

Oklahoma Lagoon Sludge Study Released

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It took us 14 years, but Oklahoma State is finally publishing the results of a swine lagoon sludge accumulation study. Thanks to the Rickey, Stabel, Falcon, Baker, and Oeschlager farms for letting us float on their lagoons all those years. Next month, the final report will be printed in *Transactions of the American Society of Agricultural and Biological Engineers*. You can read an electronic version by visiting my website at www.osuwastemanagement.bae.okstate.edu/articles.

So what did we learn?

Sludge builds up in predictable pattern: If left undisturbed, sludge accumulates in manner consistent with the complex sludge accumulation model proposed by Clyde Barth back in the 1980s (Figure 1). What's important for lagoon management is the critical point labeled t_c in figure 1. This is when the sludge layer starts to choke off the treatment volume in the lagoon. You need to remove sludge before it reaches this stage.

Sludge accumulates slower than originally believed: Again, if left undisturbed, sludge builds up about half as fast as predicted by current design standards.

Disturbing the sludge layer makes it grow faster: If you try to remove a little sludge each time you irrigate liquids, the sludge layer will accumulate more rapidly (Figure 2). This may sound illogical, but if you think about it, sludge is a mixture of living bacteria and their food. If you are constantly removing living organisms, they will have a harder time digesting the food.

Sludge begins to accumulate rapidly when 1/3 of the lagoon's volume is occupied by sludge: Before completing this study, I told producers to start removing sludge when solids reached 6 feet of lagoon surface. Depth to sludge does not appear to be as important as I once believed -- at least there is no magic number to tell you start removing sludge based on depth. The results of this study suggest that sludge begins to accumulate rapidly when 30% of the total volume of the lagoon is occupied by sludge.

So how should you decide when to remove sludge?

Have the people who designed your lagoon draw a stage-storage curve. This is a diagram that plots the volume stored in the lagoon against the depth of liquid or sludge in the lagoon. Every year or two go out in a boat and find the depth to the sludge layer. I heard an interesting talk yesterday on using a weighted CD lowered from by a fishing pole to measure depth to sludge --could be the topic of a future *Pork Pages* article. When your stage-storage curve shows sludge volume is getting close to 1/3 the total lagoon volume, it's time to start cleaning.

References:

Barth, C.L., and J. Kroes. 1985. Livestock waste lagoon sludge characterization. In *Agricultural Waste Utilization and Management, Proceedings of the 5th International Symposium on Agricultural Wastes*, pp 660-671. St Joseph, MI: ASAE.

D.W. Hamilton. 2010. Sludge accumulation in two anaerobic/facultative lagoons treating swine manure from breeding farms in Oklahoma. *Transactions of ASABE*. 53(2):529-536.

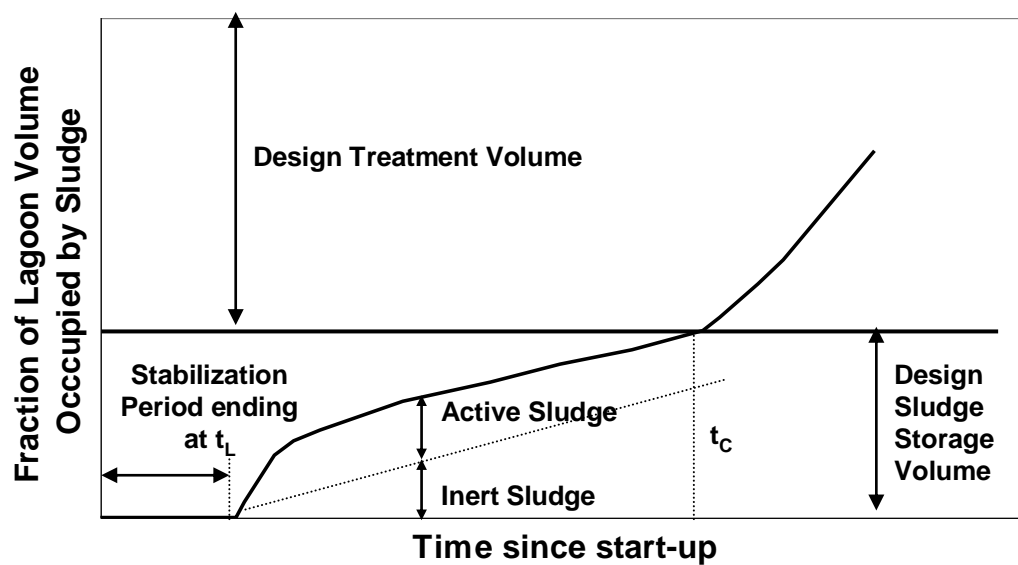


Figure 1. Complex Sludge Accumulation Model (Barth and Kroes, 1985)

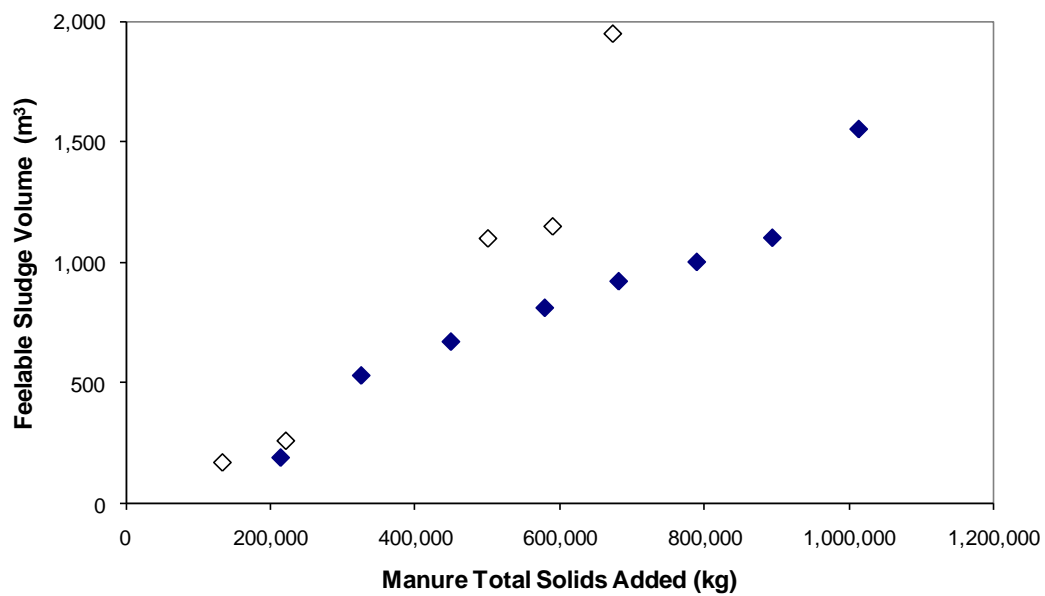


Figure 2. Sludge Volume Versus Manure Solids Added to Lagoons. The two lagoons shown have similar size and manure loading. Solid diamonds represent sludge volume in a lagoon with undisturbed sludge. White diamonds are for a lagoon where sludge was removed with each irrigation.