

**NATURAL RESOURCES CONSERVATION SERVICE
INTERIM CONSERVATION PRACTICE STANDARD**

COVERED ANAEROBIC LAGOON

(NO.)
CODE 360

DEFINITION

A constant volume lagoon designed for methane production and recovery in conjunction with a separate waste storage facility.

PURPOSES

To produce and recover methane as an energy source while minimizing lagoon odors.

CONDITIONS WHERE PRACTICE APPLIES

- (1) where methane production and recovery are components of a planned livestock waste management system.
- (2) where existing waste impoundment(s) can be modified to the requirements of this standard or for new construction.
- (3) where the total solids (TS) concentration in the influent waste is less than 2%.

CRITERIA

General criteria:

Separation of Ruminant Manure Solids. Ruminant manures shall be treated with solid separation prior to entry into the lagoon.

Contaminated Rainfall Runoff. Manure-contaminated runoff shall bypass the covered methane production lagoon to the waste storage facility. Uncontaminated runoff shall not enter either the methane production lagoon or waste storage facility.

Lagoon. The lagoon shall meet the criteria for an anaerobic lagoon contained in Practice Standard 359, Waste Treatment Lagoon, with the following additional requirements:

- (1) Design Operating Volume. The design operating volume shall be based either on the daily volatile solids (VS) loading rate per 1,000 ft³, or the minimum hydraulic retention time (HRT) adequate for methane production, whichever is greater. The maximum daily VS loading rate shall be selected from the values listed on the map in Figure 1. The minimum HRT shall be selected from values listed on the map in Figure 2.
- (2) Length to Width Ratio. The ratio of the length to the width of the lagoon is limited to 4:1 or less.
- (3) Operating Depth. The operating depth of the lagoon shall be 12 feet or greater.
- (4) Interior Slope. The interior slope ratio (horizontal:vertical) shall be as steep as possible, 1:1 or greater as required by soil properties or construction techniques.
- (5) Location of Inlet and Outlet. The inlet and outlet devices shall be located as far apart as practical to minimize "short circuiting".
- (6) Inlet. Inlets shall be of any permanent type designed to resist corrosion, plugging, and freeze damage, incorporating erosion protection as

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necessary. Inlets from enclosed buildings shall be provided with a water-sealed trap and vent or similar devices to control gas entry into the buildings or other confined spaces. Inlets emptying above the surface of the lagoon shall not be covered by the methane recovery cover.

(7) Outlet. The lagoon shall be equipped with an outflow device that will maintain the lagoon water surface at its operating level and release directly to the waste storage facility.

(8) Embankments and disturbed areas surrounding the facility shall be treated to control erosion.

Waste Storage Facility. The waste storage facility shall meet the requirements of Practice Standard 313, Waste Storage Facility. No storage credit shall be attributed to the lagoon in meeting minimum storage requirements in Practice Standard 313.

Lagoon Cover. The cover materials and all appurtenances such as weights, floats, and attachments shall be designed to capture and convey the methane to a designed outlet. The cover shall also collect and direct precipitation to a designed outlet while exposed to site climatic conditions for its design life.

Safety. If the lagoons or methane recovery system will create a safety hazard they shall be fenced and warning signs posted to prevent children and others from using it for purposes other than intended.

Regulatory. Local, state, and federal laws shall be reviewed and complied with; there may be regulations that affect animal population, distance separations, storage volumes, storage periods, land requirements for nutrient application, fencing, or visual screening in excess of recommendations contained herein.

CONSIDERATIONS

Location. Location of the waste storage facility should consider elevation and distance from the lagoon to take advantage of gravity flow.

The covered lagoon should be located as near the source of manure as practicable and as far from neighboring dwellings or public areas (minimum distance of 91 m (300 ft)) as possible; proper location should consider slope, distance of manure transmission, vehicle access, wind direction, neighboring dwellings, proximity of streams and floodplains, and visibility.

The covered lagoon should be located near a suitable site for energy utilization equipment. Short distances for the transmission of methane through buried pipe are preferable.

Visual Screening. Vegetative screens or other methods should be used to shield the lagoons from public view and to improve conditions.

Rainfall and Runoff. Uncontaminated runoff should not be introduced into the covered lagoon. Contaminated runoff should bypass the covered lagoon to the storage facility. Incident rainfall on the covered lagoon may be drained into the lagoon or pumped off the lagoon cover to a drainage structure.

Lagoon Depth. The lagoon shall be as deep as possible to maximize methane production and minimize the lagoon cover size.

Cover Material. Capital cost, repair technique, and warranty life should be considered when selecting a cover.

