologicalLabs.com

CS16100

"Keeping Algae Growth In Check" - Technical Paper by Mark J. Krupka, Vice- President & Technical Director at Ecological Laboratories, Inc.

Introduction:

There are a number of causes for murky, fouled water in ponds. The most common are algae and suspended particulates, both organic and inorganic. The worst of these in terms of fouling the waters, by far, is algae.

Algae are almost ubiquitous in the biosphere and makes up a large portion of the total biomass on earth. They are a vital component of the biogeochemical cycles and provide a food source for many forms of aquatic life. They are extremely adaptable, living at the polar ice caps at sub-zero temperatures as well as in hot sulfur springs at temperatures exceeding 400 degrees F (204°C). Algae can be observed as single cells, e.g. cyanobacteria, which make water appear green and turbid; as filaments that looks like strands of hair; or massive clumps of seaweed. They can flourish in freshwater as well as brackish water. And some people wonder why it is difficult to control.

Particulates can come from two sources. Inorganic particulates can enter a pond or lake through runoff, be deposited by wind or streams that may empty into a pond or lake. Organic particulates can be formed as certain flora and fauna, for example algae, die off or as bacteria grow on this or other decomposing organic matter.

Characteristics of Algae

There are thousands of different types of algae, but all have certain things in common. First, they are photosynthetic, which means they are capable of using carbon dioxide as their primary source of energy and carbon. Some algae can also fix nitrogen, the macronutrient required in the greatest concentration. Being able to fix carbon and nitrogen makes algae very adept at surviving without a lot of outside help.

Like most photosynthetic plants, algae give off oxygen that can be beneficial to the overall ecology of the pond. However, when algae blooms are heavy they can degrade not only the aesthetics of the pond, but interfere with the ecology and functionality of the pond as well.

The most common forms of algae in pond are filamentous algae and planktonic algae. The filamentous algae, also referred to as hair or string, are usually the most problematic since they cause the mats and clumps that are not only unsightly and foul smelling, but can also clog pumps and filters. The planktonic, or free swimming algae, are usually associated with "green" water and are mostly cyanobacteria.

Some of the most commonly found nuisance algae in ponds include the filamentous algae Spirogyra, Pithophora, Chara, Nitella and Hydrodictyon (also known as water-net"). The common cyanobacteria include Oscillatoria, Anabena, Microcystis, Anacystis, and Lyngbya.

Conditions That Promote the Growth of Algae

Like most photosynthetic plants, algae fixes inorganic carbon and converts it to sugars that can be used as a source of energy and organic matter. If sunlight, nitrogen and phosphorous are abundant, along with some trace minerals and metals, e.g. iron, algae will usually flourish. Temperature is also a factor, as most common pond algae tend to thrive in warmer weather.

Minimizing Proliferation of Algae

Control Buildup of Nutrients Where Possible

Since turf (grass) comprises photosynthetic plants, it requires many of the same conditions and macronutrients as algae, often more since turf usually can't fix nitrogen. Frequently, ponds are located on low-lying areas of the farmland and golf course, which means that the runoff often contains nitrogen and phosphorous in the form of fertilizer makes its way into the pond.

Ways to minimize the amounts of nutrient runoff into ponds include using an organic fertilizer that is not as water-soluble and which will, therefore, release nitrogen and phosphorous more slowly. Recent studies with humates have also shown that these compounds can sequester many of the nutrients in fertilizers and release them as the turf requires them, cutting down on fertilizer use and runoff pollution.
It also helps to physically clean out the dead or decaying vegetation in ponds or lakes where there is extensive vegetation or algae blooms, as this composting process will release nitrogen, phosphorous and other nutrients back into the water feeding another cycle of algae blooms.

Chemical Algaecides

There are a number of chemical agents for controlling algae. Among the most common is copper sulfate. Copper sulfate dissociates to the copper cation and sulfate anion in water. The copper, being a heavy metal is toxic to most living things. Like most chemical algaecides the result is often observed quickly at relatively low concentrations of copper.

When taken up by the algae the copper interferes with the metabolism at a cellular level resulting in the destruction of the algae. Once the algae dies off and decomposes the copper, like most heavy metals, persists in the environment. Over time this copper can build up in lake sediments and become toxic to aquatic life and render dredge spoils a toxic material if the levels of copper get high enough. Most states have outlawed the use of copper sulfate for algae control in certain situations for this reason.

More recently, another chemical algaecide group has become available. These work by either interfering with metabolism or attacking the cell wall. Our product AlgAway® uses a quaternary ammonium salt - polyquat, with the chemical name "poly [oxyethylene (dimethylimino) ethylene (dimethylimino) ethylene dichloride]" that works through this mechanism. Used for some time in swimming pools and spas, this chemical has been shown to be safe to use with fish and

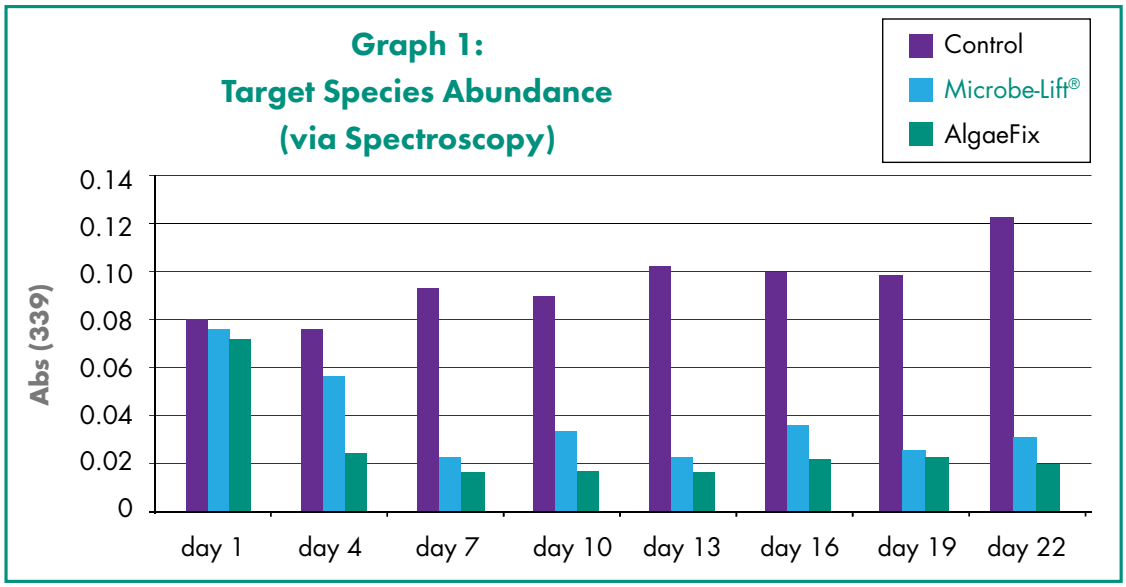
aquatic plants. The product is shipped at a 60 percent concentration, and must be diluted to 5.4 percent solution before application. Treatment has been very successful at rapidly eliminating most forms of algae, but steps should be taken to reduce the rate of algae growth as the original algae decomposes and returns the nutrients to the water. This can be accomplished by introducing the beneficial bacteria found in MICROBE-LIFT®, which will compete with the algae for the available nutrients.

Biological Control

Most biological control agents work in one of three ways. 1) The most common is by competing with the algae for macronutrients. This is especially effective with photosynthetic bacteria, which occupy the same ecological niche as the algae. This mechanism may not be effective in ponds or lakes where there is a high residual nutrient concentration, as there are plenty of nutrients to go around. 2) Some microorganisms, such as Pseudomonads, can also produce antibiotic-like compounds that inhibit the growth of algae. 3) Finally, there are some organisms that produce compounds called siderophores that tie up iron, which is essential to the metabolism of algae. Currently, no one has registered a biological algaecide with the EPA, but used in conjunction with a polyquat, like AlgAway®, biological treatment with MICROBE-LIFT® can effectively control algae-blooms through nutrient competition.

The major advantage in the use of "biological pesticides" is that they are compatible with the environment and usually exhibit no toxicity for plants, animals or mammals. A study conducted by a graduate student in Ecology at a Midwestern university compared the effectiveness of a biological product containing photosynthetic bacteria to Algae Fix, a commercial pond product containing 4.5% of the polyquat referred to earlier. While shown to be much safer than other algaecides for plants and aquatic fauna some toxicity was still observed, especially to crustaceans, which is noted on the Algae Fix label.

Results on effectiveness of the two products against algae are shown in Graphs 1 and 2. The toxicity results appear in Table 1.



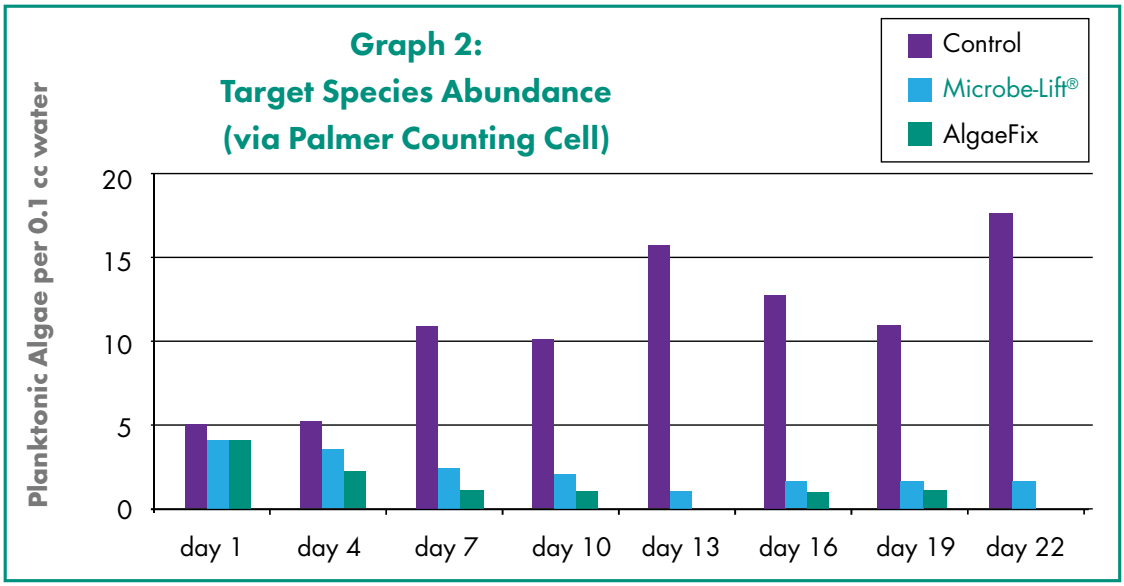


Table 1: Non-target species % dead.

		# Alive	# dead	total	% dead
Control	ghost shrimp	6	4	10	40.0
	guppies	18	2	20	10.0
	pouch snails	14	2	16	12.5
Microbe-Lift®	ghost shrimp	4	6	10	60 .0
	guppies	19	4	23	17.4
	pouch snails	13	3	16	18.6
AlgaeFix	ghost shrimp	0	10	10	100 .0
	guppies	16	4	20	20.0
	pouch snails	5	11	16	69.0

Table 2: 2x2 contingency Chi Square results

	tank	X^2 (1, n=20),p<.05
shrimp	2 vs 1	0.4
	3 vs 1	8.57
	2 vs 3	5
snails	2 vs 1	0.237
	3 vs 1	10.5
	2 vs 3	8.13
guppies	2 vs 1	0.49
	3 vs 1	0.94
	2 vs 3	0.05

Table 1 *– Toxicity of Algae Fix and MICROBE-LIFT PL*

Barley Straw

In recent years, barley straw has gained popularity as an algae control agent. This approach came predominantly from the water gardening market in England where Scottish barley straw bales have been used for years. In this case, barley has been used for years without any real understanding of what the scientific basis for its positive effect. With the increasing popularity of barley straw, various Groups tried to determine whether it's use was just another "snake oil" remedy, as well as Groups trying to register barley straw as an algaecide, more investigations have been undertaken to determine what if any mechanism is implicated in the control of algae through the use of barley.

What has been determined to date is that as the barley decomposes certain breakdown products are produced including humic and fulvic acids. This makes sense since it normally takes from 4 to 6 weeks to start demonstrating some impact on the barley straw. Both the humic and fulvic acids are strong sequestering agents and have been hypothesized to tie up nutrients. In addition, it has been determined that the breakdown products react with sunlight to release hydrogen peroxide at low concentrations over an extended period of time.

Particulates

Generally particulates are not the kind of logistical problem presented by algae but there can be some relationship. Inorganic particulates will generally only stay suspended when there is turbulence or charge interactions that interfere with normal settling. Isolating the cause of turbulence will usually solve this problem. Some flocculants can also aid in settling but over time inorganic flocculants can build up and cause other problems so a biodegradable flocculant is preferable.

Organic particulates will normally also flocculate out and settle naturally once the organic load in the water is stabilized. The bacteria in the pond can do this but may be sluggish. In these cases, augmenting with organisms that can quickly stabilize the organic load will speed up natural flocculation and lead to naturally clear water.

Recommendations

While it is desirable to minimize algae growth and buildup for both aesthetic and practical reasons, regulatory guidelines and environmental impacts have to be taken into consideration. Addressing the conditions that promote the growth of algae is the first step to take in this effort because it is usually the least expensive and has no adverse environmental ramifications. If you do that, it is feasible to control the conditions that promote algae growth. If the algae bloom is still beyond what is acceptable, then the alternatives discussed above should be considered based on level of urgency, cost and environmental impact.

While a less significant a problem, particulates can be eliminated by settling or filtration, by reducing turbulence where possible, and overcoming charge interactions that may stabilize suspensions of particles and biologically stabilizing the pond.

For more information on MICROBE-LIFT® Technology contact
Ecological Laboratories Inc.
www.EcologicalLabs.com
P16101

Microbe-Lift® Technology Has Cult Following for Pond Treatment

Customer Responses to Ecological's Pond Newsletter that explains specific product application and overall pond maintenance. Their responses validate numerous product benefits.

Easier, More Effective Pond Maintenance Restoring Natural Balance:

"Consider this a love letter for MICROBE-LIFT®. Our five-family, 1/3-acre retention pond that at its deepest is about 16 inches is beautiful this year!

We began MICROBE-LIFT® treatment approximately one year ago, hoping it would solve the problem of 6 inches of black, stinking pond bottom muck that had developed over the pond's 16-year history.

I must say there were some cynics among us (when we started this treatment). Last week I had occasion to don my waders and go slogging around in the pond. To my delight, only a tan (clay) sediment rose from my footfalls and no thick black muck stench. Now, when those of us whose homes surround the pond look out our rear windows, we can see down to the pond grass growing on the bottom that the resident ducks seem to enjoy. Another indication that MICROBE-LIFT saved the pond from reverting to a bog is that some volunteer water lilies have chosen a spot near the cattails to flourish. MICROBE-LIFT is a wonderful and simple solution to a very frustrating problem." MICROBE-LIFT®

Joan

"I'm just calling to thank you for your excellent advice. We live in New Hampshire and restored a 1/4-acre pond a few years ago and were having nothing but problems. My husband wanted to fill it in last summer!

We followed your advice using MICROBE-LIFT® /PL, MICROBE-LIFT® /SA, MICROBE-LIFT® /Barley Straw Pellets, and MICROBE-LIFT® /PBD. We are just thrilled with the results! We are just so happy! The wildlife is thriving; the pond is clear and such a JOY!"

Nancy Werner (New Hampshire)

Clearer Pond Water:

Last year I tried MICROBE-LIFT®/PL GEL... I love it! This spring I used MICROBE-LIFT®/PL. I have not turned on the UV light yet! Clear water, happy fish! If I didn't see it, I wouldn't have believed it!

Jackie Nantz (NC)

Pond Balance that Controls Algae Growth:

"I used MICROBE-LIFT®/ ALGAWAY5.4 last year for string algae. It's by far, the BEST product I have used in 3 years, and believe me, I tried most of them!"

Michael

"I've used another competitor's product for years. Recently, I had a massive algae bloom, then the water temperature dropped back to the upper 50's. I added MICROBE-LIFT® ALGAWAY 5.4 at around 9:30 PM and by 6:30 PM the next day, the algae was gone! Now, two weeks later, my pond is still crystal clear, never looked so good."

Janette - NJ

Microbe-Lift® Technology Has Cult Following for Pond Treatment

Pond Balance that Controls Algae Growth:

"I want to say how happy I am with MICROBE-LIFT® /BARLEY STRAW PELLETS +. I have a client who is telling me he has never seen his pond so clean."

Verne G, "Canadian Retailer and Active Hobbyist"

"I changed 25% of the water yesterday, added MICROBE-LIFT® BARLEY STRAW CONCENTRATED EXTRACT and this morning my pond is the clearest it has been for some time!

Marjean

Healthier Pond, Improved Fish Viability:

"Thanks for continuing to send your newsletter. At home, I'm only a gold fish gardener, but I must be doing something right because the fish are getting huge and the red tail hawks are being well fed!

I work in Lawn & Garden at our local Garden Center. We have some pond products but not enough to help the serious water gardeners in our area. Ironically, I purchase most of my products from your local distributor! I just wanted to drop a line to tell you how much I appreciate and am learning from your newsletters and years of experience."

Gary C.

Healthier Pond Naturally with Fewer Chemicals:

"I just wanted to let you know that the MICROBE-LIFT® NITE-OUT II and MICROBE-LIFT® AQUA EXTREME are working great! Zero ammonia and nitrite, pH and alkalinity rock steady at 8.0 and 107.4. After a month of horrible weather extremes, these two products performed beautifully "

Judy L

"Whenever doing a water change I always add MICROBE-LIFT® DECHLORINATOR PLUS"

Will

Excellent Customer Service:

"Service above and beyond..."

Robert

"Thanks so much for your perceptive help- even more for the excellent products MICROBE-LIFT® gives us. "

John

Consistent Product Efficacy for Recommendation to Retail Customers:

"We have carried, used, and recommended MICROBE-LIFT® products to our customers for years. We don't sell any products that we have not tested ourselves and we were really pleased with the MICROBE-LIFT® results we experienced."

Anne -FL retailer

"My dealer pushes all your products and I can see why! I bought MICROBE-LIFT® FLOCCULANT PLUS, used it in my pond and it immediately became crystal clear, like a mountain stream. I'm ecstatic!"

Cape Cod Consumer

Microbe-Lift® Technology Has Cult Following for Pond Treatment

Satisfied customers have built a loyal following for MICROBE-LIFT technology:

"I am very much a committed consumer of the MICROBE-LIFT® products for my ponds and have been telling anyone who has a pond question that MICROBE-LIFT® is a pond owners' answer to water quality issues!"
Harv Peterson, President Heart of Texas of Water Garden and Pond Society

"I love MICROBE-LIFT®. Nothing else goes into my water garden, EVER. Well, the fish and plants and the water and...but you get my point. I use the integrated line from MICROBE-LIFT® Fish Foods to MICROBE-LIFT® dechlorinator. I've never had any issues (other than the neighborhood raccoon.)

Keep up the good work? NO, keep up the fabulous work all y'all. Do and know you have made my ponding the joy it is supposed to be!"
B. Hayes

"I tried your MICROBE-LIFT® product in our large koi ponds, with incredible results. My koi are spectacular, the water is clean and I love this product.

I've been singing its praises to everyone! Thank-you so much! My friends think I should do commercial for you!"
Mariellen

"I would recommend MICROBE-LIFT® products to everyone with a water feature. In fact, I do!"
Bob

"We swear by your products...I have been buying MICROBE-LIFT® by the gallons, for myself and for my pond friends. My pond looks great, crystal clear. I am a walking billboard ...great stuff!"
Lisa

"I don't just love your products – I worship them! They are the only products that go into my pond."
Bruce H "Devoted MICROBE-LIFT® consumer"

"I don't know what I'd do without MICROBE-LIFT®/PL. It is the best!"
Ann

For more information on MICROBE-LIFT® Technology contact
Ecological Laboratories Inc.
www.EcologicalLabs.com
T16102

Excellent Water Quality And Fish Health of 17 Year Old Koi Has Been Solely the Result of Using Microbe-Lift®/PL

Summer 2010

I live in Toronto, Canada. I have had my pond for seventeen years and still have one of the original Koi! The seventeen year old has survived our winters and he is just as healthy now as he has ever been thanks to MICROBE-LIFT®/PL!

And for some reason, this year especially, the pond only needs cleaning once every two weeks! No sludge gathers and all the water parameters are perfect when I perform my weekly tests. I have an Oase filter and pump. My pond is only 1,000 gallons with only four Koi.

There are two waterfalls, one from the skimmer and one from the filter. This year, I must say, it has been so easy to maintain.

In essence, I do think the excellent water quality and fish health has been solely the result of my using MICROBE-LIFT®/PL. Thanks for great help when needed and for a great product.

Sincerely,

Carol D.

Microbe-Lift® Sludge-Away Cleans Pond with Less Work for Garden Center in Lake City, PA

December 7, 2011

Dear Ecological Laboratories,

My wife Cheryl and I operate Holland's Water gardens in Lake City, Pa. and have used and sold Microbe-Lift® products for several years. It has become a staple product for us and our customers.

Personally, I can't imagine a pond without Microbe-Lift®/PL in it. Following surgery I haven't been able to use my left arm for some time and cleaning ponds is very difficult. We had been introduced to Sludge-Away last fall and I was looking forward to trying it out.

WOW! In just a couple of weeks the results were visible. In one display pond I could actually read Firestone Pond Guard on the bottom. Our customers have also been back with very positive results and actually promote it to each other.

Your products still stink, but they also still work!

Thanks for the good work,

Don and Cheryl Holland

Holland's Water Gardens
Lake City, PA

16200 AQUARIUM MAINTENANCE

With the use of the right bacterial products maintenance can be kept to minimum.

In order to keep your aquarium clean and healthy there is a certain amount of maintenance that you will have to perform. Cleaning the filter, partial water changes, and cleaning of the substrate and ornaments are important parts of the maintenance.

- The filters should be cleaned as needed, but should in most cases be done at least once a month. Since you will lose some of the "Good Bacteria" when you clean the filter, you can inoculate your filter media at each cleaning with ML/GEL to avoid spikes in ammonia and nitrite.
- If you test your water weekly and use the correct products to help control waste build up in the aquarium you can keep water changes to a minimum. Performing them only when needed, however, some people like to do them on a schedule just to play it safe. If you prefer to do water changes on a schedule you can do them in a way that works for you. (20% a month, 10% every two weeks, etc.)
- If you have uneaten food and waste building up in the gravel and on the ornaments you will need to siphon it out or remove the ornaments for cleaning. Adding ML Gravel and Substrate Cleaner to the aquarium as directed will greatly reduce the need for this.

Note: Make sure to use the proper water conditioners whenever adding water to the aquarium.

For more information on MICROBE-LIFT® Technology contact

Ecological Laboratories Inc.

www.EcologicalLabs.com

CS16200

An Excellent Angelfish Protocol Is Improved in Germany with MICROBE-LIFT® Technology

Location: **Germany**

Background:

Stephan is a well known high end breeder of freshwater Angelfish, Pterophyllum scalare, in Germany with over 35 years experience.

Over the years Stephan had modified and adapted his aquatic aquarium systems to achieve a breeding process and grow out program he believed second to none. His breeding and growth process resulted in extremely beautiful high-end healthy fish that where ready for sale to his customers in 18 months.

His breeding and growth process produced high-end saleable fish with only 5-10% mortality during the breeding period. The first color development was seen at 4 to 6 months. During color stage the fish body grew but fins were retarded due to energy expenditure for color set. Full development of color, body, and spawning was complete by 14 months for sale at 18 months.

Objective:

With his many years of experience, Stephan was not open to the suggestions presented to him by Oliver Schultheiss of ARKA Biotechnologie GmBH, a key distributor of MICROBE-LIFT® technology. Oliver was providing ways of improving water quality, achieving rapid cycling, controlling ammonia and nitrite, even reducing nitrate. Oliver explained the elimination of nitrate by MICROBE-LIFT®/Special Blend's denitrifying capabilities. This was simply "not possible" according to Stephan's long-term experience.

To prove his point, Stephan decided to set up an aquarium system for a new set of Angelfish Babies following the suggestions made by Oliver for use of MICROBE-LIFT® /**Special Blend** and MICROBE-LIFT® /**Nite Out II** and an additional product MICROBE-LIFT®/**TheraP.**

He followed the MICROBE-LIFT® program exactly according to instructions, first setting up a new aquarium system, then placement of the babies, and addition of MICROBE-LIFT®/ **Special Blend** and MICROBE-LIFT®/**Nite Out II**. He followed instructions for the initial dosage followed by four weeks of a lowered dosage rate, then the suggested maintenance dose every other week.

At this point, the fifth week in the treatment program MICROBE-LIFT®/**TheraP** was added, using the same treatment rate as MICROBE-LIFT®/**Special Blend** alternating the two products every other week and then MICROBE-LIFT®/**TheraP** the next week. This was done for improved reduction of organic waste and improved control of potential pathogens.

Stephen was confident that this was a waste of time and resources.

Results Achieved: What Stephen saw can be described as follows:

1. From the very start of the process the new babies were very active with movement like little bumble bees, as described by Stephen, rather than slow movement that is normally seen in his existing breeding program.
2. During these early weeks he would normally lose from 5-10 of the little fish. Using this new treatment no fish were lost (not a single fish) and all fish seemed healthy.
3. Color started to appear at 8 to 9 weeks rather than the expected 4 to 6 months.
4. During the color set the body and fins grew at the same rate with no noticeable difference in body to fin growth.
5. Fish maturity, color, and spawning were seen at 6½ to 7 months and the fish were ready for sale at 7 to 7½ months

Stephen wanted to know how these benefits were possible. Oliver explained:

- Everything starts with water quality. One component of organics in the water is the food we feed the fish. We assume the selection and use of the best fish food is ideal for the fish and the aquarium environment. But consider, most large aquaria add protein skimmers to eliminate the excessive protein. Consider that fat is only 10% bio-degradable resulting in the slow steady build-up of fatty acids and food fiber. These constituents slowly build up as pollutants with in the aquarium water and filter system steadily increasing the level of pollution. MICROBE-LIFT® /**Special Blend** is the only microbial consortium that offers the capability to rapidly degrade these slow to de-

grade compounds thereby reducing pollution toxicity to marine life. These biological agents even improve the ability of the fish to metabolize the food.

- Reduction of toxic nitrogenous compounds through nitrification and denitrification. Ammonia produced by the breakdown of protein is quickly oxidized to nitrite and then nitrate. The nitrate is then removed by denitrification capability of MICROBE-LIFT® technology. Through denitrification nitrate is converted to non-toxic nitrogen gas that is harmlessly bubbled to the atmosphere.

The combined capabilities in MICROBE-LIFT® technology improve and enhance water quality eliminating difficult to degrade pollutants and reducing toxic nitrogenous compounds. No other technology on the market can match these benefits.

Based on the results seen with the use of MICROBE-LIFT® technology Stephen completely revised his aquatic practices using MICROBE-LIFT® in all of his aquarium systems. MICROBE-LIFT® technology is used to start and maintain every aquarium system within his shop and is highly recommended to all of his customers.

For more information on MICROBE-LIFT® Technology contact

Ecological Laboratories Inc.
www.EcologicalLabs.com

CS16201

Major Pet Store Demonstrates 85% Less Maintenance and 45% Reduced Fish Mortality with In-Store Use of MICROBE-LIFT® Technology

Location: **PETCO, San Diego, CA**

Background: Aquarium maintenance requires frequent cleaning to maintain a healthy, clean tank. Pet stores who sell live fish spend significant time and effort maintaining clean aquaria and viable healthy fish. A major pet store chain calculates the total cost of aquarium maintenance in the total of their stores at $300 per minute, seven days a week.

Objective: Major pet store PETCO was searching for a non-chemical treatment for in-store aquarium maintenance. Dr. Edling, Director of Veterinary Medicine, became aware of **Ecological Laboratories Inc. (ELI)** technology at PETCO's annual supplier EXPO in California in August 2003. Since this technology resolved water quality problems naturally, without the use of added chemicals, Dr. Edling arranged for an evaluation in store 1759 in Wilkes Barre, PA, a store which had been experiencing maintenance problems in their in-store tanks. To evaluate MICROBE-LIFT®/Special Blend technology control tanks were compared to treated tanks. Within two weeks of product use the treated tanks had improved significantly over the control tanks that received PETCO's standard maintenance protocol.

In October 2005, after evaluating the results of the Wilkes Barre trial, PETCO's animal care group launched a 30 store nationwide product evaluation program in evaluating MICROBE-LIFT®/Special Blend from **Ecological Laboratories** for over two years in multiple in-store well-controlled test programs.

MICROBE-LIFT®/Special Blend was selected for this testing based on the Wilkes Barre test plus positive recommendations from known aquaria experts. In fact no competitive company that PETCO contacted believed that their technologies could achieve PETCO's goal to eliminate chemical use.

The objective of this testing program was to determine product efficacy as well as the cost/benefit of its use. The goal was to improve water quality and fish health in store aquaria, reduce costs based on the requirement for less cleaning and water changes, and determine whether or not the benefits justified incorporation of the technology into their maintenance protocol.

