Operations and Maintenance Manual
Wastewater Discharge Permit ST0045535

AstaReal, Inc.
Moses Lake WA

President, CEO — Date: 12/13/2022

Quality Manager — Date: 12/13/2022

Wastewater Tank Operations and Maintenance Manual

AstaReal Inc.
7761 Randolph Road
Moses Lake, WA 98837
Permit ST0045535

Contents:

Attachments:
F218 Process Wastewater Neutralization Tank

Definitions:
PLC: Programmable Logic Controller
LT-EAST & LT-WEST: Float Switches
FV-E/DSCH or FV-W/DSCH: Float / Discharge Valves in the East or West Tanks
LSH-EAST & LSH-WEST: East – West High Level Wastewater Alarm
FV-E/MX or FV-W/ MX: Float / Mixing Valves in East or West Tanks
AE/AT-EAST & AE/AT-WEST: East – West pH Sensors
TDS: Total Dissolved Solids
GPM: Gallons per Minute
RO: Reverse Osmosis

Dept. of Ecology Emergency 24-hr Reporting
(509) 329-3400

1.0 Safety

1.1 Facility Contacts

Contact	Title	Phone Number
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1.2 The process water, coming from the AstaReal facility, may fluctuate between caustic and acidic and may produce low levels of oxygen depending on the operations/cleaning tasks occurring. Plant technicians are required to wear suitable personal protective equipment when working inside the tank. Additionally, Standard Operating Procedures, Lock-Out, Tag-Out and Confined Space Programs, have been developed for blocking the incoming water line to ensure no water can flood the tank while plant personnel are inside for maintenance operations.

1.3 The tanks are vented to provide an air balancing mechanism for the water entering the tank but will not ensure adequate oxygen respiration levels in the tank. The gases, above the water level, may be low in oxygen and unable to support respiratory functions. The plant technicians will follow operating procedures for testing oxygen content, positively ventilating the tank, and for entering the tank in accordance with our confined space entry program.

1.4 The wastewater tanks are not tied into the main plant control system. All alarms are locally indicated at the Programmable Logic Controller (PLC) for the wastewater tanks. Plant technicians are trained on responding and notifying the correct authorities for such alarms.

2.0 General

2.1 The AstaReal facility grows algae to produce biomass that will be used to manufacture food-grade supplement products. Algae is grown in tanks, then processed, dried, and packaged for shipment to our customers or other facilities for additional processing and distribution. This is a batch process which involves stages of growing and transferring algae to progressively larger tanks at various growth intervals. Batches of mature algae are harvested, decanted to remove excess water, dried using a steam-fed drum dryer, then packaged and temporarily stored onsite prior to offsite transport by truck for further processing or for direct sale to our customers. Sanitary sewer is handled separately and is not plumbed to the wastewater equalization tanks.

Wastewater generated from the different steps in the processing includes:

- Tank and general equipment cleaning water,

- Reverse osmosis water,
- Decanted water, after algae harvest, and
- Boiler blow down and miscellaneous lab fixtures.

2.2 The neutralization tanks are the primary collection points for plant effluent from processing areas. The tanks are divided into two sections: East and West. Each tank is a mirror image of the other. The tanks are concrete with an epoxy coating on the internal surfaces which are exposed to the wastewater. The piping penetrations are grouted to ensure a continuous seal for the epoxy coating. The tank sections are joined, and a butyl sealant is used at the junctures of the tank wall and floor sections. The hardware behind the seal is stainless steel to avoid corrosion in the event of a seal failure.

2.3 During processing, the effluent will be analyzed with instruments inside the tanks to determine whether the water is within the acceptable criteria specified in the facility's wastewater discharge permit.

2.4 The discharge piping is equipped with instrumentation to monitor the effluent discharge for conductivity, pH, and flow rate during discharge. A sampling port, in the discharge piping, is used for collecting wastewater samples, in accordance with the facility wastewater discharge permit. If during a discharge period, the wastewater is determined to be out of compliance the system will automatically reverse the valve arrangement to divert flow back to the tank of origin and stop discharging to the Port of Moses Lake industrial wastewater system.

