

CONSERVATION PRACTICE STANDARD

POND SEALING OR LINING - FLEXIBLE MEMBRANE

(No.)

CODE 521A

DEFINITION

A manufactured hydraulic barrier consisting of a functionally continuous layer of synthetic or partially synthetic, flexible material.

PURPOSE

To restrict, impede, and control seepage of contaminants from water and waste impoundment structures for water conservation and environmental protection.

CONDITION WHERE PRACTICE APPLIES

On ponds and water storage structures that require treatment to control seepage rates within acceptable limits.

On earthen waste storage lagoons and other waste impoundment structures that require treatment to control seepage of contaminants from the storage structure.

CRITERIA

Design. Structures to be lined shall have been constructed to meet all applicable NRCS standards. All inlets, outlets, ramps, and other appurtenances may be installed before, during, or after the liner placement, but shall be done in a manner that does not damage or impair the proper operation of the liner.

Flexible membrane liners must be planned, designed, and installed in compliance with all applicable, state, and local regulations.

Design and installation of the flexible membrane shall be in accordance with manufacturer recommendations. All flexible membrane installations shall be certified by the installer as meeting the material and installation requirements of the plans and specifications.

Manufacturer recommendations shall be followed with regard to protection from weather and exposure. The liner shall meet or exceed the minimum criteria set forth below:

Minimum Criteria for Membranes		
Type	Limiting Parameter	
	Wastewater	Clear Water
HDPE	60 mil ^{1/}	30 mil
LLDPE	40 mil	20 mil
PVC	30 mil	20 mil
GCL	0.75 lb./sq ft (bentonite)	
EPDM	45 mil	
PP (Reinforced)	36 mil	24 mil
(Un-reinforced)	40 mil	20 mil
RPE	NR	24 mil

^{1/} For waste storage facilities < 4 feet deep at the design full level, 40 mil HDPE may be used

HDPE – High Density Polyethylene Geomembrane

LLDPE – Linear Low Density Polyethylene Geomembrane

PVC – Polyvinyl Chloride Geomembrane

GCL – Geosynthetic Clay Liner

EPDM – Synthetic Rubber Geomembrane

PP – Polypropylene Geomembrane

RPE – Reinforced Polyethylene Geomembrane

NR – Not Recommended

1 mil = 1/1000 of an inch

Subgrade Preparation. Subgrade preparation shall conform to manufacturer recommendations. Subgrade materials shall not contain sharp, angular stones or any objects that could damage the liner or adversely affect its function.

Padding. For waste storage facilities, a padding shall be placed beneath the liner, unless otherwise determined by the Engineer based on sub-

grade conditions. The padding shall be a 12-ounce or greater non-woven geotextile.

In addition, in the vicinity of equipment operation (e.g., pumps, agitators) or hydrodynamic impingement (e.g., pipe outfall or intake), an additional layer of the same geomembrane material should cover and be adhered to the primary liner.

Cover Soil. PVC and GCL liners shall be covered with a minimum of 12 inches of soil. Cover soil may be used on other liners but is not required.

Cover soil shall be used as cover for liners when required for the proper performance, protection and durability of the installation. Cover soils shall not contain sharp, angular stones or any objects that could damage the liner. Maximum allowable particle size of soil cover material shall be 3/8-in for geomembrane liners and 1/2-inch for geosynthetic clay liners, unless the liner is cushioned by an 8-ounce or greater needle punched, non-woven geotextile padding material. Cover materials shall be stable against slippage down the slope under all operational and exposure conditions.

Anchorage. Liners shall be anchored to prevent uplift due to wind or slippage down the side slope.

Safety. Design shall include appropriate safety features to minimize the hazards of the structure. Warning signs, fences, ladders, ropes, bars, rails, and other devices shall be provided, as appropriate, to ensure the safety of humans and livestock.

All facilities with flexible membranes shall be equipped with a means of emergency egress. For those facilities with intended access points, emergency egress shall be provided at each access point.

All facilities with flexible membranes shall also be fenced to protect the liners from livestock, wildlife, and vehicles.

Additional Criteria for Waste Storage Ponds (PA313) and Waste Treatment Lagoons (PA359)

The foundation under waste storage ponds and treatment lagoons shall be investigated as required in their respective practice standards.

All waste storage ponds and treatment lagoons with flexible membranes shall be designed with leak detection systems. A non-woven geotextile pad or other flow medium shall collect leakage from under the entire flexible membrane liner and direct it to a collection pipe. The sides and bottom of the pond or lagoon shall be sloped to the trench containing the collection pipe. The collection pipe shall have an outlet that discharges into an accessible sump or at the ground surface at least 50 feet from a stream or other water body. The leak detection system shall be separate and isolated from any drainage system that is installed around or under the facility.

CONSIDERATIONS

Venting of wastewater pond liners not covered with soil is recommended unless other site conditions exist to allow dissipation of gas pressure from beneath the liner. One such condition is the presence of granular foundation soils (SW, GW or GP). A minimum vent spacing of 30 feet is recommended.

If high water tables could adversely affect the proper functioning of the structure, interceptor or relief-type drainage systems should be considered to control uplift pressures.

Slope stability and shear stress between the liner and the underlying materials should be evaluated if the liner is placed on a slope steeper than 3:1, or if the vertical height of the lined slope exceeds 10 feet.

PLANS AND SPECIFICATIONS

Plans and specifications shall be prepared for specific field sites in accordance with this standard and shall describe the requirements for applying the practice to achieve its intended uses.

As a minimum, the plans and specifications shall provide the following:

1. Layout of the containment structure, collection points, waste transfer locations or pipelines, and topography of the site
2. Required liner properties, cushion materials, and pipeline materials
3. Subgrade details, including tolerances on smoothness of the finished grade

4. Details of liner installation, seaming requirements, and requirements for attachments and appurtenances
5. Quality control testing
6. Fence and signage requirements, if required.

OPERATION AND MAINTENANCE

A plan for operation and maintenance (O&M) of the liner and structure shall be prepared. The plan shall be consistent with the purposes of the type of liner chosen, intended life, safety requirements and design criteria. The plan shall contain requirements including but not limited to:

1. Design capacity and liquid level of the structure.
2. A description of the normal operation, safety concerns and maintenance requirements. This should also include any drawdown restrictions to assure slope stability of soil cover, and monitoring requirements for leak detection.
3. Repair procedures; of both the liner and any soil cover.
4. Periodic inspection of the following:
 - Visible portions of the liner for tears punctures, or other damage;
 - Liner interface with inlets, outlets, ramps, or other appurtenances for damage;
 - Liquid level in the structure;
 - Ballooning of the liner indicating presence of gas beneath the liner.
5. Emergency action plans for containing and controlling discharges from leak detection systems.

REFERENCES

Quality Assurance and Quality Control for Waste Containment Facilities, EPA/1600/R-93/182, September 1993.