Substantially positive results would also determine whether or not to add this technology to their retail store offering.

Results Achieved: Following the five-week start-up procedure, PETCO noted that MICROBE-LIFT®/Special Blend was already having a beneficial effect on their store central systems. After 30 days, PETCO reported that use of MICROBE-LIFT®/Special Blend provided a significant reduction in store aquarium maintenance while achieving reduced nitrate levels and lower fish mortality. This was quantified as follows:

Major Pet Store Demonstrates 85% Less Maintenance and 45% Reduced Fish Mortality with In-Store Use of MICROBE-LIFT®

1. Aquarium maintenance was reduced by 85% during the first 30 days of treatment. This represents significant savings as management assessed the chain's total cost of aquarium maintenance at $300 per minute seven days a week.
2. Nitrate levels were reduced from an average of 125 ppm with their standard water change schedule to an average of 1-2 ppm even with with reduced water change. This effect is due to MICROBE-LIFT®/Special Blend's ability to achieve rapid biological denitrification.
3. Fish mortality was reduced by a dramatic 45%.

Based on their in-store testing program, PETCO selected MICROBE-LIFT®/Special Blend for use in more than 1,100 super stores as their primary water treatment protocol. All other chemicals were eliminated from use. PETCO continues in-store use of Special Blend and based on continued successful performance in in-store use for a period of two years, PETCO added MICROBE-LIFT® products to its retail line. MICROBE-LIFT® products are now available to retail customers in PETCO stores nationwide.

The two key products in **Ecological's** MICROBE-LIFT® line are MICROBE-LIFT®/Special Blend and MICROBE-LIFT®/Nite--Out II. When used together they represent breakthrough technology. They can affect the start-up of a new aquarium or recovery of an existing system following down time or cleaning without the usual concern for the build-up of toxic ammonia or nitrite levels. They also promote effective denitrification to eliminate excessive nitrate. Together these products can cycle new tanks in less than 24 hours, a standard unmatched in the industry.

The combined capabilities in MICROBE-LIFT® technology enhance water quality eliminating difficult-to-degrade pollutants and reducing toxic nitrogenous compounds. This results in less maintenance and healthier fish... every aquarium owner's dream. No other technology on the market can match these benefits.

Based on the results from in-store use of MICROBE-LIFT® technology, PETCO was able to recommend this natural, safe technology to its customers with confidence that their customers will achieve the same positive results. In fact, PETCO's careful prelaunch testing was well validated by customer 5 star product reviews!

For more information on MICROBE-LIFT® Technology contact
Ecological Laboratories Inc.
www.EcologicalLabs.com
CS16202

16300 PUBLICATIONS & TESTIMONIALS

16301 MICROBE-LIFT®/Special Blend - "the Right Tool Makes All the Difference"

16302 MICROBE-LIFT®/Special Blend Clarifies Water, Removes Diatom Growth

16303 Customer States That MICROBE-LIFT® Products Reduced Aggression and Helped Wound Healing

16304 Testimonials On Fish Health Maintained with MICROBE-LIFT® Products from Industry Specialists

For more information on MICROBE-LIFT® Technology contact

Ecological Laboratories Inc.
www.EcologicalLabs.com

CS16300

MICROBE-LIFT®/Special Blend - "the Right Tool Makes All The Difference"

Ecological Laboratories
Cape Coral, FL

January 16, 2012

Dear Karin,

I do not have a question....just praise!

Due to a leak in our 55 gallon aquarium, we had to change tanks. One of the local "experts" said we'd be fine just transferring the gravel but within two weeks of the changeover, we lost all but four of our "community" fish due to fin rot.

We went to "That Fish Place" in Lancaster, PA for real help and were steered to MICROBE-LIFT/Special Blend.

Within the first few days after applying MICROBE-LIFT/Special Blend, I could see a difference in the environment. I have just completed the "day 22" dose and we still have the last four fish. They are healthy looking and have regrown their fins. The 20-year-old catfish looks like he has 20 more left!

Thanks so much for a great product. I've learned that having the right tool makes all the difference, and I am so glad that you have the right tool for me!

Keep up the good work and I'll help spread the word at my end!

"A confirmed user"

Gregory Witmer
York, PA

Microbe-Lift®/Special Blend Clarifies Water, Removes Diatom Growth

Ecological Laboratories
Cape Coral, FL

November 24, 2011

Dear Karin,

You have been the most helpful person I've ever gotten support from online.

I'll add a bag of Special Blend behind the slate and ferns to be safe. I tried it in a 15 gallon tank a couple of weeks ago and I could really tell the difference in the actual cleanliness of the plants in there! Before they looked like they had dirt build-up on them.

Now it's gone.

The wood and rocks even look better. This particular tank used to be plagued by this brown dust like diatom algae that I just couldn't kill no matter what I tried.

It'd wipe right off but be back in a week.

I haven't seen it since my first MICROBE-LIFT®/Special Blend treatment.

Thank-you for being so helpful.

Danny Brown

Customer States That Microbe-Lift ® Products Reduced Aggression and Helped Wound Healing

Ecological Laboratories
Cape Coral, FL

December 23, 2011

Re: MICROBE-LIFT®/Restore and Protectant

Dear Karin,

Are you interested in a testimonial? I gave my son all of my back-up bottles of MICROBE-LIFT®/Thera P, Special Blend, Artemiss, and Herbtana. I had to use an alternate brand of fish protector temporarily as I couldn't find your product.

He is sold! He saw almost immediate improvement. His fish suffered when he was in Japan. I sent my products home with him at Thanksgiving as an early Christmas gift and he reordered all of them for me. One of his severums got beat up pretty bad while he was away and is now almost completely healed and the products reduce aggression from the other fish. He used a therapeutic dose of Thera P in both of his 20 gallon and 90 gallon tanks along with Artemiss and protector for the bacterial and fungal problems.

All fish are doing better. He has some bleeding heart tetras that had a fungal infection. Using your products as well as adding more water circulation has healed those fish. I was being a good Grandma looking out for my little "Grand Fish".

I ordered all my replacement bottles from Pet Mountain and yesterday I wrote reviews for all MICROBE-LIFT products. I have been using both Special Blend and Thera P for over two years now.

Because of my efforts, Pet Supply Plus in Lima now carries many MICROBE-LIFT products.

"A dedicated user"

Judy Decker

For more information on MICROBE-LIFT® Technology contact
Ecological Laboratories Inc.
www.EcologicalLabs.com
T16303

Testimonials On Fish Health Maintained with MICROBE-LIFT® Products from Industry Specialists

Testimonials on Fish Health Maintained with Microbe-Lift Herbtana:

MICROBE-LIFT/Herbtana works by supporting the fish's natural immune system to drive off the excess parasites. The parasites cannot return to the fish during treatment, thus, the majority of the parasites will starve without a host.

From David Lass, an Expert in the Field of Aquaria:

I asked a few local fish stores that I know and trust to test MICROBE-LIFT/Herbtana for me. They tested this product over a period of about six weeks, using Herbtana both as a dip for receiving fishes and for treating marine ich.

As a dip for receiving fishes, Herbtana worked exceptionally well. The treated fishes were all very healthy and active once released into the store tanks.

As a cure for marine ich, Herbtana worked in all cases. One storeowner said that he saved 90% of the infected fish and it took exactly ten days to cure them. Herbtana cured a hippo tang that came down with the ich (they do that a lot) without harming the invertebrates in the tank.

MICROBE-LIFT/Herbtana does stimulate the natural immune system of fishes, and it does it without using any harsh chemicals or drugs. It takes between five and ten days for a cure to work, but Herbtana does so using natural ingredients and in a manner that does not stress fishes.

David Lass, aquarium product reviewer
"The Fish Room"
FishChannel.com

From Experienced Fish Store Owners:

We are out of Herbtana and need it as soon as possible, so we are willing to pay the difference in freight if you are able to send it overnight. We are open seven days a week so Saturday delivery is okay for us.

We have been using the MICROBE-LIFT products for all the tanks and our death rate has dropped even more dramatically than the last time we reported to you. (See "The product MICROBE-LIFT/Herbtana is wonderful.")

We are up to 54 tanks in our store and are planning to add a couple more 55-gallon tanks to the showroom.

"Your product is awesome."

Tina T. Hammond & Laurie Davenport
Store Owners of "Guppy Sales"

From Another Experienced Fish Store Owner:

In my twenty years of experience with aquariums I have seen every type of disease you can imagine. At certain times you have to make a horrible decision in whether to treat the one sick fish or risk losing life in the aquarium across the board.

Herbtana has simply solved all the negative effects of medication in the marine aquariums.

Since using the product I am able to put our reliable – yet dangerous – copper sulfate back on the shelf. There is now no need to worry about a nitrite spike. The important thing is the confidence I have in selling the product to a customer and knowing that there will be no adverse effects.

Ecological Laboratories has struck gold and we are all the beneficiaries of this important product.

Thank-you Ecolab! You have my support.

Martin Caceres
Total Aquariums Inc.
Lynbrook, NY

For more information on MICROBE-LIFT® Technology contact
Ecological Laboratories Inc.
www.EcologicalLabs.com
T16304

ECOSYSTEM RESTORATION

Ecological Laboratories network of In-Field Water Treatment Experts have restored both man made and natural bodies of water including retention and drainage ponds, streams and rivers, estuaries and municipal water management operations worldwide for over 40 years.

MICROBE-LIFT® Technology for the 100% natural restoration of health, quality, and ecological balance to polluted waterways including....

- Ponds
- Rivers & Streams
- Retention Ponds
- Estuaries
- Municipal Waterways

For more information on MICROBE-LIFT® Technology contact

Ecological Laboratories Inc.
www.EcologicalLabs.com

CS17000

Made in the USA

AQUATIC ECOSYSTEMS APPROACH

Ecological Laboratories' combined educated technical knowledge of environmental process and problems allows the company the ability to address and resolve a wide range of difficult to resolve environmental problems to include, but not limited to aquatic ecosystem water restoration, the enhancement of wastewater processes, soil bioremediation, agriculture soil and plant enhancement, and the ability to resolve residential on-site wastewater water problems. These unique capabilities are the result of **Ecological Laboratories'** staff (and management team) undergoing rigorous in-house education training that combines their university knowledge with a full understanding of practical environmental processes achieved through real world exposure to factors responsible for the causes of difficult to resolve environmental problems.

Product Technology and Capability...

Ecological Laboratories Inc's expertise combines novel bio-technology not available within the general market with a level of real world technical capability and experience that effectively address esand resolves a wide-range of environmental problems, offering natural/effective solutions few companies are capable of providing, allowing ELI the capability to address and resolve most environmental problems.

Capability...

ELI's advanced knowledge of biological processes and pathways provide the company with the capability to recommend solutions that remediate environmental pathways and processes. These solutions are achieved through the use of **ELI's** bio-technology to restore natural process within a balanced environment thereby controlling pollution and managing nutrient recycling.

These achievements include the ability to address a wide range of pollution concerns, fully restore aquatic eutrophic ecosystems, achieve odor abatement, eliminate hydrogen sulfide and corrosion, through using the company's unique natural non-chemical methods.

For more information on MICROBE-LIFT® Technology contact

Ecological Laboratories Inc.
www.EcologicalLabs.com

Made in the USA

17100 LARGE RECREATIONAL PONDS

For more information on MICROBE-LIFT® Technology contact

Ecological Laboratories Inc.

www.EcologicalLabs.com

17100

MICROBE-LIFT® Restores Beauty to a Popular Municipal Pond in Huntingtin, NY

Location: **Huntington, NY**

Background: Heckscher Park is located on Main Street in Huntington, NY, a pleasant town on Long Island close to New York City. This park is a popular recreation site for community enjoyment with its attractive, landscaped walking paths around a beautiful pond.

Fig.1: *View of restored Heckscher Pond*

Objective: The pond was experiencing excess nutrients from waterfowl, upland runoff, and vertical mixing which resulted in filamentous algae matting two-thirds of the water surface, a situation that is aesthetically unpleasant and discourages the hobbyists who sail radio-controlled model boats.

The pond is large, covering three acres with a volume of water approaching 4 million gallons and an 8% daily replacement volume. The town considered dredging the pond to help eliminate the algae, however, the financial commitment and permitting requirements were more than they could afford. Over a two-year period, various algae control treatments had been tried and failed.

The town's Environmental Control Department advised that the town institute a trial of Ecological Laboratories' MICROBE-LIFT® technology. A plan was developed and implemented.

Results Achieved: Based on treatment with MICROBE-LIFT® technology, the pond showed a dramatic reduction in algae throughout the warm season for the first time in many years. A testimonial from the town's engineer is available.

For more information on MICROBE-LIFT® Technology contact
Ecological Laboratories Inc.
www.EcologicalLabs.com
CS17101

Microbe-Lift® Restores Pond at Housing Development in Bowling Green, Ohio

Location: Larch Landing Development, Bowling Green, OH

Background: This development includes a water retention pond in a scenic, restful area. Unfortunately this pond became overloaded with algae, building scum on the surface and greatly distracting from its beauty.

Fig. 1 & 2: *In the pictures, the ducks are living in an unhealthy environment. The picture below shows the surface scum, a condition that is not only unsightly but interferes with natural cycles that provide a healthy environment for wildlife.*

Microbe-Lift® Restores Pond at Housing Development in Bowling Green, Ohio

Objective:

This development had an active association that sought a solution to this problem. When they learned that MICROBE-LIFT® technology could restore the natural health of this pond without the use of harmful chemicals they decided to run a trial.

Results Achieved

Using standard dosage rates of MICROBE-LIFT®/PL they were able to turn the situation around in a few months.

Fig. 3: *This picture shows happy homeowners next to a completely restored pond. Note the surface is so clear that we see their reflection as a perfect image on the water.*

MICROBE-LIFT® products act by restoring the natural microbial balance in ponds. The specialized microbes in MICROBE-LIFT® metabolize the excess nutrients that encourage algal growth, eliminate sulfur and other unpleasant odors, and degrade the organics that cause turbidity, toxicity, and oxygen depletion. A MICROBE-LIFT® treated pond is a clean, stable ecosystem that supports fish and other wildlife growth.

For more information on MICROBE-LIFT® Technology contact

Ecological Laboratories Inc.

www.EcologicalLabs.com

CS17102

Microbe-Lift® Technology Restores A Lake at A College in Ireland

Location: Terenure College, Dublin, Ireland

Background:

Terenure Collage is a secondary school located in the Terenure area of Dublin, Ireland. Founded in 1860, the college comprises a primary and secondary school. The school is part of the popular "Rugby Belt" or Leinster Schools Rugby playing institutions. With a strong rugby tradition, it has won the Leinster Schools Senior Cup 10 times.

Fig. 1: *Ternenure College.*

The lake at Terenure College is one of the main features of the grounds. It is 330m long running along the length of the playing fields and is estimated to be between 15,000m³ and 20,000m³ in volume. The lake is fed by surface water as well as some local spring water.

Fig. 2: This picture shows the massive amount of algae and surface solids accumulated on the lake surface.

For many years a combination of natural organic decay, surface water pollution, and nutrient run-off from adjacent playing fields has produced a build-up of organic sludge and inorganic silt in the pond. The resultant nutrient imbalance led to cloudy water, pungent malodors, and regular algae blooms across the entire lake.

Objective:

In May 2012 the College was approached with a recommendation to apply a natural bacterial product, MICROBE-LIFT® formulation to supplement the ecosystem within the lake and restore the natural balance. Nova-Q, began treatment of the lake at the end of June with a relatively high dose inoculation to kick start the process followed by a standard treatment protocol.

Results Achieved

With ongoing treatments Nova-Q was able to use the non hazardous, natural bacteria MICROBE-LIFT® technology to remediate the lake and restore the micro-nutrient balance in a manner that was of no risk to the natural wildlife of the area, the college students, staff or visitors.

As part of the "Environment and Heritage" aspect of their 150th Anniversary Celebrations during the academic year 2009/2010, Terenure College developed the Lake Wildlife Walk. The walk provides a little known quiet zone in the Terenure area that is growing in popularity. With a restored pond, the walk has now become a more pleasant experience for young and old alike.

Fig. 2: *This picture shows a totally recovered, clean pond with no algae or other surface solids*

The Benefits of Treatment with Microbe-Lift® Technology

The benefits of treatment with MICROBE-LIFT® technology include the following:

- Restores the ecosystem balance clearing ponds of algae and surface solids
- Eliminate noxious odors
- Reduces contamination including nitrogenous compounds ammonia and organics restoring oxygen levels.
- Breaks down organic sludge

These benefits are accomplished with natural biological technology that restores ecological balance.

For more information on MICROBE-LIFT® Technology contact

Ecological Laboratories Inc.
www.EcologicalLabs.com

CS17103

Microbe-Lift® Revives Pond at the Sanctuary Housing Development in Jacksonville, FL

Location: Sanctuary Housing Development, Jacksonville Beach, FL

Background: Sanctuary housing area was developed in the early 1990's along the inter-coastal waterway. This development had a 2-acre pond surrounded by homes that are 10 to 15 feet away from the edge of the pond and pollution was a problem. At this point there was active construction on the last phase of the housing development. They had experienced 3 fish kills between August 2004 and March 2007.

The primary points of pollution are fertilizer run-off and grass clippings from lawn care companies, debris from neighborhood trees, dust blowing into the pond from the construction site and fill material leaching into the pond through the silt fence from the construction site. A company that used copper sulfate and blue dye to abate algae had previously treated the pond with less than satisfactory results.

In search alternative remediation technology, the management company discovered MICROBE-LIFT® technology. MICROBE-LIFT®(ML) is a series of biological products developed and manufactured by Ecological Laboratories Inc. (ELI).

Objective: When contacted, ELI's technical staff assessed that the pond had a very large amount of string and mat algae. Additionally, the proximity of the houses to the pond provided significant nitrogen and phosphorus loading. ELI physically removed approximately 50% of the algae from the pond by raking it from the bank, then implemented a MICROBE-LIFT® dosage schedule as follows:

Dose	ML	ML SA	ML PBD	ML BSP
	Gal	Gal	8 oz packets	40 lb bags
Initial Dosage	8	3	20	5
Weekly doses (4)	2	1	4	
Monthly Maintenance	2	.25	2	

***Note:** *Due to budgetary constraints the pond was treated at half the normal rate recommended for a 2-acre pond.*

Results Achieved: The pond treatment was initiated in April 2007. The pond has not had one fish kill since initiation of treatment. Approximately 85% of the algae was gone by August and 95% was gone by October. Less than 5% of the algae remained. Continued maintenance dosage will improve water clarity as construction activity continues and supplies dust and run-off to the pond. Additionally, as the pond goes through a turbidity causing inversion during cold weather the maintenance dosage will help restore and maintain water clarity.

Comparison

BEFORE AFTER

Fig. 1: *The "before" picture on the left is not indicative of the actual coverage of algae on the pond because the wind had blown it to one side. On a calm day the coverage was actually 80% of the surface area.*

The office park management was very pleased with the results and the relatively inexpensive, small maintenance dose required to assure a clear and aesthetic pond.

For more information on MICROBE-LIFT® Technology contact
Ecological Laboratories Inc.
www.EcologicalLabs.com
CS17104

MICROBE-LIFT® Technology Reduces Total Phosphorus Level in Two Different Ponds by >70%

Location: Cason & Associates, Berlin, WI

Background: Cason & Associates is a professional company specializing in the environmental management of lakes, ponds, rivers, and wetlands.

Objective: Most environmental problems in natural waterways result from excess nitrogen and phosphorus nutrients caused by fertilizer run-off, dead organic matter breakdown, and animal waste pollution. MICROBE-LIFT® technology is well recognized for effective remediation of high nitrate levels. It contains a proprietary consortium of highly effective denitrifying bacteria that promote the natural cycling of nitrogen forming nitrogen gas that returns to the atmosphere. Since algae and other less desirable biological life forms require both nitrogen and phosphorus for growth, reduction of nitrate levels can curtail this growth.

However, for a truly pristine environment, phosphorus nutrients should be removed as well. Since phosphorus cannot be recycled to the atmosphere, removal is more difficult.

Based on successful phosphorus removal by MICROBE-LIFT® technology achieved at Islesworth, FL and other locations, Chad Cason, Senior Biologist at Cason & Associates, planned a test of MICROBE-LIFT® in a two-pond contaminated site that he was restoring.

Two ponds, an upper and lower pond, had high total phosphorus levels. As assayed by an outside laboratory on July 6, 2012, prior to treatment, the Lower Pond was determined to have 160 ug/l total phosphorus and the Upper Pond contained 120 ug/l total phosphorus.

Results Achieved: On October 14, 2012 after 4 ½ months of treatment with MICROBE-LIFT® laboratory results showed that the phosphorus levels had been reduced to 40 ug/l total phosphorus in the Lower Pond and 35 ug/l total phosphorus in the Upper Pond. Treatment achieved a dramatic 75% reduction in the Lower Pond and 71% reduction in the Upper Pond. "That's pretty impressive," stated Chad "I'm sure we will be purchasing more".

This trial was one more well-documented field test validating MICROBE-LIFT® technology's ability to not only eliminate excess nitrate but to also control excess phosphorus restoring ponds to a more natural, pristine condition.

For more information on MICROBE-LIFT® Technology contact
Ecological Laboratories Inc.
www.EcologicalLabs.com
CS17105

Independent Laboratory Results Confirm Bioremediation Dramatically Reduced Fecal Coliforms at Jacksonville Zoo

Location: **Jacksonville Zoo, Jacksonville, FL**

Background: The ½ acre swan pond at Jacksonville Zoo was contaminated with an unacceptably high level of fecal coliforms. Well known for the leading pond maintenance technology, **Ecological Laboratories Inc. (EL)** was called in to help remediate the pond.

Fig. 1: *Shows the very popular swan pond at Jacksonville Zoo.*

Objective: **EL** first evaluated the water quality assaying pH, organic and nutrient loading, and accumulated pond bottom solids, and then MICROBE-LIFT was dosed according to protocol.

Fecal coliforms were reduced from 36,000 cfu/ml to 4,600 cfu/ml in just a few weeks of treatment. In addition, the water and surfaces were significantly cleaner as shown in the data below:

Analyte	Method	Units	Pretest 15 Jan	Test 1 5 Feb	Test 2 10 Feb	Test 3 18 Feb	Reduction Improvement
BOD	SM185210E	mg/L	16	9.7	1	1	94%
COD	SM 5220D	mg/L	240	85	120	35	85%
Nitrate N	EPA 300.0	mg/L .	60	.31	BDL	BDL	100%
Nitrite N	EPA 300.0	mg/L	.23	.13	BDL	BDL	100%
TSS	SM 2540D	mg/L	62	56	106	25	60%
Fecal Coliform	SM 9222D	CFU/ 100ml	36,000	10,000	14,000	1,200	96%

Fig. 2: *Analysis validates reduction in fecal coliforms plus increased cleanliness of the pond water.*

The lab report summary above shows the nitrates and nitrites have been reduced to below detectible limits and the water is much cleaner with BOD/COD/TSS levels significantly lowered.

In addition to providing cleaner water, MICROBE-LIFT® technology has reduced the bottom sludge by some 4 to 6 inches. There was a noticeable visual difference in the water quality and the zoo caretakers see an improvement in the general health of the swans.

For more information on MICROBE-LIFT® Technology contact

Ecological Laboratories Inc.
www.EcologicalLabs.com

CS17106

Made in the USA

Private Equestrian Park Uses MICROBE-LIFT® to Restore Two Ponds

Location: **Private Equestrian Park, St. Johns County, FL**

Background: The design of this privately held, large equestrian park included 3 acre, 1 acre, and 0.5 acre ponds. These ponds became polluted from dust from construction activity and fertilizer run-off from its use on surrounding grass and other landscape features. Algae had built surface scum and there was no longer fish in the ponds. Unwanted insects were also a problem.

In search of a solution, the management discovered MICROBE-LIFT® technology. MICROBE-LIFT® (ML) is a series of biological products marketed by Applied & Experimental Microbiology (AEM) of Jacksonville, FL, often under the private label of Quantum Growth. This biotechnology-based product line is manufactured by **Ecological Laboratories Inc.**

Objective: When contacted, AEM's technical staff assessed that the ponds had very little bottom solids or leaves and twigs but did have high levels of nutrient, which caused the algae growth. They implemented a Quantum growth dosage schedule to the one acre pond as follows:

Dose	ML Gal	ML SA Gal	ML PBD 8 oz packets	ML BSP 40 lb bags
Initial Dosage	8	3	20	5
Weekly doses (4)	2	1	4	
Monthly Maintenance	2	.25	2	

***Note:** *Dosage for the one-acre pond is provided. Dosages for the other ponds were extrapolated from this dosage.*

The pond treatment was initiated in December 2006. The algae was substantially reduced in the following few months. The most notable observations were made on the pond's ecosystems. Predatory waterfowl and snakes were observed the following May. An alligator sighting was reported by a construction worker in June. The most notable observation was the absence of mosquitoes around the ponds.

For more information on MICROBE-LIFT® Technology contact
Ecological Laboratories Inc.
www.EcologicalLabs.com
CS17107

MICROBE-LIFT® Restores a Natural Refuge for an Upscale Neighborhood

Location: **Appian Way Housing Development, Doylestown, PA**

Background: Appian Way is a beautiful community of upscale homes in Buck County. This development maintains a common area of nine acres and a one-acre pond.
In 2004, the property manager experienced a problem with an ugly algal bloom on the pond. In addition, sludge was building up with the development of 1 ½ to 2 feet of bottom solids, and the fish were not visible due to the turbidity of the water. They had experienced fish kills due to lack of oxygen in the water.

Fig 1: *Severe string and mat algal blooms destroy the beauty of this preserve. Turbidity and solids accumulating on shore detract further from this potential retreat. (pictures taken 4/21/2004)*

Objective: The facility management contacted **Ecological Laboratories** who developed a treatment program using MICROBE-LIFT® Technology. The goal of treatment was to eliminate ugly surface scum, which was mostly algae, reduce the mucky bottom solids, and clarify the water. Nutrient levels were monitored and a dosage schedule was initiated.

Results Achieved:

Dramatic results were seen the first year of treatment and management has continued to use the product annually as recommended. After three years of treatment, the pond ecosystem has been completely restored. During treatment 3 to 4 inches of shoreline muck and over 2 feet of bottom sludge had been digested, fish kills were eliminated, and you can see the pond bottom in many places even though the pond is over 8 feet deep.

For more information on MICROBE-LIFT® Technology contact
Ecological Laboratories Inc.
www.EcologicalLabs.com
CS17108

Made in the USA

MICROBE-LIFT® Technology Restores Health and Balance to a Pond Ecosystem at South Seas Resort

Location: **South Seas Resort, Captiva Island, FL**

Background: South Seas is a family resort and wildlife sanctuary that promotes adventure and relaxation. All amenities are designed to take full advantage of the beauty of the existing landscape.

Objective: When their 3/4-acre round pond had become increasingly unbalanced they needed a plan to return it to a healthy state. This 6-foot deep pond experienced heavy nutrient loading, low oxygen levels, and lack of beneficial bacteria that could break down organics. These conditions resulted in algal blooms, heavy bottom sludge accumulation, foul odors, and a lack of water clarity.

A bioaugmentation plan was developed based on MICROBE-LIFT® technology. In addition they added an AquaMaster surface spray type aerator to supply dissolved oxygen to the pond to support aerobic digestion by the bioaugmentation strains. The MasterClear Muck B Gone was added to accelerate sediment reduction.

On initial application 6 gallons of each product was introduced into the pond. For the next 6 weeks, 1 gallon of each product was applied each week. A monthly performance dosage was then to be determined. The pond was monitored twice a month.

After eight weeks of treatment, improvement was noted. Algal blooms were less intense. Water was clearer and there appeared to be less sludge. No foul odor was present.

Results Achieved: After 16 weeks improvement was dramatic. Slight algal blooms were seen in only a few areas. Water clarity had improved significantly and all odors were gone. Sludge Reduction was dramatic. Originally, 6 inches of sludge was noted at the shallow shoreline areas and up to 2 feet at the center of the pond. After 16 weeks of treatment, sludge was negligible at the shore and less than 6 inches in depth at the center of the pond.

Oxygen levels increased throughout the water column. The pond water BOD (Biochemical Oxygen Demand), the measure of organic loading, was decreased. This shows that the pond is effectively replenishing oxygen consumed by biological activity. The higher oxygen level supports beneficial microbes for faster degradation of organics to maintain water clarification and sludge reduction. This pond's health, balance, and aesthetic appeal have improved substantially. The synergistic use of aeration and beneficial bioaugmentation should be very effective in maintaining this healthy pond ecosystem.

For more information on MICROBE-LIFT® Technology contact
Ecological Laboratories Inc.
www.EcologicalLabs.com
CS17109

Bioremediation of Occum Pond at Dartmouth College Clears Water and Eliminates Algae

Location: Occum Pond, Dartmouth College, PA

Background

Pine Park is a ninety-acre forest of 125-year-old pine trees at Dartmouth College. This park begins at the north end of campus, along the edge of the Hanover Country Club golf course, and extends along the Connecticut River from Ledyard Canoe Club northward. The trees were saved from the Diamond Match Company in 1900 by local residents who later turned the land over to the College and to the Town of Hanover.

