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Biogas from Industrial Effluents Experience at Fonterra Tirau and Proposals for Timaru and PPCS Finegand (Balclutha)

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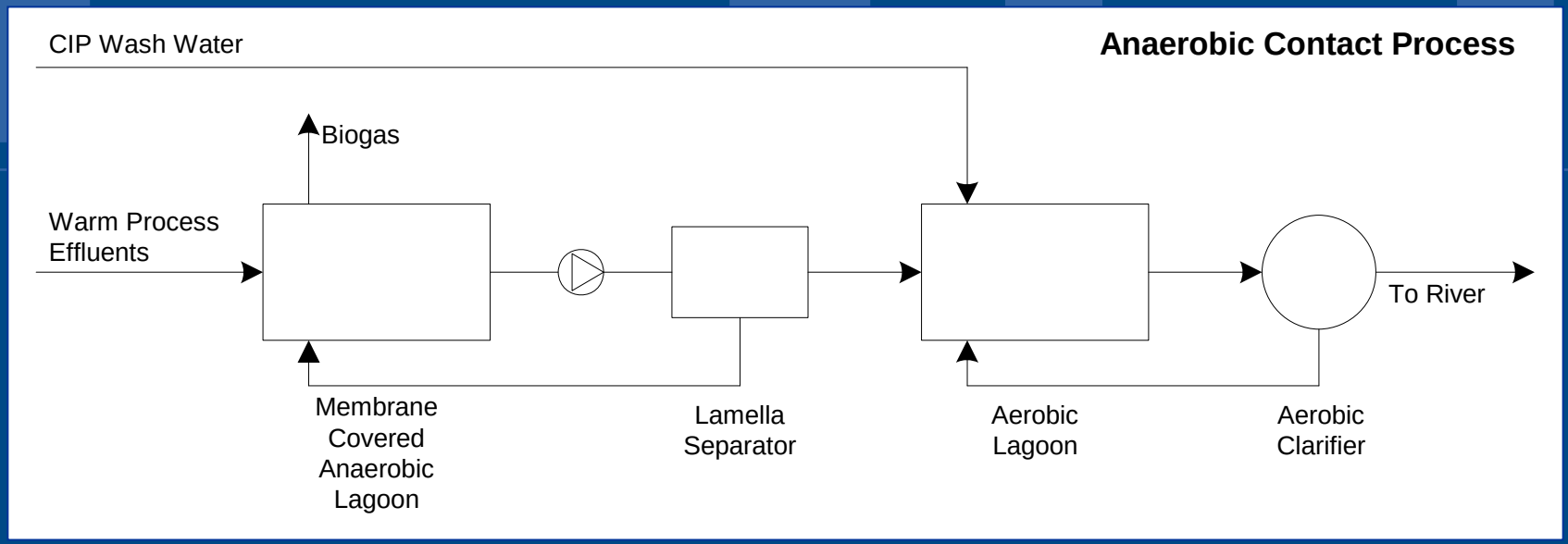
Scope of Presentation

- Experience at Fonterra Tirau since 1984, with membrane covered anaerobic lagoon and co-firing of biogas in a boiler with natural gas
- Proposed anaerobic treatment of industrial effluents at Timaru (separated from domestic sewage) with biogas reuse
- Proposed anaerobic treatment of PPCS Finegand meat processing effluent with biogas reuse

Fonterra Tirau (1) 1984 Upgrade

- Prior to 1984, two aerobic lagoons in series for effluent treatment
- Factory expansion up to 2,000m³/day milk intake would have required 3 MW of aerator power if aerobic lagoons retained
- Converted one lagoon (26,000m³ volume) to anaerobic contact process with external lamella plate separator to recycle the anaerobic biomass (AC Biotechnics)
- Anaerobic lagoon covered with butyl rubber membrane in eight panels – close to largest in the world at that time
- Aerobic lagoon in series, with 1 MW aerator power

Fonterra Tirau (2) Flow Diagram



Tirau 1984 Butyl Rubber Membrane Cover

Tirau 1984 Butyl Rubber Membrane Cover

Tirau Lamella Separator

Tirau Aerobic Lagoon

Tirau Experience (1)

