Control of Vapor Losses from Production Tanks

Methane to Markets Partnership Workshop

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Background

- Emissions from production storage tanks are often a significant source:
  - CH4 and other hydrocarbon emissions.
  - Odours.
  - Air Toxics (e.g., benzene).
  - Lost revenue.

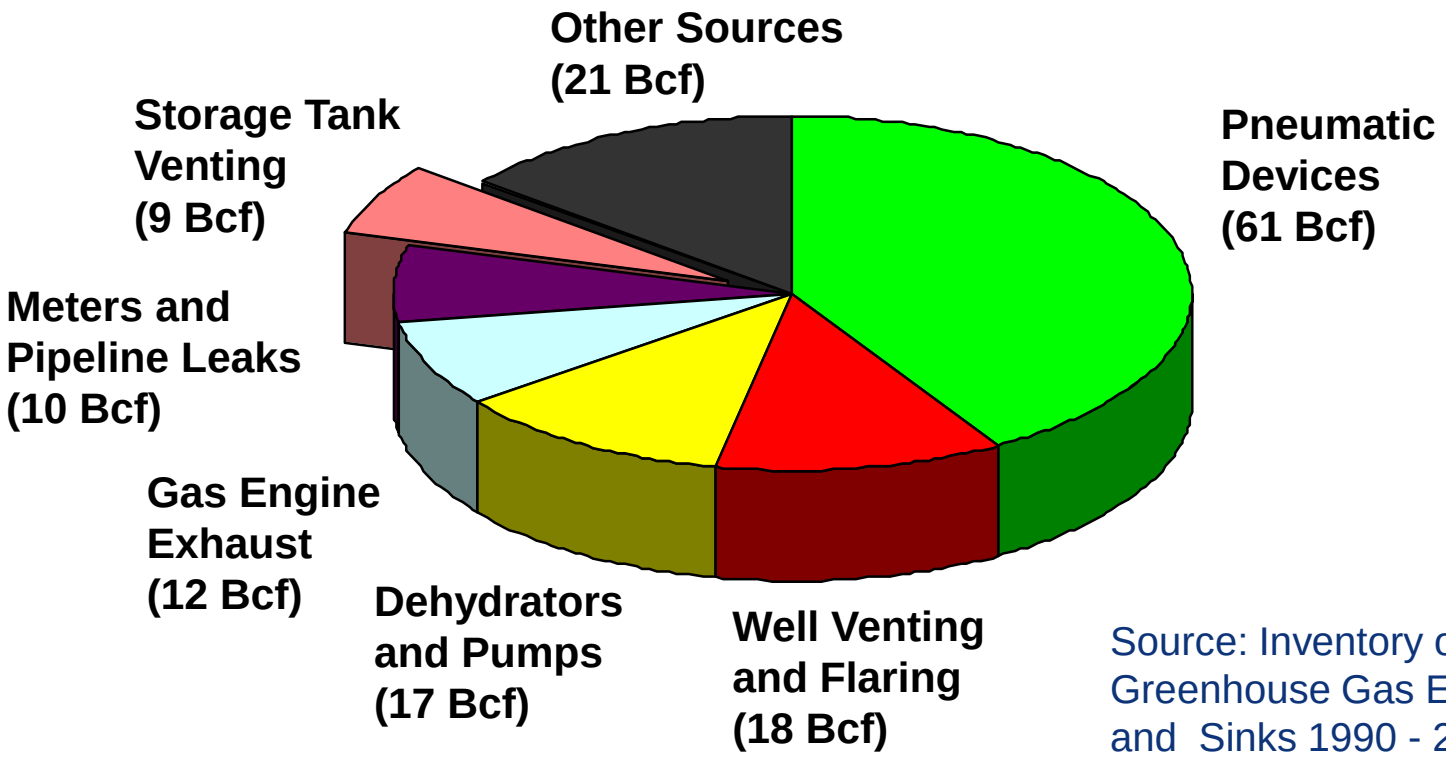
Methane to Markets

NaturalGas EPA POLLUTION PREVENTER

CH4 Losses from Storage Tanks

Storage tanks are responsible for 6% of methane emissions in natural gas and oil production sector in the U.S.