The park is a pristine area where forest and river ecosystems interface, home to a rich mix of water and forest wildlife. Many trails that wind through the woods provide` excellent walking, cross-country skiing and jogging often with a spectacular sense of isolation from the human world.

This site includes a 10-acre pond designed to add to its enjoyment.

Unfortunately the pond had not been well maintained. It had built a large layer of bottom sludge; the water had turned murky, algae contributed to surface scum, and a malodor had developed.

With limited budget and the size of the pond it was doubtful if it could ever be returned to its pristine state.

Fig. 1: *This picture taken May 15, 2006 shows the turbidity of the water.*

Fig. 2: *Also taken of the pond surface on May 15, 2006 this picture is a close up showing turbidity and surface scum.*

Objective:

The College worked with Ecological Laboratories (EL) to develop a biological augmentation program using MICROBE-LIFT® technology to clean the pond. The purpose of the program was to speed the biological degradation of all accumulated organic matter within the pond's ecosystem: along the shore (litteral zone), on the surface of the open water (limnetic zone), and the bottom sediment (benthic zone).

The program called for a year-long treatment initiated during the summer months.

Program goals include:

1. Reduce bottom solids 6-18" over a 12 month period
2. Assist in controlling algae blooms, in combination with pond management steps
3. Reduce pond malodors
4. Achieve a reduction of at least 20% in BOD, COD, and SS
5. Reduce pond nutrient concentrations
6. Improve water quality and clarity

Treatment was implemented from May 24 to October 13 in 2006 by a very competent Dartmouth team led by Stephen Glaholj and Robert Thebodo. **Ecological Labs** worked closely with the team to assure success.

Modifications to the program were made by **EL** as necessary based on weather and results. Dosage was reduced during heavy rainfall in May, June, and July while increased rates were applied in August and September when rainfall was lower. Data was tracked for the first six months of the program.

Results Achieved:

During the first phase of the bioaugmentation program from May to October 2006, the Occum Pond area experienced heavy rainfall with a reported 8 to 9 inches above average rainfall (reference "Rainfall in Lebanon, NH") The heavy rainfall impacted water volume and organic content as expressed by BOD, COD, SS, and TSS, and increased nutrient levels through excessive run-off from the surrounding area. There were no buffer zones to protect the pond from fertilizer and pesticide run-off.

Occum Pond's bottom solids level and percent organic content were determined at various points as indicated in the sediment chart. The first recorded baseline start points were incorrect due incorrect use of the sludge judge. Therefore bottom solids data review should be compared to the high data points shown about May 20th. This data point represents true baseline levels as determined prior to the first treatment on May 24th. Thereafter, solids data was compiled and monitored twice a month following the start of treatment.

Data indicates that bottom solids were reduced significantly during the treatment phase. This was accomplished in spite of excessive rainfall.

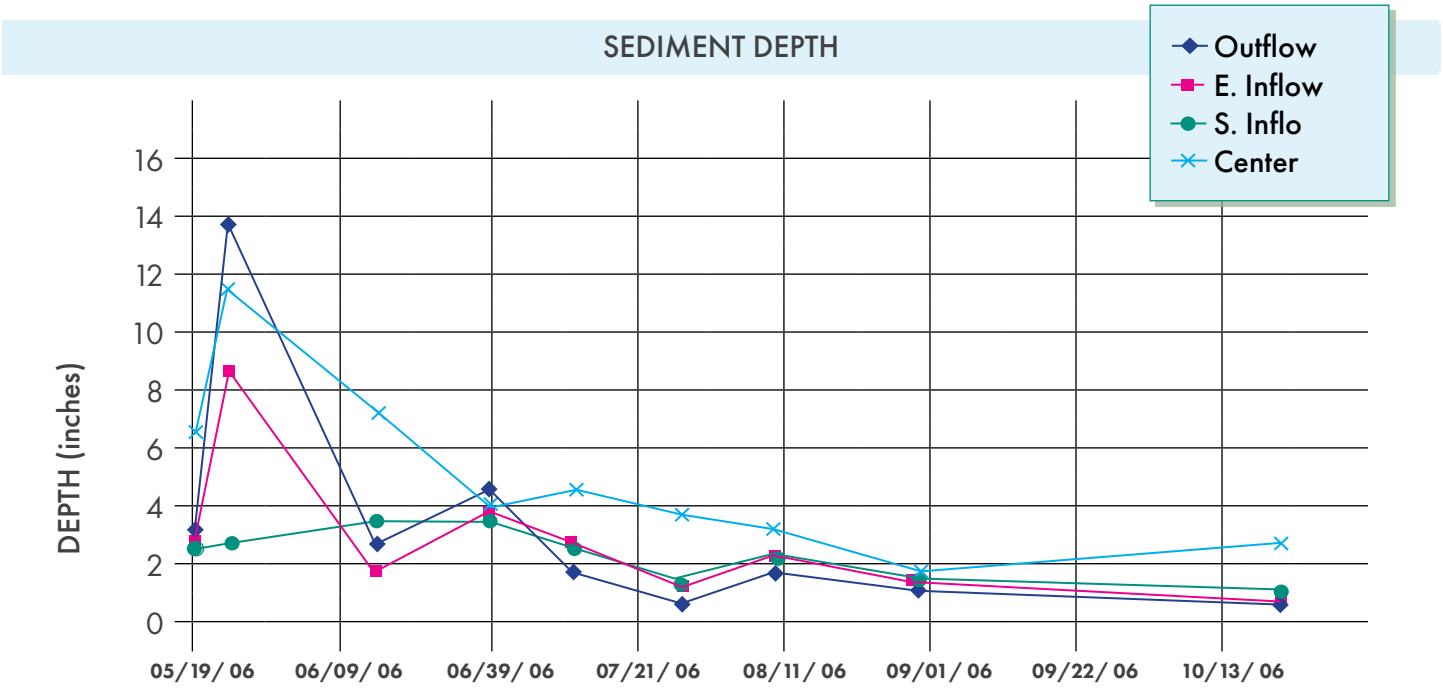


Chart 1: *This graph shows the reduction in sediment in bi-monthly recordings throughout the treatment program. The first data point was incorrect due to improper use of the sludge judge, making the second data point the true baseline.*

Microbial metabolism will continue to breakdown organic solids until mineralization is achieved, leaving only the inorganic portion of the sludge. The percentage of organic solids in the sludge determines the potential for biological removal. The data below indicates the organic portion of Occum Pond sediment is high, thus, the potential for a successful biological removal of sludge is high. **EL** estimates that it is reasonable to expect up to 6 to 12 inches of removal per year depending on temperature and other environmental factors.

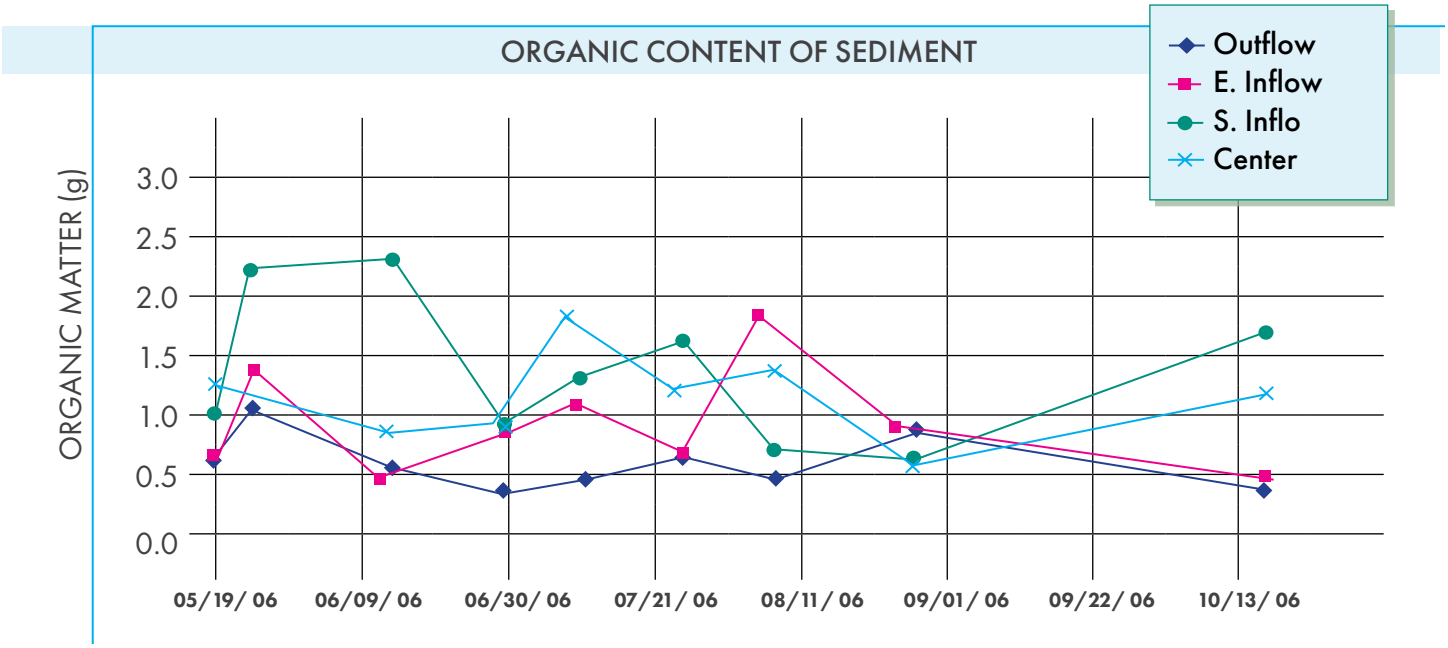


Chart 2: *Sediment is high, thus, the potential for a successful biological removal of sludge is high.*

During the biological oxidation of sludge organics, by-products will be released to the water column increasing the organic loading (BOD, COD) on the microbes in the water phase. This release may temporarily increase BOD results until the microbial activity from the bioaugmentation program balances.

The spikes in BOD in the above graph also coincide with high rainfall as the influent water carries organics in both particulate (settleable) and soluble form. The South influent zone indicates that the heavy rain events may have contributed unusually high organic matter to both pond water and sludge.

Nutrients were also tracked in the water phase. Ammonia levels are primarily developed by biological breakdown of organics containing nitrogen releasing ammonia or deamination. Various microbial metabolic processes can convert ammonia to nitrate, a form that can be utilized by plants or microbes or microbes can convert it completely to nitrogen gas whereby it is returned to the atmosphere. Since the Occum Pond has excess nutrients, microbial action is necessary to remove nitrogen.

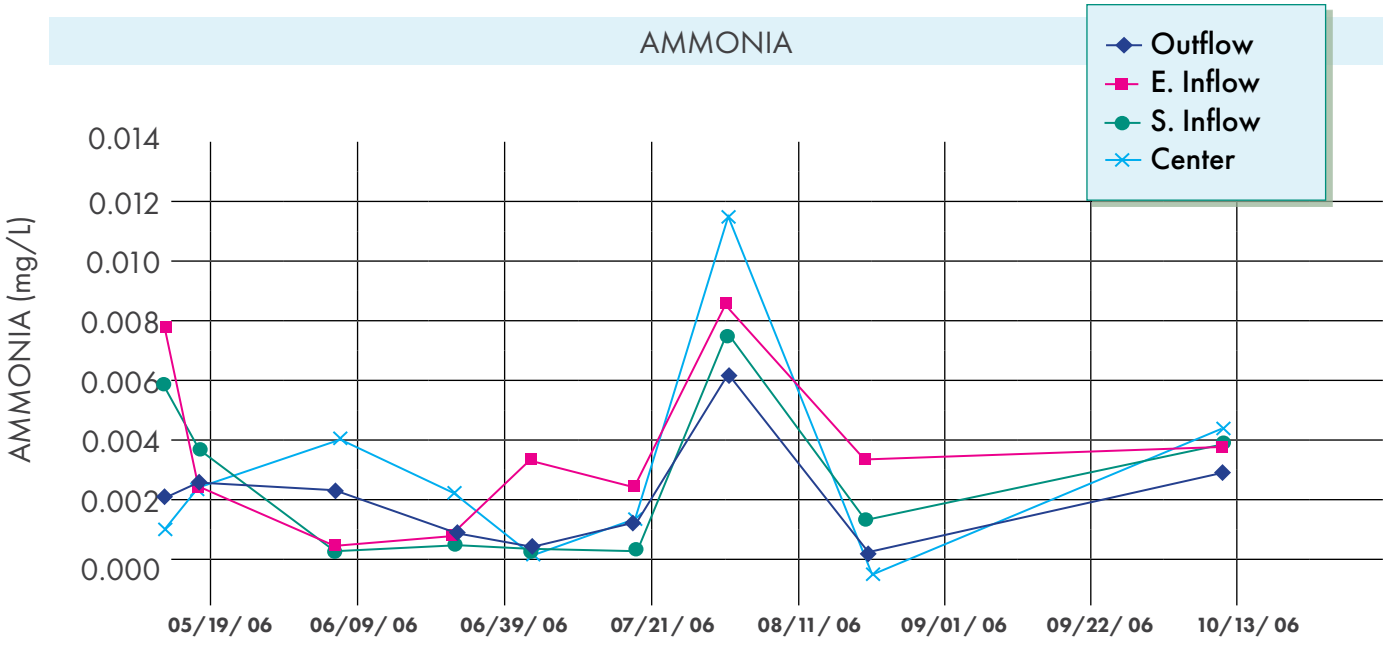


Chart 3: *Ammonia spikes occur after bioaugmentation in August and September.*

Aside from the normal pathway of oxidizing ammonia, nitrate builds to excess due to fertilizer run-off. Surface waters collect fertilizer and deposit it in ponds, rivers, and other waterways. Locations close to residential homes, golf courses, or farms are particularly vulnerable. As seen by the graph below, initial stages of high rainfall concentrates the nitrate contamination.

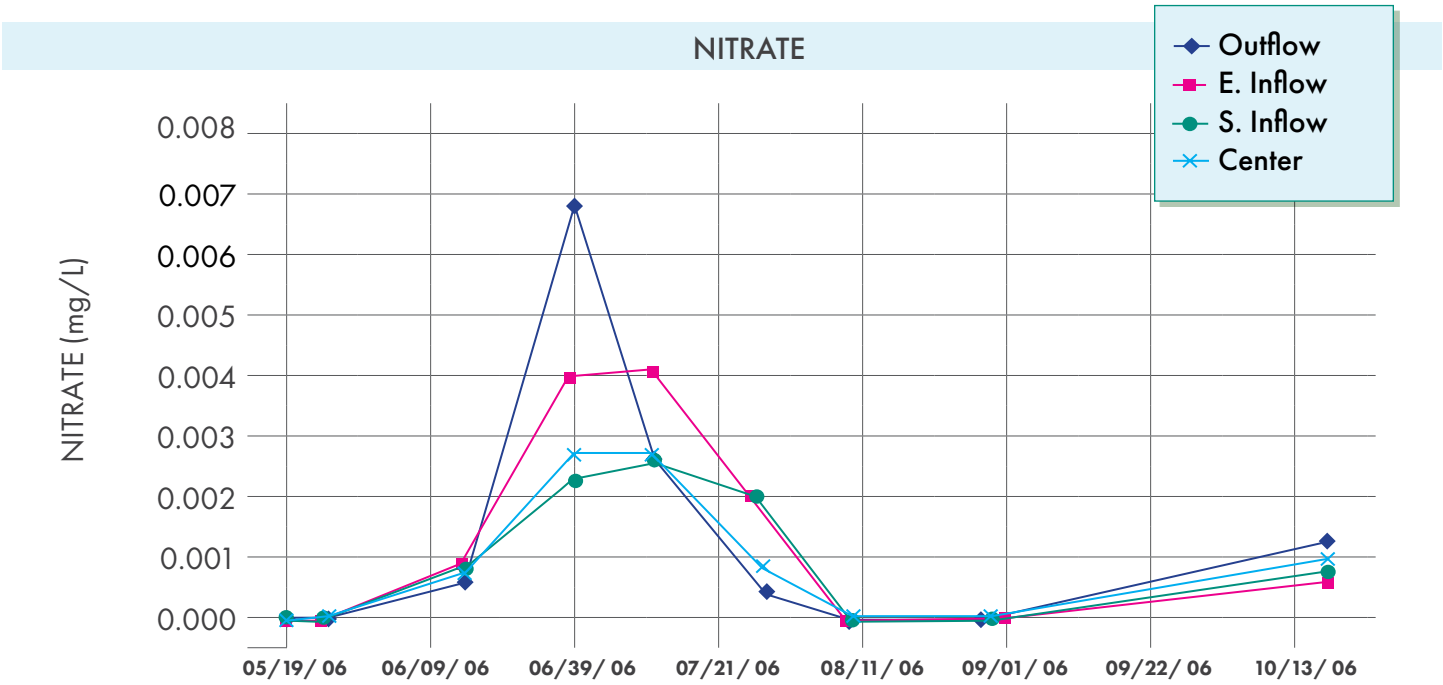


Chart 4: Initial stages of high rainfall concentrates the nitrate contamination.

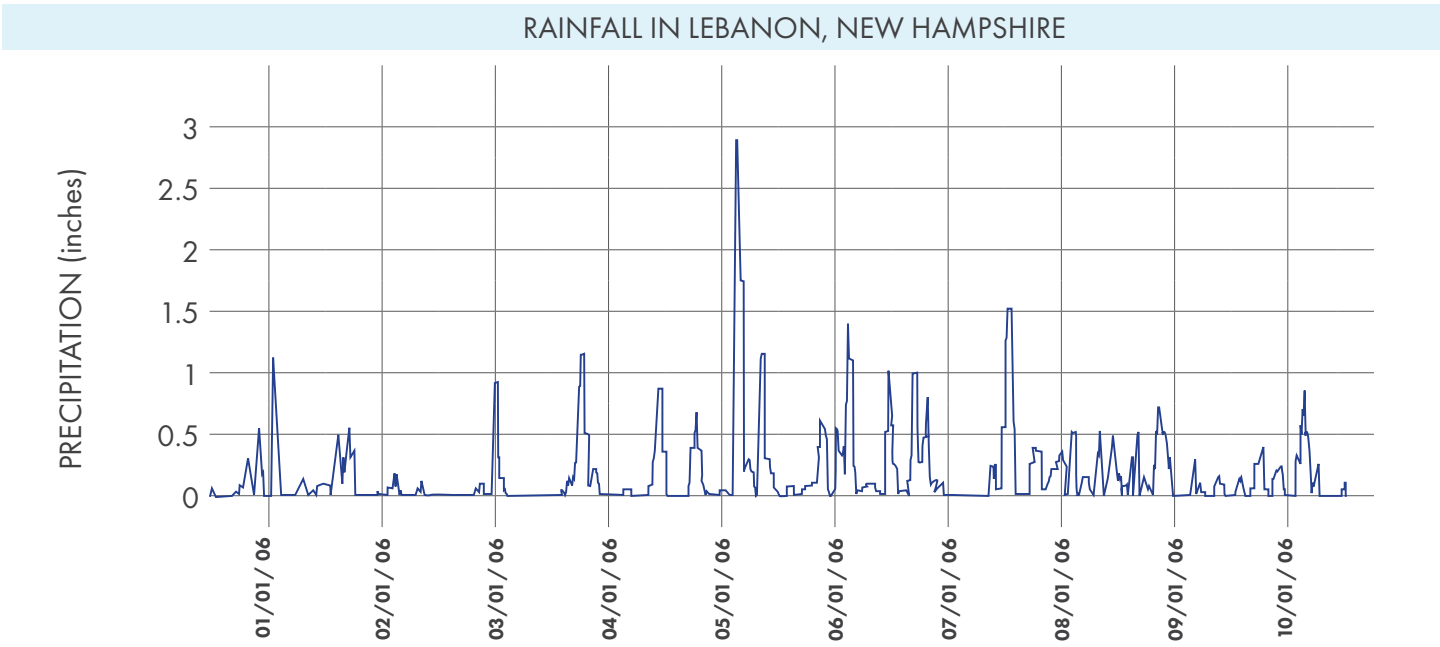


Chart 5: *Note how the spike in rainfall correlates to the spike in nitrate concentration in the pond.*

A high nitrate level is a problem because it encourages algae growth and excess bottom plant growth leading to eutrophication. Microorganisms capable of denitrification utilize nitrate for a terminal electron acceptor in place of oxygen releasing nitrogen gas. This occurs in the anaerobic sludge zones often producing bubbles on the water's surface where gas is released.

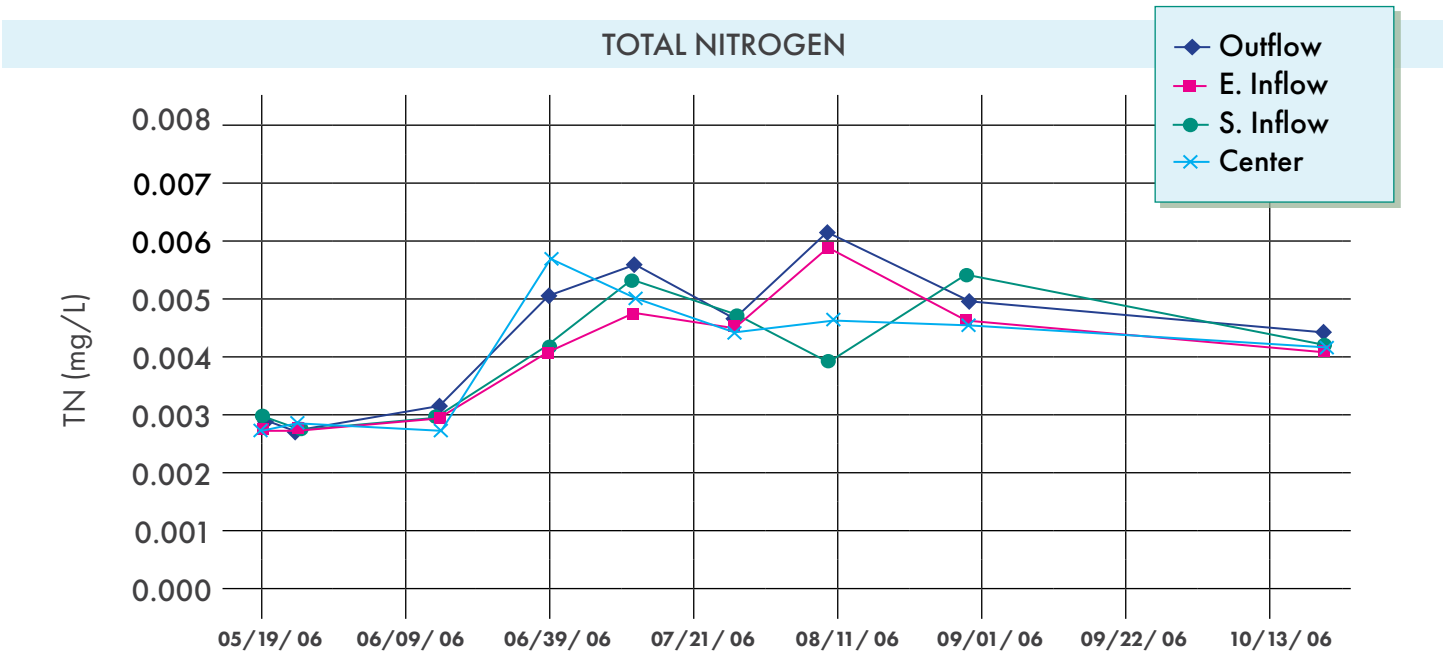


Chart 6: *Total nitrogen includes all forms of nitrogen: ammonia, nitrite, and nitrate plus the nitrogen in organic compounds. This curve shows the influence of the peaks in both nitrate and ammonia*

Phosphorus is another nutrient of concern as it is also a primary contributor to algae growth. Occum Pond sits in a bowl in close proximity to a golf course and borders home sites. These factors contribute to pond phosphate levels via fertilizer run-off. There is no buffer system to contain run-off which would ameliorate these factors.

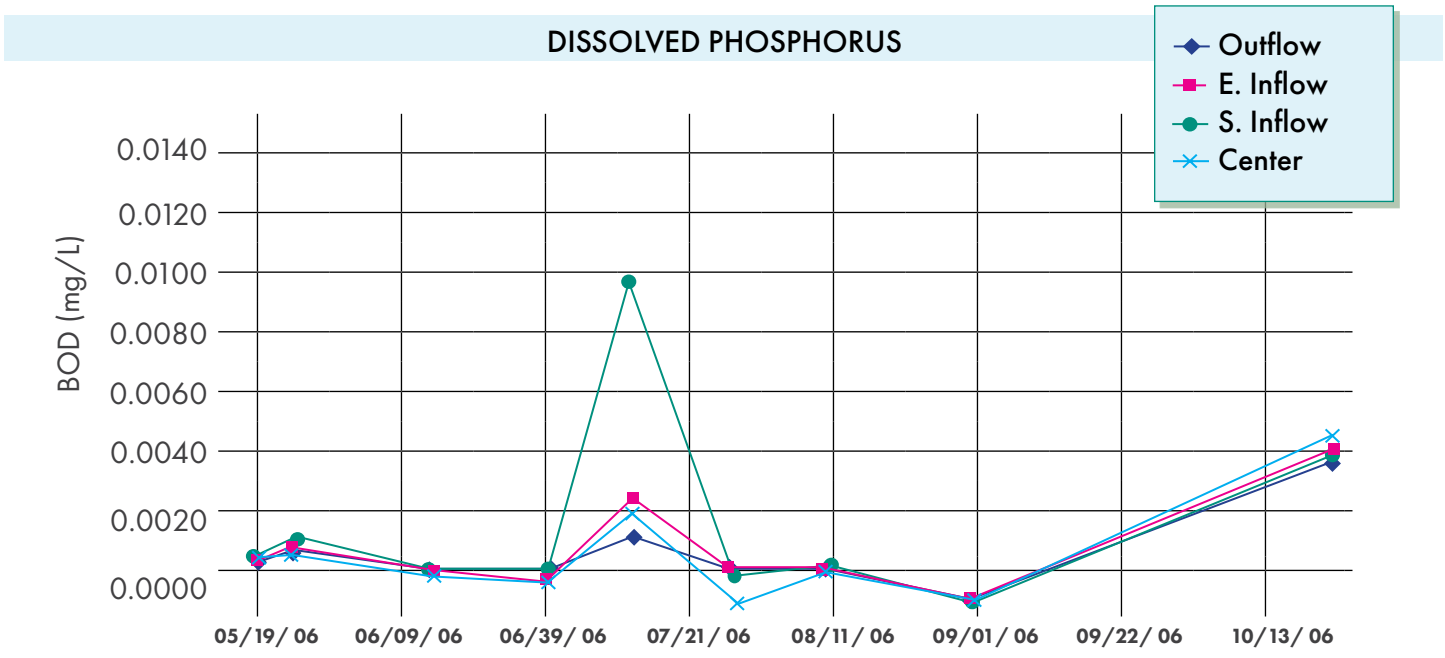


Chart 7: *Phosphorus also shows a peak that coincides with heavy rainfall.*

To compensate for heavy rainfall the augmentation treatment program was modified monthly with dosages changes as necessary to assure long-term effectiveness of the project.

Biochemical Oxygen Demand (BOD) or organic contamination of water results from a number of factors: a) soluble organic matter released from bottom solids, b) conversion of some COD or slow to degrade material to degradable material based on capabilities of selected microbes, and c) organic matter coming into the system in the influent waters or other natural sources such as animal waste. This chart shows increased deposit of organic matter with heavy rainfall peaking on June 30th.

