

Sizing Anaerobic Effluent Treatment Ponds

A case study from the Australian Pork Limited "Environmental Principles for Piggeries" Training Materials

Prepared by Robyn Tucker, National Co-ordinator

Anaerobic ponds provide a simple and effective method for digesting the organic matter in piggery effluent. When anaerobic ponds are adequately sized and properly managed, full anaerobic digestion can proceed. The end-products of anaerobic digestion are relatively low odour gases, including methane, carbon-dioxide and ammonia.

Complete anaerobic digestion is a two-step process involving separate groups of microorganisms ("bugs"). In the first step, the organic matter is broken down to volatile organic acids. In the second step, the acids are converted mainly to methane, carbon-dioxide and ammonia. However, the methane forming bacteria in the second step can only function within a narrow pH range. If too much organic matter is added to the pond, a large amount of organic acid is produced. This makes the water in the pond more acidic (i.e. it lowers the pH) and the second step cannot proceed. This incomplete digestion releases odorous volatile organic acids to the air. Inappropriate organic matter loading rates generally result from under-sized ponds or from shock loading of ponds. The latter condition could occur through emptying the static pits from all sheds on the one day, rather than staggering pit emptying throughout the week.

Unfortunately, many anaerobic ponds at Australian piggeries are under-sized for the effluent stream they must treat. This case study provides a simple method for evaluating whether anaerobic pond capacity is adequate based on the number of standard pig units (SPU) at a piggery.

Background Information

The volume of an anaerobic pond is split between active volume and sludge storage volume. The active volume stores much of the water, the treatment microorganisms and most of the organic matter. The sludge storage capacity mainly stores material that cannot readily be digested and water.

The required active volume depends on the climate at the piggery. Since the treatment microorganisms are more active in warmer climates, piggeries in these climates require less active volume to treat a given quantity of organic matter than piggeries in cooler climates.

The volume needed for storing sludge depends mainly on the intended desludging frequency. The greater the time period between desludging events, the greater the required sludge storage capacity. It is generally accepted that providing additional pond volume equivalent to 40% of the active volume provides about ten years sludge storage. If the pond is not desludged according to the design desludging frequency, sludge will start to occupy the pond's active volume. This is a common cause of over-loaded, malfunctioning ponds.

Following are suggested pond capacities for three climatic zones and two desludging frequencies:

Climate	Example Area	Anaerobic Pond Volume for 5 Yearly Desludging*	Anaerobic Pond Volume for 10 Yearly Desludging*
Cool	Albury, Bendigo, Murray Bridge, Orange	6.3 m ³ /SPU	7.9 m ³ /SPU
Warm	Kingaroy, Toowoomba, Northern NSW	5.1 m ³ /SPU	6.7 m ³ /SPU
Hot	Dalby, Moree, Biloela, Atherton	4.5 m ³ /SPU	6.1 m ³ /SPU

* Pond volumes assume no pre-treatment of solids e.g. screening or screw press.

The Problem

Farmer MacDonald operates a 1085 SPU piggery in Northern New South Wales. He treats the effluent using an anaerobic pond and a wet weather pond in series. He plans to desludge the anaerobic pond after it has been in use for ten years. He wishes to confirm that this pond is adequately sized to treat the effluent from his piggery.

What anaerobic pond capacity does Farmer MacDonald require?

Assessment

The required pond capacity will be the product of the number of SPU (1085) and the appropriate pond capacity per SPU for the climatic zone (warm) and the intended desludging frequency (every ten years). From the table above, the appropriate pond capacity is 6.7 m³/SPU.

1085 SPU X 6.7 m³/SPU = 7270 m³ or 7.27 ML.

Solutions

If Farmer MacDonald's anaerobic pond's capacity is less than 7.27 ML, he should consider pre-treating the effluent stream to remove some of the solids, reducing the desludging frequency (e.g. from once every ten years to once every five years) or expanding the capacity of the pond.

This case study is the fourth of a series condensed from the APL "Environmental Principles for Piggeries". Participants at these workshops work through a series of case studies each highlighting the dilemma's faced by the fictional Farmer MacDonald.

"Environmental Principles for Piggeries" is now being presented as a series of workshops throughout Australia. Your group may be eligible for APL funding assistance. For more information, please contact the National Co-ordinator, Robyn Tucker, on 03 – 5381 0709 or 0419 – 787 137 or the APL Communications Manager, Geogy Philip, on 1800 - 789 099.