96% of tank losses occur from tanks without vapor recovery



Source: Inventory of U.S. Greenhouse Gas Emissions and Sinks 1990 - 2003

Storage Tanks:

- Causes of Emissions:
  - Working and breathing losses.
  - Flashing losses.
  - Unaccounted for contributions:
    - Unintentional Gas carry-through.
      - Leaking drain and dump valves.
      - Vortex formation at inlet to drain lines.
      - Malfunctioning level controllers.
      - Inefficient upstream gas/liquid separation.
      - Piping changes resulting in storage of unstablized product.
      - Non-routine storage of unstabilized product in atmospheric tanks.
    - Malfunctioning vapor recovery systems:
      - Faulty blanket gas regulators or pressure controllers.
      - Fouled vapor collection lines.
      - Leaking roof fittings and seals.

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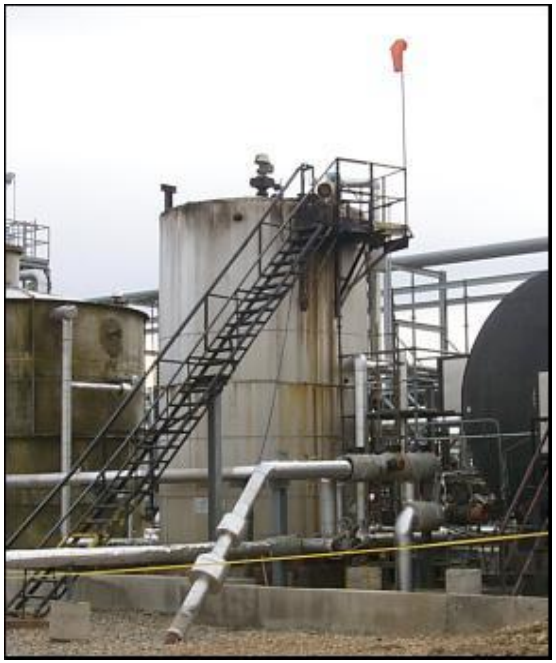
Storage Tank Emissions

- Field measurement results for 9 gas plants.

Facility	THC Emissions ($10^3 m^3/y$)	CH4 Emissions ($10^3 m^3/y$)	Value of Lost Product ($/y)
Plant 3	1,663	57	441,370
Plant 5	95	93	24,559
Plant 8	4,469	2,651	1,880,267
Total	6,227	2,801	2,346,197

•Value of emissions based on a $6.78/GJ for natural, $8.13/GJ for propane, and $9.63/GJ for butane and condensate.



