One man's trash,

is another man's treasure

Beneficially Reusing Industrial Wastewaters & Waste By-products

presented by

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for the

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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)

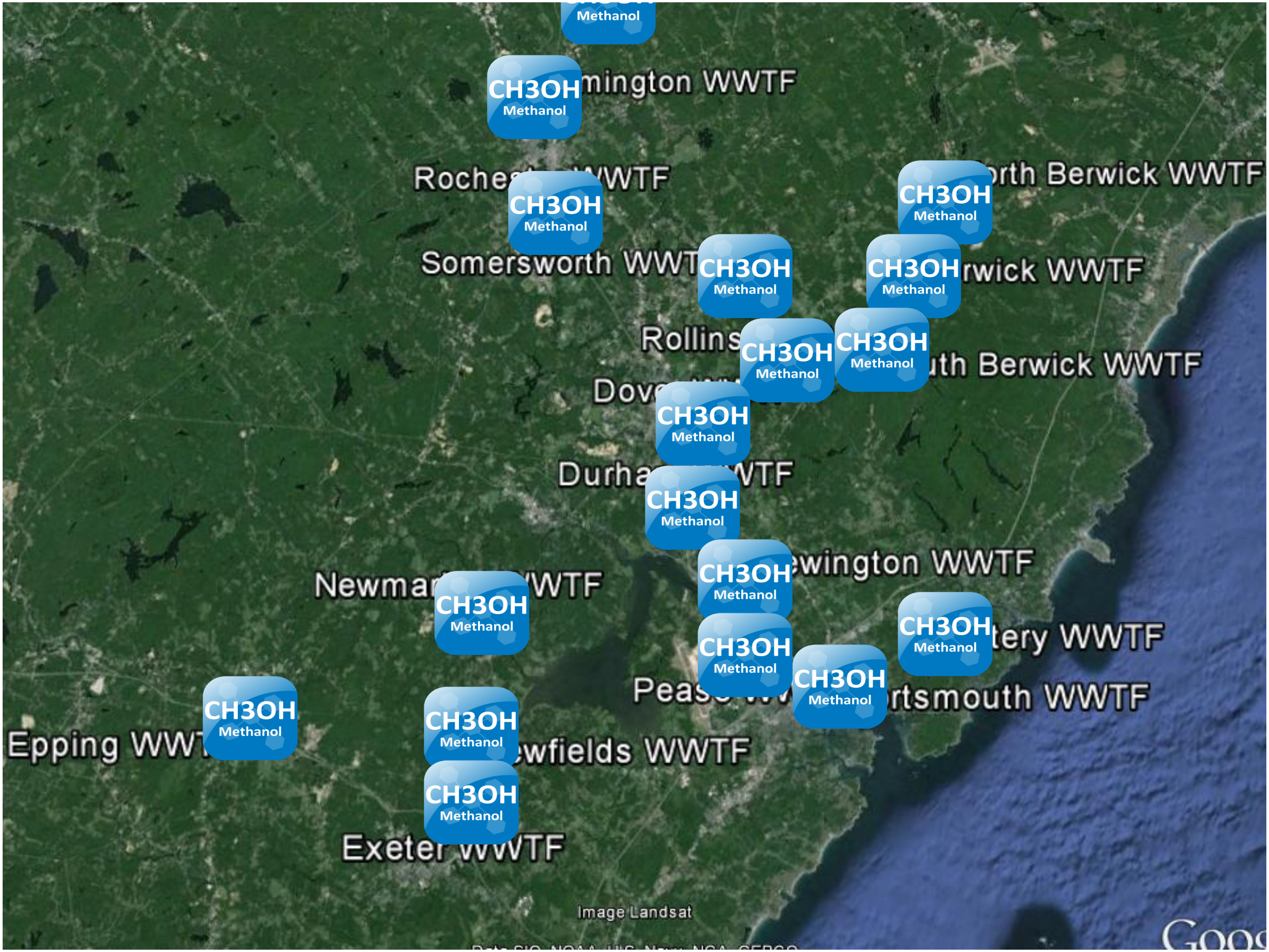
So, what do nitrogen removal, Great Bay & Pilgrim Foods have in common?

- 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


Milton WWTF
Farmington WWTF
Rochester WWTF
North Berwick WWT
Somersworth WWTF
Berwick WWTF
Rollinsford WWTF
South Berwick WWTF
Dover WWTF
Durham WWTF
Newington WWTF
Newmarket WWTF
Kittery WWTF
Pease WWTF
Portsmouth WWTF
Epping WWTF
Newfields WWTF
Exeter WWTF



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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 WWTF

