Livestock and Poultry Environmental Stewardship (LPES) curriculum

CAFO Fact Sheet series

Fact Sheet #15: Liquid Level Markers for Uncovered Manure Storages and Lagoons

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Introduction

A central purpose of the 2003 U.S. EPA confined animal feeding operation (CAFO) rule is to minimize the potential for discharge from confined animal production areas (see Figure 1). While states may have additional, more stringent requirements, a minimum requirement is that Large CAFOs must conduct "weekly inspections of the manure, litter, and process wastewater impoundments." In addition, "all open surface liquid impoundments must have a depth marker that clearly indicates the excess capacity available at all times to contain the runoff and direct precipitation" from a specific storm event. For existing Large swine, veal calf, and poultry CAFOs and for all Large beef and dairy CAFOs, this excess capacity should be capable of handling a 25-year, 24-hour storm event. New Large swine, veal calf, and poultry CAFOs will need to contain rainfall and runoff from a 100-year, 24-hour storm event.

Figure 1. Two-cell manure lagoon

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Refer to *CAFO Fact Sheet #2: Do I Need an NPDES Permit for My Livestock or Poultry Operation?* to identify if your facility is a Large CAFO. Medium and Small CAFOs must comply with requirements established in their permits that may or may not include requirements for liquid level markers. Contact your permitting authority to determine what requirements apply to your operation.

Manure storages can be emptied partly or entirely when they are pumped. In this case, the visual marker only needs to indicate a "start pumping" level where the storage is still capable of storing the rainfall or runoff from the design storm event (see Table 1). Treatment lagoons are somewhat different than simple storages. Single-cell lagoons and the first cell of multi-cell lagoons must always maintain a "treatment volume" so an adequate supply of microbes is available to treat incoming manure and wastewater. These types of lagoons should have both a start pumping depth (at the freeboard level) and a "stop pumping" depth (to maintain a design treatment volume level). In multi-stage lagoons (see Figure 1), the last lagoon in the series can be pumped completely so only a start pumping marker is needed. At this time, however, current U.S. EPA regulations only require a start pumping marker for outside manure or wastewater storages at Large CAFOs. Two relatively low-cost methods of indicating pumping depths are vertical markers and sloping markers. Floats and electronic indicators are also commercially available but can be relatively complex and expensive and may not be appropriate in areas that experience significant ice cover.

Table 1. Guide to marker type

Type of Impoundment	Marker Type
Manure storage and two- or three-stage lagoon	Start pumping indicator
Single-stage lagoon	Start and Stop pumping indicators

Vertical Marker

With a vertical sidewall storage, the vertical marker can be mounted directly on the interior sidewall (see Figure 2). With an earthen structure, a vertical marker stake is embedded in the bottom or interior sidewall of and extends above the highest liquid level expected. The advantage of a vertical marker is that it can be seen relatively easily. A disadvantage is that its installation will puncture the earthen structure's liner (soil or synthetic) and may increase manure infiltration into surrounding soil. **Note: There is also a danger of a person falling when installing a vertical marker on an earthen structure's steep interior sideslope.** If the liquid level is high enough, the marker can be installed from a boat. If workers will be working on a sloping embankment, make sure they wear a safety harness and a tether and that someone capable of assisting them remains on the top of the berm.

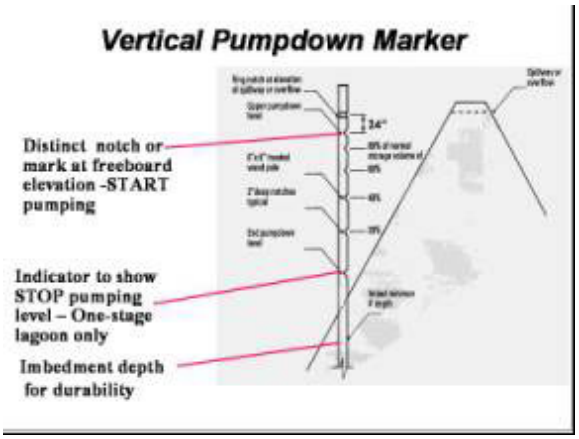

Figure 2. Vertical pumpdown marker

Sloping Marker

A weighted sloping marker anchored to the top of a berm is a safe, effective method of indicating liquid depth in earthen structures (see Figure 3). The marker should have clearly visible start pumping (and stop pumping, if needed), liquid pumping depths markings placed on it before it is installed. These markings can consist of permanent paint markings or painted couplings placed at appropriate start and stop depths. A sloping marker should be