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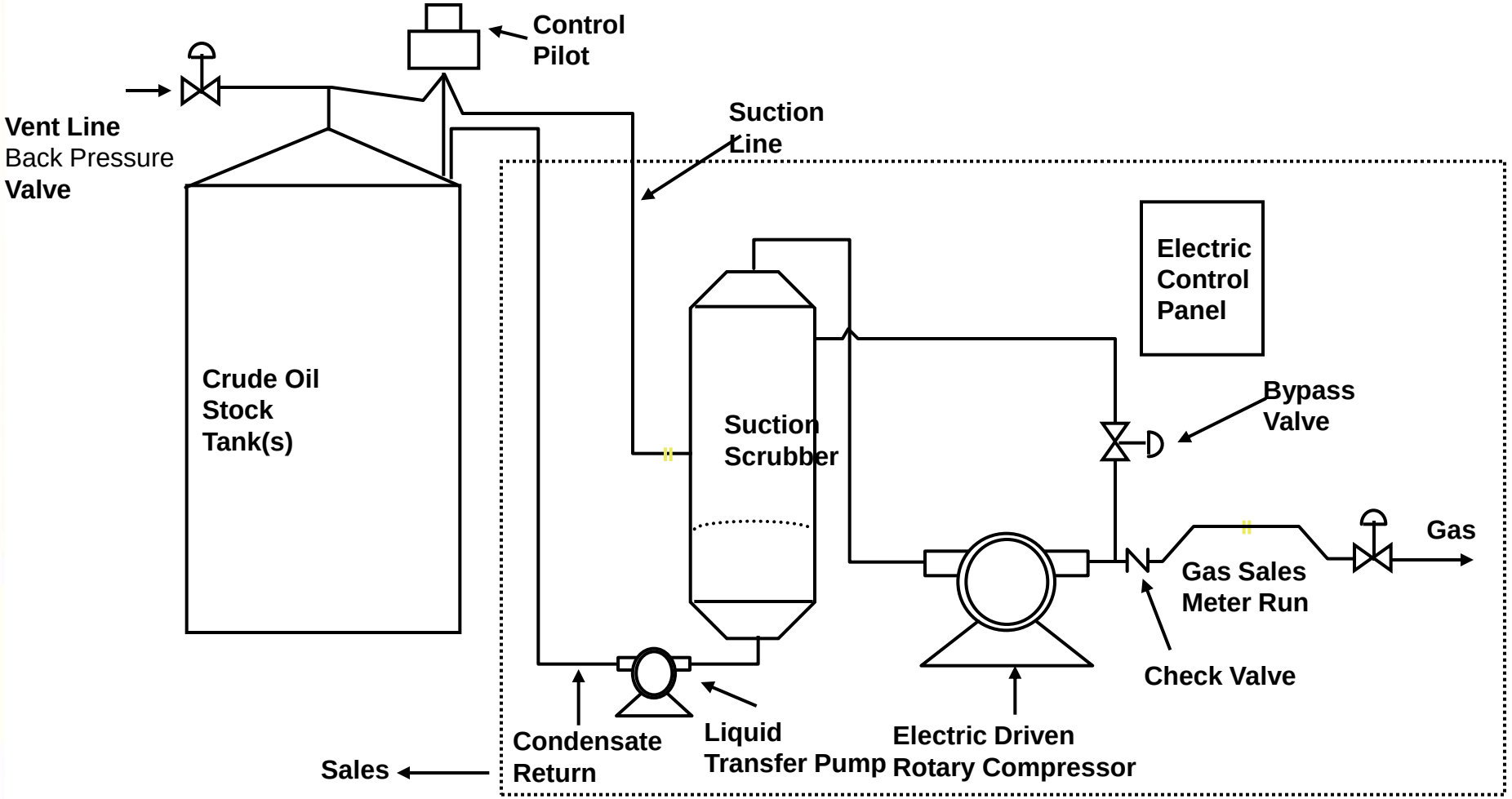
Benefits of VRUs

- Capture up to 95 % of hydrocarbon vapors that accumulate in tanks.
- Recovered vapors have much higher heating value than pipeline quality natural gas.
- Recovered vapors can be more valuable than methane alone and have multiple uses:
  - Conserve by compressing into a natural gas gathering system.
  - Re-inject into a crude oil pipeline for delivery to a downstream facility with gas conservation.
  - Use as onsite fuel or process needs or production or marketable electricity.
  - Process for recovery of NGLs.