2.5 The tanks' water inlet, 10-inch main lines, drops the wastewater to the floor of the tank. The low water level will be above the bottom of the pipe to help seal any gases in the tank from returning to the building. Each inlet has an actuated valve which will direct flow based on tank levels.

2.6 The tanks are equipped with various internal sensors: level transmitters, a high-level switch, and a pH sensor. Each tank is supplied with an acid and a caustic line which pumps from containment rooms in the building. Acid or caustic will be automatically dispensed to the tanks from the PLC to neutralize the water in the tank.

2.7 A submersible sump pump is provided within the tank for the purpose of either recirculation (during neutralization), or for discharging from the tank. When the tank contents are neutralized, the recirculation/discharge valve arrangement reverses to discharge the neutralized effluent to the Port of Moses Lake wastewater system.

2.8 There is a secondary vault on the north side of the wastewater tanks. This vault houses a flow meter, a sample valve, a pH/temperature sensor, and a conductivity sensor. These instruments are used to ensure compliance with the site Permit for discharge of wastewater.

3.0 Wastewater Tank Startup or Maintenance Checklist:

☐ Confirm all pipes are hanging from stainless steel mounting hardware.

☐ Confirm all pipes, penetrating the tanks, are continuously epoxy sealed from the wall to the piping.

- ☐ Verify all conduit piping has a seal between the internal pipe and the conduit.
- ☐ All motors have been checked for correct rotation and verified for operation.
- ☐ Verify the submersible sump pump lifting chain is suitably attached for extraction of the pump.
- ☐ Confirm the unions for the pump are tightened.
- ☐ Stroke all actuated valves to ensure they cycle and move freely. Verify actuation signal to actuated valve position.
- ☐ Verify the 10-inch inlet valves (1 per tank) are installed so the valve is in the horizontal position. This arrangement is preferred to allow solids to pass freely without encountering the disk and potentially building up a blockage in the pipe at the valves disk.
- ☐ Verify that all instruments are connected to the PLC panel and that all calibration is complete.

4.0 Operation

4.1 The neutralization tank will automatically fill, from the facility process wastewater floor drains, as various tanks and wash-downs are occurring in the facility.

4.2 LT-EAST & LT-WEST, float switches, are used to measure the level of process wastewater in each section of the neutralization tank (Tank-EAST or Tank-WEST). The flow is diverted to the active tank by the inlet valves (Flow Valve-W/INLET or FV-E/INLET). When the level rises 6 inches above the low-water level, the mixing valve is opened, the tank sump pump turns on and will begin to recirculate water to mix the contents. In subsequent stages of operation, when the level in the tank returns to the low-level value, the pump turns off and the recirculation and discharge actuated valves revert to their normal position where the recirculation valve and the discharge valve are both closed. NOTE: The pump is controlled by a series of floats and a standalone control panel.

4.3 East/West high level wastewater alarm (LSH-EAST & LSH-WEST) are safety devices which are not intended to be used for routine control of the tank levels. If LSH-EAST or LSH-WEST is triggered, the PLC initiates an audible alarm, and the valve positions reverse the currently filling tank to begin filling the standby tank. If a tank high level alarm is activated, an alarm sounds and is visible on the PLC operator station to alert the plant operators that an abnormal condition has occurred, and to make them aware that discharge into the process waste system may need to be curtailed.

4.4 Recirculation is intended to help distribute and mix the acidic or caustic (as required) to neutralize the effluent. The recirculation is accomplished by running the sump pump, opening the mixing valve (East/West pH Sensor: FV-E/MX or FV-W/ MX), to divert flow to the far end of the tank, while closing the discharge valve (East/West pH Sensor: FV-E/DSCH or FV-W/DSCH). The mixing action will stop when the pH value is

between 6.00 – 9.00, but only after the mixing sequence has run for 15 minutes to ensure proper mixing has occurred. After the pH reading has consistently measured a value within this range the valves will allow for discharge of the wastewater.

