

## SECTION 11380 – ANAEROBIC LAGOON COVER AND BIOGAS HANDLING SYSTEM

### PART 1 – GENERAL

#### 1.1 SUMMARY

- a. The Contractor shall design, furnish, and install all equipment, materials, piping, instrumentation, and accessories to provide a safe and operable biogas collection and handling system for the anaerobic lagoon.
  
- B. The biogas collection and handling system shall include the following:
  1. Floating flexible membrane cover and ballast system.
  2. Gas collection piping and appurtenances.
  3. Storm water removal system.
  4. Sludge removal system
  5. Gas handling and safety equipment.
  6. Two blowers.
  7. One waste gas burner.
  8. Electrical controls.
  
- C. The Owner will provide all supporting structures, buildings, foundation, and electrical switch Gear and wiring as required for installation of all equipment.
  
- D. The Contractor shall provide and execute a “held harmless” agreement with the Owner, Which will protect the Owner and Engineer from a patent infringement lawsuit.

#### 1.2 RELATED WORK

- a. Section 01300 – Submittals
- b. Section 11000 - Equipment General Provisions
- c. Section 16150 – Electric Motors

#### 1.3 SUBMITTALS

- A. Shop drawings in conformance with Section 01300 shall be submitted. The data submitted shall include material of construction of each component, installation details Characteristics of operation, electrical and control drawings, and system PID.
  
- B. O & M Manuals: The CONTRACTOR shall provide four (4) copies of operations and Maintenance manuals.
  
- C. The CONTRACTOR shall submit installation layout showing the location of the various Components for approval by the ENGINEER.
  
- D. The Contractor shall provide the following information:
  1. Size and location of any structures and buildings.
  2. Capacity of required electrical power and control services.
  3. Number, size, and type of electric motors.
  4. Weight of all equipment and accessories.

- B. The HDPE cover membrane shall have the following physical characteristics:

Property	Test method	Requirements
Density	ASTM D792	0.95
Thickness-60 mil HDPE	ASTM D751	1.5mm+ 10%
Tensile Strength at Break	ASTM D638	240 lb/in-width Min.
Elongation at Break	ASTM D638	700% Min.
Tear Resistant	ASTM D1004	45 lb/w., Min.
Water Absorption	ASTM D570	<0.01%
Low Temperature Britleness	ASTM D746	-103 F, Max.
Dimensional Stability (212 F/1hr.)	ASTM D1204	2%, Max.
Carbon Back Content	ASTM D1603	2.0% Min.
Carbon Black Dispersion	ASTM 3015	A2
Melt Flow Index (g/10 min)	ASTM D1238	<1.0
Environmental Stress Crack (hrs)	ASTM D1693	3,000
Puncture Resistance (lbs)	FTMS 101-C, Method 2065	80

- C. Material certification showing the HDPE cover material meets or exceeds these Specifications requirements shall be supplied by the material manufacturer.
- D. The HDPE cover shall be secured at the lagoon perimeter utilizing an anchor trench. The Anchor trench shall be constructed with rounded corners in order to avoid sharp bends. Large rocks and other objects shall be removed from the trench sides. Good construction practice shall be used during backfill to prevent damage to the cover membrane.
- E. The membrane panels shall be located and installed based on the site conditions and Installer's experience. Extrusion and fusion welding shall be used for field seaming. The installer shall only install membrane panels during acceptable environmental conditions. Trial seams shall be used to verify acceptable environmental conditions. Specimens of the trial seam shall be tested in shear and peel using a field tension meter. The seaming equipment shall not be used if the specimens fail the testing.
- F. SEAM TESTING
1. Non-Destructive Testing
    - (a) All field seams (entire length) shall be tested utilizing a vacuum test unit, air pressure testing, or other method approved by OWNER. This non-destructive testing shall verify seam continuity and shall be conducted during the progression of HDPE membrane seaming. The INSTALLER shall not conduct this testing following completion of all field seaming.
    - (b). The INSTALLER shall submit a detailed description of the testing equipment and procedures prior to initiation of seaming work. The INSTALLER shall obtain the OWNER'S approval prior to initiation of seaming work.
  2. Destructive Testing
    - (a). Shear and peel tests shall be conducted on field seams in order to verify seam strength.

- (b). Destructive seam testing shall be conducted at OWNER-selected locations and frequencies. Unless agreed otherwise by the OWNER, the sample interval shall not exceed 1 sample every 150 linear feet of welded seam.
- (c). Samples shall be collected and tested as seaming work progresses.
- (d). INSTALLER shall collect the selected samples and identify each sample with a sample number. The sample location shall be recorded utilizing the HDPE membrane panel and seaming identification numbering systems. The daily recorded sample information shall be submitted to the OWNER in 24 hrs.
- (e). All sample holes in the installed HDPE membrane shall be immediately repaired in accordance with the HDPE membrane manufacturer's recommendations.
- (f). INSTALLER shall submit a detailed description of testing procedures to the OWNER prior to initiating seaming work. The submitted description shall include procedures for additional testing and seam reconstruction for sample that fail the seam strength testing. The INSTALLER shall not begin seaming work prior to OWNER approval of testing procedures.
- (g). All testing procedures shall conform with current ASTM methods and geomembrane manufacturer's recommendations unless otherwise authorized by OWNER.

