

Geosynthetic Biogas Collection Covers

Andrew Mills

Layfield Environmental Systems



www.LayfieldGroup.com

Introduction

- Geosynthetic Biogas Covers
- Types of Covered Containments
- Cover Types and arrangements
- Materials
- Installation
- Maintenance



Large potable water floating cover
El Toro CA



Potable water tank cover

Biogas Containments

- Number of applications producing biogas
 - Ponds
 - Slurry storage pond
 - Water Treatment pond
 - Tanks
 - Slurry (manure) storage tanks
 - Anaerobic digesters
- Cover collects gas and delivers it for other use



Biogas flare
www.abutec.com

Biogas Containments

- Main issue for covers is level changes
 - Work best when levels don't change
 - Part of a process
 - Settle solids before digestion pond
 - If cover peeled back there can be damage
 - Agitation and pump-out tough on a cover
 - Want to leave cover in place

Manure agitation impeller



Geosynthetic Cover Types

- Slurry Storage Ponds
- Water Treatment Ponds
- Slurry Tanks
- Anaerobic Digester Tanks



Large Biogas pond cover in California

Slurry Storage Ponds

- Typically swine manure
- Cover keeps volatiles in solution (odor)
- Cover opened for agitation and pump out
- Cover design needs to deal with rainwater
- Gas pumped out to keep cover flat
- Gas can be flared for carbon credits
- Biogas is a secondary consideration
- Air leakage a common problem

Slurry Storage Covers

- Design criteria
 - Level changes
 - Pull back cover for pump-out
 - Odor control is focus
 - Gas handling is secondary



Blowers remove biogas (not used)



Simple cover on swine slurry storage



Elite Swine
Strathmore Alberta



Rain handling issues with this type cover

Hilarides Dairy
Lindsay California



Large pipe in perimeter.
Defines edges.
Stores Biogas

North View Dairy
California

Partial biogas covers
on dairy slurry storage.
Perimeter skirt contains
gas. Gas used for
electricity generation.

Water Treatment Pond

- Typically dairy and food processing
 - Solids separation before treatment
 - Water treatment is the focus
- BioGas use is a key benefit
- Cover may lift under gas pressure
 - Need stabilizing weights
 - Can store gas under the cover
- Need to minimize level changes
 - Typically can't drain these ponds

Water Treatment Covers

- Design Criteria
 - Constant operating level in pond
 - Cover floated into place (tight)
 - Solids separation or minimal solids
 - Gas collection/water treatment focus