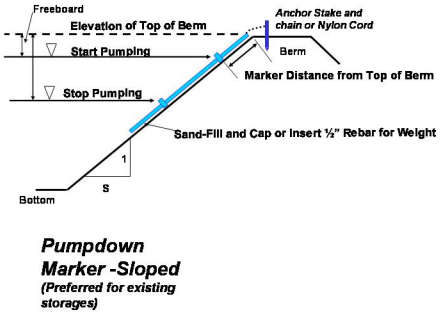

Figure 3. Sloping lagoon marker

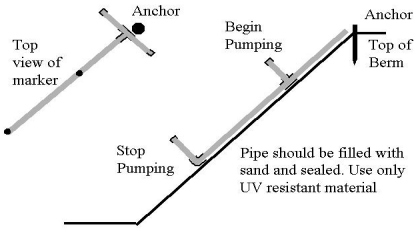

Figure 4. Sloping marker with more visible depth indicators

constructed with a closed, weighted pipe or other heavy marker that will not float. It should be well anchored with chain or nylon rope at the top of the berm and extend vertically down the slope of the interior sidewall. An advantage of this marker is that the worker does not need to stand on a steep interior slope or use a boat to install the marker.

With both types of markers, simple paint markings should work satisfactorily in relatively dilute lagoons, but structures with higher solids content require a marker that is clearly visible when the marker has been coated with manure. One method of accomplishing this is to install a pipe marker with tee fittings and capped pipe extending 6 inches to 8 inches out from the marker at the indicated level (see Figure 4.) Sloping markers that use tee markers should have an additional tee fitting at the top end to hold the depth indicators perpendicular to the sidewall, making the start/stop depth markings easily seen. All pipe openings must be tightly sealed and only UV-resistant pipe should be used.

The following table shows the location of depth indicators, as measured from the inside corner to the top or berm of a storage constructed at various interior sideslopes.

Table 2. Linear slope distance, ft

Vertical Distance, ft	Interior Sideslope, Run:Rise				
	1:1	1.5:1	2:1	2.5:1	3:1
2	2.8	3.6	4.5	5.4	6.3
4	5.7	7.2	8.9	10.8	12.6
6	8.5	10.8	13.4	16.2	19.0
8	11.3	14.4	17.9	21.5	26.3
10	14.1	18.0	22.4	26.9	31.6

Summary

This fact sheet is intended to aid operators in their management of outside manure storages and lagoons. Visually distinctive depth indicators can improve the ease and accuracy of estimating the amount of time remaining before material must be removed. They are required for Large CAFOs under the National Pollutant Discharge Elimination System (NPDES) program. In one-stage lagoons, markers can also indicate when to stop pumping, leaving adequate treatment volume in the lagoon to treat incoming manure. Two types of relatively inexpensive physical markers are discussed in this fact sheet. ●

Definition of Terms

Berm–Portion of earthen manure storage or lagoon sidewalls that are above grade.

Lagoon–Earthen treatment basin used to help stabilize organic material in wastewater.

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Reviewers

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For More Information

Environmental Regulations Related Resources

EPA CAFO Phone Line–202-564-0766

http://www.epa.gov/npdes/caforule/–To obtain copy of regulations

http://www.epa.gov/npdes/afo/statecontacts/–To obtain state environmental agency contacts

http://www.epa.gov/agriculture/animals.html/–To obtain compliance assistance information from EPA

http://cfpub.epa.gov/npdes/contacts.cfm?program_id=7&type=REGION/–To obtain EPA Region Animal Feeding Operation contacts

Land-Grant University Resources

The local contact for your land-grant university Cooperative Extension program is listed in the phone book under "Cooperative Extension" or "*(county name)* County Cooperative Extension."

http://www.reeusda.gov/1700/statepartners/usa.htm/–To obtain state Cooperative Extension contacts

http://www.lpes.org/–To view the Livestock and Poultry Environmental Stewardship (LPES) curriculum resources

USDA Farm Bill Resources

To obtain more information about the Farm Bill 2002, see the USDA-NRCS website at http://www.nrcs.usda.gov/programs/farmbill/2002/. You can also contact your local USDA Service Center, listed in the phone book under "U.S. Department of Agriculture," or your local conservation district.

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