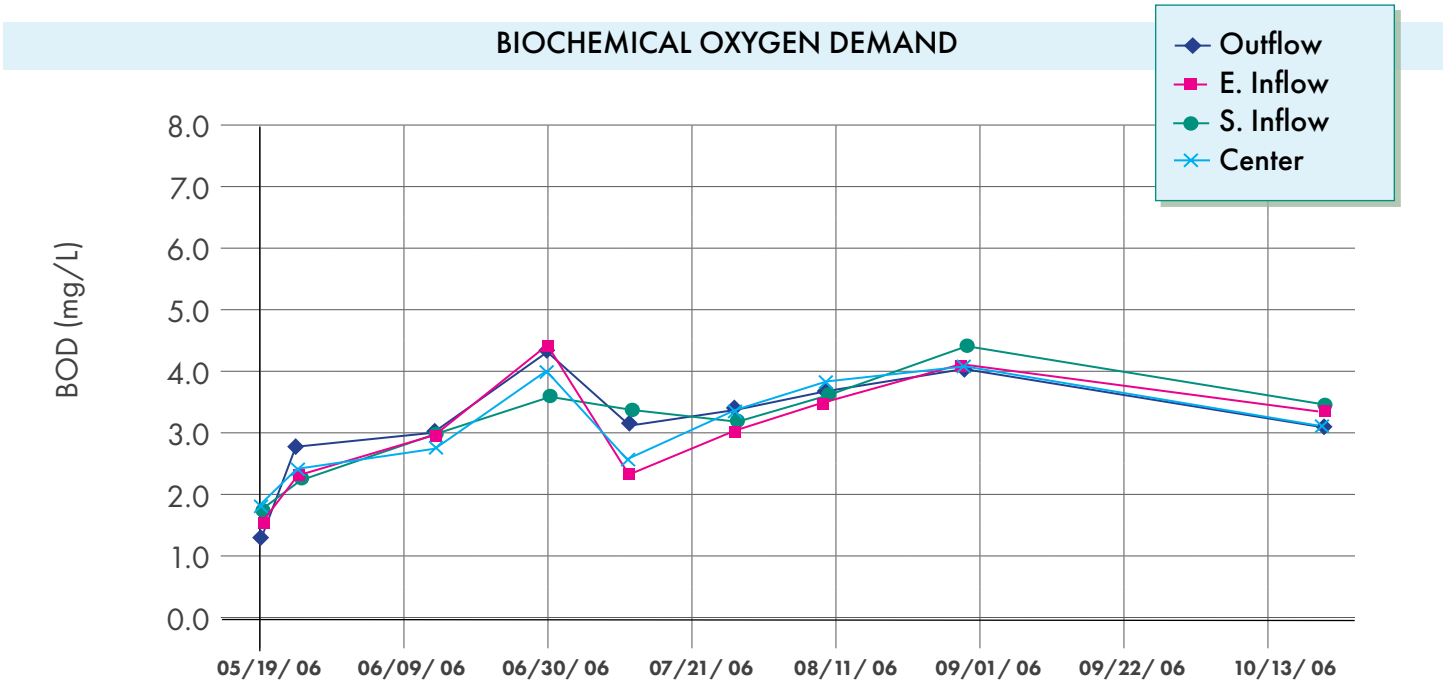


Chart 8: *Biochemical Oxygen Demand (BOD) shows increased deposit of organic matter with heavy rainfall peaking on June 30th.*

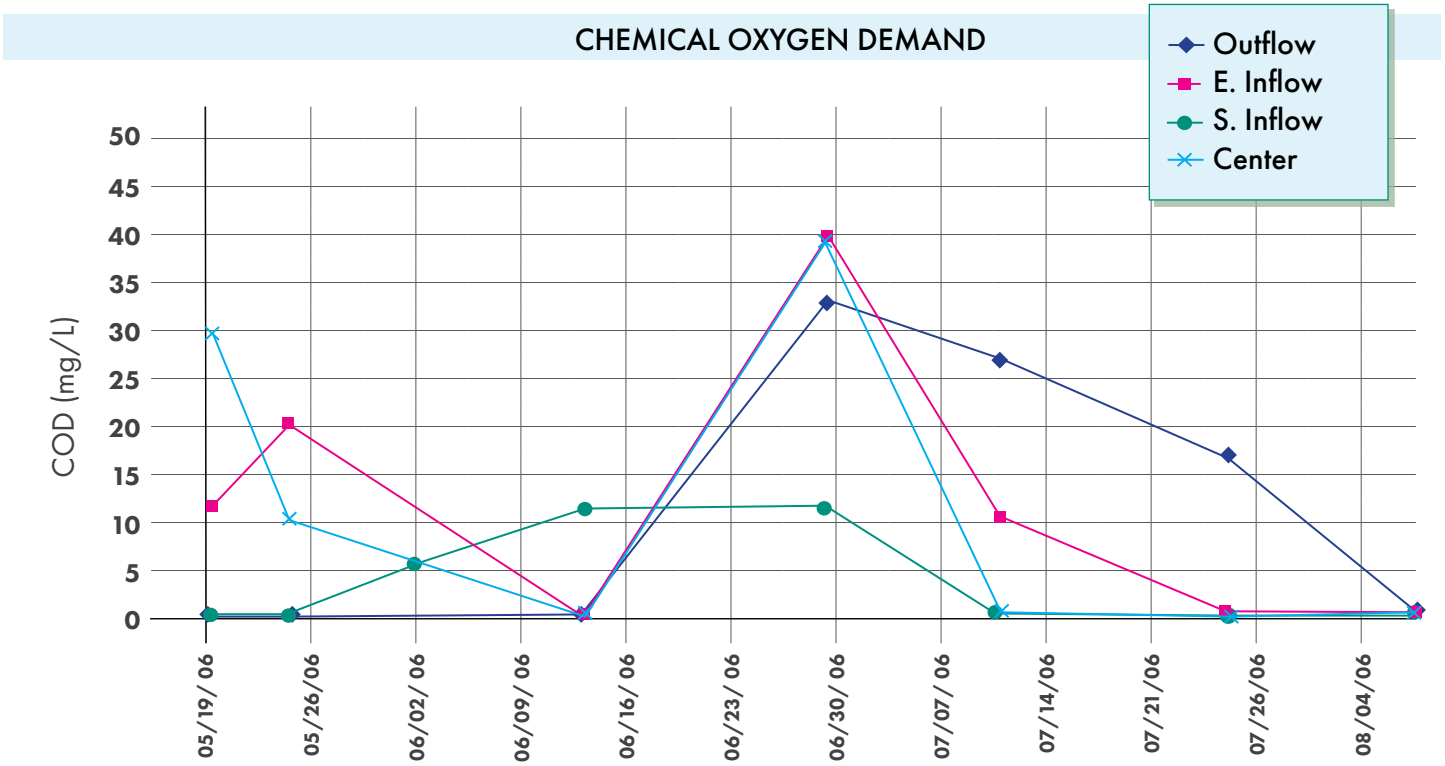


Chart 9: *Chemical Oxygen Demand (COD) shows an increase in influent in heavy rains that then decreases in the outflow as microbial action degrades the organics.*

Chemical Oxygen Demand (COD) is a measurement that includes the biologically degradable material (BOD) plus the non-biodegradable organics that usually require strong chemicals to breakdown. The COD in Occum Pond controlled largely by the introduction of slow-to-degrade and non-biodegradable matter via rain events and the increase in COD mirrors the increase in rainfall. There is also a reduction in the non-biodegradable fractions as the result of high rate microorganisms converting slow-to-degrade compounds to BOD followed by biological oxidation.

Conclusions and discussion:

This first phase of treatment with MICROBE-LIFT® technology was designed to span a period of twelve months. This report summarizes the first six months of treatment with a significant data collection plan. The goals of enhanced water quality, algae reduction, odor reduction and a primary goal of achieving a reduction in the level of bottom solids.

During this first six-month treatment, the augmentation program was negatively impacted by above average rainfall. The heavy rain events were countered by revisions in the treatment programs via changes in the application rates and time of application to assure the most effective treatment.

Based on the data collected, the bioaugmentation program has progressed at a satisfactory rate. Most impressive was the bottom solids reduction while still improving the water quality. In addition, the program achieved odor reduction by eliminating the hydrogen sulfide and other septic odors, and controlled the development of surface algae when compared to the pond history before treatment.

The data was so encouraging that the college made a commitment to continue the program for two years. The results follow:

Fig 3: *Recap: Water condition at the start of the program, May 14, 2006 prior of treatment*

Fig 4: ***Year one:*** *May 15, 2007 after one year of treatment*

Bioremediation of Occum Pond at Dartmouth College Clears Water and Eliminates Algae

SECOND YEAR RESULTS

Fig 5: Year 2: *May 15, 2008 After two years of treatment the pond water is very clear.*

Fig 6: *This pond has been returned to its pristine condition with two years of treatment with* MICROBE-LIFT® *technology. In fact, the water is so clear that one can even see the stocked goldfish as evident in the picture below.*

MICROBE-LIFT® products act by restoring the natural microbial balance in ponds metabolizing excess nutrients that encourage algal growth, eliminating sulfur and other unpleasant odors, and degrading the organics that cause turbidity, toxicity, and oxygen depletion. A MICROBE-LIFT® treated pond is a clean, stable ecosystem that supports fish and other wildlife growth.

For more information on MICROBE-LIFT® Technology contact

Ecological Laboratories Inc.
www.EcologicalLabs.com

CS17110

Lee County Health Park in Fort Meyers, FL Restores Pond Ecosystem with MICROBE-LIFT® Technology

Location: Lee County Health Park, Fort Myers, FL

Background: Health Park is a well-respected health facility in Fort Myers, FL that includes a scenic pond on the grounds.

When this 1.5-acre oval pond became unbalanced, they needed a plan to return it to a healthy state. This 6-foot deep pond showed signs of excessive nutrient loading from lawn fertilizer run-off and the water was becoming turbid. An accumulation of bottom solids and algal blooms indicated inadequate microbiological degradation or "cleansing".

Objective

When contacted for a solution, AquaMaster, a private label distributor of MICROBE-LIFT® technology evaluated the situation and developed a bioaugmentation treatment plan supplemented with AquaMaster surface spray aeration. MasterClear LSC was utilized to increase aerobic metabolism to clarify the water. It also contains denitrifying bacteria that utilize excess nitrate discouraging algae growth. MasterClear Muck B Gone microbial formulation was added to rapidly metabolize the accumulated bottom solids.

The plan called for an initial dosage of 6 gallons of Muck B Gone and 20 gallons of LSC (diluted mix) to be added to the pond. For the next six weeks, 1 gallon of Muck B Gone and 20 gallons of LSC (diluted mix) was applied each week. Thereafter, a maintenance dose of 10 gallons LSC (diluted mix) was added each month. During the program, the pond was monitored twice per month.

Results achieved

After the first six weeks of treatment, significant improvement was noted. The algal blooms were less intense, water clarity had improved, and it appeared that sludge reduction was starting to occur.

After 12 weeks improvement was very obvious. There were only few, slight algal blooms remaining. Water clarity had improved significantly.

Sludge reduction was very dramatic. Originally, 4 inches of sludge was noted at shallow, outer shoreline areas and up to 12 inches at the center of the pond. After 12 weeks of treatment, there was no muck at shallow areas and only 1 to 2 inches of sludge in the center of the pond, Oxygen levels throughout the water column were increased. The pond's BOD (Biochemical Oxygen Demand), the measure of organic loading, was significantly decreased. This shows that the biological activity has increased and degradation of organics or "cleansing" of the water has improved and, due to the aeration, the pond is no longer consuming oxygen faster than it can replenish it. This data indicates that the pond has been restored to an environment where the beneficial microbes can thrive and perform.

The water clarity had improved so greatly that AquaMaster's Bluzyme pond colorant/enzyme mix was used to shade the visible pond bottom from the sun's UV rays, thus, preventing growth of bottom plants.

In summary, the pond's health, balance, and aesthetic appeal have greatly improved as a result of the treatment program. The synergistic use of aeration and beneficial bioaugmentation proved to be a valuable tool in pond maintenance.

For more information on MICROBE-LIFT® Technology contact

Ecological Laboratories Inc.
www.EcologicalLabs.com

CS17111

MICROBE-LIFT® Restores Retention Pond at South Point Office Park in Jacksonville, FL

Location: South Point Office Park, Jacksonville, FL

Background: This 12-acre office park in Florida was designed with a one-acre pond at its bottom edge for water retention. However, as the surrounding areas were maintained with fertilizers and pesticides the pond became filled with algae scum creating a very unattractive eyesore. The primary points of pollution were run-off from fertilizer applied by the lawn care company, grass clippings from the lawn maintenance company, storm water from the parking lot, and debris from surrounding trees. The pond had been previously treated by a different company with chemical algaecide and blue dye to remediate algae but this treatment was not effective long-term.

Objective: In search of improved remediation technology, the management company discovered MICROBE-LIFT® technology. MICROBE-LIFT® (ML) is a series of biological products marketed by Applied & Experimental Microbiology (AEM) of Jacksonville, FL, often under the private label of **Quantum Growth®.** This biotechnology-based product line is manufactured by **Ecological Laboratories Inc.**

When contacted, AEM's technical staff evaluated the problem. They determined that the pond had a significant layer of debris, including leaves, branches, and 3 to 4 inches of bottom solids. In addition, there was high nitrogen loading from grass clippings and fertilizer. Initially, AEM removed approximately 35% of the algae scum from the surface by raking it off from the bank. Then they implemented a **Quantum** growth dosage schedule as follows:

Dose	ML Gal	ML SA Gal	ML PBD 8 oz packets	ML BSF 40 lb bag
Initial Dosage	8	3	20	1
Weekly Doses (4)	2	1	4	
Monthly Maintenance	2	.25	2	

Results achieved

After initiation of treatment in May of 2007, water clarity improved within 48 hours and the algae was completely gone by September (4 months).

MICROBE-LIFT® Restores Retention Pond at South Point Office Park in Jacksonville, FL

BEFORE

AFTER

Fig. 1: *The "before" pictures on the left are not indicative of the actual coverage of algae on the pond because the wind had blown it to one side. On a calm day the coverage was actually 80% of the surface area.*

The office park management was very pleased with the results and the very small maintenance dose required to maintain a clear and aesthetic pond.

For more information on MICROBE-LIFT® Technology contact

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CS17112

Sanctuary Housing Development Utilizes MICROBE-LIFT® Technology on Seven Lakes in Jacksonville, FL

Location: Sanctuary Housing Development, Jacksonville Beach, FL

Background: After a dramatically successful remediation of a pond in their upscale housing development using MICROBE-LIFT® technology, the management of this development chose to treat all the lakes within its borders.

MICROBE-LIFT® technology is incorporated into a series of bioremediation products developed and manufactured by Ecological Laboratories inc. This series includes the following formulations designed for lake or pond treatment:

- MICROBE-LIFT®/PL – for organic removal
- MICROBE-LIFT®/SA – for bottom solids reduction
- MICROBE-LIFT®/PDB – professional dry blend for leaves & twigs
- MICROBE-LIFT®/BARLEY (BSP) – binds nutrients

Initially it is important to first inspect pond and lake conditions by assessing water quality (nutrients and organics) and measure bottom solids to assess cause of pollution to determine proper product application. Establish baseline data for water clarity, pH, nutrient levels and presence of algae. Identify the type of algae present. Once the analysis is completed, a treatment plan is developed. General application rates per surface acre are listed below:

Product	Initial Dose	Weeks 3 - 5 Weekly Dose	Maintenance Dose (Monthly)
MICROBE-LIFT/PL	10 Gal	2 Gal	2 Gal
MICROBE-LIFT/SA	3 Gal	1 Gal	¼ Gal Based on Bottom Solids
MICROBELIFT/PBD	20 - 8 oz Packets	4- 8 oz Packets	2- 8 oz Packets
MICROBE-LIFT/BSP	40 Lbs	See Application Chart	See Application Chart

Fig. 1: *Dosage rates per acre/by product. Note that application rates may vary depending on site conditions.*

This development had a total of seven lakes and three creeks with a total surface area of 8.5 acres. The waters were all brackish with salinity between 10 and 17 ppt. The Intercoastal Waterway fills three lakes directly through creeks at high tide. The lakes are created by weirs that stop the water flow on outgoing tides. Another three lakes are fed directly from the Intercoastal Waterway annually during storm season through breaching the spillway systems. Lake number seven is totally landlocked. All lakes have loading from storm drains, watering from lawn-care companies, runoff, and natural debris. The homes are close to the waterways, some as close as four feet.

The following picture shows the position of the lakes and the general location of the homes. Lake two was the first lake treated with "before" pictures taken in February 2009 and “after” pictures taken in October 2009, eight months later.

Fig. 2: *Aerial view of the property showing all lakes to be treated, the location of homes, and the relationship to the Intercoastal Waterway.*

Each lake was assessed and treatment modified slightly based on conditions of each lake. Overall objectives are to decrease or eliminate surface scum of oils and algae, reduce bottom solids and organic debris, and improve water clarity.

Results Achieved: Lake #1:

This is a 2-acre lake with a spillway to the Intercoastal Waterway connected by two culverts that will backflow in the event of storms. While there was a healthy, beneficial population of natural plants growing in the southwest corner of the lake, there was erosion along the entire west bank. There was moderate nutrient loading from lawn care companies, run-off and natural debris. This lake had a history of moderate algae blooms

Fig. 3: *Overview of Lake #1.*

The pictures below show the condition of Lake #1 before and after treatment. The first set of pictures show the north shore of the lake.

Fig. 4: *These are pictures of before treatment (left) and after treatment (right). These are views of the north side of lake #1. Algae scum on the left has been completely removed.*

Fig. 5: *These pictures show the removal of the algae that was so evident prior to treatment in the pictures on the left versus the clear water in the right set of pictures resulting from* MICROBE-LIFT® *treatment. This is the south shore of lake #1.*

Results Achieved: Lake #2:

Lake #2 is a 2-acre lake connected to Lake #1 by one culvert. Heavy loading from lawn care companies, run-off, natural debris, and development on the east bank have degraded the water quality. There is no Intercoastal Waterway.

Fig. 6*.: Aerial view of lake #2*

Fig. 7: *Based on "before treatment" pictures on the left and "after treatment" pictures on the right,* MICROBE-LIFT® *treatments were very successful in #2.*

Fig. 8: Additional "before" (left) and "after" (right) pictures of lake #2.

Results Achieved: Lake #3:

Creek and Lake #3:

The creek and Lake #3 make an hourglass shape as seen on the right of this aerial view. This lake is fed by a creek from the Intercoastal Waterway transferring under the road as seen by the white section in this view. The creek is impaired at low tide by accumulated bottom solids of approximately 3 ft. Moderate load from lawn care and heavy load of natural debris are targeted for remediation.

Fig. 10: **Lake #3** *also shows dramatic results from* MICROBE-LIFT® *treatment. Pictures prior to treatment on the left show algae and scum, which is no longer present in pictures of treated lake on the right.*

Fig. 11: *The adjoining creek also showed benefits of treatment.*

Results Achieved: Lake #4:

Creek and Lake #4:

This one-acre lake is fed by a tidal creek from the Intercoastal Waterway. It is an elongated lake with the creek running under the white section in this aerial view. Heavy bottom solids have accumulated on the eastern section of the lake. There is good flow from the tidal creek to the Intercoastal Waterway.

Fig. 12: *Aerial view of Lake #4 and the creek feeding it.*

Fig. 13: Before and after pictures show results of treatment in Lake #4. Surface scum visible in "before" pictures on left are no longer visible and water clarity has substantially improved. Bottom solids have also been reduced.

Fig. 14: Likewise the river responded to treatment with less scum and dramatically increased water clarity.

Results Achieved: Lake #5:

Creek and Lake #5:
This is a 0.75-acre lake with a tidal stream that connects to the Intercoastal Waterway. Both the lake and creek have moderate to heavy bottom solids. There is a heavy load from the accumulation of natural debris.

Fig. 15: *The aerial view on the right shows the lake and the channel to the Intercoastal Waterway.*

Fig. 16: *Pictures below on the left prior to treatment show scum, turbidity, and debris that is no longer present in pictures on the right taken after treatment.*

Fig.17: *Before (left) and after (right) pictures of the creek.*

Fig. 18: *Additional pictures of the creek associated with Lake 5 show the increased clarity of water after treatment (right) as opposed to those taken prior to treatment (left). The major benefit was reduction in bottom solids, which provides additional turbidity to be degraded.*

Results Achieved: Lake #6:

Lake 6:

Lake 6 is a 1.5-acre lake with a spillway that flows into a creek totally obstructed by accumulated bottom solids that are overgrown with vegetation. This lake experiences moderate loading from lawn care, nutrient run off and natural debris.

Fig. 19: *Note the scum in pictures of untreated lake (l eft), which are dramatically reduced or eliminated with treatment (right).*

Results Achieved: Lake #7:

Lake 7:

A 0.75-acre lake connected to storm drains from the street, this lake has no connection to the Intercoastal Waterway. There is a great natural wetland on the southern edge of the lake. This lake still suffers from collected debris and increased nutrients from nearby homes.

Interestingly, MICROBE-LIFT® technology was able to remediate all seven lakes in spite of heavy influx of seawater and homes very close-by with associated debris and run off of harmful home care chemicals including fertilizer and pesticides. MICROBE-LIFT®'s reduction of bottom solids helps restore the natural and bioaugmented restorative powers of such waterways allowing reduction of dosage to maintenance levels for continued remediation.

Fig. 20: *Pictures demonstrate improved surface cleanliness and improved water clarity.*

For more information on MICROBE-LIFT® Technology contact
Ecological Laboratories Inc.
www.EcologicalLabs.com
CS17113

A Favorite Austrian Swimming Pond Was Restored by MICROBE-LIFT® Technology

Location: Municipal Parks & Recreation, Aschach, Austria

Background:

The swimming pond was a key attraction of this weekend community. The pond was created by a dam and was used solely for swimming. Due to the build-up of organics and grease from sun tan oil, the pond was experiencing algae blooms, causing a slimy coating on the pond's edges and on the floating diving board rafts. At various times during each season the pond would be closed due to these general water conditions and health risks which included higher than acceptable levels of Escherichia coli.

After some experiments and advice from "experts" this municipality had tried unsuccessfully with numerous products, including chemicals and microorganisms, to try to clear the algae. They never could stop the algae growth or maintain acceptable levels of coliforms.

Objective

When **Ecological Laboratories,** the creator of MICROBE-LIFT® technology for wastewater, learned of the problem they offered a solution. They evaluated the analysis of water conditions and proposed a bioaugmentation program.

The pre-trial water analysis (shown below) had been ordered from Steinbacher & Steinbacher Laboratories on 5/3/98 by Mr. Helmut Raab. Water quality results indicate high level of nitrate and nitrite, which contribute to conditions that favor the growth of algae. Often this indicates a relative deficiency of denitrifying microbes that can convert these compounds to nitrogen gas, which will be passed to the atmosphere.

	GUIDELINE VALUE	MEASURED VALUE
pH	6.5 - 8.5	7.1
electic conductivity		1190
hardness		31.9
carbonate hardness		24.5
magnesium hardness		7.4
Ca ++/ppm		175
Mg++/ppm		31,1
NH4+/ppm	0.05	0,01
NH4-Nippin N	0.04	0,006
NO3-/ppm	50	46
NO3-Nippan N	11,3	10,4
NO2-/ppm	0,01	0,003
NO2-Nippan N	0,003	0,009
Cl-/ppm	100	45
SO4-/ppm	250	115
Fe++/ppm	0,1	0,02
Mn++/ppm	0,05	0,00
H2S/ppm	not detectable	not detectable

Fig.1: ***Water quality prior*** *and during treatment.*

Note: -N: calculated with M(O)=16,M(H)=1, M(N)=14, results are reported in mg/l.

Results achieved

Inoculation with MICROBE-LIFT® formulation resulted in significant reduction in organics and reduction of Escherichia coli to well below the regulated limits. Visually, the slime coating was eliminated; In general the conditions of the pond were significantly improved. For the first time in many years, the pond was not longer forced to close for periods of time.

PARAMETERS	METHODS	UNIT	MEASURED VALUE
appearance	organoleptic	-	clear
color	organoleptic	-	colorless
odor	organoleptic	-	faint moldy
oxidizable	ONDRM M 6249	mg KMnO4/L	1,6
chlorophyll (a)	DIN 384 12-Teil 16	pg/L	<3
NH4-N	ONORM ISO 7150/1	mg N/L	0,02
NO2-N	ONORM M 6282	mg N/L	0,003
NO3-N	ONORM M 6283	mg N/L	0,25
P	ONORM M 623775	mg P/L	<0.010

***Fig. 2**: Results after treatment show reduction in nitrogenous compounds.*

	Guideline Value	New Anaysis before BTM--System	New Anaysis with BTM--System
NH4-N/ppm	0,04	0.008	0.02
NH4-N/ppm	11,3	10,4	0.25
NH4-N/ppm	0,003	0,009	0,003
Total Nitrogen	n.a.	10.417	0.273

***Fig 3:** This table highlights the critical data before and after treatment BTM –system.*

In the words of the Superintendent of Municipal Parks and Recreation, Mr. Helmut Ransomed,

*"Thanks to your analysis on site and your right combination of your products, we now have mastered the algae problem. About 3 weeks after initiation of treatment we could see a dramatic improvement of the situation. Even the persistent algae in the swimming part and around the spring stone and on the stones around the pond died away and were dismantled by the microorganisms! Additionally the water is now not only clear, it is crystal clear, and when you swim the feeling on your skin is comfy and soft. For me there is only one conclusion: If you're facing a problem concerning pond water, there is only one product to use...*MICROBE-LIFT®*."*

A Favorite Austrian Swimming Pond Was Restored by MICROBE-LIFT® Technology

Fig 4 & 5: *These pictures show the remediated condition of the swimming pond.*

For more information on MICROBE-LIFT® Technology contact

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CS17114

ECOSYSTEM RESTORATION

17200 River and Lake Clean-Up

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17200

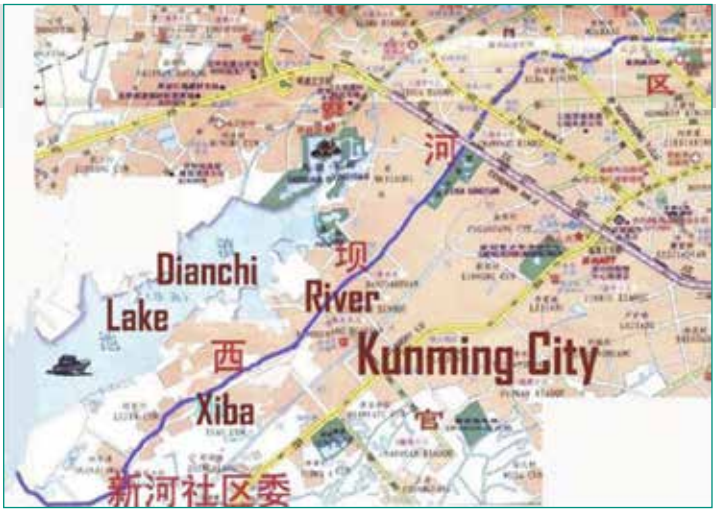
Made in the USA

Engineering Research of the Microbial Revitalization of Xiba River with Microbe-Lift® Technology

Location: **Kunming City, Yunnan Province, China**

Study conducted by Prof. Hu Kailin, Deng Liu, Wang Lifeng, Dang Yan, Chen Yusong, Han Bing and Wang Hao (Faculty of Environmental Science & Engineering, Kunming University of Science and Technology, Kunming) Project Advisor: Goh Kwang Beng. Project Period21 Nov 2004 to 22 April 2005.

Introduction:



"More than US$ 2 billion have been spent from 1993 to 2000 to clean up the Dianchi Lake in China's scenic Yunnan province. But the investments have produced little if any payoff because they have not addressed the root sources of pollution such as agricultural runoff. The central and provincial governments are now looking for innovative ways to address the problem." Quoted from an online April 2000 report by the U.S. Embassy Beijing.

According to a 1998 report by the State Environmental Protection Administration (SEPA), 185 million cubic meters of liquid waste were dumped into the Dianchi Lake in 1995, of which roughly 50 million cubic meters were industrial wastewater and 135 million cubic meters were domestic sewage. Pollution levels in the upper Dianchi Lake still regularly exceed the worst level (Five) on China's five-level water quality scale. Level-Five is defined as being suitable for agricultural use but not appropriate for swimming or for fishing. Water quality is somewhat better in the southern part of the Lake, usually measured at level-three (acceptable for swimming and fishing) or level-four (suitable for industrial and non-swimming recreational use) standards. The current target is to improve water quality throughout the lake to a minimum level-four standard by 2010.

The cleanup measures to date have failed to stem the pollution because they have focused almost exclusively on point sources around the lake's periphery. They have not addressed agricultural runoff or pollution of the Lake's tributaries. According to a recent press report, 80 percent of domestic sewage entering the 16 rivers that flow into the Dianchi Lake remain untreated. Meanwhile, heavy use of chemical fertilizers and pesticides on farm fields lying east of the Lake leads to extremely high runoff of nitrates and phosphates. According to the 1998 SEPA report, 1,021 metric tons of phosphorous and 8,981 tons of nitrogen entered the Lake in 1995. The Dianchi Lake Management committee is fully aware that the main cause of water pollution is water flowing into Dianchi from its 16 tributaries.

Ecological Laboratories authorized representatives from the United States presented a program for biological remediation of Dianchi Lake using Ecological's unique bacteriological based products in March 2004. The small, but badly polluted river was offered to Oakwell Engineering as a trial project using products formulated with Ecological's MICROBE-LIFT® proprietary technology. The Xiba River flows into the most polluted Northern part of Dianchi Lake, and was deemed to be good, but challenging test of open water bioremediation. Kunming

Engineering Research of the Microbial Revitalization of Xiba River with Microbe-Lift® Technology

University of Science & Technology was engaged as an independent research party to conduct the trial, and working as the local administrator for the project.

A preliminary laboratory test on the effectiveness of Ecological Laboratories products in treating the polluted water and sludge in Xiba River was conducted at the University in May 2004 with satisfactory results. However, the actual trial project was postponed to 21 November 2004 to avoid the rainy season in July and August. The project was carried out from 21 Nov 2004 to 22 April 2005.

Objective of the Xiba River Trial:

Formulations developed, manufactured and packaged by Ecological Laboratories were proposed as a bioremediation product for the Dianchi Lake rehabilitation in March 2004. The Dianchi Management Committee offered Xiba River to Oakwell Engineering Limited to conduct a trial testing the effectiveness of these products in treating polluted water in the Dianchi Lake. The river is a small, slow flowing tributary with extremely polluted water emanating a bad odor. The trial project was conducted to determine the effectiveness of this unique and novel biological treatment plan to eliminate odor, improve water quality and to accelerate river rehabilitation to reinstate higher forms of living organisms in the river.

