Minnesota Pollution Control Agency

Water Quality

Wastewater Technical Review and Guidance

ANAEROBIC SLUDGE DIGESTION– REVIEW CHECKLIST

Water/Wastewater/#5.03, May 2001

FACILITY NAME _____ DATE _____

CONSULTING ENGINEER _____ SITE INSPECTION (DATE & INSPECTOR) _____

PLANNING OR DESIGN PHASE _____

General

A. Multiple Units (number of units) _____

B. Depth of Side Water (per unit)
(recommended 20-foot minimum depth)
(range 25 to 45 foot) _____

C. Diameter
(20-115 ft) _____

D. Maintenance, Emptying and Cleaning _____

1. Tank bottom slope _____

Recommend for tanks with suction sludge withdrawal minimum 1:12 _____

For tanks with gravity withdrawal minimum 1:4 _____

2. Access manholes top
(at least two in top 36 inches) _____

Access manholes in sidewall for maintenance
(large enough for equipment access) _____

Contents:

Wq-wwtp5-03

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E. Toxic Material _____

1. Analysis provided to determine presence of high sulfate concentrations or inhibitory concentrations of heavy metals. _____

F. The vector attraction reduction requirements of section 503.33 of the Federal Regulations are met. _____

G. Sludge meets requirements for PSRP sludge "sludge treated in the absence of air for a specific mean cell residence time and temperature shall be between 15 days at 35 to 55 degrees Celcius (95˚F to 131˚F) and 60 days at 20 degrees Celsius (68˚F)." _____

Sludge Inlets, Outlets, Recirculation and High Level Overflow

A. Multiple Drawoffs (number) _____

B. Multiple Inlets (number) (Inlet location: one above the liquid level and approximately the center of the tank to assist in scum breakup. The second should be opposite the suction line about the 2/3 diameter point.) _____

C. Multiple Recirculation Suction and Discharge Points (Location to minimize short circuiting to digested sludge or supernatant.) _____

D. Sludge withdrawal from Bottom (Valving to recirculation piping to increasing operational flexibility.) _____

E. Emergency Overflow _____

1. Unvalved and vented (to prevent damage to the tank and cover) _____

2. Piped to treatment process or sidestreams _____

Tank Capacity:

A. Rational design (calculations to justify basis of design required) _____

1. Volumetric loading (.038 – 0.1 $ft.^3$/cap/d) _____
2. Percent solids concentration _____
3. Solids loading (.04 - .41b vss/ft^3/d) _____
4. Type of mixing _____
5. Volatile solids reduction (%) _____

6. Method of sludge disposal
7. Digested sludge storage volume
8. Number of digesters
9. Volume of digesters
10. Hydraulic residence time
11. Type of sludge (primary, secondary, WAS or combination)
12. Single or two state digestion

B. Standard design (assumes ordinary domestic wastewater)

1. Temperature digester
(PSRP = 15 days at 35˚ to 55˚C (95˚F to 131˚F) and 60 days at 20˚C (68˚F) mean cell residence time)

2. Percent volatile material (40 to 50 percent recommended)

3. Frequency of digested sludge removal

4. Mixing systems

a. Completely mixed – pounds of volatile solids (recommended up to 80 lbs/1000 cf)

b. Moderately mixed system – pounds of volatile solids (recommended up to 40 lbs/1000 cf)

c. Multistage system (1st stage shall be loaded in accordance with A or B above. 2nd stage – secondary is to be designed for sludge storage concentration and a gas collection and shall not be credited in calculations for volume required for sludge digestion).

5. Type of mixing - Final Design

a. Aeration
b. Mechanical
c. Recirculation pumps

Gas Collection, Piping and Appurtenances:

A. In all portions of gas system, gas will be maintained under pressure?

B. Ventilation of all enclosed areas where gas leakage may occur _____

C. Safety equipment provided:

1. Pressure and vacuum relief valves? _____
2. Flame traps? _____
3. Automatic safety shut off valves? _____
4. Protection from freezing? _____
5. No water seal equipment?
6. Safety Equipment and gas compressor housed in separate room with exterior door? _____

D. Gas Piping

1. diameter (minimum 4", smaller diameter at gas production meter) _____
2. Slope to condensate trap at low point _____
3. Condensate trap protected from freezing _____
4. Tightly fitted self-closing doors _____

E. Gas Utilization Equipment

1. Located in well ventilated rooms _____
2. Gas lines provided with suitable flame traps _____

F. Electrical fixtures and controls in places enclosing anaerobic digestion, where hazardous gases may accumulate, shall comply with National Electric Code for Class 1, Division 1 locations _____