#### G. HDPE MEMBRANE REPAIR PROCEDURES

1. The INSTALLER shall utilize good construction practice and the geomembrane Manufacturer's recommendations to repair any defective damages of the liner. The INSTALLER shall submit the proposed repair and testing procedures to the OWNER prior to commencing any applicable repair work. The INSTALLER shall Obtain OWNER's approval of the repair procedures prior to commencing any Repair work.

#### H. HDPE MEMBRANE BALLAST SYSTEM

1. INSTALLER shall provide a permanent ballast system for the HDPE cover system. The INSTALLER shall design and install a ballast system based on the expected environmental conditions, process operating conditions, and HDPE membrane manufacturer's recommendations.
2. The ballast system shall prevent the uplift of the cover during anticipated environmental conditions (i.e. high winds).
3. The design of ballast system shall prevent damage or significant wear of the HDPE membrane liner during warranty period.
4. The ballast system shall not use liquid media.
5. The ballast system shall not penetrate the HDPE membrane cover.
6. If the ballast system is attached to the HDPE membrane, the system shall be Designed for the attachment device to fail prior to failure of the HDPE.

7. The INSTALLER shall submit a detailed description and drawings of the proposed ballast system prior to installation of cover. The INSTALLER shall obtain the OWNER's approval of the proposed ballast system prior to installation of cover.
  - I. The cover shall include at least six 6" sample ports that will be used to retrieve wastewater And sludge samples from the lagoon's contents. The sample ports shall prevent the escape of biogas while the port is open. Each port shall have a secured cover or cap.
  - J. The cover shall include at least three manway hatches located along or near the center of the lagoon. Each hatch shall have a secured cover or cap. The OWNER shall approve the location of these manways.
  - K. The cover shall include all necessary collections piping and other conducts to collect and convey the generated biogas handling system. Biogas collection within the cover shall include a central collection conduit located along or near the centerline of the lagoon. this central collection conduit shall allow easy removal of generated gas from the central portion of the lagoon. The gas collection and handling piping shall be HDPE.
  - L. The INSTALLER shall provide and execute a "hold harmless" agreement with the OWNER, which will protect the OWNER and Engineer from a patent infringement Lawsuit.

### 2.3 STORM WATER REMOVAL SYSTEM

- A. The cover shall include a storm water removal system that conveys collected precipitation to sumps.
- B. The storm water removal system shall not utilize pumps and piping to dispose of collected storm water.
- C. The distance between sumps shall not exceed 50 ft. The sumps shall be located at all locations expected to accumulate storm water.
- D. Each sump shall discharge the collected storm water to the lagoon contents. Each sump shall prevent the escape of biogas.

### 2.4 SLUDGE REMOVAL SYSTEM

- A. The sludge removal system shall allow removal of accumulated sludge from the lagoon contents.
- B. The cover shall have at least 10 access hatches located as indicated. The size of each access hatch shall be at least 1.5 ft. diameter or 1.5 ft. x 1.5 ft.
- C. Each access hatch shall prevent the escape of biogas while the hatch is open.

## 2.5 BIOGAS HANDLING AND SAFETY EQUIPMENT

### A. PRESSURE GAUGES

1. Gas Pressure Gauge – Well typed Manometer, single tube type pressure gauge to indicate pressure in the biogas system. Varec Model 217 or equal.
2. The group of gauges shall be mounted on common bases and shall have 1/8 inch pipe taps for connecting to the gas piping system at indicated locations.
3. Large diameter tubes with scales properly calibrated to read gas pressures directly in inches of water shall be provided. Stop and vent cocks pinned to prevent the possibility of gas escaping into the room shall be provided for setting the zero position of the scales.
4. The top of the tubes shall be manifold and provided with a flame check and connection for ½ inch O.D. tubing.

### B. CONDENSATED AND SEDIMENT TRAP - Sediment trap with drip trap for condensate And sediment, Varec Model 233 or equal.

1. The accumulators shall be of welded steel construction and shall be provided with suitable baffles, removable reservoir to provide convenient access to the interior of the unit a sealed inspection pipe for safe determination of liquid level inside without closing the gas supply line, sight glass for liquid level indication, plugged opening for sediment removal and a 2-quart manually operated drip trap complete with shut-off valve and connecting pipe and fittings for safe condensate removal. The capacity of the unit shall provide for 6 gallons of accumulated sediment and 6 gallons of accumulated condensate.
2. The trap shall be hot-dipped galvanized.
3. The trap shall have a rated capacity of at least 82,700 cu. ft. per hour of biogas.

