

# **WASTEWATER LAGOON BIO-REMEDICATION PROJECT**

*Engineering report on sludge and BOD reductions from a 10 MG three cell lagoon system plagued by solids buildup and effluent BOD higher than permit levels;  
Plant brought into compliance and Reduction of Sludge*

The Wastewater Lagoons were originally constructed in 1969 as a two-cell facultative system. In 1973, an additional cell was constructed due to the increase in homes being built in the area. The original design for the two cells provided for a surface area of five acres, and with the additional cell the surface area was increased by five acres for a total surface area of approximately ten acres. This capacity should provide for a 150 day retention time, prior to discharge to a creek under an EPA approved NPDES discharge permit.

The lagoon system has continued to have high BOD<sub>5</sub> readings throughout the winter months for many years. The permit allows for a BOD<sub>5</sub> of 45 Mg/L. The BOD<sub>5</sub> readings through the winter months range from 50 Mg/L to 90 Mg/L and the summer months range from 10 Mg/L to 20 Mg/L.

The lagoons have an influent flow of approximately 60 gallons per minute, and an outfall or effluent of approximately 200 gallons per minute. This increase is a result of infiltration from a spring into the third cell of the system. During the summer of 1992, several test holes were dug around the third cell to determine the flow of this infiltration water. At this time, no plans to remediate the spring infiltration are planned.

Due to the number of years of operation of the lagoon system and the limited amount of maintenance on the lagoons, it was believed that a high volume of sludge had hampered the lagoon system to function at its designed capacity and achieve a high quality of effluent. Solids loading had also reduced retention time of the wastewater prior to discharge. Maintenance was limited to occasional burning of the weeds and grasses around the perimeter of the lagoon cells. Junction boxes and equalization structures were packed with solids and inorganic materials which hampered the operation of the cells and which caused influent flows to be diverted from Cell #1 into Cell #2. This resulted in solids loading of Cell #2, and occasionally caused Cell #1 to become septic and non-functional.

## **Project Goal**

Based on the history of the lagoon system, the identified needs were to bring the system not only back into permit compliance through the year, but to also bring the system back into operation as it was designed. The identified problems were:

1. Cell #1 going septic
2. Equalization and diversion structures being plugged or non functional
3. High BOD

In order to accomplish the identified needs, the Engineer and Sanitarian reviewed available data, determined and researched the alternatives and began a plan to remediate the problems. The main problem, which funding would support, was that of solids and sludge build up in Cells #1 and #2.

## **Alternatives**

The alternatives identified for reduction of sludge buildup in the lagoon system were:

1. Drain the lagoons and mechanically remove the solids using heavy equipment

2. Dredge the lagoons using a portable dredge
3. Utilize a newer technology such as bioremediation

The first alternative of draining the lagoons was not feasible as it represented major obstacles in diverting the flow, discharging untreated waste and land application of the solids. This, along with the cost to perform such a project ruled this option out. The second option of having the lagoons dredged was researched. The inherent problems of this option were locating a place to transfer and dispose of the dredged liquid and the solid mixture, the eventual land application problems and the cost to perform such a project would be approximately \$40,000 to \$60,000.

The alternative to perform bioremediation was researched and prices were obtained from product suppliers. These cost estimates were based on variables such as lagoon size, amount of sludge and local weather data. It was determined that bioremediation would cost significantly less than the estimates obtained for both the lagoon draining option and the dredging option. The product chosen was **BYO-GON PX-109®**, because of its ability to provide the required bacteria stimulation to achieve higher degradation/digestion of organics and because it does not require adding other customized bacteria.

### **Project Breakdown**

The project involved performing sampling and analysis to determine sludge depths, proceeding with contracting for the product, the contractor on-site activities, monitoring the lagoon system during the project and final sampling and analysis.

### **Sampling and Analysis**

Sampling of the sludge depths was performed in May and again in August. Sludge depth results were charted. The conclusions from this sampling showed results of approximately 10.63 inches of sludge (average) for Cell #1 and approximately 7.72 inches of sludge (average) for Cell #2.

Samples of sludge and liquids taken from the cells showed total solids of 386,000 Mg/L and total volatile solids of 346,000 Mg/L for Cell #1. Analysis of Cell #2 showed total solids of 510,000 Mg/L and total volatile solids of 457,000 Mg/L. The BOD-5 of the effluent showed 25 Mg/L.

### **Project Close Out, Sampling and Analysis**

Based on comparisons of pre-project and post-project analytical data and sludge depths, the use of such a product as **BYO-GON PX-109®** for bio-remediation in a lagoon system is both cost effective and advantageous in reducing solids buildup and sludge digestion problems in a wastewater treatment system. The results are summarized as follows:

### ***Lagoon Cell #1***

*Average sludge depth reduction of 68.5%*

*A reduction of Total Volatile Solids of 94.7%*

*A reduction of Total Suspended Solids of 68.9%*

### ***Lagoon Cell #2***

*Average sludge depth reduction of 50.2%*

*A reduction of Total Volatile Solids of 70.2%*

*A reduction of Total Suspended Solids of 92%.*

As can be seen by the reductions shown, the product stimulated the bacteria to perform a high rate of digestion, thus reducing the volatile solids to water and ash (dead bacteria). This accounts for the increase in the water levels in the cells and decreases in the sludge depths.

Since the end of the project, no noticeable odors have recurred from the cells and the BOD-5 readings have been reduced from their previous levels consistent with this time of the year.

In conclusion, a product such as **BYO-GON PX-109®** may be a viable alternative for other wastewater systems which are suffering from high solids buildup, odors (septic), lack of maintenance and which are faced with short bacteria activity cycles due to weather conditions. It is also noted that based on the products effectiveness, a maintenance program using **BYO-GON PX-109®** may effectively regenerate a wastewater treatment system and save future remediation dollars and extend the life of an older system requiring renovation or expansion.