

Lagoon Monitoring and Condition Parameters

Lagoons combine storage and treatment functions and thus are more sensitive to management inputs than are solid or slurry facilities. The establishment and maintenance of desirable microbiological populations in lagoons requires more specific procedures in the way lagoons are loaded and monitored.

Startup and loading procedures

Lagoon startup is a very important factor in developing a mature lagoon that has an acceptable odor level and will perform in the expected manner over the long term. Lagoons are designed with a “treatment volume” that provides an environment for development and maintenance of a bacterial population that degrades and stabilizes manure. The size of the treatment volume is based on a volatile solids (VS) loading rate, which depends primarily upon temperature. Volatile solids are the “non-mineral” or organic solids in manure that are subject to bacterial degradation. At warmer temperatures, bacteria are more active and VS loading rates are higher. The converse is true for cooler temperatures. For the bacteria to develop and function properly, the actual VS loading rate should be as designed. The proper VS loading rate is achieved only if the lagoon contains a volume of water equal to the treatment volume at startup. A lagoon with only one-tenth of the treatment volume filled at startup will experience an “overload” by a factor of 10 (VS loading rate is ten times greater than designed). Therefore, it is very important to plan a procedure to have sufficient water in a lagoon at startup. The treatment volume should be used as a target. Achieving this goal may require identifying a water source (pond, lake) and implementing the needed pumping procedures to transfer the desired volume of water to the lagoon. Since bacteria are more active at warmer temperatures, consideration should be given to starting a lagoon in the spring or early summer. In this way, bacteria will have a warm season to establish themselves before activity slows during the winter. Spring startup of lagoons often requires special planning of construction schedules and animal procurement.

Problems associated with insufficient volume at startup include excessive odor and high rates of sludge buildup. A lagoon that is started with insufficient volume may take years to recover and may never attain an operating state equal to a lagoon that is started properly.

In addition to startup, long-term loading procedures are critical to lagoon performance. A somewhat common and unfortunate practice in the livestock industry is to expand animal numbers without expanding lagoon size. This results in a proportionate increase in VS loading, and the associated problems can be expected to develop. Volatile solids loading should not be increased beyond the design loading. Alternatives to reduce VS loading (or expand animal numbers) include solids separation, construction of additional lagoon volume, or pretreatment of manure. Lagoons should also receive manure in a consistent manner (no “slug” loading). This is usually accomplished in modern production systems utilizing hydraulic transport of the manure to the lagoon.

Salt and nutrient levels, testing

Bacterial activity is somewhat sensitive to salt levels in the lagoon. Salts are a natural byproduct of the biological degradation of manure. The removal of some salts as the lagoon is pumped and the addition of fresh

Proper startup and loading procedures are critical to the long-term “health” of a lagoon.

Salt levels in a lagoon should be monitored because high levels can reduce lagoon performance.

Many manure releases and spills occur during pumping activities. Extra care should be taken during these operations.

water via rainfall, runoff, and wash water combine to generally keep salt levels within an acceptable range. However, some conditions can occur that may lead to elevated salt levels. These include extended periods of dry weather, high rates of evaporation, little or no dilution with lot runoff and wash water, and perhaps overloading of the lagoon. Elevated salt levels inhibit bacterial activity, and lagoon performance is characterized by increased odors or “sour” smells and increased sludge buildup rates. A simple field test called “electrical conductivity” (EC) is effective in monitoring salt levels. A University of Missouri study found that EC values in the range of 8,000 to 12,000 umho/cm were associated with greatest bacterial activity. If salt levels rise too high in a lagoon, the most effective remediation is to pump the lagoon and add water from a freshwater source (pond or lake). The availability of such a freshwater source is an enhancement to long-term lagoon operation, and consideration should be given to such a source when planning a lagoon.

While overall salt levels are the primary concern in lagoon health, occasionally other more specific compounds may affect lagoon performance. These might include copper, arsenic, (dietary inputs), certain medications, and perhaps excessive use of harsh cleaning agents. If reduced lagoon performance is suspected due to factors such as these, specific testing may be required to isolate the source.