What is MICROBE-LIFT® Technology?

MICROBE-LIFT® products are highly active liquid bacteriological consortiums designed specifically for use in polluted lagoons, lakes, rivers, industrial and municipal wastewater systems. This "core technology" contains a diverse blend of selected microorganisms with a specification of 387/450 million microorganisms/ml. The product, through Bio-augmentation, accelerates the biological oxidation of slow to degrade organic matter utilizing a broad spectrum of aerobic, anaerobic, facultative, chemo- and photo-synthetic bacteria.

Products manufactured with MICROBE-LIFT® formulas by **Ecological Laboratories** are very effective....
In enhancing the biological oxidation of the slow to degrade organic compounds various types of wastewater systems, as well as open water ponds, lakes, lagoons, and rivers. Treatment results have significantly improved overall system performance and environmental health and stability.

By increasing overall microbial oxidation rates, significantly increasing organic degradation performance. This unique microbial consortium provides reductions in final effluent BOD, COD, TSS, turbidity and improves effluent discharge into the rivers, lakes or sea, while reducing waste sludge volume that has been built up in the river bed over time.
The Xiba River has very high nitrogen and phosphorus content that supports eutrophication, which in turn causes serious algae problems in the lake. Bioremediation is the most cost effective means in reducing eutrophication and improving water quality in the river.

About Xiba River

The Xiba River is 4km long, with a width range from 4 to 9m, and a depth ranging from 0.5 to 1.0m. The average flow rate is 0.3 m3/s (26,000 m3 per day). The water is badly polluted and has a grayish color most of the time. It emanates bad odors, particularly during the dry months from April to August, that can be detected as far as 20m from the river bank.

The pollutants are mostly from illegal dumping of direct domestic sewer discharge, agricultural and animal farm wastewater, slaughter house wastewater as well as small industrial waste, including waste from cement plants. River flow can be extremely high during illegal discharge, occasionally completely upsetting trial results. The trial was conducted in the last 1.5km before the river mouth at Dianchi Lake.

Figure 2: *Condition of Xiba River before Trial Treatment on 21st November 2004*

Procedure of the Xiba River Trial.

The trial was conducted on the last segment of Xiba River on a stretch ranging 1,460m to 300m from Dianchi Lake. The segment from 750m to 1,260m was installed with our uniquely designed biomedia to increase the bacteria resident count. Fig 3 shows the dosing and water sampling locations. Dosing is applied daily based on water flow volume at approximately 1 ppm per day. The MICROBE-LIFT® formulation was poured directly into the designated dosing location. Water samples were taken from the river with a plastic cup with an extended arm scooping water from the river center at the sampling point.

Fig 3: *Dosing and water sampling location of the Xiba River trial*

The water parameters that were monitored were BOD5, CODcr, Total Nitrogen, Total Phosphorus, Turbidity, TSS and pH on a weekly basis. Appendix 1 tabulates the dosing volume, water parameter measurement record and weather record during the trial period.

Table1 shows the water parameters before treatment at the beginning of the trial. The ultimate desired standard of the authorities is Level-Three, as indicated in the last column of the table for reference.

Parameter	Before Treament April 5, 2004	Start of Treatment November 21, 2004	Level III Standard
COD (mg/l)	176	56.20	20
BOD (mg/l)	64.4	31.8	4
TSS (mg/l)	63	8.0	
TN (mg/l)	28.1	11.04	1.0
TP (mg/l)	2.58	1.0	0.1
Turbidity	130	39.8	
pH	7.29	7.0	6 - 9

Table 1. *Existing Water Parameter vs Level III standard*

Dosing Computation

A river is a continuous dynamic system with great variations in flow from time to time. It is not possible to accurately compute the water volume and retention time in the trial zone. We have computed the dosing based on the assumption that river flow is relatively low as has been noted at the site most of the time. The trial zone was designated from the 300m from the mouth of the Dianchi Lake upstream 1,460m, for a total treatment zone of 1,160m in length. The average width and depth at this section of the river is 6.0m and 0.9m respectively. This gives a total volume of 7,884 m3. The normal flow rate without major dumping or rain is 0.3 m3/s. This gives an average retention time of 7.3 hours. That means the water takes approximately 7.3 hours from the beginning of the test zone at D1 to the end of test zone at T4. Since the retention time is less than 24 hours in the test zone, dosing is computed based on daily flow rate as per manufacturer's recommendation.

Based on a 0.3 m3/s flow rate, daily volume of water flow is 26,000 m3 (6.8 million gallons). At 10 ppm inoculation, 68 gallons will be needed. At the time of project evaluation, the estimated flow was based on 3.2 million gallons per day as detected earlier. The inoculation was hence carried out with 32 gallons on 21 Nov 2004. The flow rate was subsequently detected at 6.8 million gallons per day, it was then recommended to maintain 4.7 ppm of daily flow rate per week for the next four weeks. Regular large volumes of untreated wastewater were found to have been dumped into the river, thus upsetting the water volume computation and trial progress.

It was decided that the dosing be converted to 6 gallons (0.88 ppm per day based on daily flow volume) dosed on a daily basis from 13 Dec 2004 onwards. There were some minor changes to actual dosing depending on site condition and progress. In general, the daily dosing was divided into 4 portions with 65% dosing at dosing point C just before the start of biomedia. Very low dosage was applied at dosing point A and B because the river at this section is very narrow and has a low water volume. 15% of the estimated dosing was applied at dosing point D at the middle of the biomedia section to ensure that is sufficient bacteria to flow to the last section of the trial. With a flowing river of this nature, a single point dosing is sufficient as experienced in this trial.

Water Quality Monitoring and Result Evaluation

Water samples from four locations as indicated in Fig 3 namely T1, T2, T3 and T4 were taken on a weekly basis for water parameter monitoring. T1 is located 90m before the first dosing point upstream. The water parameter at T1 represents pre-treatment water sample. T2 is located at the middle of the biomedia zone. The water here is subject to 2 to 3 hours of treatment as it flows from T1 to T2. T3 located further downstream, 650m from Dianchi Lake. The water at T3 has gone through approximately 5 hours of treatment under normal flow. T4 is the last water sample point at 300m before Dianchi Lake. The water at T4 has been treated for approximately 7 hours under normal flow rate.

The water parameter varies from day to day as upstream discharge changes. The water quality downstream is therefore greatly influenced by upstream water parameters, i.e. influent quality at T1. It is therefore meaningless to track the water quality over time like in a lagoon system. Our objective then is to track the improvement of water quality from T1 to T4 on the day of measurement.

The commencement of the trial period coincided with a very unfavorable period of cold temperature. Although Kunming City has the reputation of a city with eternal spring, there were two periods with sub-zero temperatures and snow which severely affected the effectiveness of MICROBE-LIFT®. The period from November to March falls in the dry season, however there were a few instances of heavy rainfall in addition to low temperatures during the trial period that changed the river water completely on 29th Nov 2004, 18th Dec 2004, 12th Jan 2005 and 23rd March 2005. Besides the weather factors, the regular dumping of huge volumes of untreated polluted water upset the trial further. This is reflected on 6th March and 27th March 2005. The water quality improved significantly from T1 to T4 from Feb 6th to Feb. 27th Feb 2004. However, the improvement was severely interrupted by further dumping of a huge volume of untreated agricultural wastewater on Feb 28th 2005.

Following the dumping on 28th Feb, there was unexpected snowfall on 3rd and 4th of March with temperatures ranging from -1 to 10°C. Dosing was called off on the 4th and 5th of March 2005 and resumed on the 6th of March. Despite the interruption, the trial zone recovered its earlier ecological balance within two weeks from 6th March as seen on 20th March 2005. The ecological balance this time round was, however, upset by a huge volume of very alkaline wastewater dumped by a cement factory upstream. The river was completely covered with milky water on 23rd March 2005. The dosing ended on 29th March 2005 due to a delay in new shipment. Dosing resumed on 10th April 2005. However, the trial continued to be interrupted by blatant dumping of huge volumes of untreated wastewater. The trial ended on 22nd April 2005.

Xiba River Project

Selective Result Presentation.

T1 Untreated water Sample
T2 2nd water Sample at Biomedia Zone
T3 3rd water Sample 650 m from Dianchi Lake
T4 4th water Sample at 300 m from Dianchi Lake

BOD5 mg/l

Date	T1	T2	T3	T4	Remarks
11/21/2004	31.80	31.90	27.60	28.30	Inoculation
12/19/2004	38.80	41.50	38.30	41.90	Not much change noted
02/06/2005	14.30	12.50	7.07	7.67	about 50% improvement at T3 and T4
02/27/2005	20.90	30.60	13.00	8.81	About 60% improvement
03/06/2005	21.10	23.00	26.00	30.30	Affected by dumping and snow
03/20/2005	45.00	24.00	20.10	21.40	System recovered within two weeks
03/27/2005	30.40	38.80	31.60	26.20	Affected by cement factory waste

CODcr mg/l

Date	T1	T2	T3	T4	Remarks
11/21/2004	56.20	64.30	60.20	76.30	Inoculation
12/19/2004	90.00	88.00	92.40	94.00	Not much change noted
02/06/2005	100.00	76.00	58.00	52.00	about 50% improvement at T3 and T4
02/27/2005	53.35	71.14	43.47	39.52	about 25% improvement
03/06/2005	90.90	86.94	82.99	81.02	Affected by dumping and snow
03/20/2005	130.42	94.85	75.09	67.18	System recovered within two weeks
03/27/2005	88.92	90.90	86.94	81.02	Affected by cement factory waste

TSS mg/l

Date	T1	T2	T3	T4	Remarks
11/21/2004	8.00	5.50	4.50	2.50	Inoculation
12/19/2004	9.50	8.00	9.00	11.00	Not much change noted
02/06/2005	3.50	7.50	3.00	5.50	increase at T4, reason unknown
02/27/2005	23.00	8.50	4.00	6.00	80% improvement
03/06/2005	9.00	10.00	8.50	24.00	Affected by dumping and snow
03/20/2005	8.50	4.00	3.00	0.50	System recovered within two weeks
03/27/2005	3.00	4.00	2.00	1.50	Affected by cement factory waste

Turbidity (NTU)

Date	T1	T2	T3	T4	Remarks
11/21/2004	39.80	40.40	41.00	36.20	Inoculation
12/19/2004	67.60	67.70	68.20	60.50	Not much change noted
02/06/2005	30.50	23.20	11.20	12.90	about 60% improvement at T3 and T4
02/27/2005	11.40	28.10	12.20	2.80	Water clarity at T4 is about 1 m
03/06/2005	39.30	35.70	37.10	40.40	Affected by dumping and snow
03/20/2005	58.10	53.40	47.20	38.90	System recovered within two weeks
03/27/2005	45.70	52.10	49.20	42.60	Affected by cement factory waste

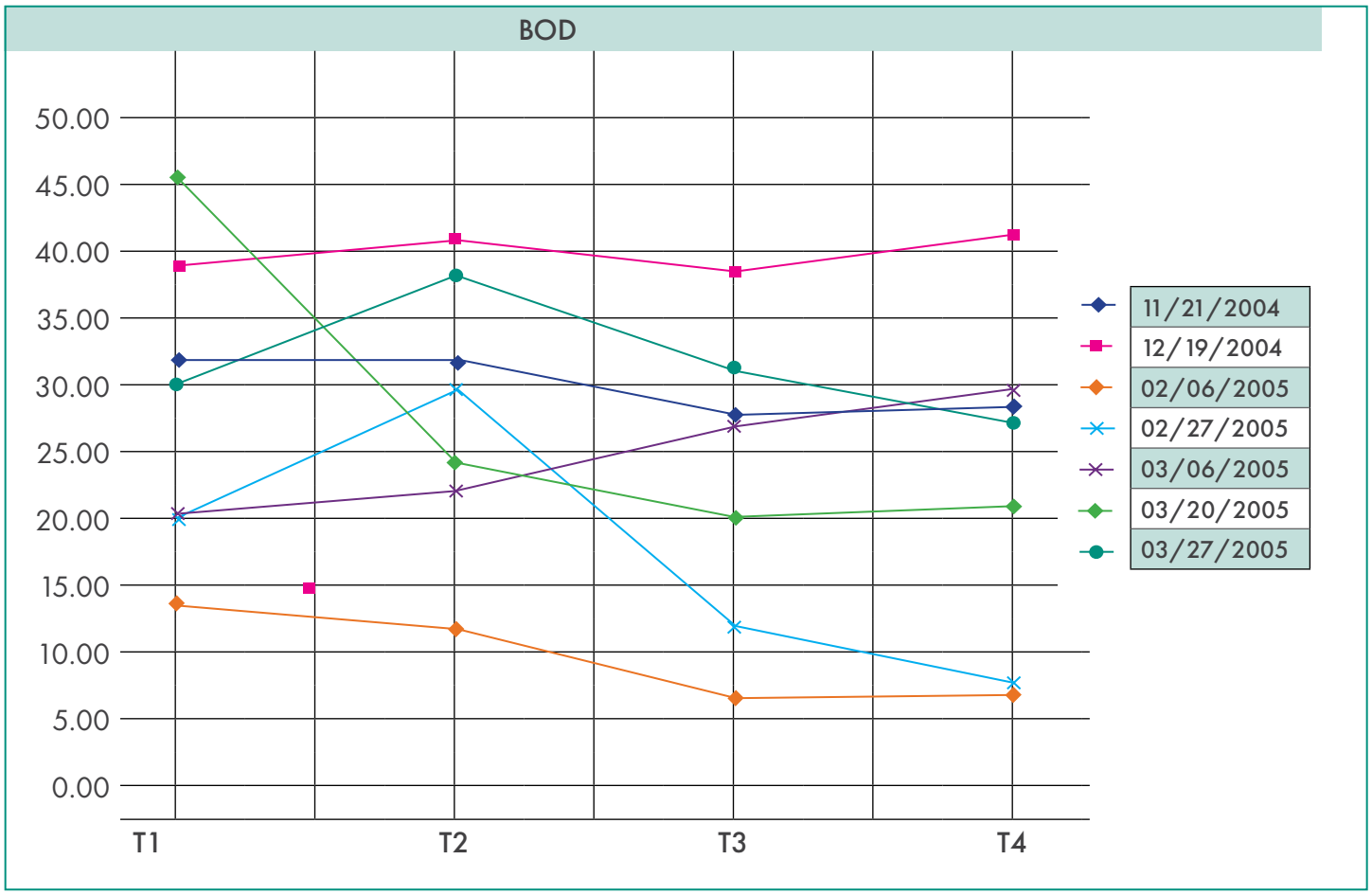
Total Nitrogen TN (mg/l)

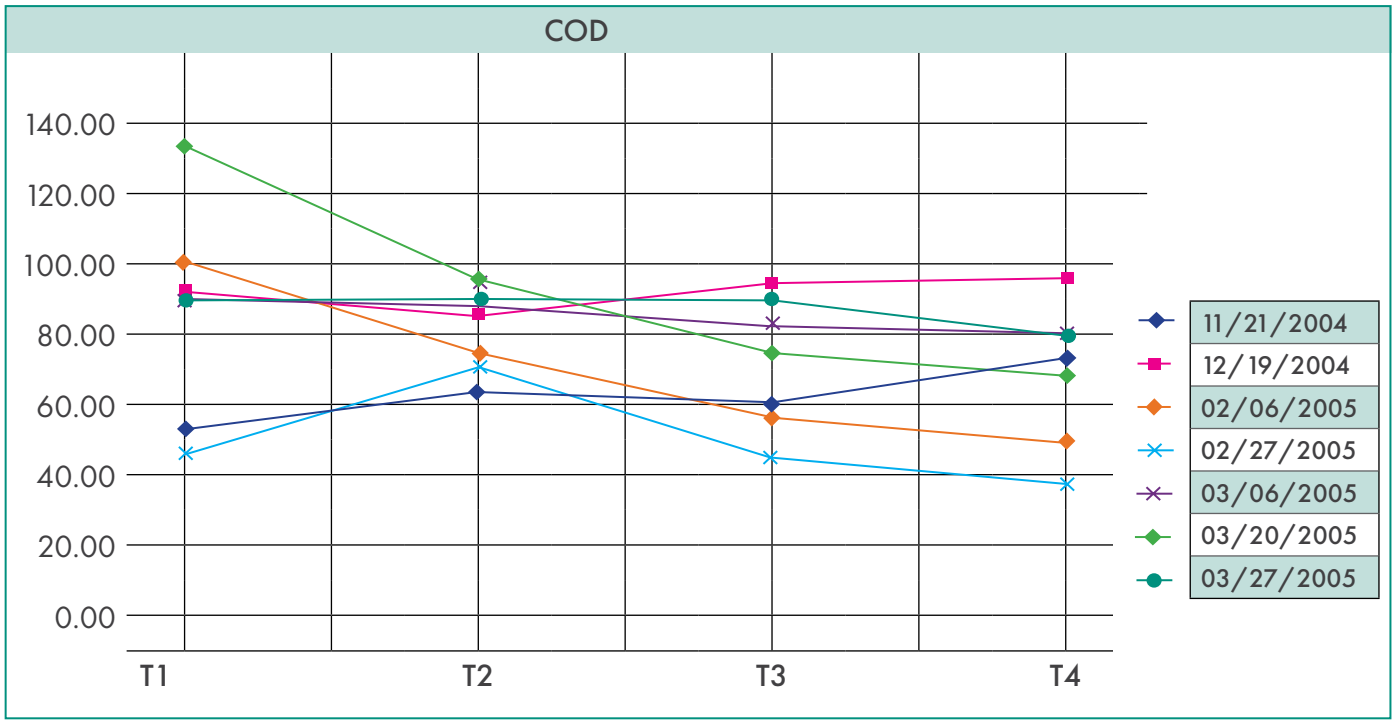
Date	T1	T2	T3	T4	Remarks
11/21/2004	11.04	15.15	16.12	15.34	Inoculation
12/19/2004	13.48	14.58	12.93	13.48	Not much change noted
02/06/2005	21.50	18.90	13.80	12.40	about 40% improvement at T3 and T4
02/27/2005	8.19	7.37	8.47	7.78	
03/06/2005	13.26	13.26	13.81	12.85	Affected by dumping and snow
03/20/2005	16.41	13.81	10.93	10.10	System recovered within two weeks
03/27/2005	14.77	9.29	9.70	8.50	Affected by cement factory waste

Total Phosphate TP (mg/l)

Date	T1	T2	T3	T4	Remarks
11/21/2004	1.90	1.64	1.73	2.03	Inoculation
12/19/2004	2.23	2.39	2.52	2.61	Not much change noted
02/06/2005	1.55	1.42	0.96	0.84	about 40% improvement at T3 and T4
02/27/2005	1.40	1.61	1.37	1.12	
03/06/2005	1.49	1.66	1.67	1.74	Affected by dumping and snow
03/20/2005	2.60	2.39	2.08	2.04	System recovered within two weeks
03/27/2005	1.68	1.93	1.71	1.75	Affected by cement factory waste

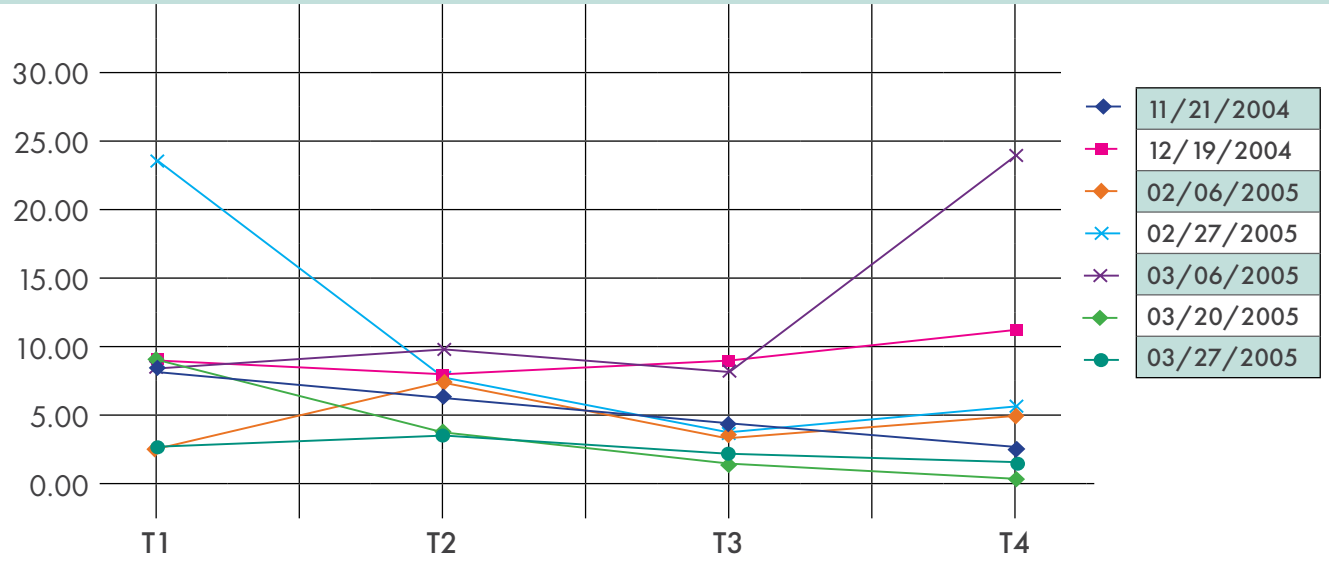
Engineering Research of the Microbial Revitalization of Xiba River with Microbe-Lift® Technology





Engineering Research of the Microbial Revitalization of Xiba River with Microbe-Lift® Technology

TSS



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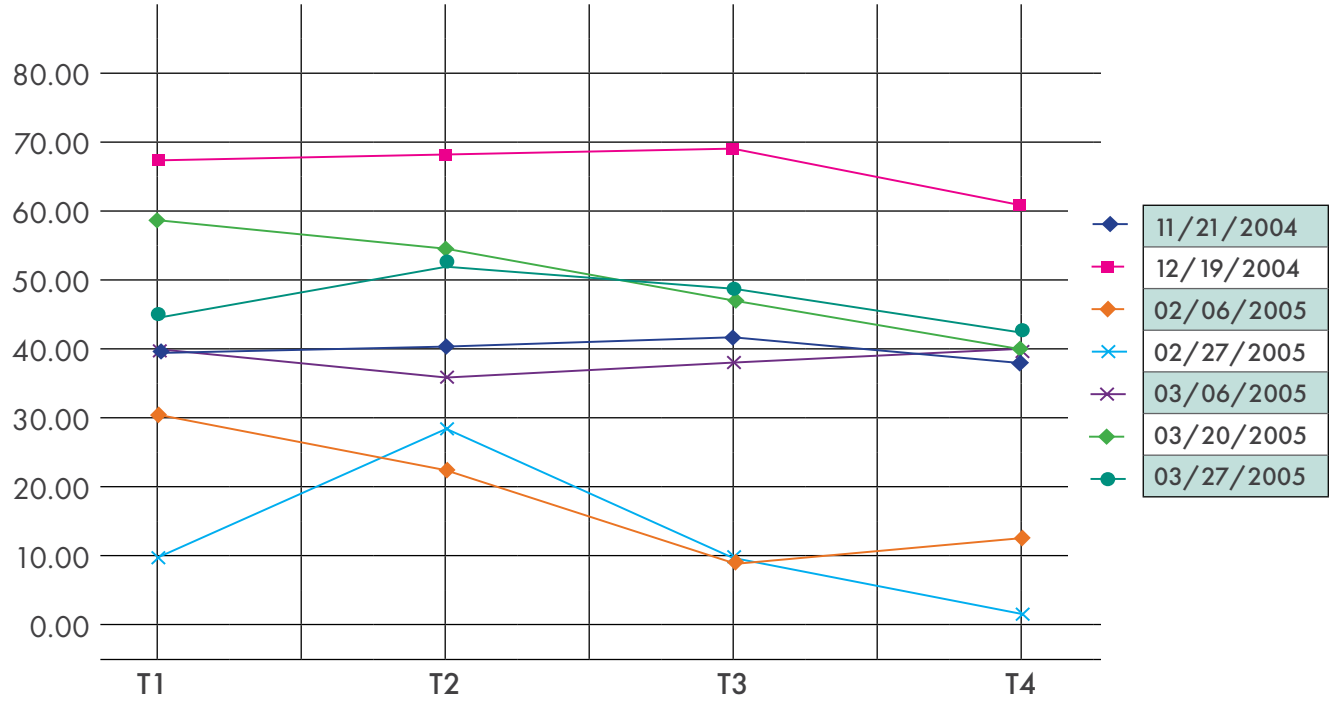
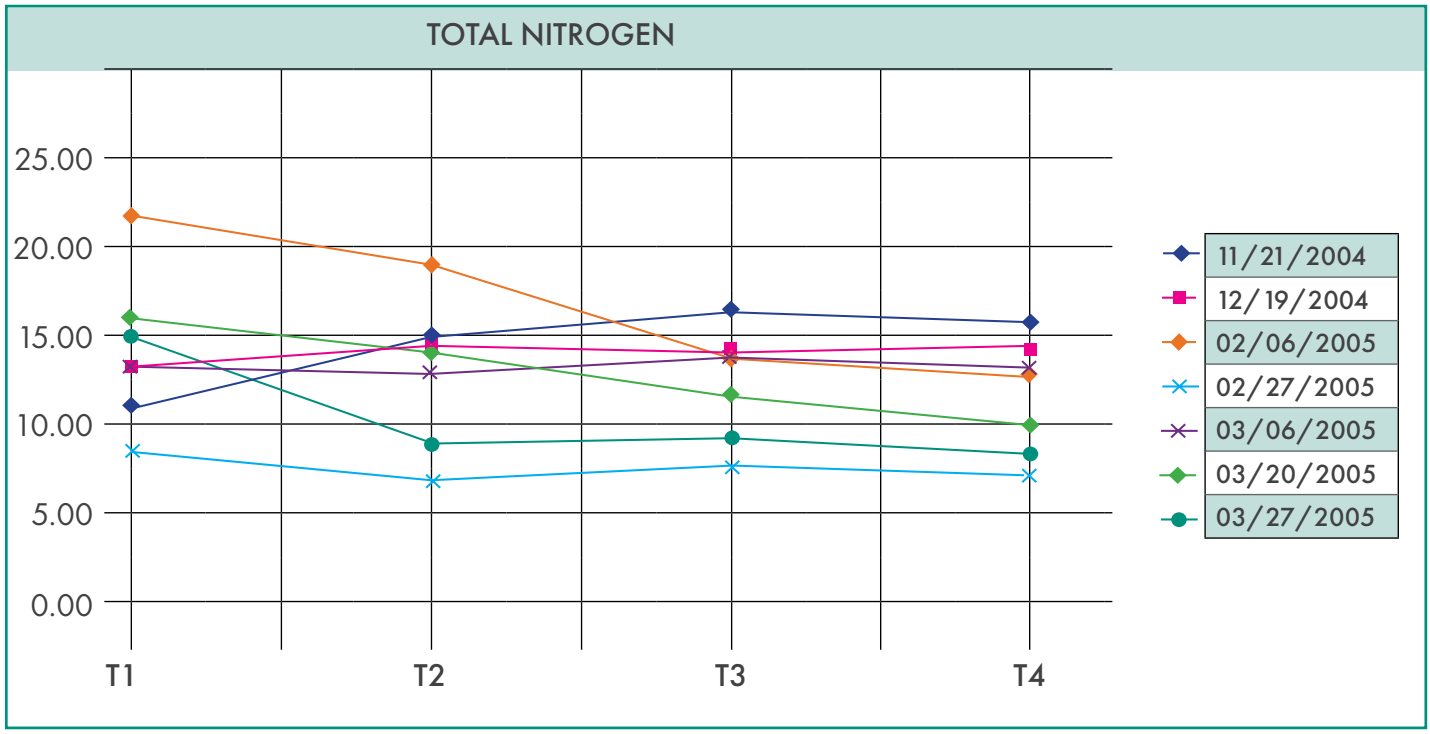




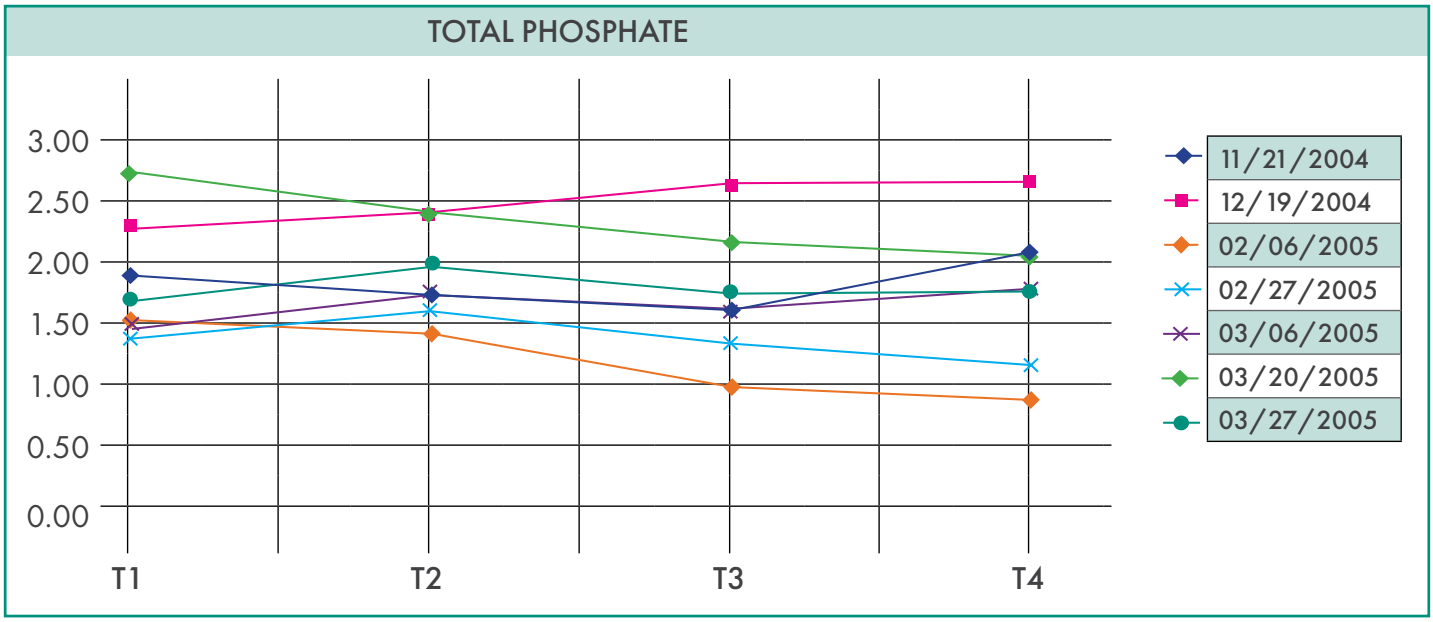


Fig. 10: *TSS of A, B, C, D sample for week by week*

The bad odor along the test zone was drastically reduced within one week of inoculation and was practically eliminated two weeks after inoculation. The river has remained odor free throughout the trial period. However, there was no change in bad odor upstream during the same period, thus confirming that Ecological Laboratories' Microbe-Lift Technology products are very effective in odor reduction. This has also been corroborated by verbal surveys with local residents along the river.