### C. WASTE GAS BURNER – Waste gas burner with automatic electric pilot igniter, Varec Model 244W or equal. Pilot light to burn on propane. Sensor shall be provided to indicate pilot light fail on control panel.

1. Waste gas burner shall be installed as indicated. A propane pilot line and biogas pipe shall be installed to the burner.
2. The waste gas burner shall be capable of passing 82,700 cu. ft. per hour of biogas.
3. The waste gas burner shall include a control panel and all necessary controls to operate an automated pilot ignition system. Control panel shall be rated NEMA 4X.
4. The pilot ignition system shall include an “Auto Start” component that operates the pilot only during waste gas flaring. This feature shall include a solenoid valve on the pilot gas supply line. This valve should fail in the open position.

D. PRESSURE/VACUUM RELIEF VALVE

1. Valve shall be Varec Model 5810.
2. Valve trim shall be 316 stainless steel.
3. Flame arrester bank sheets shall be 316 stainless steel.

E. FLAME TRAP ASSEMBLY

1. The flame trap assembly shall be Varec Model 452.
2. The drip trap shall be field installed to the flame trap assembly.
3. The flame trap assembly shall have a rated capacity of at least 82,700 cu. ft. per hour.
4. The assembly trim shall be stainless steel.
5. Flame arrester bank sheets shall be 316 stainless steel.

F. PRESSURE RELIEF AND FLAME TRAP ASSEMBLY

1. The pressure relief and flame trap assembly shall be Varec Model 440.
2. The assembly trim shall be stainless steel.
3. The flame trap bank sheets shall be 316 stainless steel.
4. The assembly shall be provided with an automatic drip trap with timer control. Drip trap shall be Varec Model 246 AT.
5. The assembly shall have a rated capacity of at least 82,700 cu. ft. per hour.
6. The backpressure relief valve shall have a 3-way solenoid to assist in control of the waste gas burner.

G. PRESSURE (EXPLOSION) RELIEF VALVE

1. The valve shall be Varec Model 7100B.

H. PILOT LINE FLAME CHECK

1. Flame check shall be Varec Model 5200 or equal.

I. DRIP TRAPS – Rotating disc type, Varec Figure No. 246, or equal.

1. Drip traps shall be of the manually operated type so that when the connection to the gas line is open, the drain is automatically closed and vice versa.
2. Drip traps shall be provided at all low points in the biogas piping system.

J. BIOGAS FLOW METER

1. The biogas flow meter shall be Eldridge Thermo mass gas flow meter. The meter shall be provided with a totalize.
2. The biogas meter shall be capable of measuring gas flow rates between 0 to 100,000 cu. ft. per hour.

2.6 BLOWERS

- A. Provide and install two regenerative type blowers.
- B. Blowers shall be Rotron Model CP909.
- C. Each blower shall have a capacity of at least 690 scfm and suitable for conveying biogas.
- D. Each blower shall be provided with a suitable inlet and outlet flexible connector.

2.7 PILOT GAS STORAGE AND FEED SYSTEM

- A. Provide and install a complete propane storage and feed system.
- B. The system shall be sized to meet the waste gas burner requirements.

2.8 ELECTRICAL CONTROLS

- A. Provide and install an electrical control panel. The control panel shall be NEMA 4X (stainless steel).
- B. The control panel shall include switches, relays, motor starters, transformer, PLC operating and alarm lights, alarm horn, touch screen display and interface, and all other hardware to operate and control the biogas handling system.
- C. Controls Description.
  1. The blowers and waste gas burner shall be controlled on a time cycle (primary) and by measured system pressure levels (secondary). The primary controls will allow the operator to select the on/off time cycle based on operating conditions. The secondary controls shall include adjustable pressure settings. If the system pressure reaches the low pressure setting (vacuum), the secondary controls will shut down any blower and waste gas burner in the "auto" mode. Upon blower shut-down, the blower and the waste gas burner will re-start based on the time cycle of the primary controls or system pressure high level.

If the system pressure reaches the high-pressure setting, the secondary controls will start any blower and the waste gas burner in the "auto" mode. Upon start-up, the blower and waste gas burner will shut-down based on the time cycle of the primary controls or system pressure low level.

3. The controls shall conserve the consumption of the pilot gas supply. The controls shall start the pilot of the waste gas burner prior to start of any blower. The pilot shall operate during waste gas burning and shall not operate when blowers are Not operating.

### PART 3 – EXECUTION

#### 3.1 INSTALLATION

- A. All equipment shall be located as recommended by the manufacturer.