Lagoon Liners
Case study # 1 - Lagoon Liner – Manure Solids Bedding – Vacuum Truck for Manure

• 1500 milking cows
• Manure solids as bedding
• Parlor waste - Separation of solids since 1990, manure from parlor goes over liq-sol separator, then concrete lined settling basin, then to lagoon
• Manure from Barns - is vacuumed and transported to fields or to lagoon
• ~ 6 years ago - Lagoon has concrete bottom with 60 mil poly lined banks (20 ft x 70 ft(x2) x 300 ft)
• Cost to redo lagoons, engineering, dirt work, liners, concrete, 4 lagoons, 12 acre feet, 11 million gallon capacity = $500,000 ($333/cow)
• Use floating pumps to pump manure and avoid liner disturbance
Case Study #2 – Sand Bedding – Flush System

• 6000 cows
• Flush system with Biolink system, lots of sand traps, trap dimensions 14 ft wide x 500 ft long (3 of them)
• Sand traps at end of barns, 2 ft x 14 ft x 20 ft
• Processing sand with sand screw
• Getting ready for installation of centrifuge
• Uses DT 360 series of liq-sol separators, 2 screen sizes, 1/8 and 1/16 inch
Case Study # 2 – Continued

• Lagoons were engineered and clay lined prior to installing liners
• Gas emission lines installed under liner to prevent gassing up of liner
• Year 2000 – 60 mil liners, 9 million gallon each (2) – 20 ft deep
• No concrete ramps, have not entered lagoons, if building new, would put in ramps
• Floating pump and stinger agitator for manure movement, stinger run off of tractor PTO
• Cost – today’s prices = $87, 120 = $15/cow
Case Study #3 – Open lots and Scraped Feed Alleys – Manure Solids as Bedding

• 5800 cows
• Manure solids as bedding, scrape feed alleys
• DT 360 liq-sol separators, 2 screen sizes
• Use of Biolink System for sludge removal, sludge is run across smaller screen size DT 360
• Liquid after separation goes to lagoon, the settling basin, and then to big lagoon
• Lagoon liquid is pumped out via pivots and low pressure nozzles
Case Study # 3 - Continued

• Material from settling basin is pumped and injected
• Big lagoon – high volume, low pressure pumps, floating
• Settling ponds have concrete ramps to bottom, but not across bottom
• Cost – 2002 – 35 cents per sq ft installed – 25 million gallons (7 acres), 2 settling ponds 1.5 million gallon each, 40 mil poly, 638,000 sq ft = $223,546
• Cost 2014 – 40 cents per sq ft – 40 mil poly - 28 million gallons and a settling pond of 500,000 gallons - $139,513 for 350,000 sq ft
• Cost = $62/cow
• Maintenance on liners done in house
Double Liner with Leak Detection System

- HDPE 40-MIL $0.55 SF Supply and Installation
- HDPE 60-MIL $0.70 SF Supply and Installation
- Geonet (leak detection layer) $0.45 SF Supply and Installation
- Geocomposite Clay liner $0.85 SF Supply and Installation

Total $2.55
Western Washington – Lagoon Liners
(a bit more water to handle)

<table>
<thead>
<tr>
<th>Size of Dairy (cows)</th>
<th>Single Liner</th>
<th>Double Liner with Leak Detection (6.5 multiplier)</th>
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<tr>
<td>500</td>
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<tr>
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