Quantifying Volume of Losses

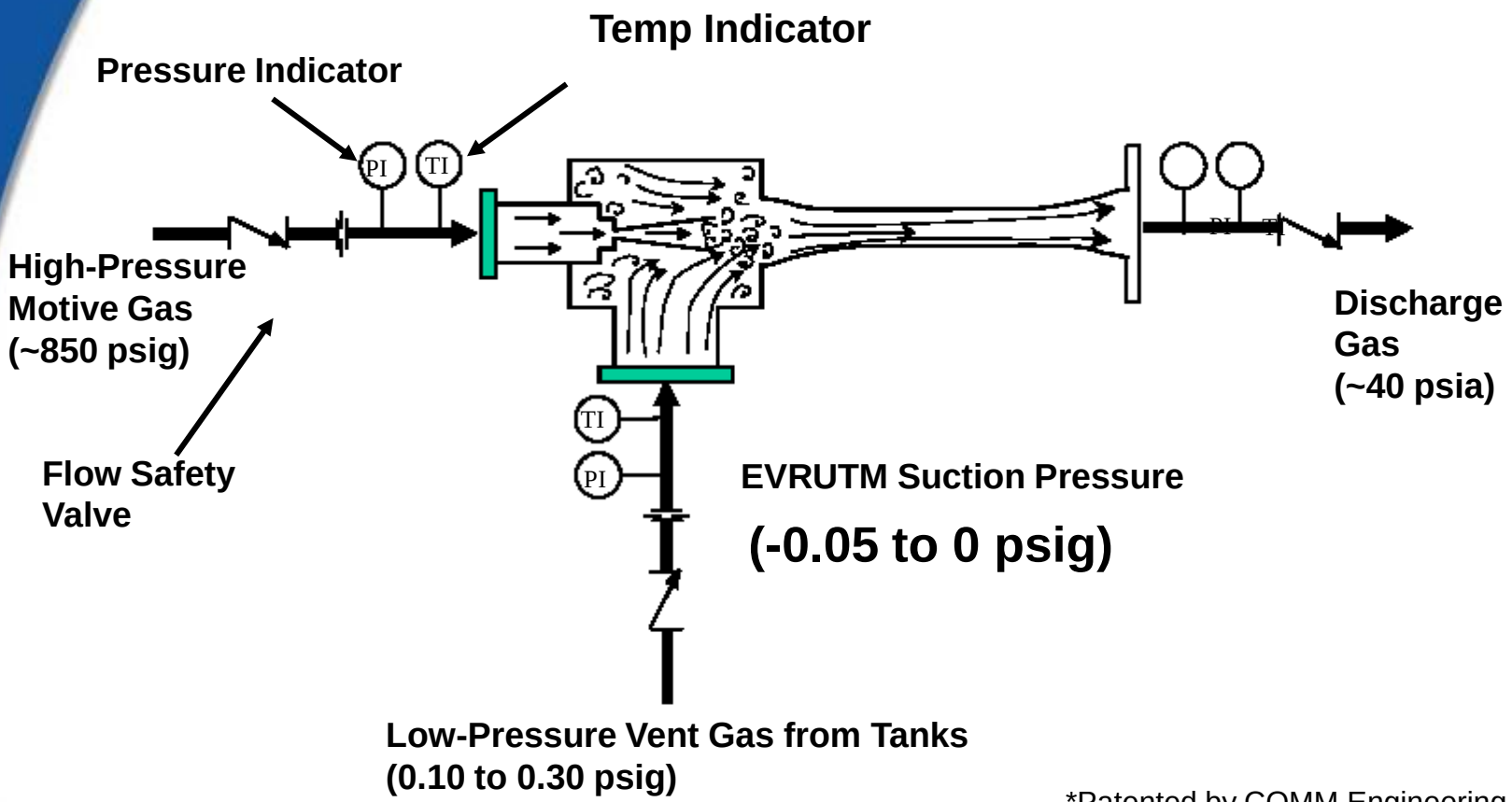
- Estimate losses from chart based on oil characteristics, pressure and temperature at each location (50%).
- Estimate emissions using the E&P Tank Model (20%).
- Measure losses using recording manometer and well tester or ultrasonic meter over several cycles (5%):
  - This is the best approach for facility design.

