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Enhancing Safety and Reducing Emissions with Compact Conditioning Orifice Meter

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Redesign of Tank Vent System

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Challenges

Alyssa Gilmore

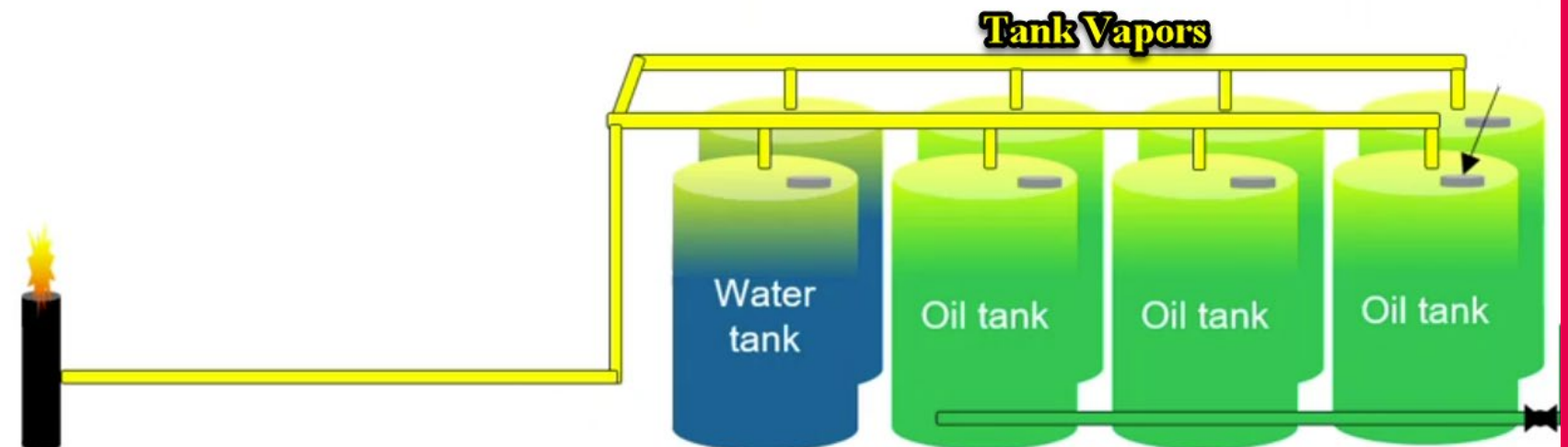
Compact Orifice Meter Solution

Alyssa Gilmore

Results and Benefits Achieved

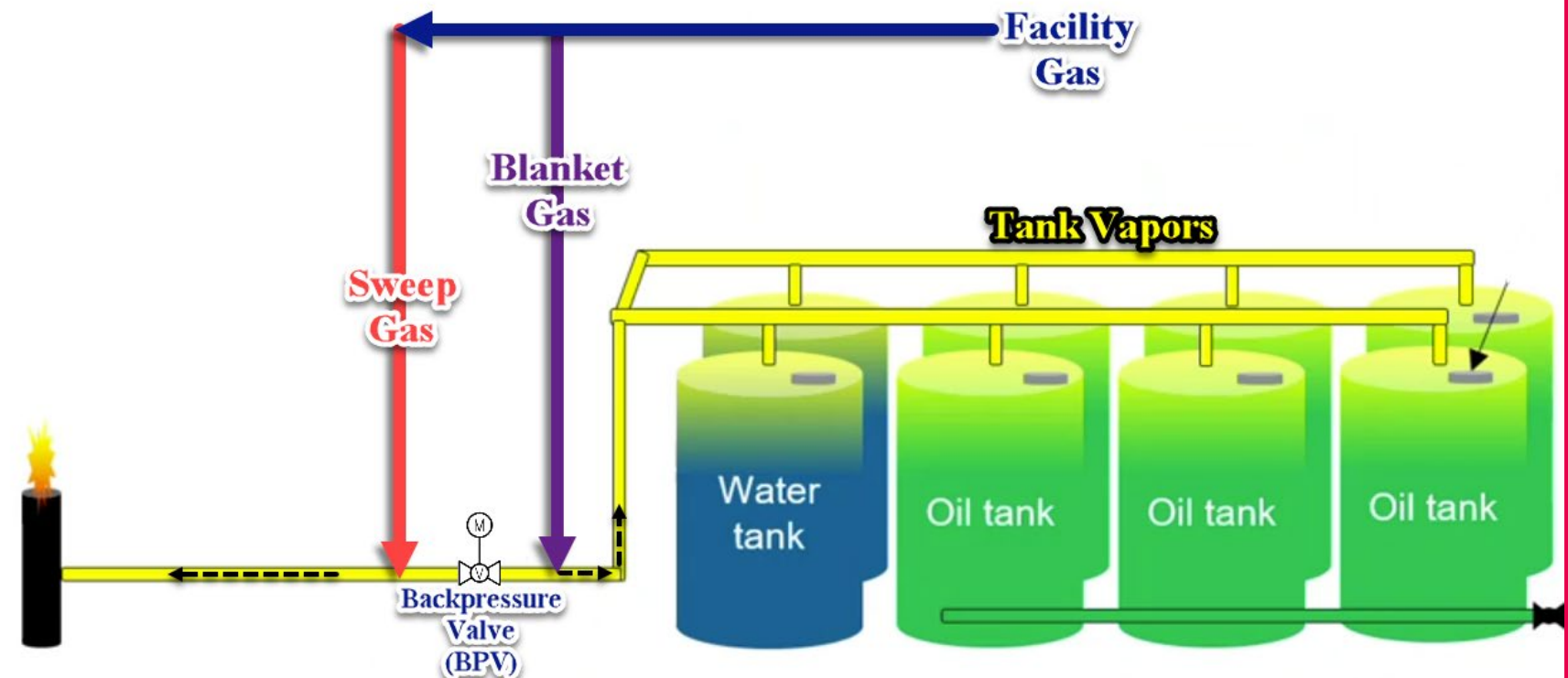
Redesign of Tank Vent System in the Bakken

- Redesign was initiated due to three key drivers
 - Safety Event
 - Emission Reduction
 - OOOOb Regulation
- Main areas of concern in the Tank Vent System
 - Back Pressure Valve
 - Blanket Gas System
 - Sweep Gas System



Redesign of Tank Vent System in the Bakken

- Main objectives for redesign:
 - Enhance Safety
 - Regulatory Compliance
 - Improve Operational Efficiency and Process Control
- Redesign Outcome:
The redesigned Tank Vent System ensures that when the back pressure valve closes, the blanket gas maintains positive pressure in the tanks, while the sweep gas purges the line to the flare at a controlled minimum flow rate.



Description of the Blanket and Sweep Gas System

- Blanket Gas System

- The blanket gas system maintains a controlled environment within the storage tanks, preventing oxygen ingress and reducing the risk of flammable gas mixtures, significantly enhancing safety protocols.
- *Safety Mechanism*



- Sweep Gas System