Cover Design. A variety of lagoon cover designs can be considered to meet the needs of the farm to collect and store incident rainwater or to exclude rainfall accumulation from the lagoons. The cover can either direct rainfall to one edge of the lagoon, drain rainfall into the lagoon, or prevent rainfall from entering the lagoon by accumulating rainfall and pumping it to rainfall discharge structures.

Cover Attachment. The cover can be attached to one or all embankments or float tethered to the embankments depending upon the cover design.

PLANS AND SPECIFICATIONS

Plans and specifications shall be prepared in accordance with the criteria of this standard and shall describe the requirements for applying this practice to achieve its intended use.

Cover. The cover manufacturer shall warrant the cover for the intended use and design life, provide maintenance instructions, and certify that the cover is properly installed.

OPERATION AND MAINTENANCE

An operation and maintenance plan shall be developed that is consistent with the purposes of the practice, its intended life, safety requirements, and the criteria for its design. The plan shall contain operation and maintenance requirements including but not limited to:

- (1) Proper loading rate of the lagoon.
- (2) Proper operating level of the lagoon.
- (3) Estimates of methane production and recovery.
- (4) Identification of a plan for safe use or flaring of biogas.
- (5) Cover and other component maintenance.

Figure 1: Covered Anaerobic Lagoon Maximum Loading Rate (lb VS/1000ft³/day)

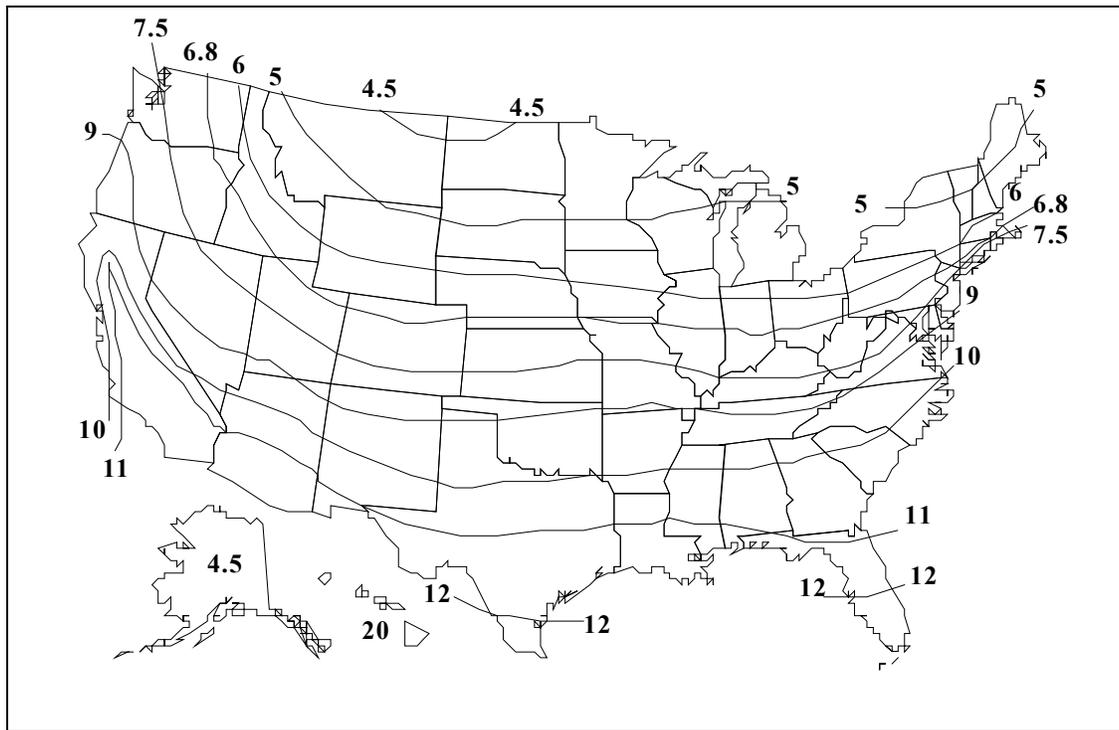
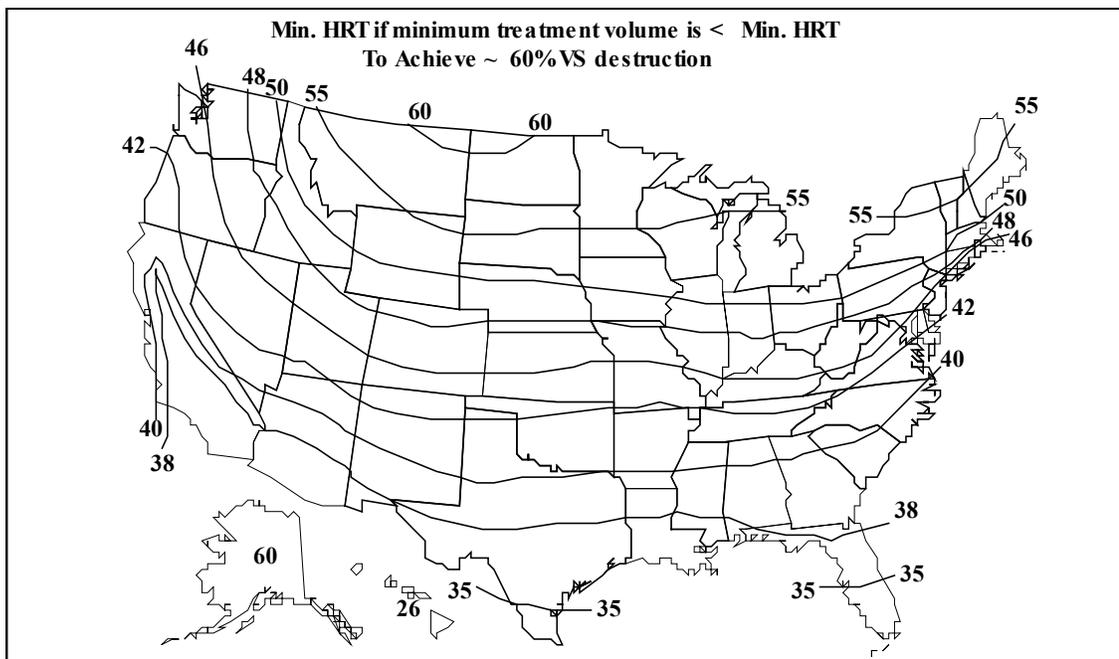


