# Treatment Lagoons
## Wastewater Tip Sheet

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This document provides industry best practices and resources for operators and system managers to avoid common mistakes that trigger non-compliance.

## System Information

**Facility Name** _____ **Receiving Water** _____

## Important Dates

**Permit Start** ____/____/____ **Permit End** ____/____/____ **Date To Reapply** ____/____/____

## Operational Best Practices

### Frequent Inspections

Items to check often (usually daily) as the operational condition of these items can quickly impact the performance of the treatment system.

- ❒ **Critical Equipment Status:** Evaluate status of critical equipment including influent pumps, disinfection systems (UV lights), chemical inventories, aerators, etc.
- ❒ **Flows and Meters:** Confirm flows throughout the system are within expectations for current conditions. Are flows fluctuating as expected for rainfall or seasonal conditions? Are flow meters intact and functioning?
- ❒ **Solids Monitoring and Freeboard:** Observe that lagoon cells show a uniform appearance with no beaching or cresting sludge. Is freeboard > 12 inches?
- ❒ **Dike Condition:** Examine dike walls for evidence of seeping, erosion, and damage from burrowing animals, rooting plants, or cattle.
- ❒ **Auto Samplers:** Clear intake lines of blockages. Check sample cycle matches the volume in the bottle and confirm all samples have been drawn.
- ❒ **Water Conditions:** Observe if there is an unusual odor, excessive foam, sheen to the water, or discoloration of the surrounding vegetation within the lagoon and outfall.
- ❒ **Treatment Issues:** Identify treatments issues from high effluent biological oxygen demand or total suspended solids, bulking sludge, increased vector attraction (e.g., waterfowl, midge flies), excessive algae and vegetation growth (e.g., duckweed, cattail, etc.)
- ❒ **Safety:** Be aware of trip hazards, personal protective equipment availability and condition, railings, walkways, and emergency flotation.

### Occasional Inspections

Items to check less frequently (usually weekly or monthly) to confirm that performance is within expectations

- ❒ **Equipment Calibrations:** Items like autosamplers, dissolved oxygen and chemical probes (including pH) drift out of range over time and will need to be recalibrated to a standard to ensure that the equipment is reading accurately.
- ❒ **Collection System:** Lift stations and manholes throughout the service area will need to be inspected periodically for condition assessment and potential fats, oils, and grease or wipes build-up that can lead to blockages and malfunctions causing sanitary sewer overflows.
- ❒ **Pump and Motor Maintenance:** Most pumps and motors require lubrication, belt replacement, or oil changes. Identify assets that need additional maintenance above manufactures estimates due to the demanding conditions experienced at wastewater systems.
- ❒ **Alarms:** Confirm alarms and other active monitoring systems are operational.
- ❒ **Safety:** Keep spill control supplies stocked, and emergency response equipment in operational condition.

### Annual & Biannual Inspections

- ❒ **Solids Accumulation:** Measure sludge depth throughout the lagoon. Sludge levels should be maintained at < 30% of the total lagoon depth.
- ❒ **Valve Operations:** All valves need to be exercised at least annually as part of operation and maintenance requirements and as part of an emergency management program.

*Use the QR code to access resources, including formulas for the calculations listed above, and techniques for nutrient reduction.*

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## Common Process Monitoring Parameters

### Dissolved Oxygen (DO)

- Treatment Microorganisms consume a large quantity of oxygen to grow and reproduce. A minimum DO of (0.5 - 2 mg/L) should be available to these organisms or the treatment capacity of the system can be suppressed leading to septicity.
- The distribution of DO throughout the lagoon indicates the type of lagoon and treatment process. Types can include Aerobic, Anaerobic, and Facultative. Knowing the type of lagoon can identify additional control mechanisms available.
- Mitigation of the negative effects of seasonal overturn can be accomplished by providing additional oxygen during these periods.

### Solids Inventory

Detention Time
Sludge Blanket
Sludge Characterization
Sludge Age

- Excessive sludge in a lagoon can reduce treatment capacity and efficiency by lowering detention time, and contributing to bulking sludge, and odors.
- Sludge can also provide a nutrient source for aquatic vegetation like duckweed and algae causing additional growth that can overwhelm a system leading to biochemical oxygen demand and total suspended solids challenges in the effluent.
- Preventing the sludge blanket from exceeding 20% of the total depth can help regulate the total microbial population and promote the dominance of the most efficient treatment organisms.
- A sludge judge or ultrasonic interface monitor can be used for sludge blanket monitoring.
- Sludge characterization is required to determine the appropriate disposal method.

### Nutrients and pH

Ammonia
Nitrate/Nitrite
Phosphorus

- Excessive nutrients within a system can create internal treatment challenges with algae and duckweed growth as well as cause effluent exceedances by exerting additional biochemical oxygen demand on receiving waters.
- Persistent low pH (< 6.5) and low temperatures can affect nutrient uptake from treatment microorganisms and lead to an increase in odor production.

## Sampling Best Practices

### Location

- Required sample locations are described in the permit and are representative of influent (before any treatment and return flows) and effluent (after all treatment is performed). Effluent samples should be representative of the water discharge through the outfall prior to mixing with the receiving water body or other waste streams.

