

Vacuum Sewer Sanitation Energy Efficiency

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ANTHC

Statewide tribal consortium

Over 2500 employees – Mostly in hospital and health divisions

Division of Environmental Health and Engineering roughly 250 employees

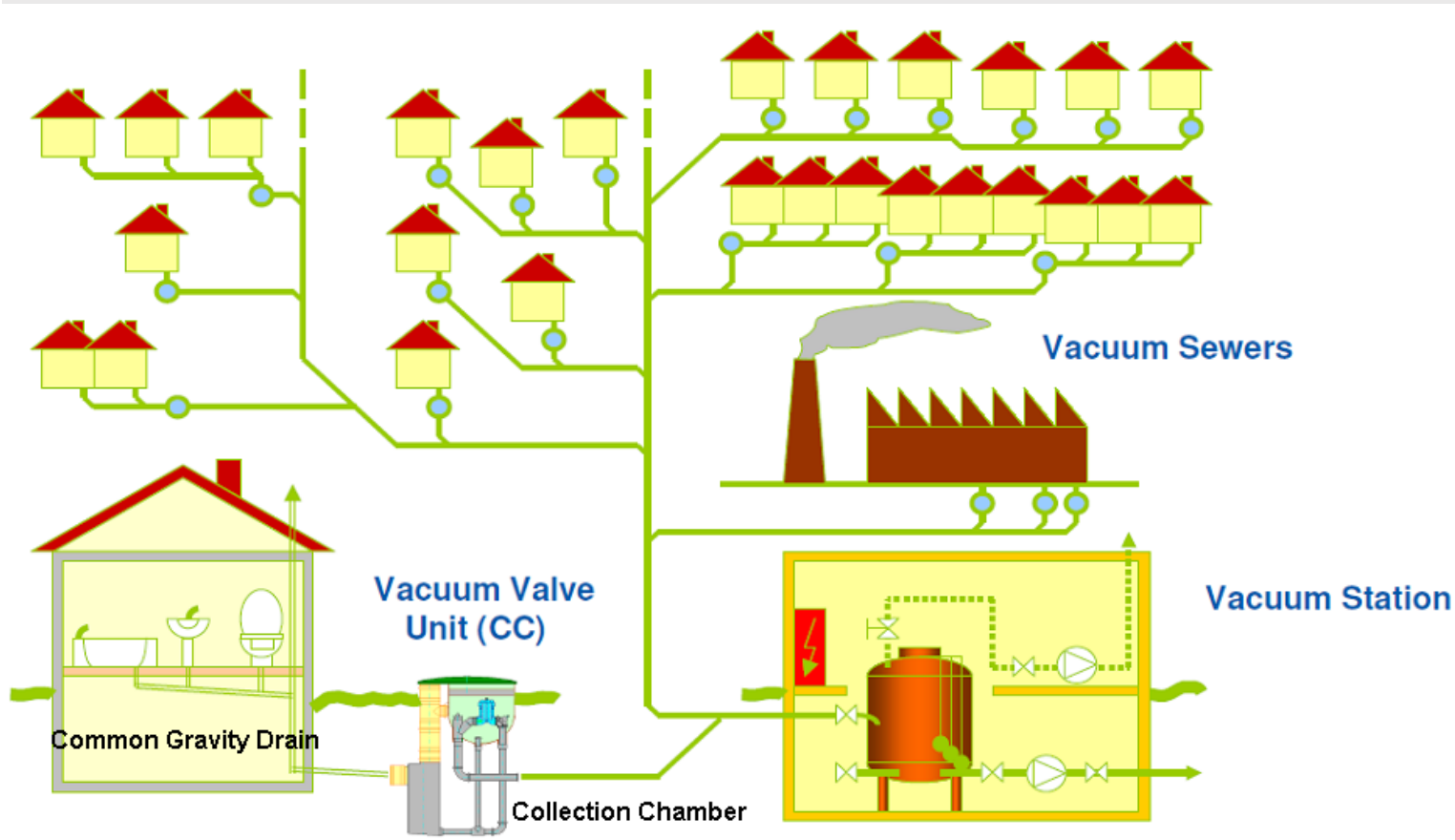
Rural Energy Initiative – 7 employees

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?