Electricity use



Valley Fig Food Processor
Fresno California

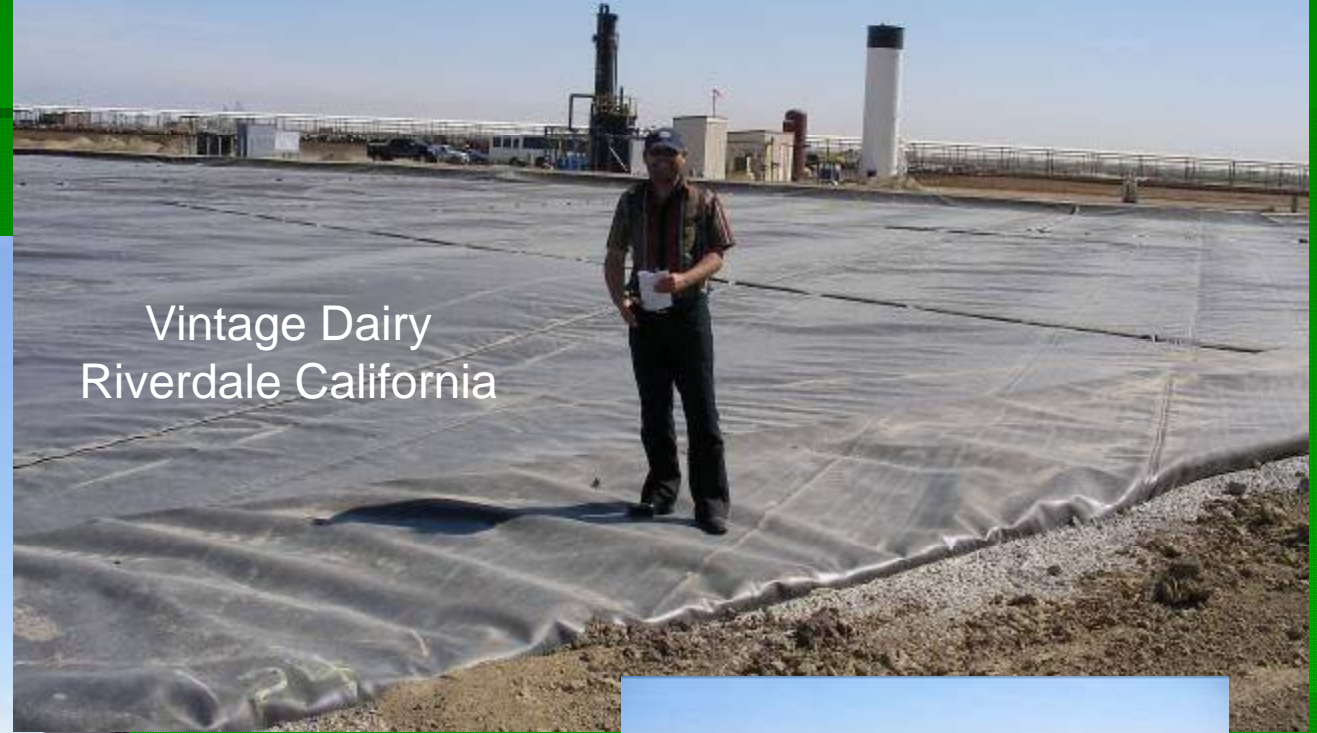


Mixing system in pond



Gas piping detail

Constant level pond with biogas cover.
Biogas is cleaned and sold to gas utility.
Currently producing 140,000 cu ft/day.



Vintage Dairy
Riverdale California



Gas cleaning plant

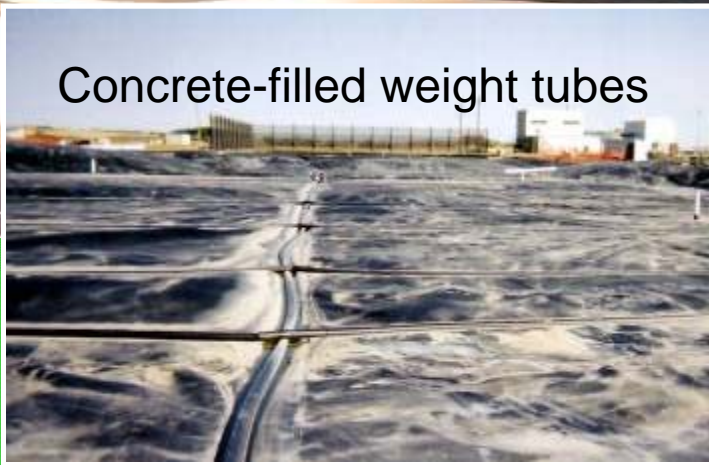


Solids separator

Cargill Foods meat processing plant
High River Alberta



Concrete-filled weight tubes



Constant level pond with biogas cover.
Biogas used for heating and hot water.

Slurry Storage Tanks

- Similar to slurry storage ponds
- High solids content
- Difficult to address level changes
 - Floating designs not attached to wall
 - Wall attached designs need to be suspended
- Problems opening cover for pump out
- Mostly odor control designs
- Limited Biogas collection options

Slurry Tank Covers

- Design criteria
 - Level changes
 - Remove or pull back cover for pump-out
 - Odor control focus
 - Gas handling is difficult (can't seal)

Hog Manure Tank
Quebec
www.firestonesp.com

Strap supported cover



Hog Manure Tank
Chilliwack BC



Manure slurry (frozen)



Chain skirt and float on perimeter
Gas venting system (gas not used)



Pump solar panel
and gas vent stack.