G. Waste Gas

1. Waste gas burners locate at least 50 feet from plant structure. _____
2. Height of burner (height to prevent injury).
3. Waste gas burner equipped with automatic ignition? _____
   a. Pilot light? Or photoelectric cell? _____
   b. Use of natural gas/propane for reliability? _____
4. Slope up to waste gas burner with condensate trap. (minimum 2%) _____

H. Ventilation

1. Continuous or Intermittent Air exchanges _____
2. Electrical components comply with Class 1, Group 1, Division 1 locations _____
3. Switches for ventilation equipment should be marked. _____

I. Meter

1. Number of gas meters? (one for each primary digestion) _____
2. Type of gas meter orifice plate, turbine, or vortext? (positive displacement should not be used) _____
3. Gas meter bypass (for maintenance unit) _____
4. Meter designed for contact with corrosive and dirty gases? _____
5. Valving gas tight to provide gas measurement from either digester or maintenance of each unit? _____

Digestion Tank Heating:

A. Insulation

1. Above ground water _____
2. Insulated to minimize heat loss _____
3. Maximize earthen banks _____

B. Heating Facilities

1. Heat by circulating through external heaters.

   a. Preheating feed sludge before entry to digester. _____
   b. Piping and valving to allow removal of heat exchanger for maintenance. _____
   c. Heat exchanger sludge piping sized for peak heat transfer requirements. _____
   d. Heat exchanger has capacity for 130% of the calculated peak heating requirement (allows for sludge tube fouling. _____

2. Other heating methods.

   a. In digester methods that require emptying digester not acceptable. _____
   b. New methods that provide heating and mixing evaluated for reliability operation and maintenance characteristics. _____

C. Heating Capacity

1. Heat capacity to consistently maintain design sludge temperature? _____
2. Auxiliary fuel provided? _____
3. Standby requirements:

   a. Standby heating capacity _____
   b. Multiple units; or _____
   c. Alternative sludge handling _____

D. Hot Water Internal Heating Controls

1. Mixing Valves

   a. Automatic mixing valve of boiler water with return water (maintain heating water temperature) _____
   b. Manual control provided by suitable pass valves. _____

2. Boiler Controls

   a. Automatic controls to maintain approximately 180˚F (82˚C). _____
   b. Automatic controls to shut off main gas supply (if pilot failure, electrical failure, low boiler water level, low gas pressure or excess boiler water temperature or pressure). _____

3. Boiler Water Pump

   a. Sealed. _____
   b. Sized to meet operating conditions (temperature operating head, flow rate). _____
   c. Duplicate units. _____

4. Water Supply

   a. Chemical quality compatible. _____
   b. Break tank required _____

E. External Heat Operating Controls

1. All controls for effective and safe operation. _____
2. Duplicate units on critical elements. _____

Supernatant Withdrawal

Where supernatant separation is used to concentrate sludge in the digester units and increased digester solids retention time, the design shall provide for ease of operation and positive control of supernatant quality. _____

A. Pipe sizing not less than 6-inch diameter. _____

B. Withdrawal Arrangements

1. Withdrawal from 3 or more levels. _____
2. An unvalved overflow should be provided. _____

   a. Emergency overflow piped to appropriate point in process at appropriate rate. _____

3. Withdrawal from fixed cover digester.

   a. Are interchangeable extensions provided with discharge pipe? _____

4. Fixed screen supernatant selector or similar device shall be used only in unmixed secondary digester. _____

   a. If fix screen selector used, one additional draw off level located. _____
   b. Unvalved emergency supernatant draw off provided. _____
   c. High pressure backwash facility provided. _____

C. Sampling

1. Sampling at each draw-off. _____
2. Sampling pipes at least 1 ½ inches diameter. _____
3. Sampling lines to terminate at sampling sink or basin. _____

D. Supernatant Disposal

1. Supernatant return and disposal do not adversely affect hydraulic or organic processes. _____
2. If nutrient removal, a separate supernatant side stream should be provided (phosphorus, Ammonia). _____

Anaerobic Digestion Sludge Production

1. Production maximum based on 5% solids concentration without additional thickening. _____
2. Solids production values on dry weight basis.

   a. Primary plus waste activated sludge at least 0.12 lb/PE/day. _____
   b. Primary plus fixed film sludge at least 0.09 lb/PE/day. _____

   P.E. = population equivalent _____