Figure 2: Covered Anaerobic Lagoon Minimum Hydraulic Retention Times (MINHRT in days)



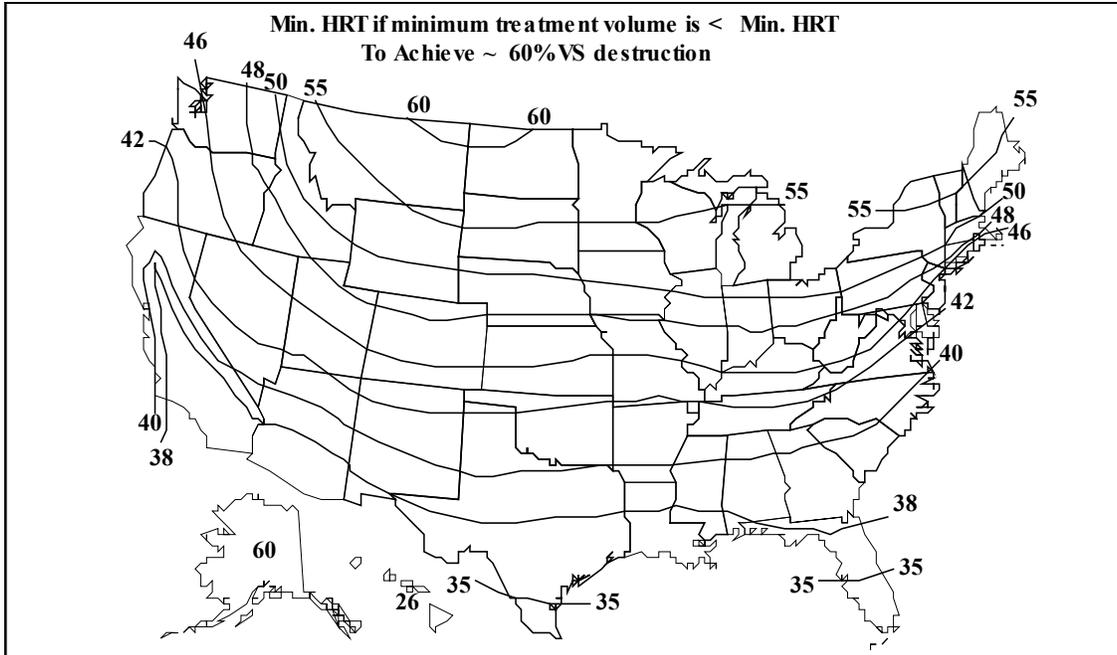


Figure 2: Covered Anaerobic Lagoon Minimum Hydraulic Retention