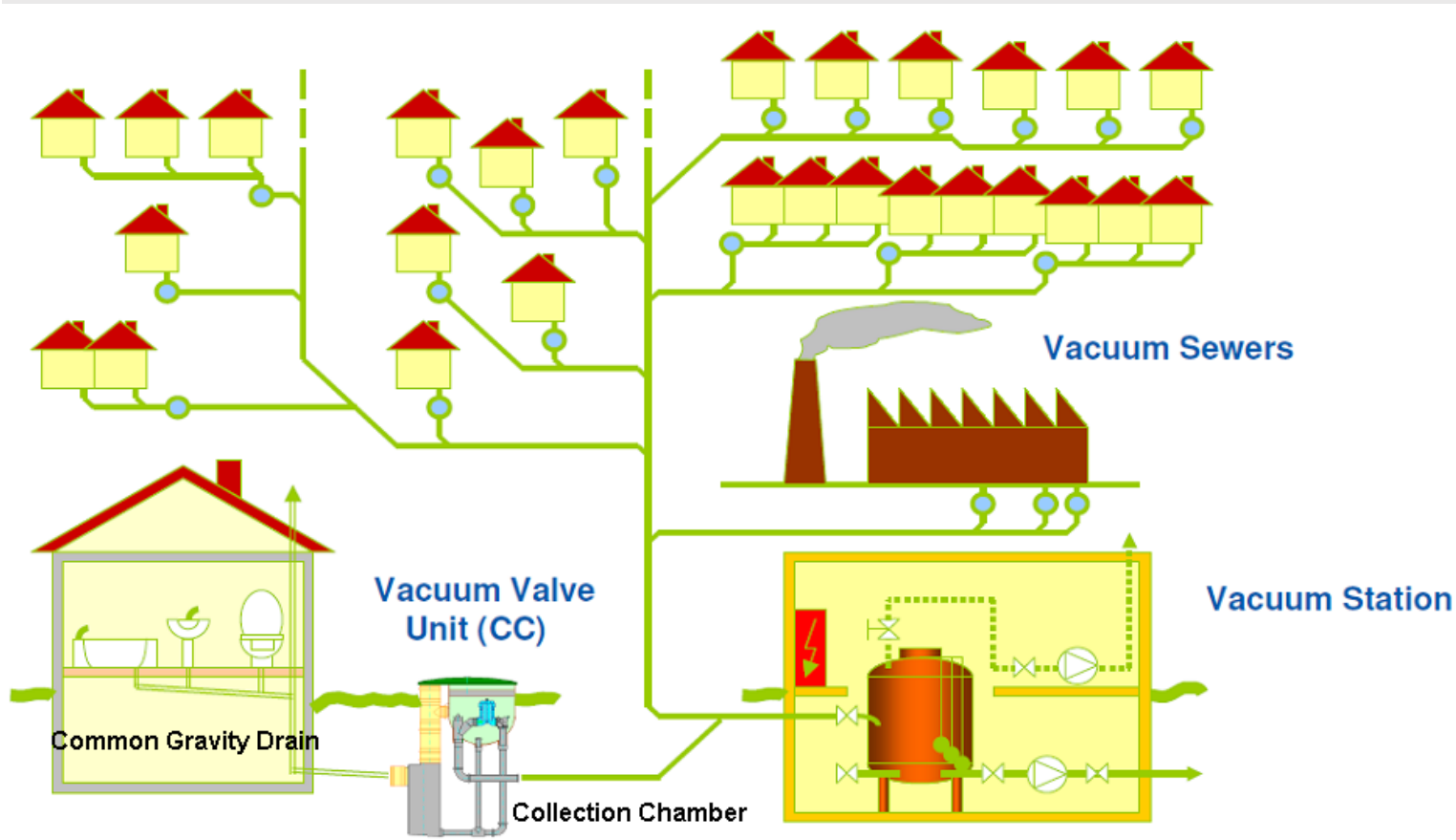
Old technology. First installed in Europe in 1882

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?