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

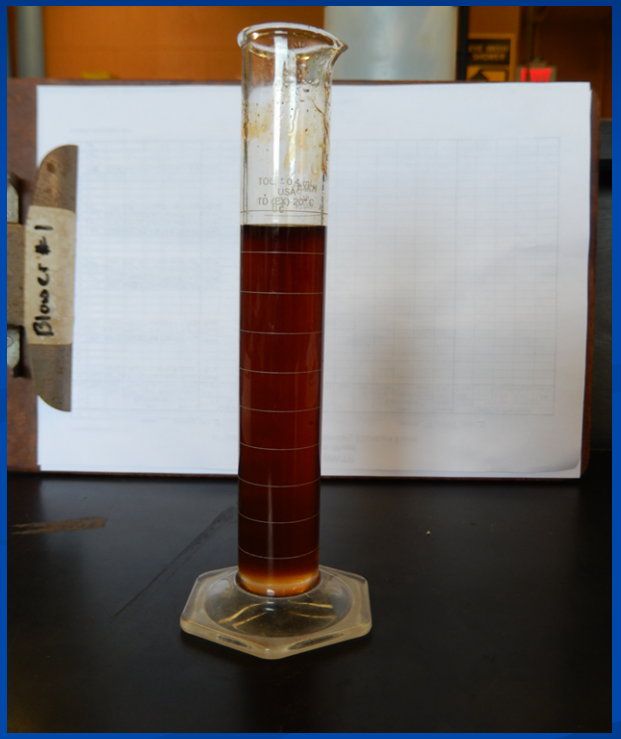
White Mountain Biodiesel

In controlled doses, it becomes another inexpensive carbon source for nitrogen removal systems

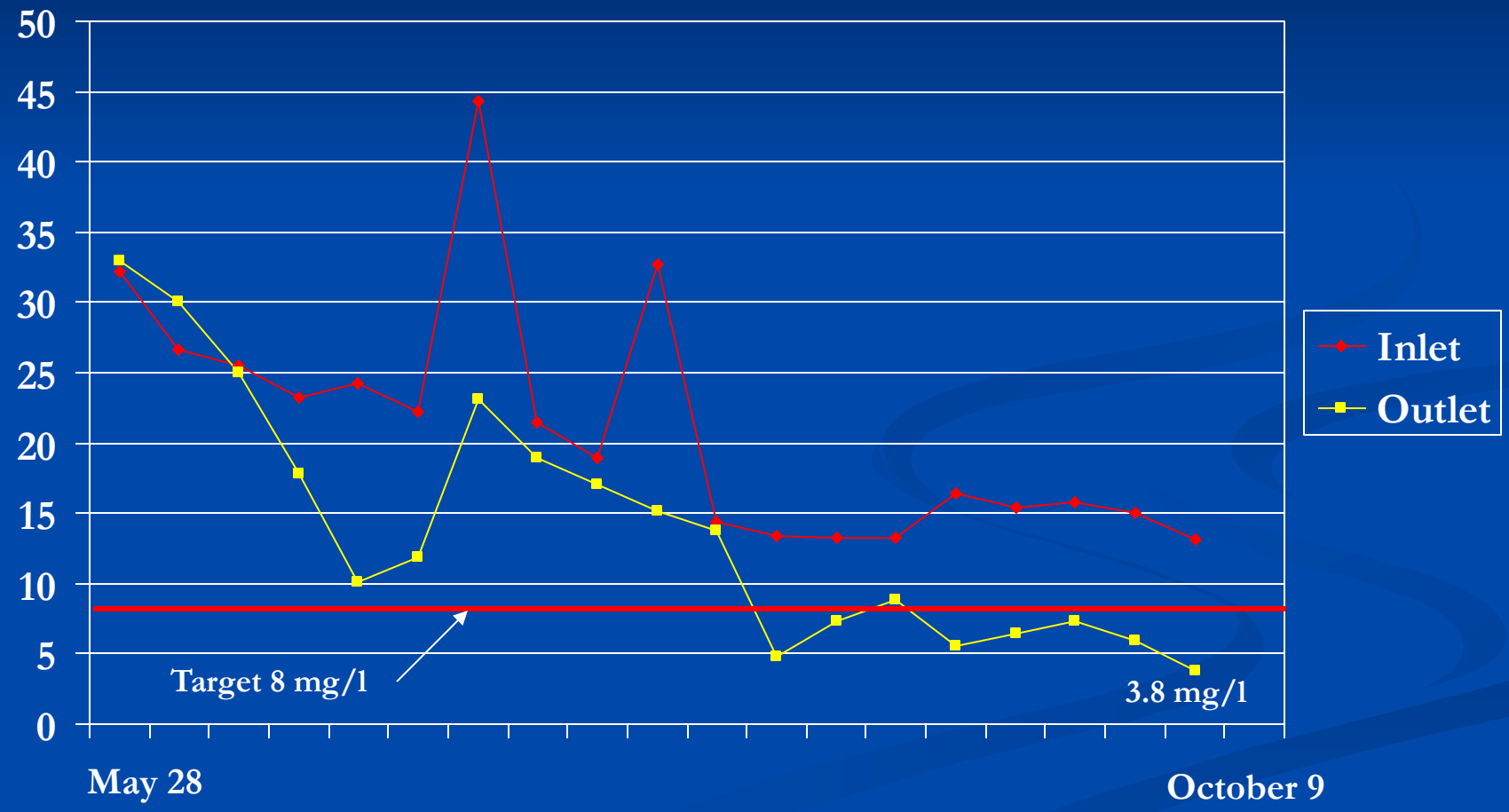
Fixed film nitrification/ denitrification

Fixed film denitrification tanks

Glycerin



Pilot Total Nitrogen



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.