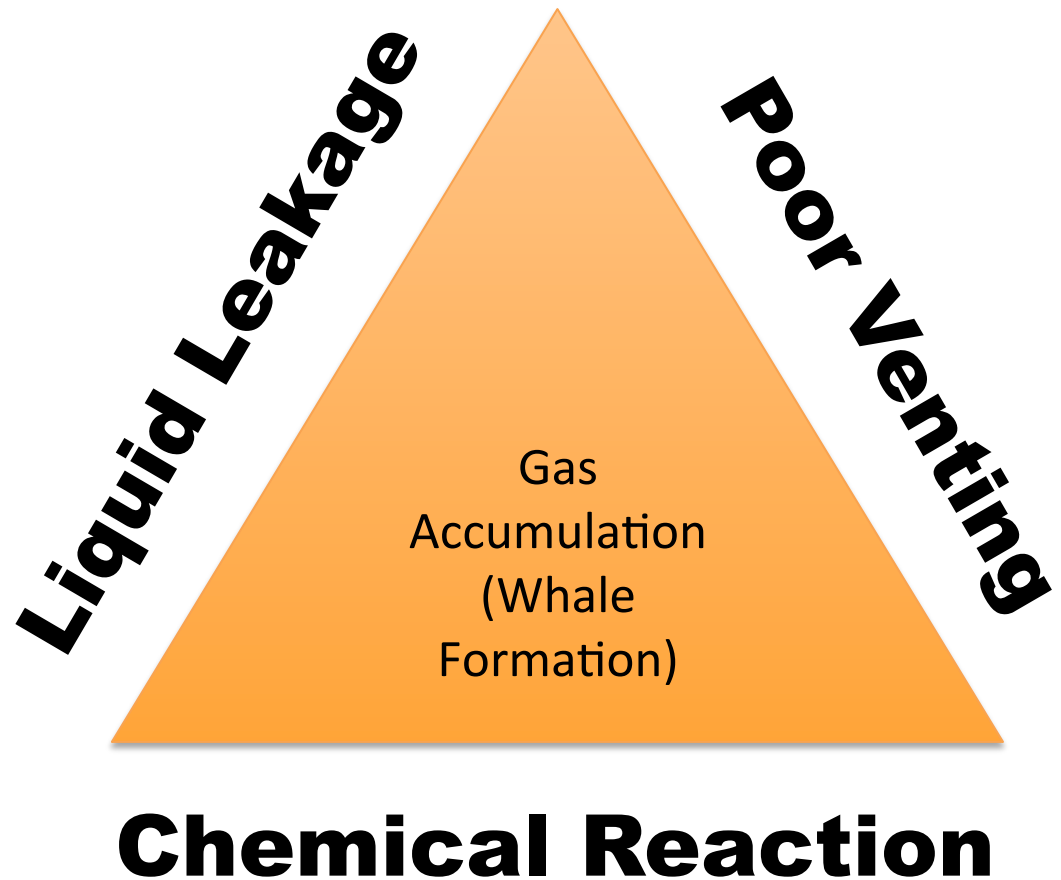# Why Whales Form in Liners

'Whales' can form under HDPE, LLPDE and fPP liners when there is leakage of the contained liquid and then a chemical reaction under the liner leading to gas generation (either methane, carbon dioxide or hydrogen sulfide).

**Liquid Leakage**

**Poor Venting**

Gas Accumulation (Whale Formation)

**Chemical Reaction**

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# *Why Whales Form in Liners*

- Whales form when liquid leaks through a geomembrane liner causing gaseous by-products to accumulate **under** the liner (or cover) which cannot vent away.

- Whale failures often arise in waste water treatment ponds or sewage lagoons due to leakage through the liner, no provision to remove leakage, the generation of methane, and the no provision to vent the methane.

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# How Whales Affect the Liner

- Whales can be particularly damaging for HDPE liners as they exert ***out-of-plane***, or ***axisymmetric*** stresses/strain on the liner

- These out-of-plane stresses can lead to yielding, thinning and rupture particularly at critical welds/seams.

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# *Preventing Whales Forming in Liners*

To prevent Whales under liners it is necessary to provide:

- a leak collection system under the liner to capture and drain away any leakage that does occur.

- a sloping floor on the bottom the pond or lagoon  which slopes to a sump – not a flat floor

- a venting system such as a network of geocomposite strips under seams to allow gases to vent

- concrete embedment strips sealing liner to concrete structures and preventing uplift

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LLDPE – PUBLIC GOLF COURSE

**LLDPE – RESIDENTIAL DECORATIVE**

LLDPE - RESIDENTIAL DECORATIVE

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EFFLUENT POND - FPP

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# Repair of Whales

- The *in situ* repair of whales in geomembranes is discussed by Koerner and Koerner in GSI White Paper #30

- [http://cloud.excelplas.com/index.php/s/fX755peKjvjoWK9](http://cloud.excelplas.com/index.php/s/fX755peKjvjoWK9)

# Contact

For independent technical investigation into the causes and avoidance of whales in liners and floating covers please contact:

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