Anaerobic Digesters

- Tank digesters with controlled temps
 - Plug flow, complete mix, etc.
 - Designed for a particular solids content
- Constant operating levels
- Covers are supported above liquid
 - Often have a structural roof
 - “Tent” designs from Europe
 - Gas supported designs gaining popularity
- Gas pressure is an issue in these designs

Digester Covers

- Design Criteria
 - Constant operating level
 - Cover is supported (structure or air)
 - Various tank designs/mixing
 - Gas collection/water treatment focus



Detail of mixer, support post, and structural roof.

Structural supported
cover examples

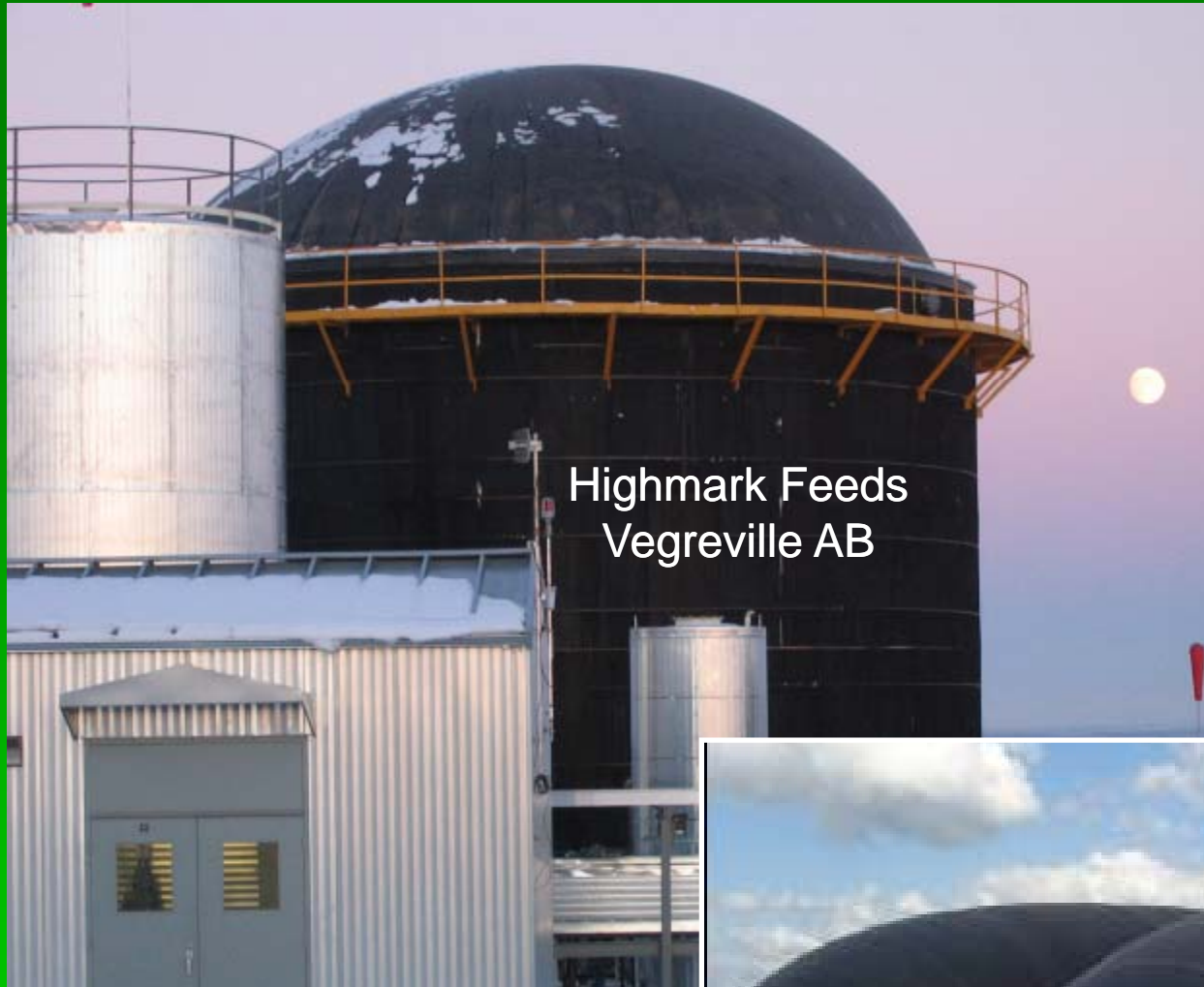


Inside the operating digester

www.planet-biogas.ca



Vandermeer Greenhouses
Niagara-on-the-Lake ON



Highmark Feeds
Vegreville AB

Gas supported
cover examples

www.firestonesp.com



Rectangular anaerobic digester

Insulated Covers

- Design criteria
 - Heat loss prevention
 - Extend treatment season
 - Protect heat sensitive bacteria
 - Needs constant operating level
 - Combines with gas collection cover
 - Can use on ponds or tanks



Insulated Tank Cover
(no gas collection)



Insulated water treatment lagoon
Fruitland ID
(no gas collection)

Digester cover with integrated insulated panels.
Gas collection for electricity generation.



Materials

- Unsupported Materials
 - High Density Polyethylene (HDPE)
 - Linear Low Density Polyethylene (LLDPE)