- The sweep gas system purges vent lines with a continuous minimum gas flow to the flare, minimizing hydrocarbon emissions and supporting compliance with environmental regulations such as OOOOb. This also prevents accumulation of flammable gases in the vent system, enhancing operational safety and reliability.
- *Emission Control*

Key Challenges

Safety and Regulatory Compliance

- Ensuring tanks always maintain positive pressure
- Adapting to evolving regulations such as OOOOb

Design Limitations

- Different facility design vintages resulted in varying layouts and equipment configurations
- Limited straight-run piping and space constraints made traditional orifice plate meters difficult to implement
- Needed a metering solution flexible enough to accommodate all site configurations without redesign

Resource and Material Constraints

- Sites were retrofitted at a fast pace. Tank vent systems were being installed without the meters due to the long lead time of the back pressure valve in a phased approach
- 150 sites in the Bakken required procurement and installation of 2 meters per site
- Simple, fast installation was critical to keeping total installed costs low

Solution

- Compact Conditioning Orifice Meter were installed on both the blanket and sweep gas lines
 - 4088 Multivariable
 - 405C w/ Integral RTD
- Highlights
 - Compact Integrated Meter eliminating the need for traditional installation with impulse piping and reducing leak points
 - Conditioning Orifice Meters only requires 2D upstream and downstream significantly reducing the required straight run