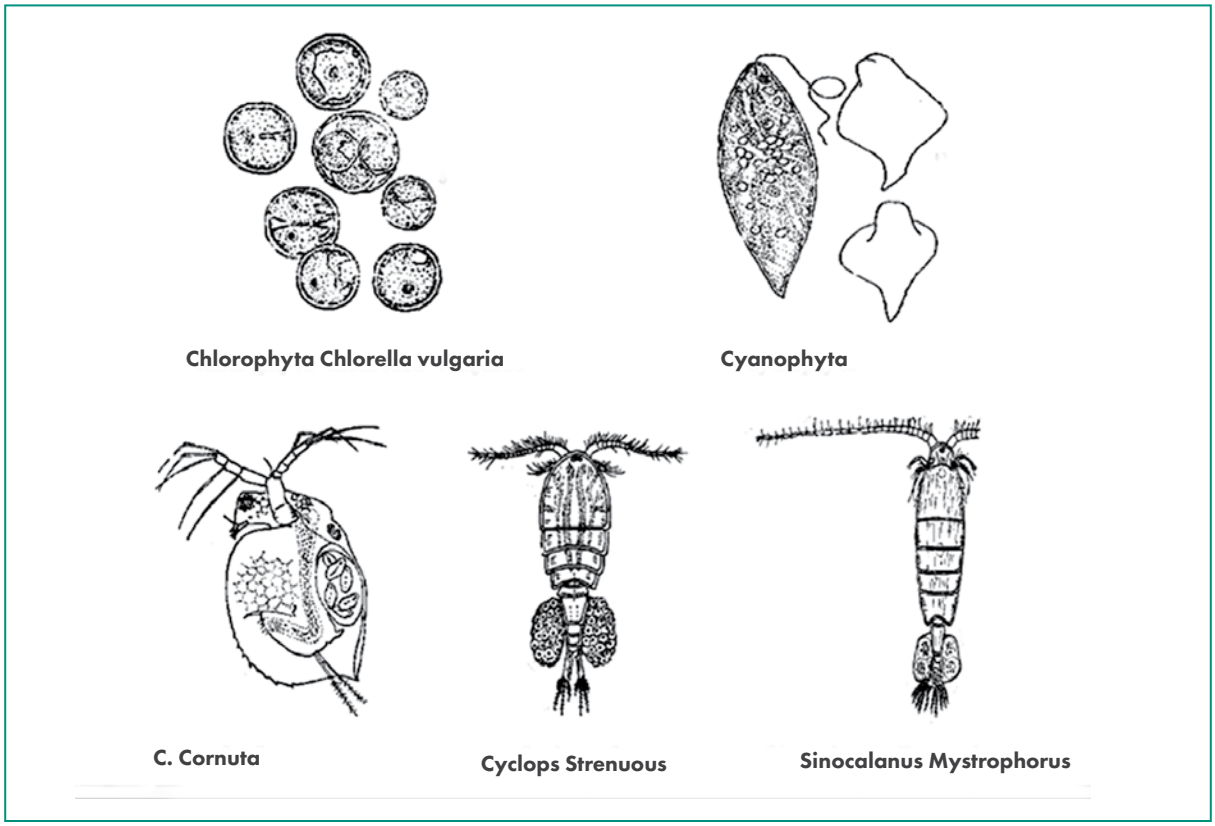


Fig. 4: *Microorganism found in Trial Zone water.*

The various types of microorganisms in the water were monitored during the trial period. 80% of plankton found at the beginning of the trial was Cyanophyta and Chlorophyta. The high percentage of these two types of plankton indicates that the water is heavily polluted. As the water quality improved in Feb 2005 at T3 and T4 locations, large amounts of Chrysophyta and Xanthophyta type of plankton appeared there, in line with water quality improvement. Protozoa type organisms were hardly seen in Xiba River before the trial. Large number of Protozoa and metazoan such as C. Cornuta, Cyclops strenuous and Sinocalanus Mystrophorus appeared at T3 and T4 locations in Jan and Feb 2005. Even kingfishers were attracted to the river by the presence of the small fish.

Fig 4 shows some of the microorganisms described above. Larger protozoa and metazoan such as Rotifera which live on small protozoa and plankton were found in extremely large quantities in late February 2005. Clusters of small fishes also appeared at T4 areas in late February 2005. Even kingfishers were attracted to the river by the presence of the small fish. Fig 4 shows some of the microorganisms described above.

On 26th Feb 2005, a very distinct improvement on the water from T1 to T4 was observed as shown in Fig 5 below.

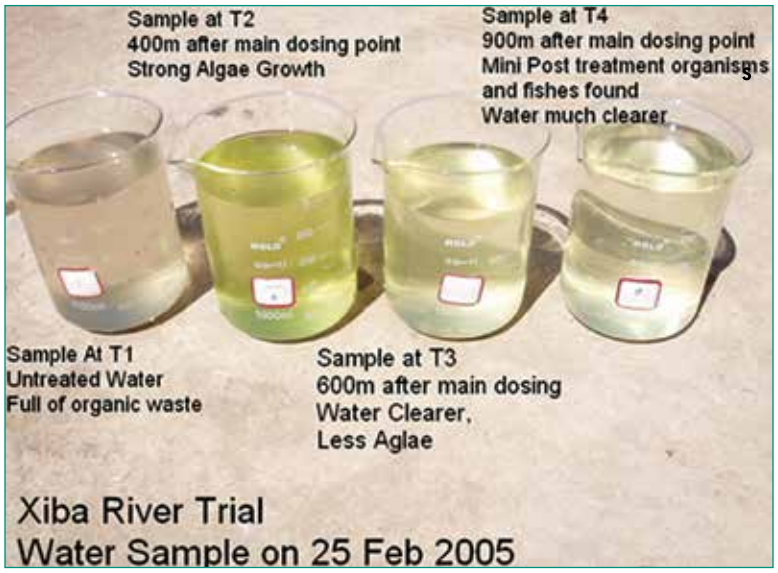


Fig 5: *Comparison of Water Sample from T1 to T4 on 25th Feb 2005*

The water before treatment at T1 was light grey with hardly any sign of life presence. At T2 where the biomedia is located, the water turbidity increased drastically due to the presence of large quantity of bacteria, plankton and algae. The water appeared very greenish. Protozoa and metazoan appeared at T3 further downstream, helping to reduce the algae content, giving the water a cleaner appearance. At T4, which is approximately 7 hours flowing time from D1, huge populations of larger protozoa and metazoan were eaten by the small fishes found there. The water looked very much cleaner with a transparency of more than 0.8m deep with underwater plants clearly visible. The presence of fish further confirms that **Ecologicals'** microbial formulations are non-pathogenic and NOT harmful to higher forms of living organisms. As the protozoa and metazoan moves upstream and more fishes move in the test zone, it is expected that water at T3 and T4 can easily achieve a standard close to level-three where there is significant water clarity and fishes swimming in the river. This ideal condition with fishes swimming gracefully in the river is the ultimate objective every government authority would like to achieve. It is possible, while using formulations manufactured by **Ecological Laboratories** to rehabilitate polluted rivers such as Xiba River with slow flowing water such that it attains the ideal environment with its natural ecological balance.

It is unfortunate in the case of Xiba River, the trial project was unable to sustain the above condition due to the regular blatant discharge of huge volumes of polluted wastewater although, despite this,, the river demonstrated more resiliency and the ability to recover faster from these events.

Fig.6: *D water sampling from Fig. 5*

Fig.7: *The fish appear in the Xiba River*

Conclusion

a) Ability of MICROBE-LIFT® technology products in rehabilitating river.

The trial project has concluded positively that treatment is effective in rehabilitating a flowing river as achieved on 27th Feb 2004. It took three months from inoculation to achieve significant water parameter reduction, a period which was in line with the manufacturer's expectations of 90 to 120 days. This was achieved even with the unexpected low temperatures in Nov and Dec 2004 and interruption of the project by repeated huge dumping of waste water into the river.

b) Effect on odor reduction by MICROBE-LIFT® technology

The trial project has also concluded very positively that treatment is very effective in odor reduction and is non-pathogenic and not harmful to fishes, as claimed by the manufacturer.

c) Effect of pH Changes

The water at Xiba River has a pH ranging from 7.0 to 7.8 which is ideal for the survival and multiplication of microbes. This is an ideal pH range for this technology.

d) Effect of Temperature Changes

The trial results do show that the product's effectiveness reduces in temperatures below 10°C.

e) Conclusion on parameter measurement

The positive results achieved in Feb 2005 leads to the conclusion that Ecological Laboratories product formulations are effective in bringing down BOD, COD, TSS, Turbidity, Total Nitrogen and Total Phosphorous by half from T1 to T4, which represents only an average of 7 hours retention time. Although the water parameter at T4 has not achieved a level-three standard as set out by the authorities, the product manufacturer is confident that a level-three standard or a standard at least close to level-three can be achieved in a complete river treatment where the bacteria has a much longer time to react and treat the water. Practical steps must be taken to prevent blatant dumping of huge volumes of untreated wastewater into the river, particularly chemical waste that inhibits the bacteria growth such as the highly alkaline cement plant waste.

f) Dosage

The experiment commenced with an inoculation at 4.7 ppm, which is, less than half the 10 ppm recommended by the manufacturer. However, it was subsequently adjusted to approximately 1 ppm per day based on the daily flow rate. This dosing is higher than the recommendation for a stagnant lagoon of 1 to 2 ppm per week. The higher dosing was recommended to compensate for the irregular flow pattern of the river and the short retention time of the test zone. In a complete river project where the length of treatment is long, a much lower dosing is recommended.

g) Effect of Biomedia

Although biomedia was introduced for a 510m long stretch at the beginning part of the trial zone, the actual effects of biomedia could not be measured because there are no control cases for comparison. We strongly believe that the biomedia helps in retaining part of the microbes as the water flows. This is likely one of the contributing factors for success in the trial.

h) Recommendations are proposed for future river treatment with MICROBE-LIFT® technology:-

1. It is strongly recommended that dosing of MICROBE-LIFT® technology for flowing rivers be done through a continuous automatic dripping dispenser rather than direct pouring into the river as has been done in this trial project. This is to prevent large quantity of bacteria being washed off if flow is inconsistent.
2. A holding pond of suitable size can be constructed to divert some wastewater into the pond to culture MICROBE-LIFT® bacteria, to increase the bacteria count before its release into the river. The continuous dripping can be done at the inlet of this breeding pond. In this way, the usage of MICROBE-LIFT® can be reduced by several fold thereby make any river treatment very economical. The principal supplier of MICROBE-LIFT® can provide a detailed project feasibility evaluation to the client.
3. Introduction of biomedia along the river with appropriate design and quantity is recommended for rivers with water flow rate exceeding 2 meters per minute. MICROBE-LIFT® principal supplier can advise the client on an economical biomedia design and sizing.

This report jointly prepared by Prof Hu Kailin of Kunming University of Science and Technology and Mr Goh Kwang Beng of **Ecological Laboratories.**

MICROBE-LIFT® Technology Restores River in the Heart of Kuching City

Location: Sungai Bintangor River, Kuching, Sarawak, Malaysia

Background:

Sg. BIntangor is situated in the heart of Kuching City. The river is about 0.65km long and 12-15m wide, forming as a tributary of the Sarawak River. It passes under a protocol road in Kuching and flows through Kpg. Masjid in Satok before joining the Sarawak River.

During high tide, the Sarawak Barrage at Sg Sarawak is closed to prevent the ingress of seawater; the water in Sg. BIntangor is rel atively stagnant. During heavy rains, the barrage is opened to prevent flooding.

On dry days, the water may eve n back flow from Sg. Sarawak when the barrage is closed as the water level in Sg. Sarawak rises faster than Sg. Bintangor due to rainfalls around the catchment area. During heavy downpour and low tide, the flow in Bintangor can be quite fast and the water is discharged within a few hours. The average depth of the water ranges from 0.5 to 1.5m.

The river emits foul odors, which are clearly noticeable at the protocol road located above the river. The pollutants include solid wastes, animal and fish entai ls, household garbage, oily and greasy scum and food remnants from surrounding eateries, workshops, and paint. It is a repulsive sight that adversely affects tourism. In addition, the dirty waters represent hygiene and health hazards. Of obvious hygiene concern, the dirty water also supports the breeding of harmful insects, such as mosquitoes.

A clean river is of paramount importance to blend in with the newly developed Sungai Bintangor riverbanks. At a recent survey of the catchment area of Sg. Bintangor, we found that the main pollutants came from four locations. These include food and sewage waste from the food courts, restaurants, hotels, lodging houses, housing estates, and the many makeshift food stalls along Jalan Nanas, Jalan Rubber, Jalan Satok, and Jelan Kulas.

One of the worst polluters is the Wet Market at Jalan Satok where a lot of animal and fish blood and entrails, left-overs, and vegetable and fruit wastes are simply flushed down drains without any type of filtration or grease traps.

Although most of the larger solid wastes are collected in rubbish bins provided by City Hall, most of the smaller and wet, untreated and unfiltered wastes, oils and greases, are washed down the culverts and storm drains, eventually ending up at the weir areas of Sungai BIntangor. Most of the time the weir area is covered in an ugly layer of smelly, dirty, and unsightly layer of grease scum.

Fig 1 & 2: *Pictures of Sg. BIntangor during low-level time prior to treatment in November 2007.*

This is very difficult remediation due to the very high level of contamination and the lack of retention time for biological treatment.

Objective:

Any successful remediation of this site has to be two-phased. The city is challenged to change practices of those discharging into the river while a program of bioremediation with MICROBE-LIFT® Technology was designed to help remove scum and soluble organics in the river stream. Due to the very low retention time in a flowing stream, AEM designed a system of biomedia cages which were installed at the weir area and at strategically located points along the full length of the river to retain as much microbial biomass as possible during heavy rain and in the presence of high and ebbing tides.

A permanent weir had been constructed at the upstream section of Sg. Bintanger near the road bridge to trap sold debris. The weir maintains the water level upstream at about 1.5m depth consistently and prevents the inflow of water from Sg. Sarawak. The water upstream the weir serves as an ideal location for the incubation of bacteria

Sometimes during thigh tide, the incoming water back-flows over the weir and at ebb tide, some floating debris and greasy scum trapped on the weir and not removed by the contractor, is carried over the weir and into Sarawak River. At certain times there is ingress of wastewaters from Sg. Sarawak into the Sg. Bintangor during high tide. This brackish water at the mouth of the river emits foul odor due to the untreated wastewaters from other tributaries discharging into the Sg. Sarawak. To prevent this malodor, all wastewaters discharging into Sg. Sarawak must be treated also.

In addition to inoculation with MICROBE-LIFT® technology, the treatment included use of BioAktiv, an oxygenation chemical to assure adequate aeration. Inoculation commenced on 1st December 2006 according to the dosage schedule listed below.

Fig.4: *Shows the installation of the biomedia cages in the river.*

In addition to inoculation with MICROBE-LIFT® technology, the treatment included use of BioAktiv, an oxygenation chemical to assure adequate aeration. Inoculation commenced on 1st December 2006 according to the dosage schedule listed on the following page.

Treatment

Date	Microbe-Lift® (gal)	BioAktiv (kg)	Remarks
12/01/2006	30	10	Inoculation dosing along the complete river.
12/02/2006	10	10	
12/03/2006	10		
12/04/2006	10	10	
12/05/2006	10		
12/06/2006	10		
12/07/2006	10	10	
12/08/2006	7		On the 8th day, 90% of the whole weir area was covered in a grayish and wrinkled layer of bubbling scum indicating active microbial in action. On the 9th day, bad odor was reduced by about 60% and surface scum at weir reduced by 50%.
12/09/2006	7		
12/10/2006	7		
12/11/2006	7		
12/12/2006	7		
12/13/2006	7		
12/14/2006	7	10	By the 14th day, bad odor has completely disappeared. Water after the weir turned greenish and cleaner, greasy scum reduced drastically. Lots of small bubbles were seen all over the weir area. Small fishes and marine creatures were found swimming along the river, especially at the weir area.
12/15/2006	7		
12/16/2006	7		
12/17/2006	7		
12/18/2006	7		
12/19/2006	7		However, as commercial solid debris continued to be dumped into the river and accumulate at tjhe weir area, part of the dosing exercise ws diverted to wste-water source further upstream.
12/20/2006	7		
12/21/2006	7	10	
12/22/2006	4		
12/23/2006	4		Water at weir area remained greenish and cleaner with noticeable marine life and the total absence of bad odor.
12/24/2006	4		
12/25/2006	4		
12/26/2006	4		
12/27/2006	4		
12/28/2006	4	10	
12/29/2006	4		

Fig. 5: *The dosage schedule specifies a total of 220 gallons* MICROBE-LIFT® formulation *and 70 gallons of BioAktiv to be introduced.*

Results Achieved

Water parameters were monitored. Samples were taken prior to treatment on 16th November, 2006, a relatively dry day. Almost two months into treatment, comparative samples show significant improvement.

	Location	BOD mg/l	COD mg/l	TSS MG/L	TN mg/l	Comments
11/16/2006	Mid stream	249	721	1350	111	pH 6.6. Very strong odor
12/20/2006	Influent	20	88	57	9	At the weir
12/20/2006	Effluent	4	18	30	11	At the river mouth, odor significantly reduced.

Fig. 6: *Pretreatment results demonstrate the extreme contamination of this site. The difference between influent and effluent parameters indicates efficiency of treatment.*

The early elimination of bad odor and the drastic reduction of surface scum are the first indication of the progress of remediation. Over the next two months, the MICROBE-LIFT® formulation will have established its optimum population in the biomedia cages at the weir and along the river maximizing the benefits. This treatment will be able to help reduce odors and scum and significantly reduce the organic loading. The introduction of hydroponic pl ants along the river will further improve organic reduction and help beautify the river, however, this site will not be fully remediated until the practice of dumping garbage into the river is changed.

For more information on MICROBE-LIFT® Technology contact

Ecological Laboratories Inc.
www.EcologicalLabs.com

CS17203

National Seminar On Biological Application and Environmental Friendly Protection of Malaysian Rivers

Location: Penang, Malaysia

Technical Paper by Magna Vappro (M) Sdn Bhd in collaboration with Oakwell Engineering Limited.

BIOREMEDIATION OF POLLUTED RIVERS, LAGOONS AND LAKES- THE MICROBE-LIFT® WAY

What Is Bio-remediation:

Biological treatment and reliance on bacteria is not new or novel; it has played a central role in conventional waste treatment throughout the history of mankind. What is new however, is our growing understanding of the natural processes and how we can utilize bacteria for industrial, agricultural and residential applications in breaking down organic waste thereby enhancing the bio-degradation process fundamental to natural recycling and sanitation clean-ups.

Bioremediation consists mainly of biostimulation, where nutrients or oxygen are added to soil or water to stimulate native bacteria a, and bioaugmentation, where select microorganisms, naturally occurring or engineered strains, are introduced to enhance the degradation process.

The primary use of biological agents has been in enhanced natural remediation and wastewater treatment of sanitation systems for residential and municipalities, lakes, rivers and ponds, once-through lagoons for agricultural and industrial activated wastewater systems. Bioremediation can usually be done in situ, without the need for existing system modification and saving large upfront capital cost in waste treatment equipment. Bioaugmentation, the purposeful inoculation of external microorganisms to a biological system with sufficient population of suitable types of bacteria will dramatically improved results where biostimulation alone has proven inadequate or ineffective. In order to understand the growing use and evolution of bioremediation, we need to understand in simple terms the biological function of bacteria (prokaryotes) and consider their role in the balance of nature.

"If there is food, some organism will eat it. If there is a place to live, some organism will live there. Every species has a great ability to produce offspring and its population expands until it runs out of food or it is limited by competition, its own waste products, or some other factor. Changes in climate or introduction of a new species from elsewhere can greatly affect the existing balance of nature."
This simple statement summarizes the interactions of all living things on Earth. Bacteria are single-cell organisms and most of them must find foods such as sugars, proteins and vitamins-nutriments to live. The various metabolic capabilities of bacteria are the key traits that we use to group and classify them into their genera/sub-species.

The ecosystem, both on land and in the water, depends heavily upon the activity of bacteria. The cycling of nutrients such as carbon, nitrogen, and sulfur is completed by their ceaseless labor. Organic carbon, in the form of dead and rotting organisms, would quickly deplete the carbon dioxide in the atmosphere if not for the activity of decomposers. This may not sound too bad to you, but realize that without carbon dioxide, there would be no photosynthesis in plants, and no food. When organisms die, the carbon contained in

their tissues becomes unavailable for most other living things. Decomposition is the breakdown of these organisms, and the release of nutrients back into the environment, and is one of the most important roles of the bacteria.

The cycling of nitrogen is another important activity of bacteria. Plants rely on nitrogen from the soil for their health and growth, and cannot acquire it from the gaseous nitrogen in the atmosphere. The primary way in which nitrogen becomes available to them is through nitrogen fixating bacteria. These bacteria convert gaseous nitrogen into nitrates or nitrites as part of their metabolism, and the resulting products are released into the environment. Some plants, such as liverworts, cycads, and legumes have taken special advantage of this process by modifying their structure to house the bacteria in their own tissues. Other denitrifying bacteria metabolize in the reverse direction, turning nitrates into nitrogen gas or nitrous oxide. When colonies of these bacteria occur on croplands, they may deplete the soil nutrients, and make it difficult for crops to grow.

Bacteria are also used in sewage treatment facilities. Solid matter, after having been separated from liquid wastes by screens and shredders, are added to a group of anaerobic prokaryotes. These bacteria decompose the material, converting it to material that can be used as landfill or fertilizer in land farming.

Bacteria are also used in solving environmental problems because of their selective capability to consume and degrade almost any compound. For instance, certain cultured bacteria are now being sprayed on oil spills and petroleum drilling lagoons, where they rapidly multiply and break down the oil molecules into less toxic compounds. In a similar way, bacteria can also clean up old mines. The water from old mines is filled with highly acidic heavy metals that are highly toxic and expensive to clean up. However, there is an increasing use of bacteria, especially a genus called Thiobacillus, which thrives in acidic water. These microbes can extract copper from the water, and other valuable metals, utilizing oxidize-sulfur to accumulate and extract the metals. These are just two examples of the ways that bacteria can be practically used to solve environmental problems, and over-time many more applications will be developed through selective breeding and mixed production of various bacteria cultures.

Basic Biological Treatment Processes Are Based on the Following Chemical Reactions:

Aerobic

$$BOD + N + P + O_2 \rightarrow CO_2 + H_2O + cells$$

Facultative

$$CO_2 + NO_3 + O_2 \rightarrow NO_3 + CO_2 + cells$$

Anaerobic

$$BOD + N + P \rightarrow CH_4 + H_2S + CO_2 + cells$$

Life Cycles

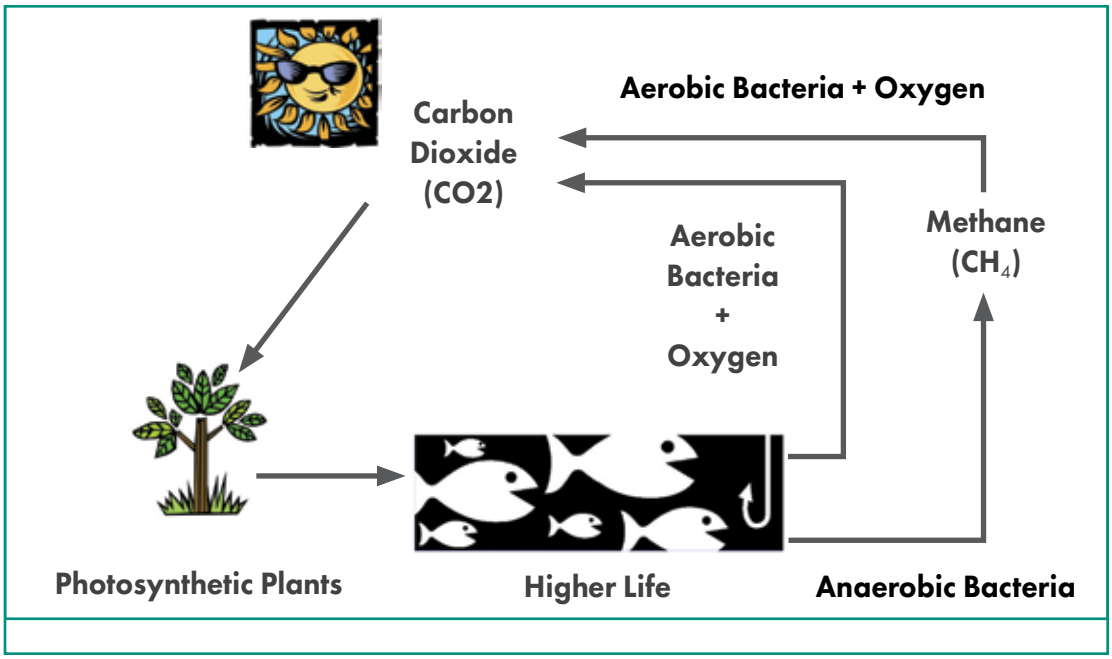


Fig 1: *The Carbon Life Cycle*

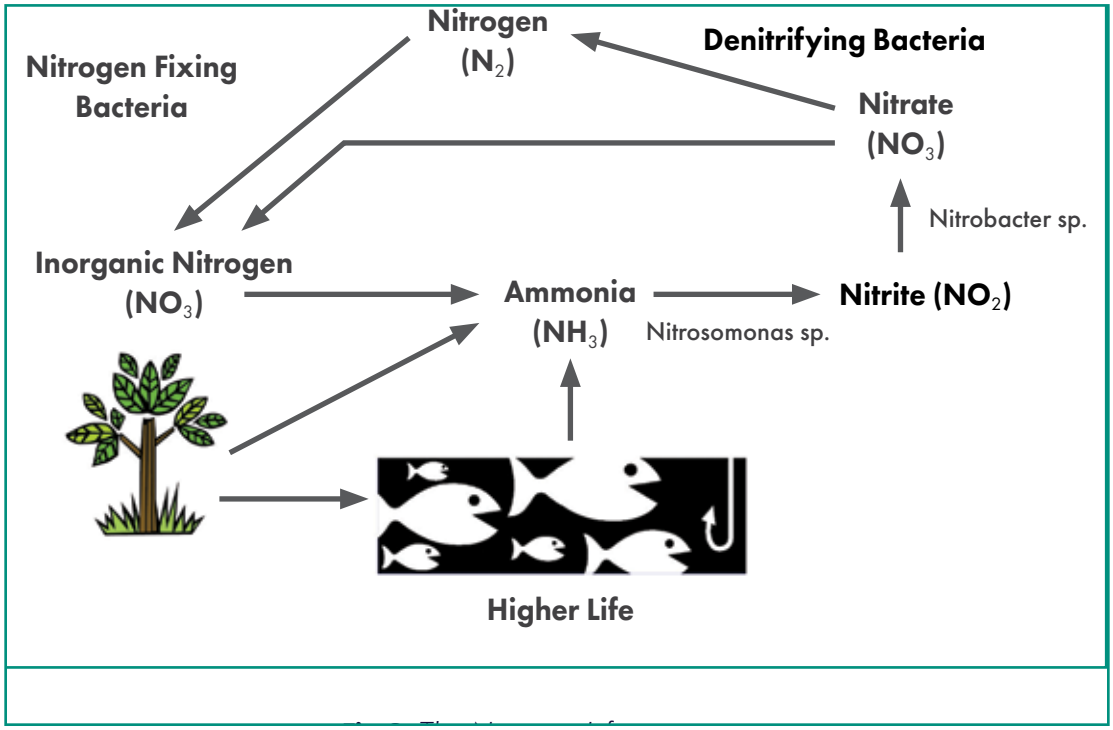


Fig 2: *The Nitrogen Life Cycle*

Bioremediation Operates On the Simplified Kinetic Model Below:

$$S_e = \frac{S_i}{1 + Xc\ Ks\ \Psi h} -$$

Where	S_e	-	**effluent concentrations of substrate**
	S_i	-	**influent concentrations of substrate**
	X_c	-	**cell mass in gm/L**
	K_s	-	**specific rate coefficient, gms/L ***
	day Ψh	-	**hydraulic residence time, days**

Fig 3: *Simplified Kinetic Model*

A successful bioremediation therefore require an adequate concentration of balance types of micro-organisms in the wastewater with appropriate pH and temperature to be treated for a sufficient amount of time for bacteria to multiply.