Standard Vapor Recovery Unit



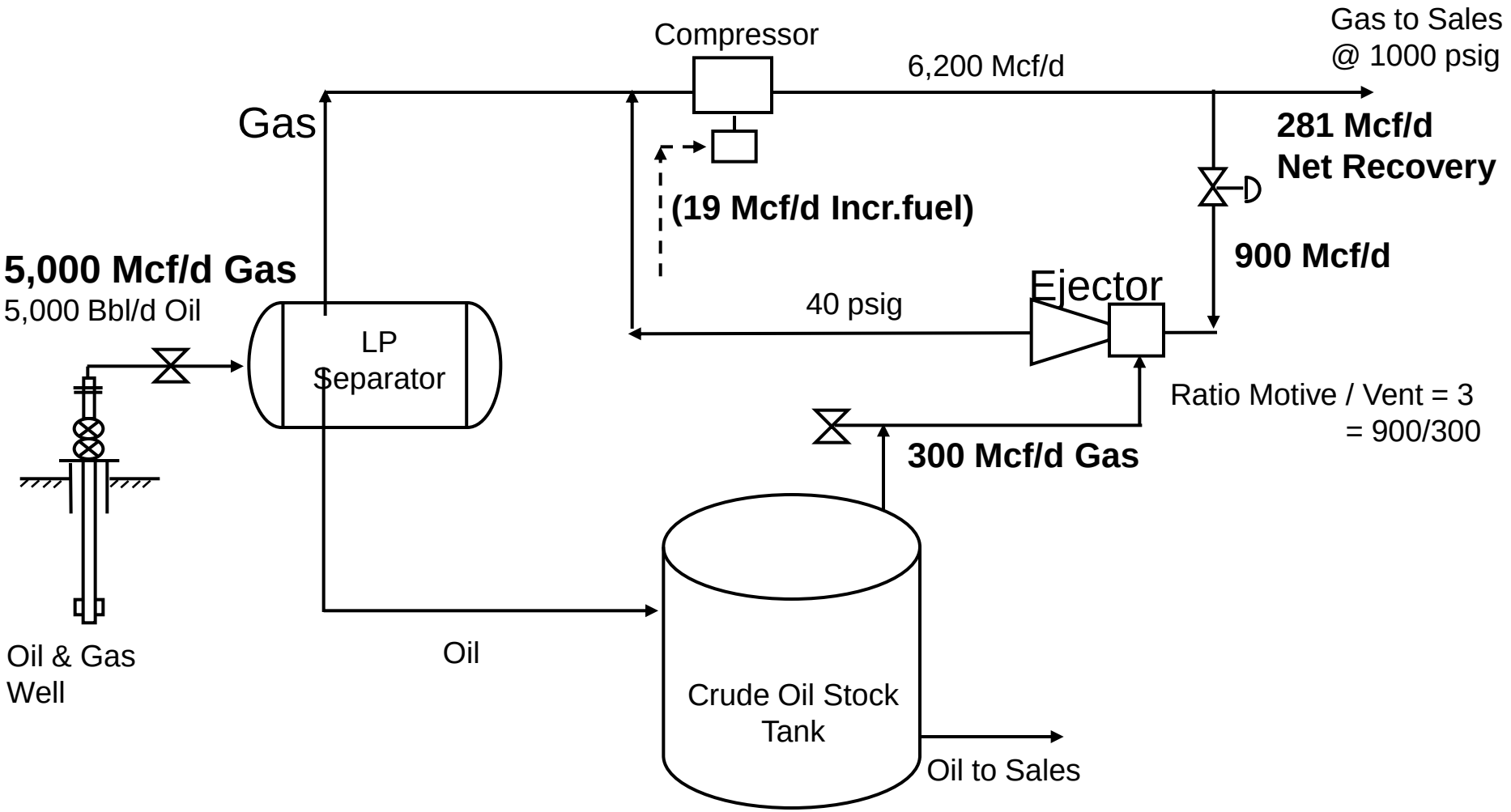
Source: Evans & Nelson (1968)