- First season start up (1984/1985) ok with digester sludge seed from Hamilton
- Second season (1985/1986) overloaded during start up due to strike action causing whole milk discharge to lagoon
- Milk fat caused softening of butyl rubber but not failure
- Rainwater accumulation on cover caused extra stress on panel ties
- Odour release from margin of lagoon and lamella separator
- Treatment system reduced BOD from up to 5,000g/m^3 to <30g/m^3

Tirau Experience (2)

- From 1986, anaerobic contact process was reliable and biogas yield >20,000m³/day (second to the Manukau WWTP)
- When volatile acids increased, iron salt was dosed as an essential element
- Lime dosed to anaerobic lagoon to aid pH stability
- Biogas co-fired with natural gas in a boiler to provide ≈ 33% of total heat energy demand
- By 1994, solids were accumulating in anaerobic lagoon

Tirau Upgrading 1994/1995

- Two mixed tanks added upstream of lamella separator to release biogas from floc
- Lamella separator covered to control odour
- Butyl rubber cover removed
- Sludge removed during off season (high in P and K)
- New XR-5 membrane cover installed
- Mixing and flow pattern changed
- Submersible mixers on rails at bank

Tirau Covered Lamella Separator

Tirau Biosolids Removal (1)

Tirau Biosolids Removal (2)

Tirau Submersible Mixers

Tirau XR-5 Membrane Cover

Tirau Membrane Cover 1995 Onwards

- XR-5 membrane from Seaman Corp USA fabricated by Structurflex
- XR-5 has integral reinforcing fabric
- Resistant to fats, acids and UV degradation
- Polyurethane and polypropylene probably ok and cheaper but less strength and less flexible
- Six panels which can be moved sideways for sludge removal – done once since 1995
- Improved rainwater handling

Tirau Summary

- Anaerobic – aerobic treatment in series works very well with separated streams from factory where possible (warm vs cold)
- Anaerobic contact process in lagoons still preferred over UASB where fat is present, e.g. meat and dairy
- Factory milk intake now increased by 50% to 3,000m^3/day and system copes
- Biogas is now 28,000m^3/day
- Treatment system has helped the overall viability of the factory
- Key points are membrane selection, rainwater handling, corrosion and sludge removal

Proposed Timaru Wastewater Treatment Upgrading (1)

- Currently has milliscreen and ocean outfall
- Population 25,000 but combined industrial effluents have pe about 400,000
- Industries grouped at Washdyke and Port
- Main trunk sewer needs replacing due to corrosion and capacity
- Proposed separate trunk sewers for industrial and domestic wastewater

Proposed Timaru Wastewater Treatment Upgrading (2)

- Anaerobic treatment of industrial stream with biogas capture and reuse
- Pond and wetland treatment of domestic stream
- Trunk sewer separation cost is justified by reduced treatment cost
- Strategy was developed during consultation in 1998/1999
- Recently reviewed due to major increase in flows and loads – viability confirmed
- Existing consent expires in 2010 and new treatment to be implemented from 2007/2008
- Trunk sewer upgrading has started

Timaru Industry Locations

Timaru Flows, Loads and Biogas Predictions

	Domestic	Industrial
Flow (m^3/d)	12,000	17,000
BOD (kg/d)	2,200	42,800
SS (kg/d)	2,500	27,500
Oil & Grease (kg/d)	Minimal	20,000

- Estimated biogas production = 33,200 m^3/d
  (assumes 75% of maximum BOD load)
- Average electrical production = 2.6 MW
- Average heat production = 4.5 MW

PPCS Finegand (1)

- Primary settled effluent is discharged to Lower Clutha River downstream of Balclutha
- Flow = 20,750m³/day and BOD = 33,000kg/day (pe 250,000)
- Currently in reconsenting process
- PPCS propose to upgrade treatment using anaerobic process with biogas capture. DAF may be used for cooler, dilute streams with final polishing in an aerobic lagoon plus UV or pond disinfection

PPCS Finegand (2)

- Biogas yield 33,300m³/day at peak season and 19,700m³/day for remainder of season (October to July)
- If used in gas engine, electrical power generation potential is:
  - Peak season = 2.6 MW
  - Shoulder season 1.5 MW
- Heat recovery potential is:
  - Peak season = 4.5 MW
  - Shoulder season = 2.6 MW