4.5 The pH sensor will provide temperature compensated pH values of the effluent in the tank. Based upon the measured values the following actions will occur:

4.5.1 pH < 6.00: Caustic will be pumped into the tank,
4.5.2 pH > 9.00: Acid will be pumped into the tank,
4.5.3 pH is between 6.00 & 9.00: Effluent is mixed and then discharged.

4.6 Valve positions are monitored to display the actual valve positions. Each valve is provided with position switches to identify whether the valve is open or closed. If after a position command has been issued from the PLC to a valve and an end switch does not identify the completion of this command within 1 minute, the PLC will alarm to indicate a possible obstruction or potential valve malfunction.

4.7 Discharge Considerations: The discharge to the Port of Moses Lake Industrial Wastewater system is regulated to prevent damage to the piping infrastructure. The most up to date permit information is used in lieu of the values provided below.

4.7.1 The flow rate is to be regulated to 200 GPM or less.
4.7.2 The neutralized water will have a pH range of 6.00 - 9.00 - temperature corrected.
4.7.3 The neutralized water will have a daily Total Dissolved Solids (TDS) of 2,200 mg/L or less.

4.8 Chemical Dosing Considerations: The actual plant effluent will vary, and the actual volumes of acid or base required for treatment will vary accordingly. The following values are to be used as a guide.

4.8.1 To treat a full batch of caustic solution (20,000 gallons total at pH 11.5) approximately 13 gallons of 50% Sulfuric Acid will be required. This treatment is expected to occur over the period of 2 hours.
4.8.2 To treat a full batch of acidic solution (20,000 gallons total at pH 2.5) approximately 26 gallons of 25% caustic will be required. This treatment is expected to occur over the duration of 2 hours.

Note: *25% Caustic is recommended as it has a freezing point of -4°F, which is below the worst design day value in Moses Lake. A higher concentration could be used, but there is a significant risk due to the higher freezing point of caustics with higher concentrations. When a caustic freezes it will cause crystallization in tank lines. Unfortunately, when caustic solidifies it is not a simple matter to unfreeze the solids and could require replacement of the lines from the tank to the building.*

4.9 The PLC will include a comparison function to analyze the amount of acid or caustic dispensed to neutralize a volume of water. The water level transmitter is used to provide the capacity of water, while the AE sensor is used to provide the tank water's pH value.

4.10 When dosing the acid or caustic, the volume dispensed is quantified for each batch of

wastewater treated and compared to the theoretical value. If the actual value exceeds the theoretical value by more than 20% the PLC will provide an alarm. Excess dosing could simply indicate a more complicated solution is present; however, it may also indicate the pH sensors are fouled, out of calibration, or possibly a leak in the tubing from the pump to the tank. This will require a pressure test between the tank and the pump to verify the tubing is not leaking.

4.11 Inspection: The neutralization tank will be inspected annually. The inspection will be documented and should at a minimum confirm the integrity of the following components:

- ☐ Inspect epoxy coating on the floors and walls for delamination, bubbling, or peeling. Where areas of the epoxy coating are found to be compromised, the epoxy coating should be repaired before the tank is returned to service.
- ☐ The butyl joints, at the tanks' vertical and horizontal seams, are inspected to confirm these remain in good condition. If there is significant shrinkage or peeling occurring at these seams, there is the potential for leakage and additional investigation would be prudent.
- ☐ The piping should be reviewed to ensure that hangers, joints, and hardware are intact and in good condition. It is advisable to replace any elements which appear missing or in poor condition.
- ☐ The instrumentation for TDS, pH, flow meter and temperature element/transmitter should be calibrated during this inspection or more frequently as may be required. Calibration may be required more frequently if the measurements begin to deviate by more than 5% from the physical samples.
- ☐ The commissioning and startup checklist should be followed as the final piece to return the system to operation.