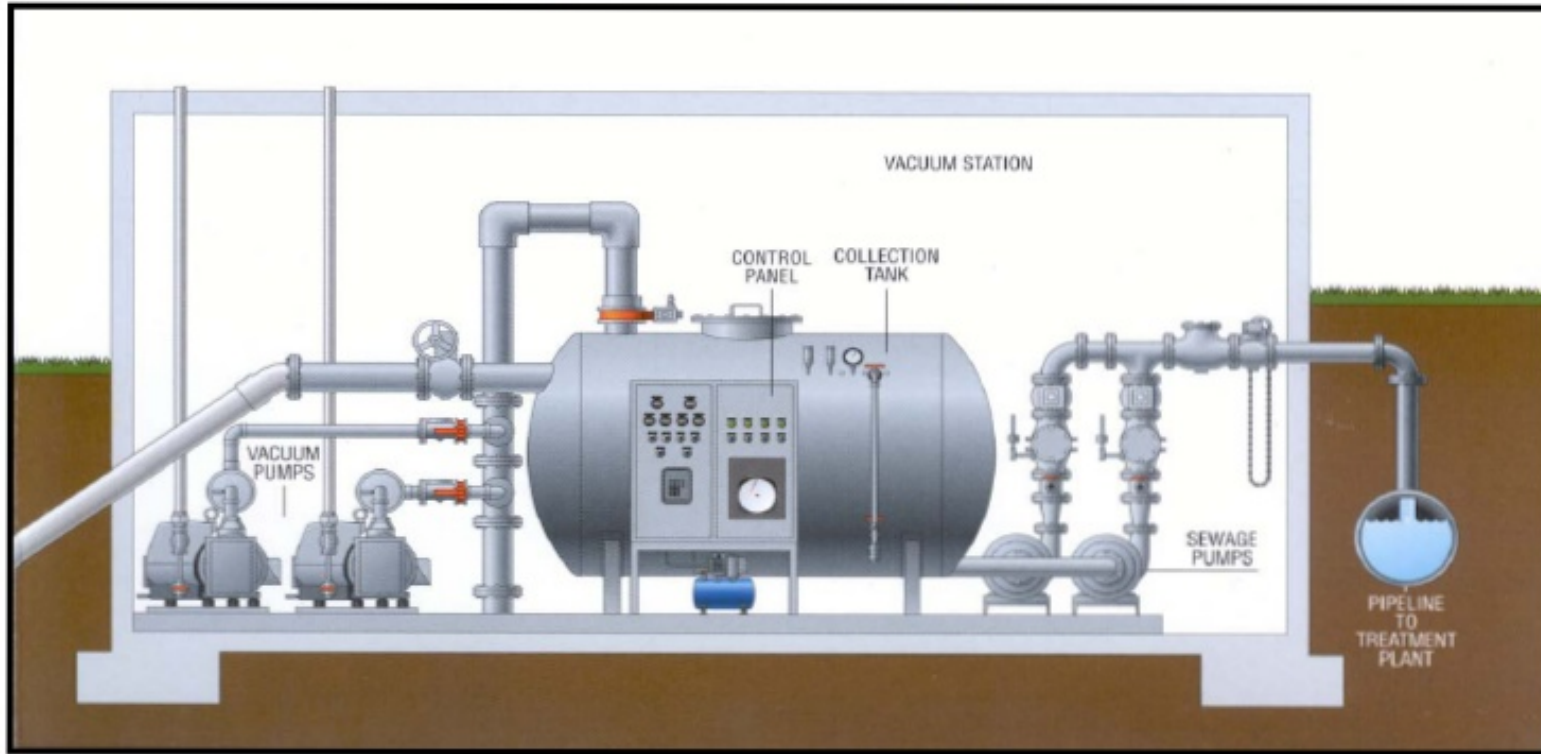
Homes plumbed in typical gravity fashion

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

Vacuum Station

Typical Vacuum Station Diagram



Vacuum Station Diagram provided by AIRVAC, Inc.