Augmentation Chemistry Vs. Stoichiometric Chemistry

Many engineers and operators are accustomed to having precise application information when using chemical products in chemical process systems. This is usually not the case with biological systems and biological products used in bioremediation process.

The reason for this is quite simple. Chemicals are non-living things and act in predictable stoichiometric ratios based on molecule for molecule interactions. A good example is pH, which is the measure of [H+] ions or [OH-] radicals in solution. To neutralize a solution which is either too acidic or too alkaline requires the addition of the reciprocal ions or radicals that combine in a direct one to one ratio to form water. For example, if a solution of hydrochloric acid, HCl, is added to an alkaline solution of sodium hydroxide, NaOH, the [H+] ions and [OH-] radicals will react to form water with the residual ions to form salt (NaCl) in a predictable, quantifiable reaction.

In biological systems, the dynamics are biochemical as opposed to chemical, and the active agents are living entities. Where one would have to increase the quantity of chemical proportionally to deal with a higher load of reactant, in a biological system the biological additive can grow to help compensate for increased loadings. While small increases in dosage may be required with increased loading, proportional increases are not required. The organisms grow in response to higher loads, so that the benefit is multiplied which makes biological additives much more cost effective than chemical additives. It also makes for dosage programs that do not seem to properly compensate for loading changes, as bacteria has an inherent ability to adjust to loading changes.

Bio-augmentation dosage programs typically follow a descending application schedule to accommodate the fact that the benefits of the addition are multiplied. These programs usually involve a "purge" or "inoculation" dosage to establish the required bacteria population quickly.

The "purge" or "inoculation" is followed by an intermediate maintenance dosage to support the development of the required population. Finally, a regular maintenance addition is used to maintain the required population to maintain the biochemical improvements, which have been realized through the "inoculum" and "intermediate maintenance" dosages.

On occasion, when a biological system experiences shock loads, either hydraulic or organic, it may be necessary to return to the "intermediate maintenance" dosages for a week or two to fortify and stabilize the bacteria population.

MICROBE-LIFT® Remediation Technique

MICROBE-LIFT® technology has proven to be one of the most successful bio-product to be used in Bioaugmentation for a broad spectrum of polluted bodies of water and various waste treatment systems. MICROBE-LIFT® technology is a combination of over 30 species of naturally occurring live bacteria suspended in a liquid medium used for the treatment of industrial, agricultural and residential organically contaminated wastewater. It is a product with high cell mass and specific coefficient.

MICROBE-LIFT® technology was developed in 1976 by **Ecological Laboratories** in the United States. With almost three decades of experience in bacteria culture selection and bio-product formulation, **Ecological Labs** has become one of the world's leading providers of live bacteria formulas for wastewater management. Over the years, their direct involvement in microbial treatment development and planning has lead to successful application programs for a broad spectrum of industrial, municipal and residential wastewater problems.

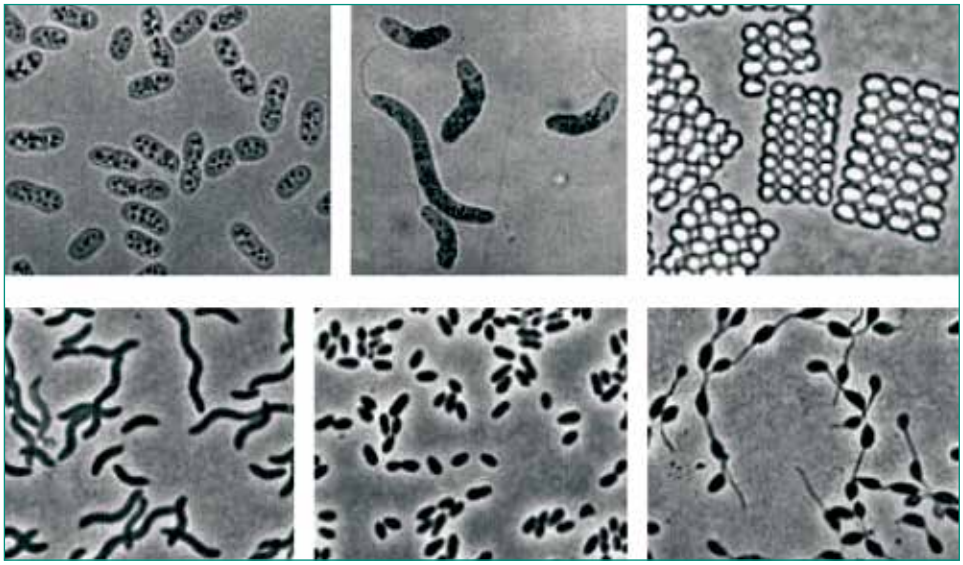


Fig 3: *MICROBE-LIFT® technology type of bacteria*

MICROBE-LIFT® bacterial culture contains aerobic and anaerobic species as well as chemo- and photo-synthetic stains. The microorganisms in MICROBE-LIFT® technology are natural occurring, non-toxic and non-pathogenic. They are living bacteria, held in a state of suspended animation in a liquid medium. The product formulas are not harmful to humans, animals, plants and all types of aqua culture. When MICROBE-LIFT® is added to a contaminated area, the bacteria immediately revive themselves and begin to feed, reproduce and attack that organic waste.

Areas of Application

The following are *Before and After* pictures of MICROBE-LIFT® treatment programs from around the world. Once you see them, you will want to know more about how the MICROBE-LIFT® method of bioaugmentation can help you and your community.

A Swine Production Waste Pond before Treatment

The same pond after 5 weeks of Aqua Clean Treatment

Domestic Sewerage Pond in Uruguay before Treatment

Domestic Sewerage Pond in Uruguay 72 days after Aqua Clean Treatment

Domestic Sewerage Pond in Uruguay before Treatment

Domestic Sewerage Pond in Uruguay 72 days after Aqua Clean Treatment

Grease Trap Pond in Panama-2002 Entire Lagoon was covered with oil, grease and solid

Domestic Sewerage Pond in Uruguay 72 days after Aqua Clean Treatment

MICROBE-LIFT® Technology Has Proven to Be Excellent In A Broad Range of Applications Utilizing Bio-Augmentation and Remediation:

1. Achieving ecological balance of natural bodies of water such as polluted lakes and lagoons, while reducing insect population.
2. Economical treatment of agricultural wastewater using simple oxidation ponds for swine, dairy, poultry and duck farms. Treated effluent has proven to improve fertilizer value as added benefit.
3. Enhancing the effectiveness of municipal and industrial wastewater treatment plants; increasing the operation efficiency and capacity by reducing COD, BOD, TSS, sludge and bad odor. The economic rewards reduce maintenance costs; lower capital expense and penalty charges.
4. Improving water quality in commercial fresh water shrimp and fish farming lagoons, reducing mortality rate and increasing yield and quality.
5. Commercial grease trap treatment of restaurant and hotels drastically reduces the cost for fat and grease removal and eliminates bad odors.
6. Rejuvenating failing leach fields and septic tanks reducing the need for expensive system removal and replacement, while eliminating odor.
7. Improving the ornamental pond water quality and significantly reducing the need for filter cleaning and maintenance.
8. Rapidly breaking down hydrocarbon pollution from oil spills and production ponds, as well as removal of hydrogen-sulfates helping to prevent tank corrosion.

Systems Program Approach

We provide total solutions and technical support to solve your water pollution and waste treatment problems by developing:

Innovative Treatment Plans

Identifying problems, establishing goals and defining criteria for success: we work with you to review your needs via systematic survey forms.

Sustainable Natural Solution

Providing environmental friendly treatment solutions to achieve ecological balanced system through natural microbial remediation and bioaugmentation technology. We maintain close technical support to review results and provide adjustments in order to continue sustainable long-term performance.

Cost Effective and Efficient

Natural solutions that in most cases are far more effective and efficient than chemical and mechanical methods, usually reducing the need for high upfront capital equipment investment.

Environmentally Safe

MICROBE-LIFT® technology uses only naturally occurring non-toxic and non-pathogenic bacteria based products that are safe for humans, animals and aquatic life. Approved by USA EPA and USDA.

Case Studies From Typical Applications Include:

1) Xiba River, Kunming Trial Project

Xiba River Project was a very interesting study of remediation in an open body of flowing water. Traditionally this type of problem has been extremely difficult to effectively treat, and many had failed in this effort. The Trial Project required that we develop a novel and unique application system, but utilized the basic principles of bio-remediation, and in the end we were able to provide a very cost efficient solution.

The Xiba River is an extremely polluted river flowing 4 km through Kunming, China. The river has an average flow rate of 26,000 m3 per day. The water is badly polluted from industrial, commercial and domestic waste. It had a grayish color, high turbidity, pungent odor and toxic effect had virtually eliminated signs of aquatic life.

The Pilot Study using MICROBE-LIFT® technology was carried out in the river's last 1.5km treating this section of the river as a plug flow reactor. The trial was carried out from Nov 2004 to March 2005 in collaboration with Kunming Technical University. The Project successfully demonstrates the efficacy of MICROBE-LIFT® bioaugmentation in an open river.

Measuring various water quality parameters along the river's pathway before and after treatment, the Environmental Graduate Students monitored the effects of MICROBE-LIFT® technology during the trial. The Project conclusively demonstrated MICROBE-LIFT® technology's ability to restore the polluted river to an ecologically balanced environment. Aquatic life returned to the River which also demonstrated MICROBE-LIFT® technology's non-toxicity to aquatic life; the odor was eliminated, water clarity was improved, and general health of the waterway was restored. MICROBE-LIFT® technology proved to be a cost effective, environmentally friendly, natural method of rehabilitation.

The various water parameters measured (such as COD, BOD, TSS, Total Nitrogen and Total Phosphate) were reduced by about 50% at monitoring station 1.4 km downstream from the point of inoculation. The average remediation (effective retention) time for 1.4km length was about 7 hours. Kunming Technical University is convinced that a much higher rate of degradation is achievable based on a complete river treatment that would significantly raises the effective retention time for the MICROBE-LIFT® treatment. The basic Kinetic Model for bio-remediation is built upon the effective rate of the selected bacteria to degrade the specific pollutants, the number of bacteria available, and the time allowed for the bacteria to interact on the pollutants. While pH, temperature, sunlight and other limiting factors will affect the results, the basic Kinetic Model is the primary focus for treatment.

The Xiba River posed a set of very challenging problems to overcome, retention time being the most difficult. Yet by developing a novel and inexpensive Bio-Media, we were able to increase the surface area and provide the treatment needed.

2) Pilot Study on Piggery Wastes Treatment at Poh Huat Pig Farm, Sarawak, Malaysia.

Searching for an effective, environmentally friendly method of treating animal farm wastewater, a pilot project was commissioned in collaboration with National Resource and Environment Board (NREB) of Sawarak in March 2004 at Poh Huat Pig Farm. The Project goal was to assess and confirm the results of MICROBE-LIFT® treatment in reducing BOD and COD in piggery waste. This is an area where MICROBE-LIFT® technology has been very successful in similar studies in the USA, Korea and Northern Europe.

The result of this Pilot Project confirmed that MICROBE-LIFT® technology would produce the same successful results in Malaysia. Characteristically, MICROBE-LIFT® 's bioremediation eliminated bad odors within one week after treatment, with significant reduction in COD and BOD. Over the next three weeks, as the bacteria began to breakup the organic sludge at the bottom of the pond, MICROBE-LIFT® technology again demonstrated its effectiveness in degrading hardened organic sludge built up over the years in an open waste lagoon. Once all the organic sludge has been degraded, the pond will achieve its ecological balance and help to maintain a clean environment.

Fig 5: *Pond Condition Before and After Treatment at Poh Huat Piggery Waste Treatment*

3) MICROBE-LIFT® Treatment to Sheraton Tower, Singapore Landscape Pond, Singpore

Sheraton Tower Hotel, Singapore has a 100m3 beautifully landscaped pond for display of koi fish. There were two small sand filters and no biological filters in place. The water was turbid with high COD and BOD, as well as a bad fishy smell. MICROBE-LIFT® remediation method was introduced to obtain and maintain a clean and ecological balance for this pond environment without the need for an elaborate and expensive biological filter.

4) Mosquito Larvicidal Evaluation by Insert Control & Research Inc., Baltimore, USA

MICROBE-LIFT® technology was evaluated for its potential as a killing agent against the aquatic stages of laboratory-reared Aedes aegypti. The efficacy of the bacteria product was assessed for its affect upon the egg stage, the larval stages, the pupal stage and the resulting emergence of adults.

MICROBE-LIFT® technology was effective on the egg stage, increasing egg mortality from 36.9% in the untreated control to 87.9% in the treatments.

5) Use of AquaClean in Freshwater Shrimp Production, Mississippi

Mississippi Gulf Coast Community College in Southeastern United States conducted an evaluation on MICROBE-LIFT® effect in the production of Macrobrachium Rosenbergii fresh water shrimp production in 2001.

The study indicates that MICROBE-LIFT® technology increases total production and average size of shrimp while improving the feed conversion and reducing production cost.

Benefits of MICROBE-LIFT®

- Total Shrimp Production: +17.4%
- Total Feed Consumption: -14.4%
- Total Weight per Shrimp: +22.4%

[A copy of the full report can be read in Case Study 12104]

6) Algae Control in Public Lagoon

MICROBE-LIFT® technology dtoes not eliminate algae, but controls algae population that is the real desired objective of most public lake and lagoons with fishes.

Further detail on Bioremediation and MICROBE-LIFT® technology is also available at **www.EcologicalLabs.com**

Prepared by
Goh Kwang Beng
29th October 2005

For more information on MICROBE-LIFT® Technology contact
Ecological Laboratories Inc.
www.EcologicalLabs.com
CS17204

Water Restoration and Enhancement of Pond at Winkler Bible Camp in Manitoba, Canada

Location: **Winkler Bible Camp, Winkler Manitoba, Canada**

Background: The following performance information was provided by Mr. Gerald Wiebe owner of Ecological Dynamics, Inc, Manitoba MB, Canada. Gerald has featured our technology for water enhancement and restoration successfully for over 12 years. Due to his success in natural biological water management he was contacted to address a water quality problem at Winkler Bible Camp.

The pond in question consists of a man made three acre pond with a maximum depth of 14 feet and is used for swimming and other recreational activities at the summer camp.

Objective: On June 14, 2016 the camp management contacted Ecological Dynamics with concerns of discolored water, excessive bottom sludge, and potential pathogenic water quality issues, making it unsafe for swimming.

- Water samples were taken and initial lab tests indicated a total coliform of 3260/cu/mg.
- Water turbidity was very poor with a layer of organic solids within the shoreline beach and on pond bottom, resulting in poor water quality and concerns for camp swimmers.

Solution: Treatment with MICROBE-LIFT®/PBL and MICROBE-LIFT®/SA started May 14th 2016.

Water Restoration and Enhancement of Pond at Winkler Bible Camp in Manitoba, Canada

The sand contained organic muck that would come to the surface as you walked on the sandy beach and had a poor rotten egg odor.

Photos of sand before treatment began.

Prior to MICROBE-LIFT® *treatment* *Five months of* MICROBE-LIFT® *treatment*

Results Achieved: Water quality improved dramatically within 30 days of treatment, odor was eliminated and biological pathogen control effectively reduced pathogen levels to acceptable levels of <10 Fecal coliforms and Total Coliforms of < 60, allowing summer camp children to once again enjoy the water and water events.

Look at the pictures left to right, review the reduction and elimination of the organic matter from the sand at shore line, and within the entire ponds ecosystem, i.e., benthic and littoral zone.

In September of 2016 camp management advised they were pleased with the recovery of their lake and requested the use of the MICROBE-LIFT® for 2017, treatment is currently being applied.

For more information on MICROBE-LIFT® Technology contact

Ecological Laboratories Inc.
www.EcologicalLabs.com
CS17205

TURF AND GOLF COURSE MAINTENANCE

MICROBE-LIFT®/GOLF

The microbial amendment that was designed to provide many benefits to the golf course superintendent including a level of insurance against drought, disease, and sun damage.

This summary paper will provide specific examples of the following benefits for the golf course superintendent:

- Improved moisture retention
- Better turf health leading to greater disease resistance leading to reduced pesticide requirement
- Improved growth density and grass color
- Decreased fertilizer requirement

The microorganisms in **MICROBE-LIFT®**/GOLF work naturally to provide food and energy for the grass allowing it to focus on root growth and healthy, dense grass.

Coupled with improved moisture retention and improved disease resistance, use of **MICROBE-LIFT®** technology helps the superintendent maintain a beautiful course cost-effectively and with less hassle.

For more information on MICROBE-LIFT® Technology contact
Ecological Laboratories Inc.
www.EcologicalLabs.com
18000

TURF AND GOLF COURSE MAINTENANCE - GOLF

GOLF COURSE MAINTENANCE

18100 GOLD COURSE MAINTENANCE

For more information on MICROBE-LIFT® Technology contact

Ecological Laboratories Inc.

www.EcologicalLabs.com

CS18100

MICROBE-LIFT®/GOLF Cleared Algae on Golf Course Pond at Moccasin Run Golf Course in Atglen, PA

Location: **Moccasin Run Golf Course, Atglen, PA**

Set in the rolling hills of South Central Pennsylvania, Moccasin Run offers golfers of all abilities a challenging golf experience in scenic surroundings.

Background: During the summer of 1999, the entire region experienced one of the worst droughts in years. Pond levels in the course's five ponds were down significantly and the water temperatures were up. The algae blooms created not only aesthetic problems but logistical ones as well since the algae were fouling irrigation pumps and filters.

Objective:

Conscious of the environment and the surrounding wildlife, Greens Superintendent Curtis King was reluctant to use chemical algaecides that might have lasting residual toxicity. Instead, Curt chose to try a biological product that naturally balances the pond environment and keeps the entire aquatic flora in balance

With the objective of clearing the ponds of algae, MICROBE-LIFT®/GOLF was added to one of the ponds with the worst algae infestation.

MICROBE-LIFT®/GOLF is a complete ecosystem of naturally occurring bacteria including photosynthetic, aerobic, facultative, anaerobic, and chemosynthetic bacteria specifically developed to restore the natural balance to ponds and lakes.

The product was added to the 1.5 million gallon pond as follows: Day 1 seven gallons was added, Days 8,15,22, and 29 two gallons were added. And thereafter a ½ gallon maintenance dose was added monthly.

Results Achieved:

Within a few weeks, the pond began to clear. By the third week, the water was clear and algae growth was minimal. At this point, algae were no longer an aesthetic problem nor did it interfere with logistics. The product was added to the remaining ponds with similar results.

The following pictures show the dramatic results.

Late summer and fall rains raised the water level in the ponds back to near normal levels. With the restored levels and clear water the ponds again became a source of irrigation water and aesthetic appeal for the course.

Fig.1: *BEFORE treatment with MICROBE-LIFT/GOLF, after a severe drought, ponds had a significant algae bloom, enough to foul irrigation pumps and filters.*

Fig.2: *AFTER treatment with MICROBE-LIFT/GOLF ponds were clear within weeks with natural, biological technology. Results were dramatic and the ponds became useful and aesthetically pleasing again.*

For more information on MICROBE-LIFT® Technology contact

Ecological Laboratories Inc.

www.EcologicalLabs.com

CS18101

Made in the USA

MICROBE-LIFT® Technology Increases Turf Health at Numerous Florida Golf Courses

Location: **Series of Golf Courses, Florida**

Background: Beautiful golf course greens require highly skilled maintenance and a substantial budget for irrigation, fertilizers, and pesticides. Runoff of fertilizers and toxicity of pesticides are also a concern. Microbial additives have come a long way in increasing turf health reducing the concern of runoff and toxic pesticides.

Objective: MICROBE-LIFT® technology is a series of biological products developed and manufactured by **Ecological Laboratories Inc (ELI)**.

MICROBE-LIFT®/GOLF is the microbial amendment that was designed to provide many benefits to the golf course superintendent including a level of insurance against drought, disease, and sun damage.

This summary paper will provide specific examples of the following benefits for the golf course superintendent:

- Improved moisture retention
- Better turf health leading to greater disease resistance leading to reduced pesticide requirement
- Improved growth density and grass color
- Decreased fertilizer requirement

Results Achieved:

Improved water retention in golf course in Florida.

Fig. 1: *The soil plugs in picture on the left show treated turf on the right holds water (as seen by the darkness of the soil) much better than the control plug on the left. The picture on the right demonstrates much larger and more turgid roots on treated grass.*

The previous pictures show the soil's ability to hold water is greatly enhanced by the photosynthetic bacterial mass in MICROBE-LIFT® technology. In addition to increased water retention, treatment helps produce larger, longer root mass for healthier grass.

MICROBE-LIFT® technology also helps grow healthier, denser grass as seen in the following picture from a golf a in Florida.

CONTROL MICROBE-LIFT®

Fig. 2: Note the greener, denser grass with MICROBE-LIFT®.

Fig. 3: *The picture of the green on the top indicates how hard packed and inhospitable the soil was prior to treatment with MICROBE-LIFT®.*

Fig 4: *The picture of the plug at the bottom shows the condition of the soil and roots after treatment with MICROBE-LIFT®.*

MICROBE-LIFT® Technology Increases Turf Health at Numerous Florida Golf Courses

A golf course in Southwest Florida demonstrated the ability of MICROBE-LIFT® technology to improve grass health and yield by promoting a healthier root system. In the words of the golf course superintendent "I wanted to let you know that what we found with the cores we pulled was astounding! Four weeks ago, I checked root depth and mass on the greens and could not find a healthy white root more than approximately one inch (in length). Yesterday, virtually all of the cores exhibited phenomenal root mass with healthy roots exceeding 4 inches!"

The microorganisms in MICROBE-LIFT® technology aid in the recycling of organic matter, effectively decomposing even the most recalcitrant organics. This eliminates build-up such as thatch and the black layer and supplies nutrients needed for the health of the grass.

In addition to helping build stronger roots, MICROBE-LIFT® technology reduces the need for fertilizer by improving nutrient uptake and "fixing" nitrogen from the air converting it to a form available as fertilizer. This increases plant health while reducing cost of fertilizer and decreasing risks due to run--off.

CONTROL MICROBE-LIFT®

Fig. 4: *The experiment depicted above demonstrates the development of healthy roots in Paspalum turf watered with salt water. The turf on the left was grown with best growers practices while the turf on the right had added* ***Quantum Growth®*** *and reduced fertilizer.*

Not only did MICROBE-LIFT®/GOLF help compensate for use of salt water in irrigation, it allowed reduction in fertilizer rate. Based on these results the course adds MICROBE-LIFT®/GOLF to every irrigation cycle.

The microorganisms in MICROBE-LIFT®/GOLF work naturally to provide food and energy for the grass allowing it to focus on root growth and healthy, dense grass. Coupled with improved moisture retention and improved disease resistance, use of MICROBE-LIFT® technology helps the superintendent maintain a beautiful course cost-effectively and with less hassle.

For more information on MICROBE-LIFT® Technology contact

Ecological Laboratories Inc.
www.EcologicalLabs.com
CS18102

MICROBE-LIFT® Helps Restore Lake Ecosystem Eliminating Excess Nutrients at Hourglass Lake in Windmere, Florida

Location: **Isleworth Golf & Country Club, Windermere, Florida.**

Background: Hourglass Lake is an eleven-acre freshwater lake located within the property boundaries of Isleworth. It is surrounded by two golf course holes to the east, north and west and by seven estate residences along its southern shoreline. For over twenty years this water body has been permitted for golf course irrigation purposes being recharged by deep well aquifer water.

Due to the demands for drinking water in the Central Florida area a new consumptive use permit now mandates that the lake must now be recharged by stormwater, reclaimed water and finally deep well aquifer water as a third priority source. This change from a low nutrient content ground water to nutrient rich reclaimed water will cause abrupt changes in the water chemistry of the lake and thereby cause a potential for degradation of the established lake ecosystem and well as a loss in real estate values for the residences that front the waterbody.

Early signs of these suspected changes in water quality became evident with the growth of algal blooms in response to the rapid increase in nutrients discharged into the lake as the new permit went into effect.

Objective: Maintain the water quality as well as the aesthetic qualities of Hourglass Lake reservoir as the water recharge transitions from deep well aquifer water to county utility reclaimed water.

Fig 1: *The growth of algal blooms in response to the rapid increase in nutrients discharged into Hourglass Lake became evident early on.*

Action Plan:

Action Plan: A plan was immediately implemented to utilize bio augmentation products, in this case, Sludge-Away and MICROBE-LIFT® PBL (manufactured by **Ecological Laboratories, Inc.**) in conjunction with subsurface water mixers to create a biologically active area within the mixing zone of the lake where the reclaimed water is discharged. The intent of the subsurface mixers is to immediately prevent a suitable environment specifically for Blue Green Algal growth by moving the water horizontally throughout the mixing zone and also supplying dissolved oxygen to the pond to support and stimulate the aerobic digestion process created by the addition of the MICROBE-LIFT® PBL blend of bacteria strains. The Sludge-Away microbe formulation is also added to enhance and accelerate the biological performance promoting sediment reduction.

Initial application of 100 gallons of MICROBE-LIFT® PBL and 25 gallons of the Sludge-Away microbe formulation was introduced into the lake. For the next 5 weeks, 25 gallons of MICROBE-LIFT® PBL was applied. A monthly maintenance dosage of 30 gallons of MICROBE-LIFT® PBL is now being applied to Hourglass Lake by injecting the microbes directly into the reclaimed water irrigation line as a pretreatment prior to the water being discharged directly into the lake itself.

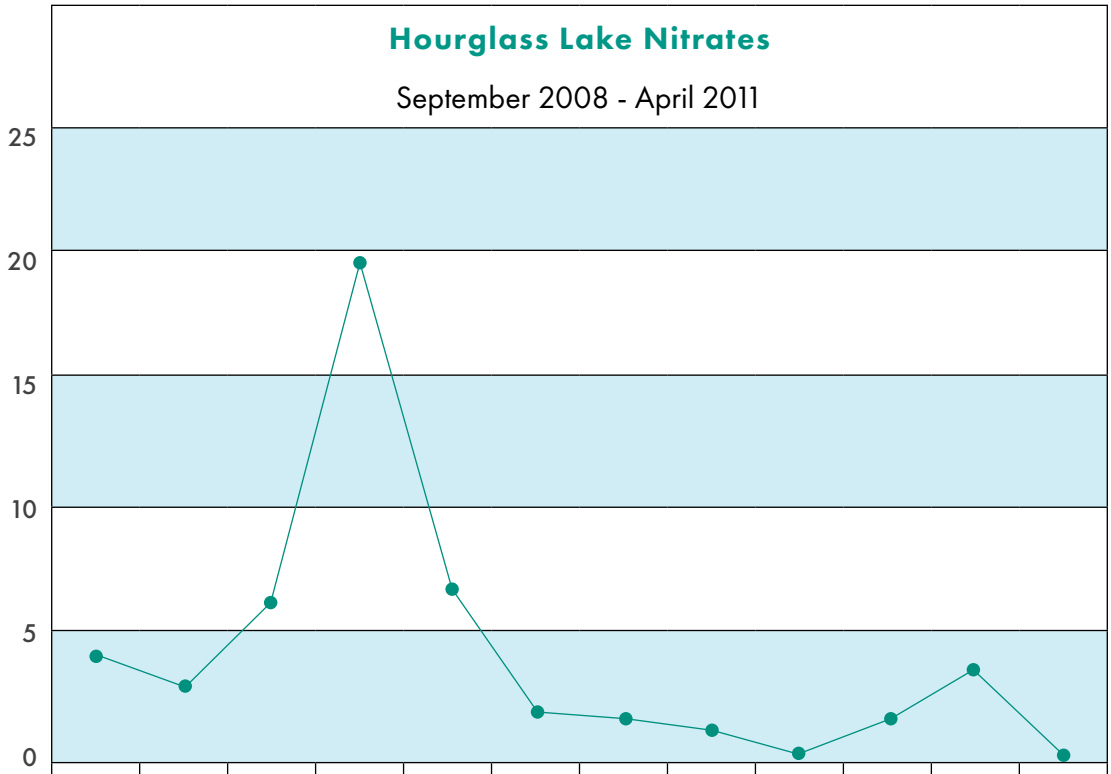
Results Achieved:

After two weeks improvement was noticed with a significant improvement in water quality evident within eigh weeks. Water clarity was improved along with the elimination of Blue Green algal blooms and the accompanying foul order. A slight sludge reduction was also evident.