Venturi Jet Ejector*

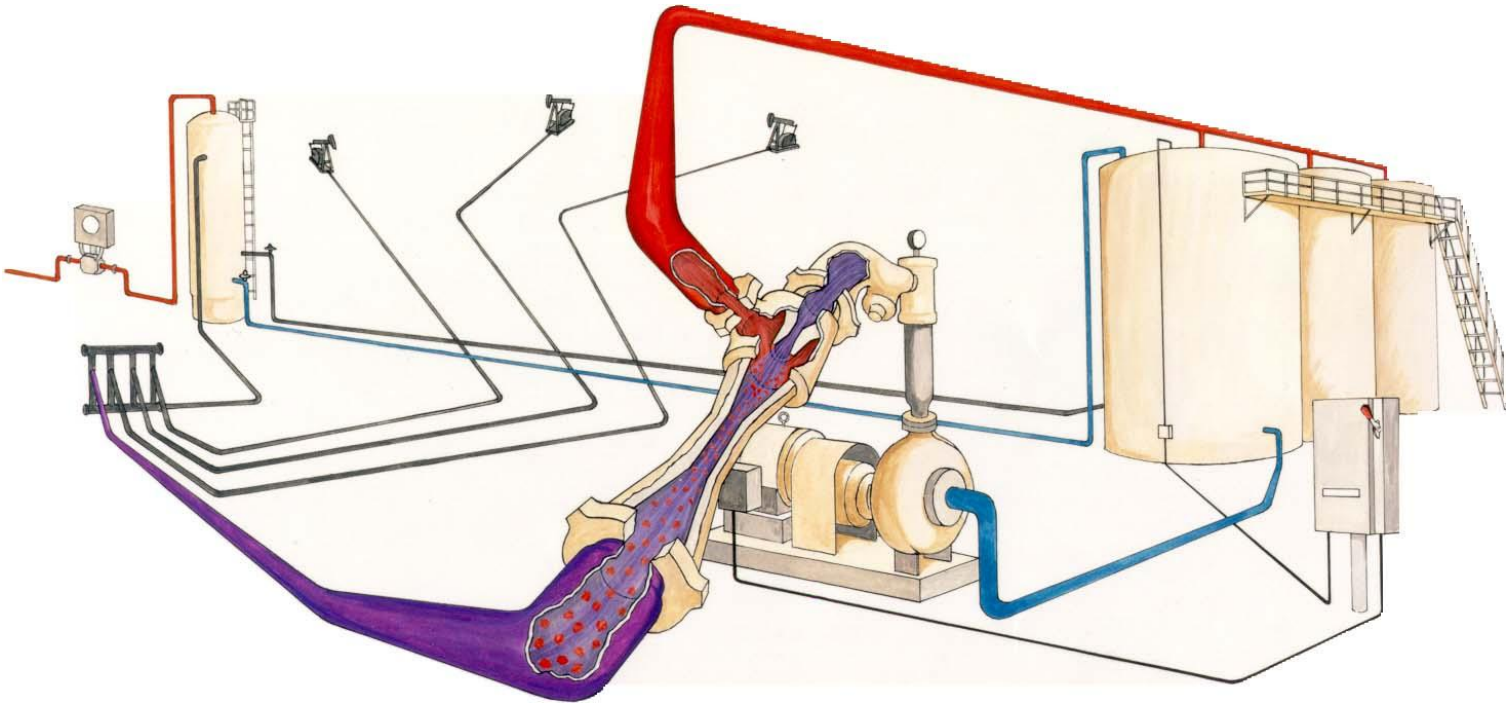


*Patented by COMM Engineering

Vapor Recovery with Ejector



Vapor Jet System*



Utilizes produced water in closed loop system to effect gas gathering from tanks
Small centrifugal pump forces water into Venturi jet, creating vacuum effect
Limited to gas volumes of 77 Mcfd and discharge pressure of 40 psig

*Patented by Hy-Bon Engineering

Vapor Recovery Towers

Source: Hy-Bon Engineering

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Lessons Learned

- VRU technology can be highly cost-effective in most general applications
- Venturi jet models work well in certain niche applications, with reduced O&M costs. Rotary vane or screw type compressors recommended for VRUs where Venturi ejector jet designs are not applicable
- EVRU™ recommended where there is gas compressor with excess capacity
- Vapor Jet recommended where less than 75 Mcfd and discharge pressures below 40 psig

Thank you!

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