### Occurrence

Specified by the permit

- **Frequency:** Sampling can occur at daily, weekly, monthly, quarterly, and annual intervals.
- **Type:** Grab (single dip sample) or composite sample (a series of flow proportional grab samples in timed increments combined into a single sample for analysis).

### Collection

- Only use sample bottles that are sterilized and triple rinsed. Discard the contents of the first sample as rinse then collect the actual sample. If there is a preservative in the collection bottle, do not rinse or overfill. The volume of preservative needed is specific to the volume of sample to be collected.
- Document the chain of custody: the time of collection, date, the person taking the sample, and unique sample identifier. Rinse all collection equipment with deionized water before storage.

### Preservation

- All samples collected should be preserved in accordance with 40CFR part 136. At a minimum, all samples should be maintained at ≤ 6°C prior to analysis; however, frozen samples will be rejected by the lab. Be aware of hold times for specific parameters. Parameters such as pH and dissolved oxygen need to be analyzed almost immediately as values can change rapidly whereas other can be stored over 24 hours before analysis is required.

### Shipping

- Include all samples, a temperature blank (provided by the lab), and the preservative (ice). Do not use dry ice as the $CO^2$ released when melting can cause asphyxiation or extreme pressure buildup in enclosed containers.

### Safety

- There is potential for exposure to pathogens in the wastewater during sampling. Wear proper personal protective equipment like nitrile gloves and safety glasses to limit entry points into the body.

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## Reporting Best Practices

### Logbook

Documenting operational actions and equipment status or calibration results is a great way to troubleshoot problems within a system that may happen later. Some documentation is required by the permit like a chain of custody and recording of operational actions. An official logbook should have a date, climate conditions, and operators on duty. Logbooks should be accessible to inspectors upon request and be retained for at least 3-5 years.

### Submitting Discharge Monitoring Reports (DMRs)

**Submission:** Sample and calculated results must be recorded and submitted on a DMR through NetDMR at the frequency required by the permit. DMRs are due on the 28th day of the month following the reporting period.

**Significant Digits:** NetDMR allows for a maximum of 8 digits after the decimal; however, the number of significant digits required is determined by the accuracy of the measurement.

- All non-zero digits and any zeros between non-zero digits count.
- Leading zeros do not count.
- Trailing zeros count if there is a decimal point.

**Rounding Numbers:** Stay consistent in rounding numbers through calculations and reporting.

- Identify the position of the digit you are rounding to.
- Leave the digit the same if the trailing digit is less than 5.
- Increase the digit by 1 if the trailing digit is 5 or more.
- If the digit 5 is dropped, round off the preceding digit to the nearest even number (e.g.,1.05 rounds to 1.0, 1.15 rounds to 1.2)

### Interpreting Lab Results

**Detection Limit:** The minimum value that an analytical method can generate with confidence. A detection limit must be ≤ the minimum value specified for a parameter in the permit. If a laboratory reports a trace amount, then a "<" sign should be reported on the DMR with the detection limit specified.

**Practical Quantification Limit (PQL):** The minimum concentration of an analyte that can be measured with a high degree of confidence that the analyte is present at or above that concentration. Often, analytical values less than PQL are considered zero for purposes of determining averages. If analytical results are less than PQL, < PQL can be reported on the DMR.

### Calculations

**Average Monthly (30-day):** Arithmetic mean of all samples for a parameter collected during a calendar month or consecutive 30-day period.

**Average Weekly (7-day):** Arithmetic mean of all samples collected Sunday through Saturday or consecutive 7-day period.

**Daily Maximum:** Greatest measured value for a pollutant discharged during a calendar day or 24-hour period that represents a calendar day for purposes of sampling. For pollutants with limitations expressed in other units of measurement (e.g., mg/L), the daily maximum is calculated as the average of all measurements of the pollutant over the calendar day or 24-hour period.

### Noncompliance

**Significant Noncompliance (SNC):** SNC violations can range from significant exceedances of effluent limits and sanitary sewer overflows to reporting violations.

**Reporting:** In any event of effluent discharge exceeding permit limits, the operator in responsible charge must notify the **permitting authority orally within 24 hours** of becoming aware of the circumstances and provide a **written submission within 5 days.** The written submission should include: **(1)** a description of the noncompliance and its cause; **(2)** the period of noncompliance (exact dates and times); **(3)** if at the time of notification, the noncompliance has not been corrected, the anticipated time it is expected to continue; and **(4)** steps taken or planned to reduce, eliminate, and prevent the recurrence of noncompliance.

**Noncompliance Hotline:** Regional EPA _____-_____-_____ State _____-_____-_____

**Disclaimer:** This tip sheet addresses select provisions of EPA regulatory requirements using plain language. The statements in this tip sheet are intended solely as guidance. Nothing in this tip sheet is meant to replace or revise any NPDES permit, any EPA regulatory provision, or any other part of the Code of Federal Regulations, the Federal Register, or the Clean Water Act. EPA recommends that operators consult with their permitting agency prior to making major changes to their systems.

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