Solution

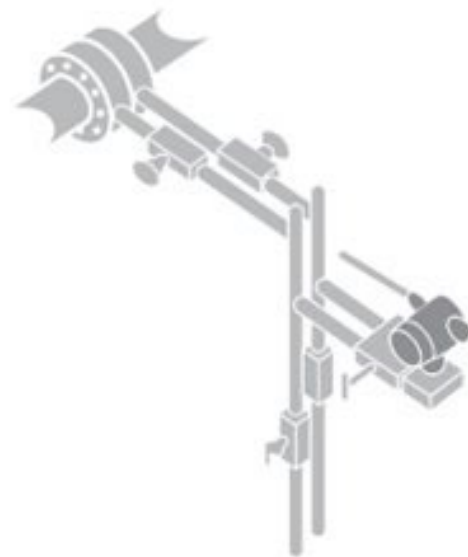
- The installation for the meters was done in a phased approach.
- A spacer was used in place of the meter when the systems were being retrofitted. This was also done for the back pressure valves.
- Upon installing the meters, the spacers could quickly be removed to “drop-in” the meter and bolt back together.



Eliminate Impulse Lines and Potential Leak Points

Traditional Installation

- Potential for over 30 leak points due to impulse piping
- Instrument tubing and elbows can be 10-20 feet long



- *Leak Points reduced*
- *Eliminates inaccuracies*
- *Consistent installations*
- *Reduced complexity*
- *No leak testing required*



Flow Meter Installation

- Less potential leak points; factory leak checked
- Transmitter is direct mounted less than 1 foot from the pipe with straight connections

Conditioning Orifice Plate

Conventional approach challenges

- **Traditional orifice plate technology**
- Orifice plate technology requires long, straight run pipe for accurate results.
- Upstream disturbances cause swirl in a pipe and create irregular flow. The effects are amplified across a concentric orifice plate, allowing the disturbance to impact measurement.

Rosemount Conditioning Orifice Plate

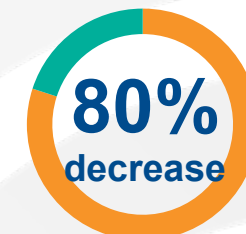
- **Innovative design**
- Four equally spaced holes of the Rosemount conditioning orifice plate eliminate swirl and irregular flow profiles eliminating the need for long straight run pipes.
- Design provides a more stable and accurate measurement.
- This technology eliminates errors caused by upstream disturbances.

Overcoming Design Limitations

- **Reduce complexity and cost**
- Less straight-run equals savings
- Improve flow accuracy with the innovative design
- Two pipe diameters from upstream flow disturbance



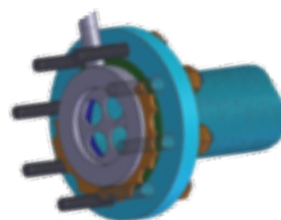
Pipe
straight-run



Leak points

Conditioning Orifice Technology

- Best in Class Performance
 - Eliminates error cause by upstream disturbances and achieves up to +/- 0.5% flow rate accuracy
- Easier Installation
 - Requires only 2 pipe diameters of straight run
 - Short straight runs allow flow meter mounted at grade, get better access, lower cost, and increase operator safety
- Compact Design
 - Only 1.125" thick
 - Easy install between existing raised face flanges
- Centering Mechanism
 - Centering ring centers flow meter with 1/16 in
- Integral Temperature
 - RTD and thermowell in meter body
 - Save installation time and money



Results and Benefits Achieved

- **COMPLIANCE AND SAFER OPERATIONS**
Reduced emissions through OOOOb compliance, enhancing both environmental performance and operational safety.
- **ENHANCED PROCESS CONTROL**
System design supports both blanket and sweep gas modes, allowing configuration based on process conditions and back pressure valve settings.
- **REDUCED TOTAL INSTALLED COSTS**
The Compact Conditioning Orifice Meter minimized footprint and reduced total installed costs by \$600K across 300 meters compared to traditional orifice installations. It also reduced material and man-hours.
- **SIMPLIFIED DESIGN**
Enables faster installations, maximizing technician efficiency and increasing line availability during both installation and long-term maintenance.





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Thank You