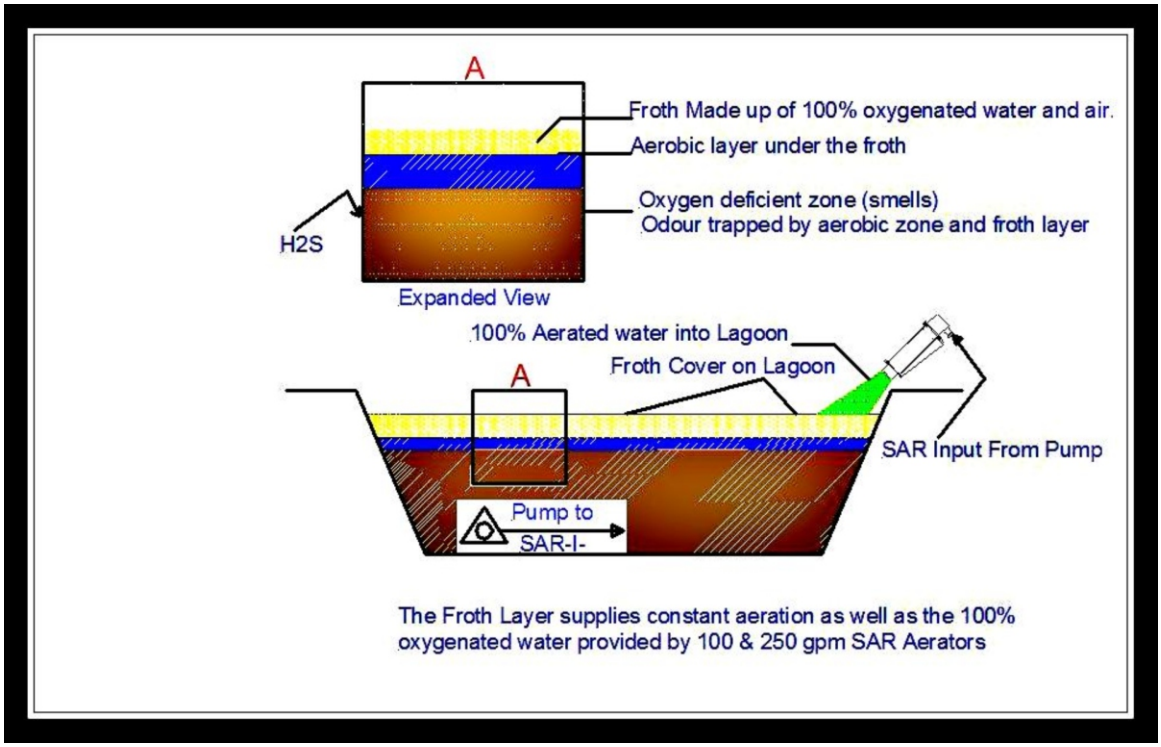
HPM

CALGARY AIRPORT CASE STUDY

ETHELYNE GLYCOL BIO-REMEDIATION

Background

- In 2011 Hydro Processing Ltd. was made aware of an odour problem at the Calgary Airport (YYC).
- The ethylene glycol, used for de-icing aircraft during cold weather, was accumulated in a pond upwind of the main terminal.
- This was causing the pond to become anaerobic in spring.
- Anaerobic (without oxygen) water gives off foul odours
- The foul odours made working conditions for outside terminal workers unpleasant and at times intolerable. In fact, in some cases both passengers and inside terminal workers complained about the smell.
- Hydro Processing's “Froth Cap” technology has been extremely successful in eliminating odours from ponds and lagoons (see Highline and Rol-Land farms case studies).
- YYC was approached to see if SAR Aeration could solve the problem.



Challenge

- Ethylene glycol, is an organic compound with a specific gravity similar to water, this means it is evenly diluted throughout the pond, nether sinking or floating
- There are very expensive chemical and mechanical methods of removing the ethylene glycol, such as ozone treatment and distillation.
- None of these expensive methods were considered practical as YYC is undergoing massive upgrades which will include an ethylene glycol catchment station through which aircraft will pass before takeoff.

