Freeze Crystallization of Wastewater in Maine

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Overview

- Background and History
- System Requirements
- System Benefits (disinfection and nitrogen reduction)
- Review of WWTP in Rangeley, Maine
- Industrial Application in Mars Hill, Maine
- Conclusions
Background History

Snowfluent™ or “Atomizing Freeze Crystallization™ (AFC) developed in Canada. ATC developed 20 years ago by Delta Engineering and Ontario Ministry of the Environment.

-Voted Best of What’s New by Popular Science in 1995. Used for Wastewater treatment and to lesser extent industrial wastewater.

“It treats sewage to the highest possible level, which even the wealthiest municipalities cannot afford in traditional systems”
    -Jeff White
Background and History in Maine

Municipal Wastewater Treatment Plants
- Carrabasset Valley Sanitary District – 54 MG, 1995
- Chick Hill Pollution Control Facility, Rangeley - 29 MG, 1996
- Mapleton Sewer District - 24 MG, 1997
- Moosehead Sanitary District, Greenville- 61 MG, 2009

Industrial Food Manufacturing
- Naturally Potatoes, Basic American Foods Division LLC – 24 MG, 2004
- Pineland Farms Creamery, Gray Maine, 2013

Sites in colder regions of country, land for spray irrigation when not making snow
**System Requirements**

**Temperature**

"Global Climate models predict that the warm season will increase by an additional two weeks over the next 50 years. Winter is warming at a faster rate than summer”

- Graph and quote from University of Maine’s Climate Future 2015 Update

Wet Bulb Temperature must be ≤27°F, which can occur at air temperatures up to 37°F if humidity is low.
System Requirements
Temperature

Maine Winter humidity typically in 70s

Not making Champaign Snow

Sites in Maine experience periods where wet bulb temperature is above 27°F

Storage is important
System Benefits

**Nitrogen Reduction:**
- Ammonia released to atmosphere during spray snow
- Canadian Pilot study in 1997 found 88% reduction in nitrogen found in runoff as compared to wastewater effluent (reductions from snow making, from sublimation, infiltration to ground)

**Controlled Runoff (ME DEP estimate at one site)**
- 15% snow is lost to evaporation during snow making;
- 20% through sublimation
- melting over time: March (5%), April (15%), May (30%), June (40%), July (10%)

- **BOD reduction**
- Return of nutrients to land
Graphs illustrate processes that occur within the snow piles.
Chick Hill WWTP

April 15 – November 15 spray irrigation (2.65 MGW on 27 acre field)

Nov 15 – April 30 snow; 29 MG per season on or two 40 acre fields

Raw Sewage flows to aerated lagoons (2.5 MG each) then to a 27 MG storage lagoon

7 snow guns in two fields combined spray capacity of 250 gpm

Monitoring to ensure groundwater meets Class GW-A standards
Chick Hill WWTP

75 HP compressor
75 HP Vertical Turbine pump
Air dryer and air filters

Kilowatt Consumption varies – roughly 6.5 Kilowatts per 1,000 gallons converted to snow
Licensed in 2004 when owned by Basic American Foods Division LLC

- Processes 700,000 to 1,000,000 lbs. of potatoes a day (200 million pounds per year)
- 40,000 gpd to 50,000 gpd wastewater generated from washing and processing
- Process wastewater separated from sanitary wastewater which is sent to the WWTP
- Two aerated lagoons, each with 500,000 gallon capacity (average flow is 125,000 gpd for 4 day detention)
- Storage lagoon is 3 acres and 20 ft. deep for 10 million gallons or 80 days
- Spray irrigation from May through November – up to nine fields with total of 176 acres – but four fields typically used.
- Snow making November through March on a 7.5 acre field; 24 Million gallons per winter; 4 mobile guns
Benefits:

Zero Discharge
Sustainable
Conclusions

• Additional Benefits
  • Industrial sites can meet zero discharge goals which are being built into sustainability plans.
  • Recognition that wastewater has beneficial uses for irrigation.
  • Nutrient capture on land as opposed to treatment and release to surface waters where plants struggle with spikes in flows
  • Functions in cold climates where other technologies have reduced effectiveness
  • Eliminates bacteria with no chemicals
  • Relatively low operating costs

Not for everyone! Need land and correct climate