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)
 - $P1/P2 = (N1/N2)^3$
 - 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

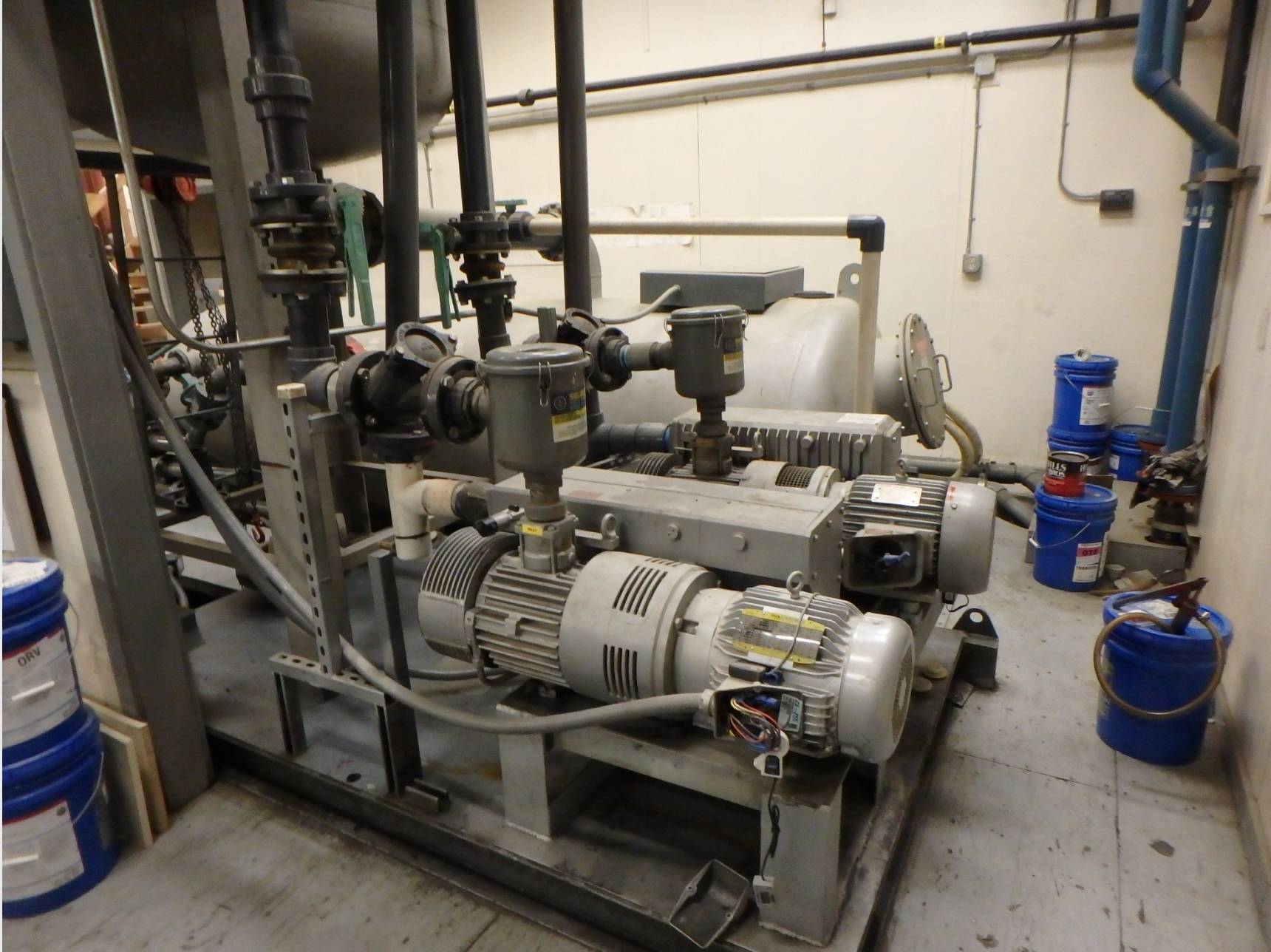