Solution

- Hydro Processing installed a 100gpm aerator on the edge of the pond.

Hydro Processing's Aerator being installed at Calgary Airport pond

- One 100gpm aerator would not produce enough froth to cover this pond, so a containment boom was put in place to restrict the froth's distribution.

The boom installed to contain produced froth

Bacteria:

- It was expected that the bacteria that were causing the odour problems in the YYC lagoon had the same properties as those which caused the problem in other wastewater lagoons that Hydro Processing's aerator had corrected in the past. These types of bacteria produce a natural surfactant which alters the surface tension of the water in order to produce a stable froth. (Definition: Surfactants are compounds that lower the surface tension of a liquid, the interfacial tension between two liquids, or that between a liquid and a solid. Surfactants may act as detergents, wetting agents, emulsifiers, foaming agents, and dispersants.)

- The bacteria in the YYC pond were not the surfactant producing type.
- When aeration began there was little froth produced.
- It was therefore necessary to introduce a bacterium which secreted surfactants in order to produce a Froth Cap on the pond.
- Hydro Processing found an “oil eating” bacteria which produced the appropriate surfactant.
- A dosing pump was purchased to introduce this bacterium into the liquid flow of the aerator.
- The Froth Cap was produced as seen in the video below.(click on IMG.)

Results and Surprise

- After filling the boom enclosure with froth, there was a consensus by airport environmental staff and Hydro Processing staff that the odour emitting from the pond seemed diminished where the Froth Cap existed.
- This could not be an absolute finding as the boomed in area was only a small portion of the pond.
- The Aerator was left to run overnight in order to verify the stability of the Froth Cap over a longer period of time.
- The dosing pump failed some time during the night resulting in no bacteria addition and no froth being created.
- A version of Hydro Processing's Aerator was initially invented to supply nano and micro size bubbles for the flotation/separation industry.
- As a result, the Aerator still possesses flotation/separation qualities.
- These qualities resulted in the building of an oil slick on the pond.
- The Aerator had “floated” the “oil” to the surface. See picture below. Note: inside the boom the surface is not shinny and there is black between and on the rocks.

Oil slick produced by the Aerator

- The dosing pump was restarted and the Froth Cap was developed.
- The froth produced by the Aerator is very stable and dense. It can be built up in depth as required. Throughout these pictures it should be noticed that as the Froth Cap built up, the froth actually pushed the boom out into the pond maximizing the round shape of the boom.

The Froth Cap spreading over the oil slick

The Froth Cap spreads over the oil slick, over rocks and between grasses.

The Froth Cap pushing out the boom and covering the area inside the boom

- The Froth Cap covered the entire oil slick and was left to run for approximately 4 hours.
- On returning, it was observed that there were bubbles the coloured with primarily reds and blues and visible activity inside some of the larger bubbles.
- When the Froth cap was pushed aside where the oil slick had been, there was no longer an oil slick.
- The boom was removed to see how extensively the froth would travel before dissipating in the pond. (see the video below)
- After observing this miraculous disappearance of the oil slick from the surface of the pond and the rocks surrounding the pond inquiries were made with professors of biology at the University of Calgary.

The pond and shore while dismantling the SAR Aerator experiments, no oil present.

- Doctors Lisa Gieg and Raymond Turner, professors in the Department of Biological Services, University of Calgary concurred that the oxygenation of the Froth Cap by Hydro Processing's Aerator would greatly enhance bioremediation as the largest inhibitor to aerobic bacteria bioremediation is the lack of oxygen.

Conclusions

- SAR Aeration, in conjunction with aerobic bacteria addition, forms a Froth Cap which consumes organic compounds.
- The production of the Froth Cap is the most effective method of distributing bioremediation bacteria on bodies of water and in shoreline “in situ” contamination.