5.0 Exceeding the allowable discharge parameters actions:

5.1 The discharge flow rate is manually balanced using an inline butterfly valve. The operator will follow all confined space requirements, when entering the vault and coordinate with another operator to override the system and pump out. While the pump is discharging to the industrial waste system, the operators can coordinate to set the valve to balance the discharge flow rate to 200 GPM or less. The discharge valve (WW-003), downstream from the flow meter, is used for balancing. The inlet valve (WW-001) is opened 100% to minimize any flow disturbances which could affect the meter accuracy.

5.2 If during a discharge operation the flow rate exceeds the allowable values, by more than 20%, the discharge valve in the tank is closed and the mixing valve opened. An alarm is generated to alert the operators the manual valve may need to be adjusted in the monitoring vault.

5.3 If the pH range is outside the allowable limits, the discharge valve will close and the mixing valve will open to allow the tank to recirculate for a period of 60 minutes. During this period, the acid or caustic pumps may dose as required to bring the pH value into compliance.

5.4 If the system begins to discharge a second time and the pH is measured again as being out of compliance the system will again alarm. The tank and discharge pH meters need inspected to ensure there is no debris blocking the unit from obtaining an accurate measurement. If the inspection does not reveal an obvious cause, the instruments will be recalibrated.

5.5 If the TDS of the discharge is above the allowable limit, the tanks discharge valves will close, and the mixing valve will open, then the system will enter a recirculation mode. An alarm is generated, and the operator will manually introduce additional fresh water into the tank to help reduce the TDS concentration to the allowable level. This will need to be done with either a hose into the man-hole cover at the tank, or with a hose into one of the drains in the RO Room (which drains to the tanks). When using this method, the operator may need to override the tank inlet valve positions so the tank, with high TDS, is being fed. Ongoing facility operations may need to be curtailed during this operation.

6.0 Effluent Monitoring

6.1 The effluent discharged, to the industrial wastewater system, is monitored for TDS levels, pH value, and flow rate. These parameters are continuously monitored during discharge events and recorded into a data base for submission to the Ecology permitting authority in accordance with the facility's Ecology permit requirements. The instrumentation in the monitoring vault is tied into the wastewater monitoring PLC, where the data is automatically recorded.

6.2 Samples of wastewater are collected using the sampling valve located in the onsite monitoring vault. Samples will be collected manually into laboratory supplied sample jars for the specific analytical testing methods required in the wastewater discharge permit. All sample containers will be labeled with a unique sample identification number, refrigerated, or placed on ice and transferred to an accredited analytical laboratory under a signed chain of custody. Composite samples will be refrigerated or placed on ice in between sample collection times. Sample information, including sample date, time, location, and initials of the individual collecting the sample will be recorded on a sample log and kept on file at the facility. All records will be maintained for a minimum of three years.

6.3 All sample results are submitted monthly to the Washington State Department of Ecology by the 15th day of the following month in accordance with the wastewater discharge permit.

6.4 Samples are collected during discharge events on a bi-weekly basis to verify the instrumentation is accurate. The samples are drawn from the sample valve WW-002 located in the monitoring vault.

7.0 Emergency shutdown procedures:

7.1 Conditions that result in non-compliance with the wastewater discharge permit will be reported to the Dept. of Ecology, in accordance with the requirements of the permit. Immediate steps will be taken to stop, contain or clean up unauthorized discharges. Any noncompliance that may endanger human health, harm the environment, cause an

unanticipated bypass, or cause violation of an effluent limit will be reported immediately to the Dept. of Ecology.

7.2 The facility has SOPs (Standard Operating Procedures) for reacting to alarms from the wastewater system. The required reaction depends on the process and safety analysis to determine the appropriate action and whether operations must be curtailed until the root cause of the tank alarm has been determined.

7.3 Entrance into the tank will be carefully controlled and monitored. The Maintenance Team is responsible for approving the procedures for entering and occupying the tank.

NOTE: Any tank, of this nature, presents significant dangers of drowning, chemical burns, and asphyxiation when personnel enter the tank.

7.4 Appropriate measures are taken in accordance with the confined space entry program to ensure the tank entrance is controlled, and a safe working condition is maintained for the plant personnel assigned to perform tasks within the tank.