Cost = \$200k

Expected Savings =

\$50k/yr



Noorvik – Vac Pumps



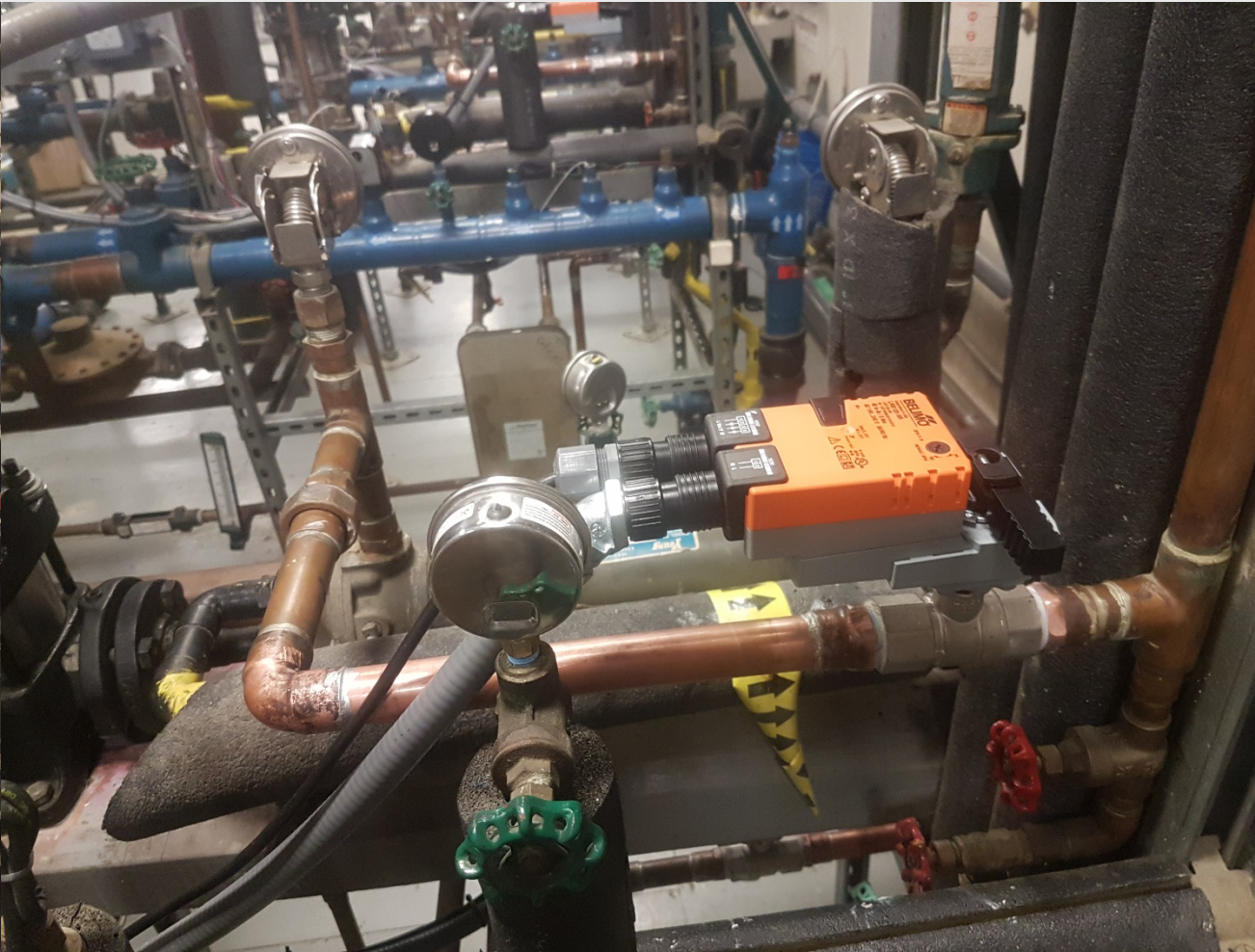
Noorvik – Vac Pumps

