Methane Reductions in Pigging

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MARKWEST NORTHEAST RICH GAS GATHERING

UTICA
- MORE THAN 400 MILES OF GATHERING PIPELINE CONSTRUCTED SINCE 2011

MARCELLUS
- MORE THAN 500 MILES OF GATHERING PIPELINE CONSTRUCTED SINCE 2009

~ 2.8 BCF/d GATHERING
WHY PIG PIPELINES?

- Reduces pipeline pressure drop
- Sweeps valuable natural gas liquids into slug catcher and processing plant for processing and fractionation
- Prevents internal pipeline corrosion
- Prevents paraffin buildup in the pipeline
PIG LAUNCHER

DON’T LAUNCH ME - I’M A SMART PIG
TYPICAL LOW PRESSURE PIGGING OPERATIONS

PIPELINE JUST PIGGED AND FLOWING GAS – NEW PIG READY TO LAUNCH

Low pressure gathering pipelines flow from well facilities to a compressor station.
TYPICAL LOW PRESSURE PIGGING OPERATIONS

LINE ACCUMULATING CONDENSED LIQUIDS

Low pressure gathering pipelines flow from well facilities to a compressor station
TYPICAL LOW PRESSURE PIGGING OPERATIONS

TIME TO PIG PIPELINE – OPEN LAUNCHER VALVES, CLOSE BYPASS

Low pressure gathering pipelines flow from well facilities to a compressor station.
TYPICAL LOW PRESSURE PIGGING OPERATIONS

PIG REACHES FIRST LOW POINT BEGINS PUSHING LIQUIDS

Low pressure gathering pipelines flow from well facilities to a compressor station.
TYPICAL LOW PRESSURE PIGGING OPERATIONS

**PIG PUSHES LIQUIDS TOWARDS RECEIVER**

Low pressure gathering pipelines flow from well facilities to a compressor station.
TYPICAL LOW PRESSURE PIGGING OPERATIONS

PIG PUSHES LIQUIDS THRU BYPASS AND RECEIVER AND INTO SLUG CATCHER

Low pressure gathering pipelines flow from well facilities to a compressor station.
CLOSE BYPASS TO PUSH PIG INTO RECEIVER – REMAINING LIQUID IN BYPASS LINE PUSHED INTO SLUG CATCHER BY GAS AND PIG

Low pressure gathering pipelines flow from well facilities to a compressor station.
TIME TO REMOVE PIG FROM RECEIVER-BYPASS, ISOLATE, AND DEPRESSURIZE

Low pressure gathering pipelines flow from well facilities to a compressor station.
TYPICAL LOW PRESSURE PIGGING OPERATIONS

LP Rich-Gas from Wells

HP Rich-Gas from Compressor Station To HP Pipelines

Low Pressure Gathering Pipeline

Gas Compressors

Condensate Storage Tank

Vapor recovery compressor

Slug Catcher/Separator

LP Condensate to sales by truck

P = 80-100 PSIG
T = 40-65 F

P = <1 PSIG
T = 40-100 F

Condensate Storage Tank

Gas shown in Yellow

Condensed Liquid shown in Cyan

Pipeline Pig

Open

Closed

1-2 gallons of trapped liquid captured in bucket

Low pressure gathering pipelines flow from well facilities to a compressor station
TYPICAL LOW PRESSURE PIGGING OPERATIONS

PREPARE LAUNCHER FOR NEXT CYCLE – BYPASS, ISOLATE, AND DEPRESSURIZE

Low pressure gathering pipelines flow from well facilities to a compressor station
TYPICAL LOW PRESSURE PIGGING OPERATIONS

OPEN LAUNCHER AND INSTALL NEW PIG – SHUT VENTS

LP Rich-Gas from Wells

HP Rich-Gas from Compressor Station To HP Pipelines

Low Pressure Gathering Pipeline

Gas Compressors

Condensate Storage Tank

Vapor recovery compressor

Slug Catcher/Separator

LP Condensate to sales by truck

Low pressure gathering pipelines flow from well facilities to a compressor station
Low pressure gathering pipelines flow from well facilities to a compressor station.
High pressure gathering pipelines flow from compressor stations to a processing plant.
PIGGING EMISSIONS CONTROLS
QUANTIFY EMISSIONS

• Calculated using the Real Gas Law

\[ m = \left( \frac{P V}{R T Z} \right) \times Wt\% \]

- \( P \): pressure inside the pipe (psfa) pound per square foot actual
- \( V \): actual volume of pipe (ft\(^3\))
- \( m \): mass of material (lb)
- \( M_w \): molecular weight of the mixture (lb/lbmol)
- \( R \): universal gas constant (1545 psfa*ft\(^3\)/lbmol*° R)
- \( T \): temperature of mixture (° R)
- \( Z \): compressibility factor (unitless)
- \( Wt\% \): fractional weight percentage of constituent trying to calculate
HIGH PRESSURE TO LOW PRESSURE JUMPER LINE
PIG RAMP AWAITING INSTALLATION

U.S. PATENT NUMBER 10012340
PIG RAMP INSTALLED
SHORT BARREL AND LIQUID CONTAINMENT
HYDROCARBON EMISSION REDUCTION DEVICE
PORTABLE FLARE
HYDROCARBON EMISSIONS REDUCTION DEVICE

Connect ZEVAC unit.
Depressurize Site A using ZEVAC
MARKWEST HYDROCARBON EMISSION REDUCTIONS

• 0.02% of total volume estimated emitted from launcher and receiver loading operations prior to enhancements

• 84.7% reduction in emissions system wide post enhancement

• 0.003% of total volume is emitted from pigging
BENEFITS OF ENHANCED PIPELINE PIGGING OPERATIONS

- Pig ramp designs are available royalty free
  - Affordable cost of fabrication
  - Ease of installation
  - Reduction liquids at launcher/receiver sites

- Short pig barrels reduce gas volume for potential release
- High/low jumpers prevent gas loss, thus increasing system efficiency
- Portable flares and Zevac reduce emissions