Fig 2: *Water clarity was significantly improved within eight weeks.*

After 16 weeks, improvement is pronounced with algal blooms slight and less often and limited to only filament algal species with no foul odors present. Water clarity continues to improve with sludge reduction becoming apparent in the shallow areas along the shoreline. Wildlife values have been preserved as Hourglass Lake serves as a rest stop for migratory birds in the winter months.

Fig 3: *The water quality of Hourglass Lake is also monitored from a site specific monitoring well mandated by permit and sampled quarterly by a certified independent water quality laboratory. These seasonal test results indicate over a 90% reduction in nitrates.*



sample 1	sample 2	sample 3	sample 4	sample 5	sample 6	sample 7	sample 8	sample 9	sample 10	sample 11	sample 12
3.98	2.84	6.17	19.7	6.7	1.84	1.58	1.15	0.174	1.48	3.47	0.0583

The nitrate spike shown above is the result of fertilizer run-off from the golf course. The rapid reduction in the nitrate level is due to MICROBE-LIFT®'s denitrification functions where nitrate is biologically converted to harmless nitrogen gas in a process termed anoxic respiration. MICROBE-LIFT® cultures assure ongoing nitrate reduction within the lakes environment. The reactions take place in the lakes anaerobic zones (muck) where nitrate is converted to harmless nitrogen gas through anoxic respiration termed denitrification.

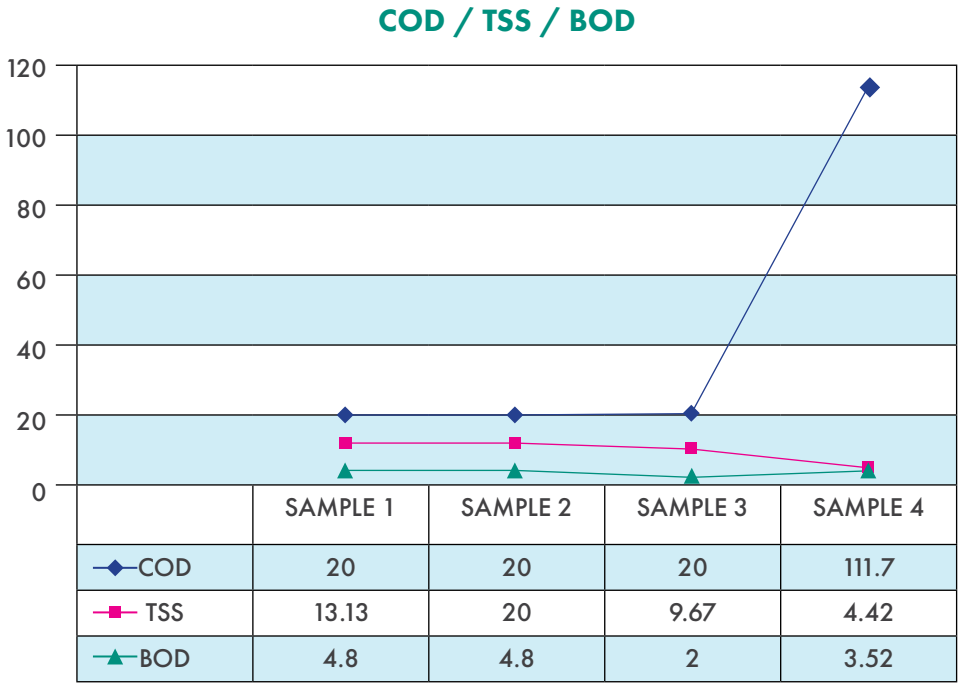
MICROBE-LIFT® cultures assure continued biological control of excessive nutrient by recycling excessive nitrate to nitrogen gas. This anoxic oxidation process speeds the biological reduction of organic bottom solids and eliminates hydrogen sulfide generation.

Organic Control

Isleworth receives wastewater effluent daily from a wastewater facility to supplement irrigation needs. The effluent contains varying levels of BOD, COD, TSS, and nutrients. Biological augmentation provides control of effluent spikes assuring water quality. The graph indicates the potential negative impact the wastewater effluent represents to the lakes environment, and how important assured biological oxidation is to the lakes environment.

Note the significant COD increase within the lake water as shown in the graph below. Rapid reduction of the COD is assured by MICROBE-LIFT® biological oxidation controlling continued influent of BOD, COD, TSS, as well as providing reduction in odorous emissions.

MICROBE-LIFT® Helps Restore Lake Ecosystem Eliminating Excess Nutrients at Hourglass Lake in Windmere, Florida



	SAMPLE 1	SAMPLE 2	SAMPLE 3	SAMPLE 4
COD	20	20	20	111.7
TSS	13.13	20	9.67	4.42
BOD	4.8	4.8	2	3.52

OCTOBER 2010 - JANUARY 2011

In summary, the lakes overall health and balance has been preserved and enhanced along with its aesthetic appeal for the residents of Isleworth, the synergistic use of aeration and beneficial bioaugmentation has proved to be a valuable tool in preserving this lakes ecosystem

A sustainable environment has now been established for the microbes to thrive and maintain the water quality of Hourglass Lake throughout the seasons of the year fulfilling the needs of the Isleworth golfers, the lake ecosystem and balanced to protect the wildlife that also call Isleworth their home

MICROBE-LIFT® cultures assure water quality and provide nutrient control. The augmentation program has proven effective in controlling nitrate levels in the lake and in the test wells located in the area of the lake. The biological augment program has been so effective the augmentation program is now used in several additional lakes at Isleworth.

For more information on MICROBE-LIFT® Technology contact

Ecological Laboratories Inc.

www.EcologicalLabs.com

CS18103

LAWN & GARDEN TREATMENT

For more information on MICROBE-LIFT® Technology contact

Ecological Laboratories Inc.
www.EcologicalLabs.com
19000

Made in the USA

RETAIL LAWN & GARDEN

19100 RETAIL LAWN & GARDEN

19101 MICROBE-LIFT® Photosynthesis Plus® Restores Health to Tomato Plant

19103 MICROBE-LIFT® CLEAR and Birdbath & Statuary Cleaner Receives Member Tested & Recommended Seal from National Home Gardening Club

Why is MICROBE LIFE a superior product line?

Our products have the following which our competitors do not:

- Photosynthetic Bacteria - promoting photosynthesis
- Autotrophic bacteria for improved CO_2 conversion
- Rare earth water soluble humates - mined from organic matter, not leonardite which is not water soluble
- Ecto - Mycorrhizal fungi
- Nitrogen-fixing bacteria to allow for reduced chemical inputs and conversion of nitrogen present in the atmosphere into forms usable by plants, lawns, trees and shrubs
- A wide culture consortium to restore balance to the soil web

A Balanced Solution From Top To Bottom

Microbe Life's unique microbial and humate products rapidly break down most pollution, vastly improving plant and turf nutrient intake; restoring the soil to a more natural, biologically active state; inhabiting the root zone resulting in better uptake of macro- and micronutrients, minerals and more efficient water usage; strengthening the root leading to a vigorous plant, accelerating photosynthesis at the foliar level, providing increased energy.

Experience deeper root growth, leading to greener, thicker grass and turf. Grow stronger, vigorous plants and greener, brighter foilage with greater blooms, using Microbe Life.

For more information on MICROBE-LIFT® Technology contact

Ecological Laboratories Inc.

www.EcologicalLabs.com

19100

Microbe-Lift® Photosynthesis Plus® Restores Health To Tomato Plant

Brett Richter
Ecological Laboratories
13 Hendrickson Ave.
Lynbrook NY 11563-1201

January 29, 2012

Dear Brett,

When I first saw your product, MICROBE-LIFT® "Photosynthesis Plus", at the Long Beach Expo, I was extremely skeptical to say the least. You see hundreds of products in a trade show environment and they all claim to be the greatest addition to your garden in the history of plants. So I listened to the pitch, got a sample, and went on my way.

I had actually forgotten about the sample of Photosynthesis Plus until I nearly killed a tomato plant that I planted for a display. When I transplanted this tomato plant into a hydroponic DWC bucket, I noticed it had white flies. Well, I overdosed Pyrethrum and nearly killed the plant. After a week or so the plant was still so pathetic looking and not worthy of a store display. There were very few leaves and the biggest leaf was no more than 1/2 inch across. Everyone in the store wanted me to get this practically dead tomato out of there.

Then I remembered the Photosynthesis Plus sample. I figured if the tomato plant was to be thrown out, I might as well try one last blast to see if it could be saved. So I added one ounce of Photosynthesis Plus to the four-gallon water reservoir to see what would happen.

To say that I was amazed is an under statement. In only two days the 1/2-inch leaf became 1 and 1/4 inches across and there was new growth everywhere. I have never seen any product produce results like this. Everyone who saw this plant on its last legs was just as stunned as I was. In fact they thought we had replaced the plant.

In only one month the tomato plant has gone from a lifeless, leafless twig to a vigorous, monster-rooting, heavy-fruiting growing machine. I have never seen such explosive growth generated by any product before. So now I am a believer. Finally a product that really is the greatest thing in the history of plants!

Thanks for making this stuff. I won't plant without it again.

Greg

For more information on MICROBE-LIFT® Technology contact
Ecological Laboratories Inc.
www.EcologicalLabs.com
T19101

MICROBE-LIFT® CLEAR and Birdbath & Statuary Cleaner Receives Member Tested & Recommended Seal from National Home Gardening Club

I can't believe the results from MICROBE-LIFT® CLEAR and Birdbath & Statuary Cleaner! It's Marvelous! And it DOES work! I always dreaded cleaning my birdbath when using Clorox. The smell affected my sinuses and the bleach affected my skin! I'm completely sold on this product

-MS, Chambersburg, PA

This is the first time I did not have that terrible rust residue - so hard to get off-in the birdbath and also the green stuff. MICROBE-LIFT® BIRDBATH CLEAR is excellent and the BIRDBATH & STATUARY CLEANER made it so easy to get the bath clean with very little effort. I would highly recommend it to anyone. Plus, it lasts because you use so little.

-RM, Leicester, MA

It is very effective in cleaning the birdbath and is not harmful to the birds.

-LM, Reading, PA

I was especially satisfied how the MICROBE-LIFT® BIRDBATH CLEAR kept the water clear and cleaner than without it. We have hard water in this area and the mineral deposits were kept at a minimum. I also tried it in my furnace humidifier and it too was cleaner. Easy to use. Not only birdbaths, but any standing water like in a humidifier works great.

-LM, Pittsburgh, PA

. . . I was amazed at how clean and clear my birdbaths got. No more bleach, soap and water to clean and constant rinse to make sure bleach is gone. The birds seem to be happy as well as I am. Thank you so much.

-DC, Charlotte, NC

I felt good using a product that is safe for the birds using the birdbath. I always worry about the safety of bleach to both birds and plants. The MICROBE-LIFT® BIRDBATH & STATUARY CLEANER made it easy to get into all the cracks and crevices. The birdbath looked like new without using bleach. Safe for birds and plants.

-BP, Pine Hill, NJ

Easy to use; worked very well with very little effort! My bird bath water has never been so clean & clear looking.

-BG, Alligator Point, FL

I really liked this product. It did exactly what it claims: I had no trouble cleaning my birdbath . The little bit of algae that did show up came off very easily. My little fountain stayed clear all summer. Great product.

-LH, Lebanon, PA

The product does exactly what it is supposed to do. No more algae or slime in the water. It stays beautifully clear from one week to the Other. Definitely worth the cost for the ease of use and effectiveness. Ease of use-just a capful. What could be simpler?

-LR, Brockton, MA

Even with bird droppings and outside debris, the water remains crystal cleat: I am very satisfied. It does not harm pets and wildlife. This is an amazing product It works!

-NL, Buffalo, NY

I am so pleased to finally have a product that cleans my birdbath and keeps the water clean and clear without the use of bleach or other chemicals that are harmful to the environment. My feathered friends and I love this product!

The product keeps birdbath water clean and clear in an environmentally friendly manner.

-KP, Oceanport, NJ

I have always had problems keeping a clean birdbath. By using this product, it cleans more thoroughly and the water stays clean and clear longer.

-CW, Warner Robins, GA

I used MICROBE-LIFT®/BIRDBATH & STATUARY CLEANER on 4 different birdbaths and a variety of statues. I was very pleased with the way it removed mildew/mold stains on all surfaces, but especially in cracks and crevices. I also used this on my fountain and was surprised to see how long the water remained clean and cleat: Best Feature ... Cleaning ability with little elbow grease.

-LG, Lakeland; FL

I loved this product. It performs as advertised. It works!

-PG, Easley, SC

I couldn't believe how well the BIRDBATH & STATUARY CLEANER worked on the old bird bath we got from my husband's grandmother! And the BIRDBATH CLEAR is miraculous. Best Feature ... safety for animals.

-MM, Savannah, GA

I live in Florida. Our weather gets hot! And the algae build-up in birdbaths gets green in 2 days. Your MICROBE-LIFT® BIRDBATH & STATUARY CLEANER is wonderful. The spray is great: spray it on; with a brush, rub out the mess; add the BIRDBATH CLEAR ... and WOW - clean water and clean birdbaths for days! This product is the best I've tried, and I have 10 birdbaths All are sparkly clean. My birds love to use!

-DN, Merritt Island, FL

At least 67% of testers must recommend a product for it to receive the Member Tested & Recommended Seal from the National Home Gardening Club. This seal is awarded to products which the testers recommend to their fellow 575,000 Club members. Ratings are based on a scale of 1-1 O and rated on 10 attributes.

For more information on MICROBE-LIFT® Technology contact

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TECHNICAL INFORMATION

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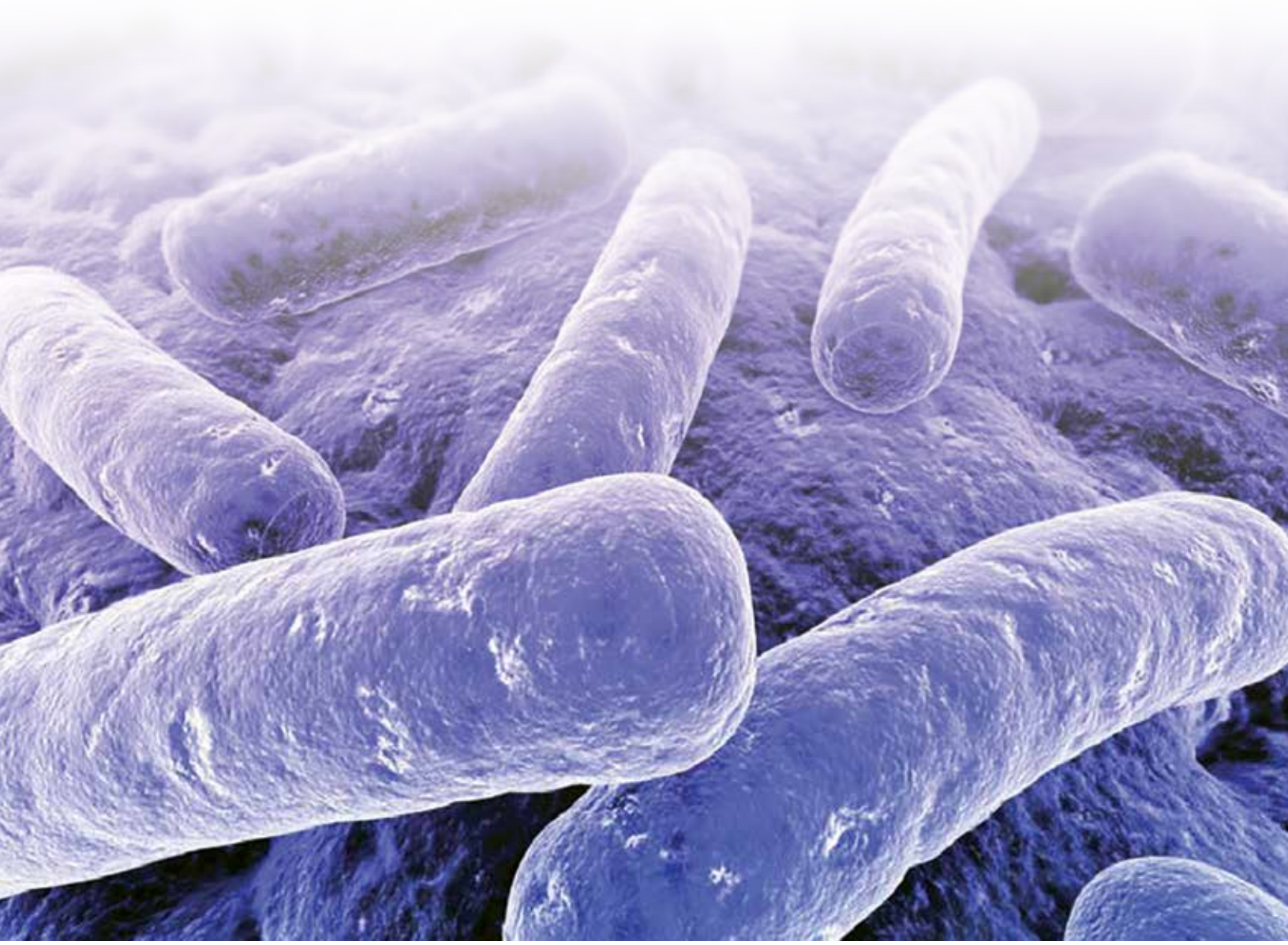
TECHNICAL INFORMATION

BIOLOGICAL PROCESSES



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TECHNICAL INFORMATION - BIOLOGICAL PROCESSES

20100 BIOLOGICAL PROCESSES

20101 MICROBE-LIFT® Novel Technology - The Value of Bio-Augmentation

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MICROBE-LIFT® NOVEL TECHNOLOGY - THE VALUE OF BIO-AUGMENTATION

When considering the value of bio-remediation to wastewater processes and environmental programs where biology already exists in great numbers, one must ask why add additional microorganisms to a biological system or process that has billions of active biological catalysts.

The answer to this important question considers the rate of biodegradability of the substrate within the environment, and the time that is required to biologically breakdown, oxidize and remove the matter from the environment.

Factors affecting biological processes

Few people understand that not all organic constituents "are degraded at the same rate in terms of time". What is important to understand is that difficult and slow to degrade material such as FOG and chemical agents are held on the outer cell membrane for much longer periods of time because they are much more difficult for the microorganisms to enzymatically breakdown, absorb and convert to cellular energy (removal). The picture below shows a drawing representing how bacteria function in their slow steady process of removing organic matter via a process termed adsorption and absorption of waste organic matter.

The drawing has boxes with some boxes marked in red. The boxes represent the bacteria's receptive sites where material lands on the cell and is then enzymatically processed. The red colored boxes provide an indication of the microbe's cellular retention of slow and difficult to degrade constituents that land on the outer cell membrane during what is termed first stage adsorption that occurs within the biological process. The red boxes represent materials that are retained on the cells receptive sites due to the microorganism inability to enzymatically break them down to small molecules thereby resulting in cell loading (stay on the cell).

The red boxes demonstrate what is considered the cellular loading of difficult to degrade matter. This means the organic matter that attaches to the cell can't easily be enzymatically removed at the same rate as the easy to degrade organic matter; this is due to their degradation difficulty, and these constituents are retained on the outer cell at first stage loading. In most cases the slow to degrade matter stays on the outer cell membrane affecting and slowing biological oxidation-reduction, with the materials resulting in excessive solids accumulation and the development of waste solids termed sludge.

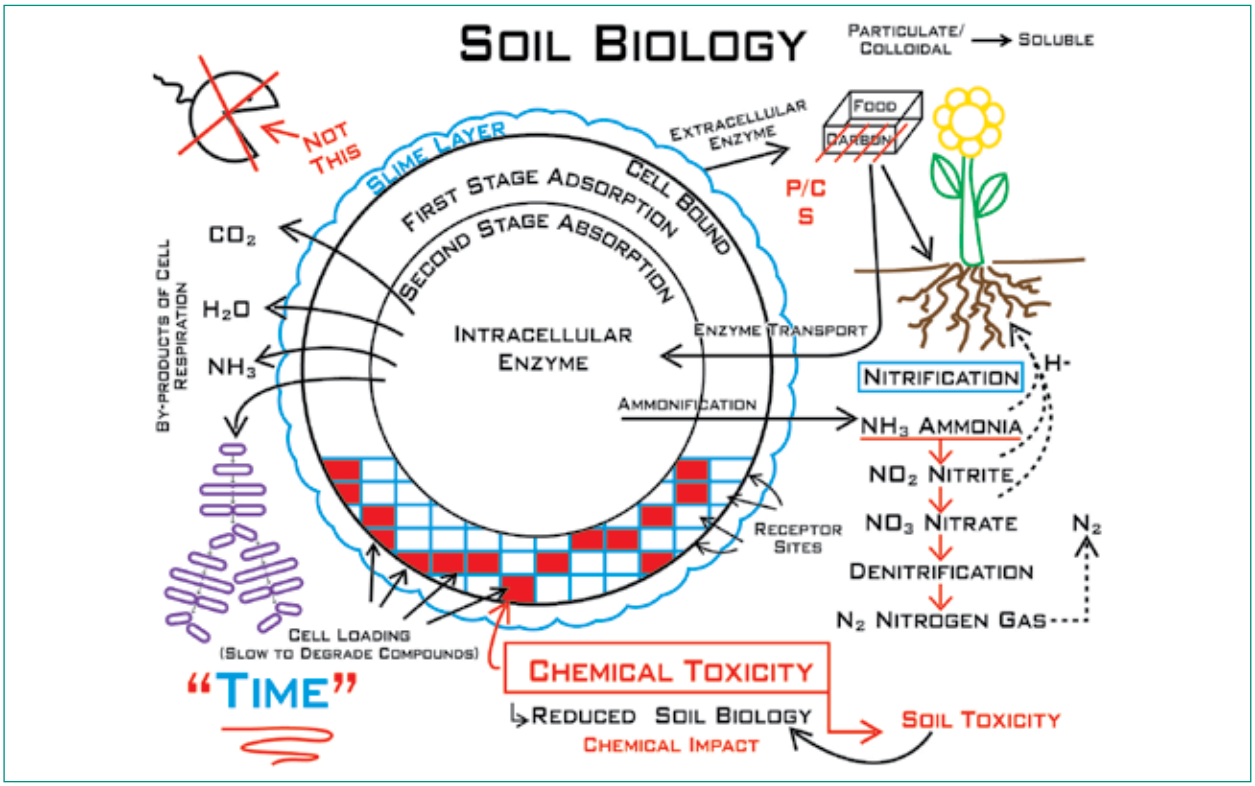
- The use of bio-augmentation with **Ecological Laboratories Inc. (ELI**) cultures has demonstrated and shown to effectively promote biomass enhancement functions and processes promoting the capability to breakdown, adsorb, and absorb a far wider range of difficult and slow to degrade compounds, and at a much faster rate thereby reducing or eliminating cell loading, and solids accumulation in waste removal biological processes.
- MICROBE-LIFT® technology - Reduces final effluent BOD, COD, SS, improves settling in clarifiers, drives nitrification for improved ammonia removal, achieves rapid anoxic denitrification, reduces waste sludge, and biologically controls hydrogen sulfide.

It is noteworthy that the bio-enhancement process requires a period of time for the microorganisms to achieve improvement. This requires the biology to acclimate to the substrate to achieve a noted reduction of difficult to degrade matter within the biological process.

The normal delay in biomass enhancement may be 10 to 15 days prior to achieving a noted improvement, however hydrogen sulfide reduction and odor abatement may be achieved within as little as 24 to 48 hours.

The picture below describes the biological enzymatic process to include extracellular enzyme functions at first stage necessary to break down particles attached to the outer cell membrane so they can be absorbed into the cell. In simple terms the ambient populations normally contain few organisms that have the capability of breaking down and removing modern day compounds. The diagram describes cell bound enzymatic and intracellular enzyme functions essential to organic removal, these capabilities differ within the microbial community, and most indigenous microorganisms fail to breakdown and remove difficult to degrade constituents. These materials end-up on the bacteria, slowing biological functions, increasing toxicity and resulting in accumulated solids.

The addition of **ELI's** select vegetative microorganisms having the ability to degrade a far greater range of difficult compounds thereby reduces bio-mass toxicity, improves overall bio-diversity capabilities, and results in sludge reduction. It is note-worthy that the **ELI's** consortium offers microbial process and pathways that include aerobic, anaerobic, facultative and anoxic reactions assuring far greater oxidation reduction capabilities. They drive the nitrification process for ammonia removal, and promote rapid anoxic denitrification for nitrate reduction. Few if any technologies offer these capabilities.

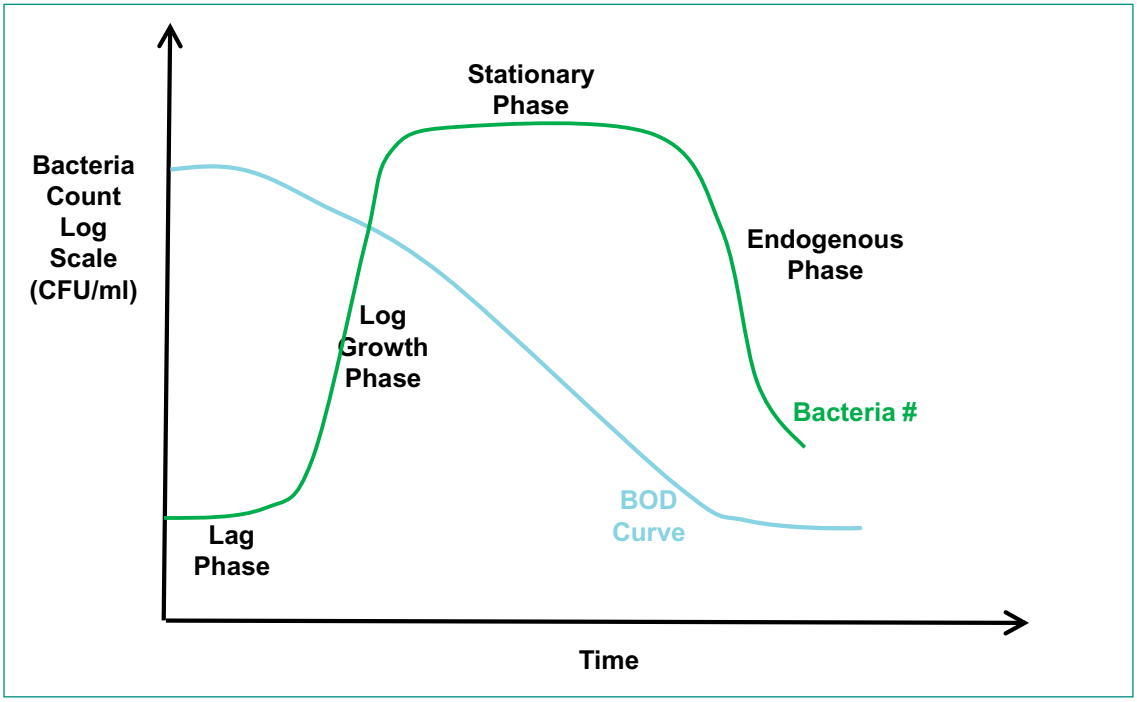


In the above pictures the red boxes indicate retained slow and difficult to degrade matter that is retained on the outer cell membrane at first stage loading, this is referred to as cell loading and results in a higher percentage of sludge build-up as the waste materials are not biologically broken- down, degraded and removed.

In the past this was often referred to as fat sludge due to the fact that most indigenous microorganisms fail to biologically breakdown and achieve a reduction in FOG, with the retained waste solids having a high percentage of FOG in the sludge, as well as in the final effluent.

- The diagram below describes the biological process and its' time frame. The biological oxidation reduction process consists of: Lag Phase, (this is the period the microorganisms requires to identify the substrate and then produce the necessary enzyme reactions, this can vary for different substrate); Log Growth, the process where the microorganisms are responding to the substrate in cell growth; then the Stationary Phase, where the microorganisms will develop to equal the waste matter, often referred to as the F to M ratio (food to mass). At this point you are seeing the result of the biological process in terms of good organic removal; then Death or declining phase as the microorganisms decline as the food supply is reduced.

Bacterial Growth Curve (static tank)



Therefore the use of bio-augmentation with **Ecological Laboratories** consortium will promote and assist in a more rapid development of the essential biology with the capability to breakdown and degrade slow and difficult to degrade matter, reducing cell loading and sludge accumulation; however the time frame for removal will still have to take place over a number of sludge ages.

The concept of bio-augmentation is to enhance biomass performance by assisting the indigenous microorganisms in the combined capability to breakdown and remove a greater range of organic matter and at a faster rate.

The information is offered to provide an understanding of the value of Bio-augmentation.

Following your review of the forgoing information should you have questions please feel free to contact me at: doug.dent@ecologicallabs.com.

For more information on MICROBE-LIFT® Technology contact
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