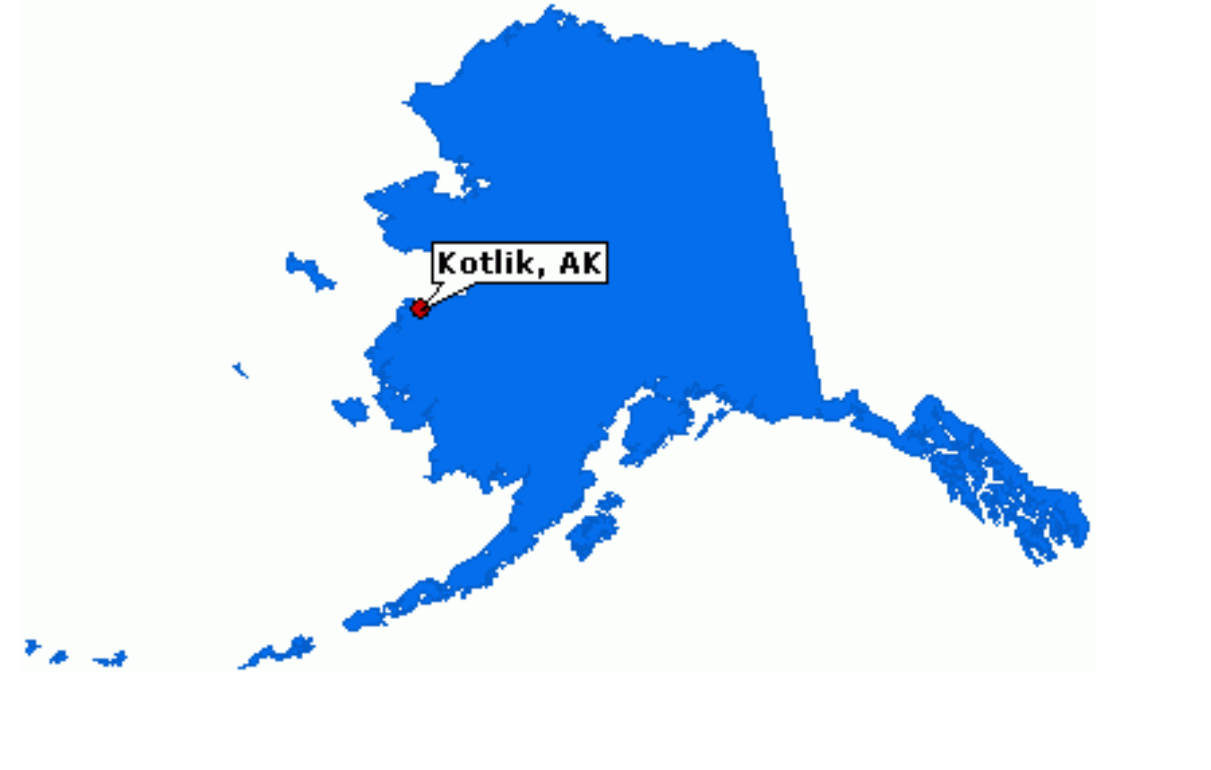


Noorvik – Vac Pump Controls



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

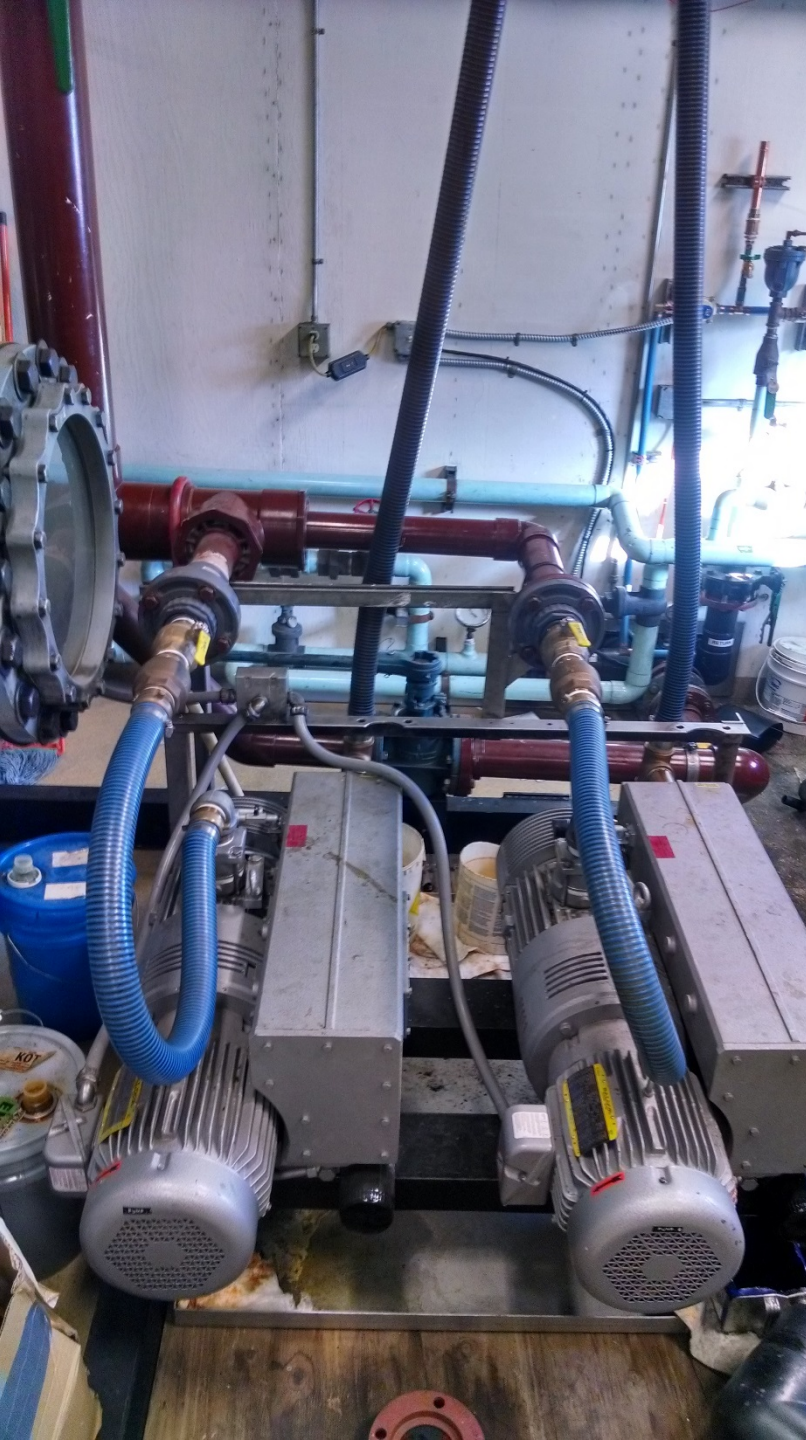
- New oil-less vacuum pumps
- Modulating controls
- Upgraded all heat adds
 - Controls
 - Control Valves
- LED lighting in all sanitation facilities