 - Ethylene Propylene Diene Monomer (EPDM)
- Fabric Supported Materials
 - Polyvinyl Chloride (PVC) coated
 - Many different alloys and blends
 - Thermoplastic Olefin (TPO) coated
 - LLDPE coated (various tape and fiber types)

Costs

Material	Life Expect	Cost ft2
Simple Cover	5 to 10 yr	0.35 to 2.00
Constant Level Cover	10 to 20+ yr	2.00 to 5.00
Structural Covers	20+ yr	3.50 to 7.00
Insulated Cover (2")	10 to 20 yr	2.50 to 5.00
Defined Sump	20+ year	3.50 to 5.00

Approximate costs. Please call your local installer for a specific estimate.

Installation

- Typically manure or wastewater pond
- Typically floated across a full pond
 - Cover made in a lay-down area
 - Need working space near the pond
 - Floats rigged to leading edge
- Pull across pond
- Place any required slack
- Bury in anchor trench or bolt to wall
- Attach weights and any other fittings



Deployment and welding
in laydown area



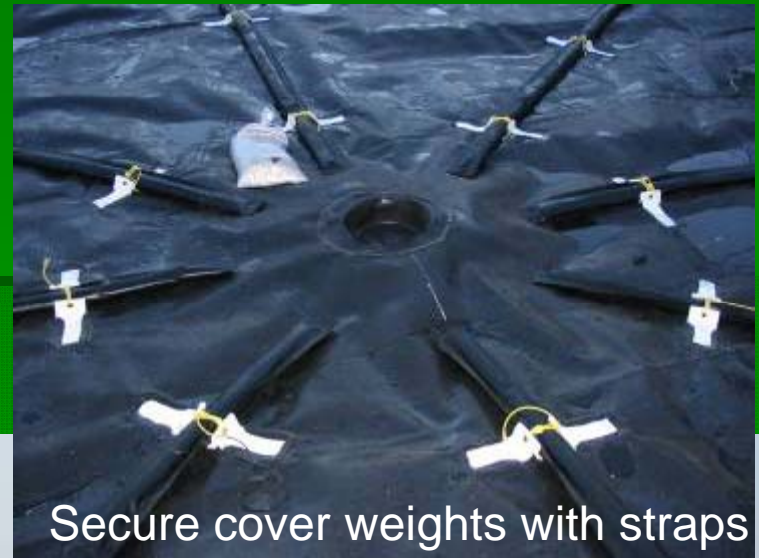
Pulling cover across full pond



Gas piping and anchor
trench prepared prior
to cover placement



Complete pulling cover
and secure in trench



Secure cover weights with straps



Maintenance

- Regular inspections are important
- Inspect covers as frequently as engines
- Can find small holes by smell
- Inspect covers at least yearly



Wrap up

- Geosynthetic Biogas Covers
- Types of Covered Containments
- Cover Types and arrangements
- Materials
- Installation
- Maintenance

www.layfieldgroup.com





