One man’s trash, 
is another man’s 
treasure

Beneficially Reusing Industrial 
Wastewaters & Waste By-products

presented by

Wes Ripple, NHDES

for the

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Conference
Pilgrim Foods – Greenville, NH

- Medium size food processing facility
- Produce mustards, vinegar and apple juice
- Generate about 5,000 GPD of process wastewater
  - Pretreat in aerated lagoons
  - Raw wastewater characteristics:
    - BOD 24,000 mg/l
    - COD 54,000 mg/l
    - Acetic acid 34,000 mg/l
- Industrial discharge permit to town sewer:
  - Flow limit 14,600 GPD monthly average
  - BOD 300 mg/l
  - Acetic acid 100 mg/l
Pilgrim Foods - Problems

- Pretreatment lagoons don’t always work very well
  - Discharge violations
  - Sludge accumulation
  - High flows
- Relationship with town difficult (on a good day)
- Odor problems/complaints
- Air permitting problems
- Arsenic in groundwater problems
- All leading to pressure to close the lagoons – What to do with the process wastewater???
  - All options cost $$$$
Great Bay Estuary

- Tidal waters, deep channels, and mudflats
- Fed by 7 rivers carrying pollution from 42 NH towns and 10 Maine towns
- Surface area of 17 sq miles, 1,023 sq miles of watershed & 150 miles of tidal shoreline
- At 10 miles inland, it is one of the largest and most recessed estuaries on the east coast
- Home to 162 bird, fish and plant species
Sources of Nitrogen in Great Bay

- 68% from non-point sources
  - Atmospheric deposition
  - Septic systems
  - Lawn fertilizers
  - Animal wastes (mostly livestock)

- 32% from point sources
  - Wastewater treatment plants
Regulate and Control Nitrogen at the Point Sources (WWTFs)

- NPDES permits will be written for 3 mg/l TN
  - The Limit of Technology, or LOT
- Administrative orders will be written for 8 mg/l
  - Time will be allowed for additional monitoring
Nitrogen Removal is a Two Step Process

- First, ammonia is converted to nitrate via biological nitrification under aerobic conditions.
- Second, nitrates are converted to nitrogen gas via denitrification under anoxic conditions (no air).
So, what do nitrogen removal, Great Bay & Pilgrim Foods have in common?

- To meet low level nitrogen limits, a food source (carbon) must usually be added during the anoxic denitrification stage.

- The bugs eat the food, and, if oxygen is not present, use nitrate (NO₃) for respiration, leaving nitrogen gas stripped off to the atmosphere, completing the nitrogen removal process.
Methanol

- Methanol is typically used as the carbon source of choice
- It is high strength
  - COD of 1,888,000 mg/l
  - Easily consumed by bacteria
- Drawbacks
  - Highly flammable
  - Highly toxic in both liquid and vapor form
  - More money invested in methanol storage facilities
Alternatives to Methanol

- Proprietary products
  - Micro C
- Pure chemical compounds
  - Concentrated acetic acid
  - High fructose corn syrup
- Brewery, soft drink, and fruit juice wastes
- Glycerin
  - Crude & various stages of refined
Rochester Pilot Test for Nitrogen Removal

- First phase – Rectify over-aeration problems.
  - Aeration system is designed more for mixing and results in excess D.O.
  - Excess D.O. interferes with denitrification and nitrogen removal.
  - Floating mixers added to keep MLSS in suspension
  - Blower output reduced for energy savings and better D.O. control

- First phase has resulted in some nitrogen reduction
Phase 2

- Add methanol to get more nitrogen reduction
Phase 2

Why not add Pilgrim Foods wastewater instead and treat it as an alternative carbon source?

Vinegar, fruit juice and mustard are ideal foods for bacteria – readily consumed in a short period of time.

Eliminates the hazards of methanol.

Meets both needs and solves 2 problems at once.
A win-win relationship has formed

- Pilot testing is about to get underway
- Pilgrim Foods will be loaning Rochester two 5000 gallon storage tanks
- Pilgrim Foods will cover transportation costs
- If successful, Rochester will accept all of Pilgrim’s wastewater on a year-round basis and get a free carbon source
- Pilgrim Foods will be able to close their lagoons and become part of the nitrogen solution to Great Bay
Additional Benefits of Pilgrim Foods and Similar Types of Wastewater

- High acetic acid content makes it an ideal supplement for biological phosphorus removal
  - Acetic acid must be generated in a Bio-P plant in order for PAOs to uptake phosphorus in the aeration zone

- Ideal food source for anaerobic digestion
  - Produce more methane, generate more electricity
Glycerin – Another Carbon Source

- A waste by-product of biodiesel production
- About 10% of biodiesel production results in glycerin as a waste by-product
- Too strong to discharge to the sewer
- 2 big producers in NH
  - White Mountain Biodiesel, Haverhill NH
    - Generates about 200,000 GPY of glycerin
  - Granite State Biofuels, Bow NH (new)
    - Expected to generate 50,000 GPY of glycerin
White Mountain Biodiesel
In controlled doses, it becomes another inexpensive carbon source for nitrogen removal systems.
Fixed film nitrification/denitrification

Fixed film denitrification tanks

Glycerin
Pilot Total Nitrogen

May 28

Target 8 mg/l

3.8 mg/l

October 9
Keep it local:
Some industries can be a resource

- Maybe it’s time to rethink how we view industrial wastes
- Industrial wastewaters & waste by-products can:
  - Save money
  - Reduce carbon footprint
  - Eliminate hazardous chemicals
  - Satisfy a need
...and this is what it’s all about.