Cost = \$150k

Expected Savings =
\$17k/yr



Kotlik – Vac Pumps



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

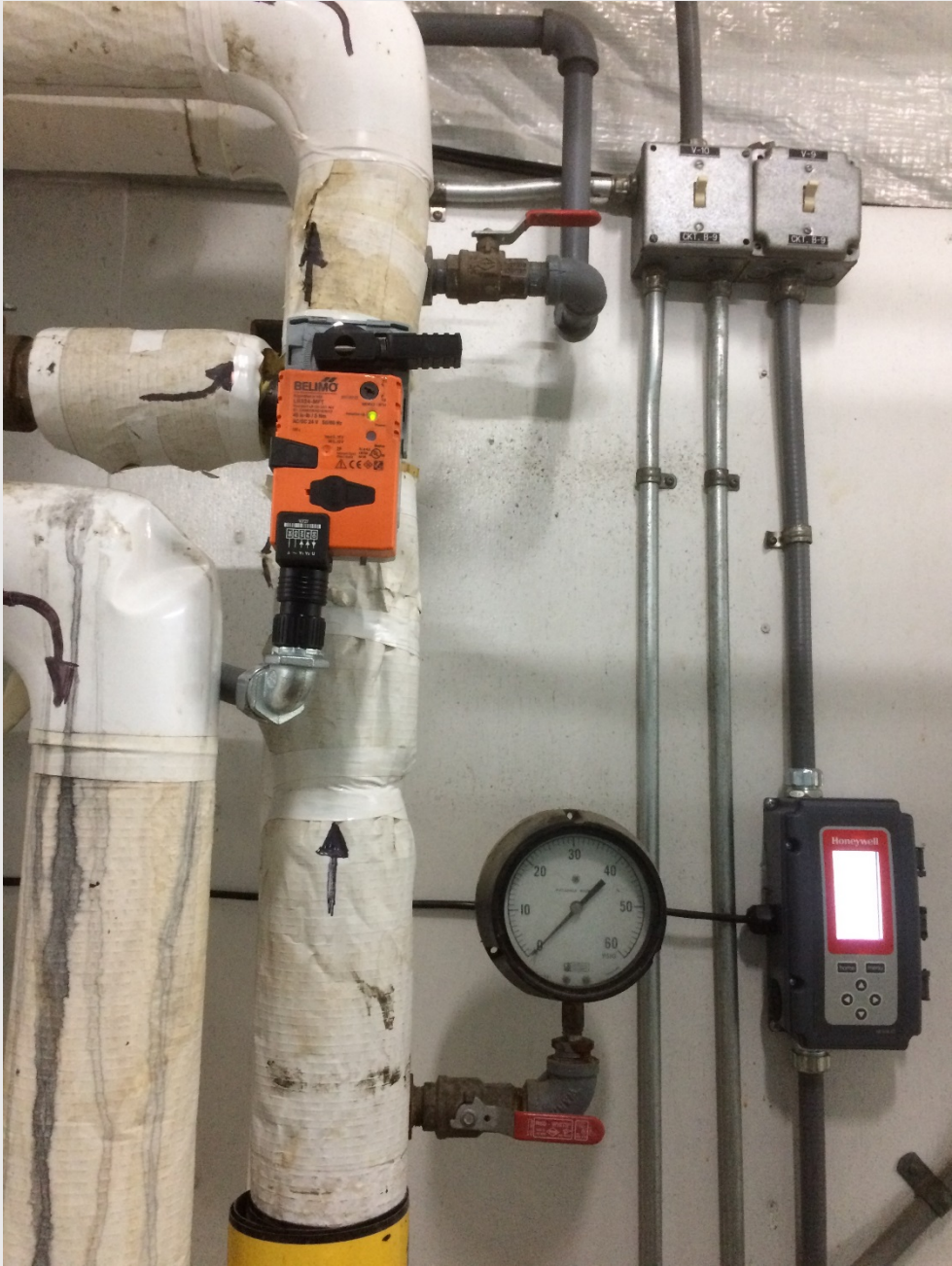
Expected Savings =
\$75k/yr



Alakanuk – Vac Pumps



Alakanuk – Heat Add



Alakanuk – LED Lighting

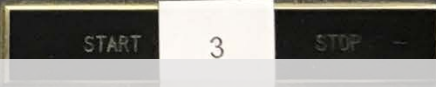


Alakanuk – Boiler Upgrades



Summary

	<u>Cost</u>	<u>Savings (per year)</u>
Noorvik -	\$200,000	\$50,000
Kotlik -	\$150,000	\$17,000
Alakanuk -	\$275,000	\$75,000
PM -	\$25,000	
Totals -	\$650,000	\$142,000



THANK YOU!



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VOLTAGE ADJUST RAISE → OVER CURRENT ØA OVER CURRENT ØB OVER CURRENT ØC SPEED CONTROL RAISE → UNDER FREQUENCY OVER FREQUENCY UNDER VOLTAGE OVER VOLTAGE

