Vacuum Sewer Sanitation Energy Efficiency

Cody Uhlig, P.E., CEM
Sr. Project Manager
ANTHC

Statewide tribal consortium

Over 2500 employees – Mostly in hospital and health divisions

Division of Environmental Health and Engineering roughly 250 employees

Rural Energy Initiative – 7 employees
Rural Energy Initiative

Reducing dependence on diesel fuel and making water and sanitation more affordable for rural Alaska through:

• Incorporation of renewable energy sources

• Microgrid optimization

• Energy efficiency
What is vacuum sewer?

Old technology. First installed in Europe in 1882

Not common in contiguous US

Alaska - Typically used in areas where soil conditions and topography prevent traditional gravity or pressure systems to operate

Collection system “de-pressurized” to around 20 inches of Mercury – around 10psi (standard atmosphere = 14.7psi)
What is vacuum sewer?

Homes plumbed in typical gravity fashion

Wastewater flows into a individual sump or common sump at atmospheric pressure

When sump gets to certain level, valve between vacuum and sump opens, pulls in wastewater and air, sucking wastewater to collection tank at vacuum station
Inside vac station, vac pumps “de-pressurize” system

As sumps evacuate, wastewater is sucked to station and gathers in low pressure collection tank

When tank gets to certain level, controls turn on pump to evacuate wastewater to treatment
Typical Vacuum Sewer Energy Efficiency Upgrades

• Oil-less Rotary Claw pumps vs. Rotary Vane
  • Higher pump efficiency
  • Lower maintenance costs

• Variable frequency modulation vs. on/off operation (affinity laws)
  • $P_1/P_2 = (N_1/N_2)^3$
  • Ex. A 10% reduction in speed = 33% reduction in power draw

• Tighten system
  • Less air leaks = less pump run time
Noorvik

Located in Northwest Arctic approx. 50 miles East of Kotzebue

Population = 650

Fuel Oil = $5.65/Gal
Electricity = $0.65/kWh

Collection system contains mix of gravity, lift stations, and vacuum
Improvements

• New oil-less vacuum pumps
• Modulating controls
• Upgraded boiler controls and header piping
• Upgraded all heat adds
  • Controls
  • Control Valves

Cost = $200k
Expected Savings = $50k/yr
Noorvik – Vac Pumps
Noorvik – Heat Add
Kotlik

Located on northern Yukon River delta approx. 165 miles Northwest of Bethel

Population = 620

Fuel Oil = $4.53/Gal
Electricity = $0.62/kWh

Collection system only vacuum
Improvements

- New oil-less vacuum pumps
- Modulating controls
- Upgraded all heat adds
  - Controls
  - Control Valves
- LED lighting in all sanitation facilities

Cost = $150k
Expected Savings = $17k/yr
Kotlik – Heat Add
Alakanuk

Located on southern Yukon River delta approx. 165 miles Northwest of Bethel

Population = 710

Fuel Oil = $4.53/Gal
Electricity = $0.61/kWh

Collection system only vacuum
Improvements

- New oil-less vacuum pumps
- Modulating controls
- Upgraded faulty heat adds
  - Controls
  - Control Valves
- LED lighting in all sanitation facilities
- HVAC Upgrades
- Boiler upgrades

Cost = $275k
Expected Savings = $75k/yr
Alakanuk – LED Lighting
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<thead>
<tr>
<th>Location</th>
<th>Cost</th>
<th>Savings (per year)</th>
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<tbody>
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THANK YOU!

Cody Uhlig, P.E, CEM
Senior Project Manager
cuhlig@anthc.org
(907)729-3589