MPLX ENERGY LOGISTICS

Methane Reductions in Pigging

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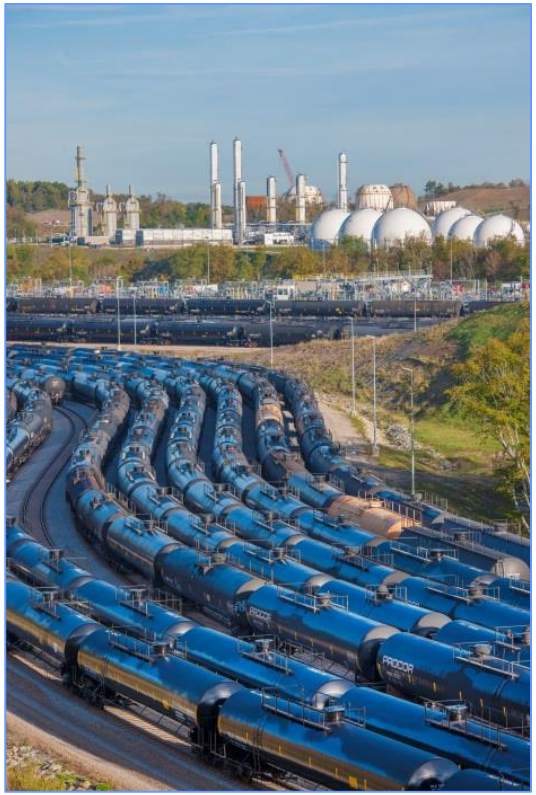
A WHOLLY-OWNED MPLX SUBSIDIARY

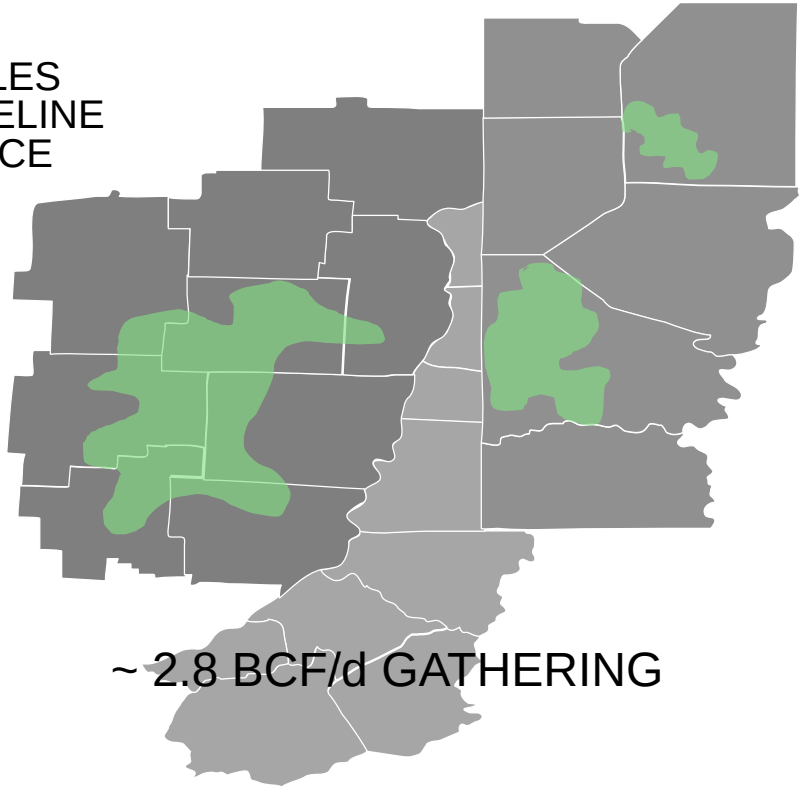
MPLX ENERGY LOGISTICS



MARKWEST NORTHEAST RICH GAS GATHERING

UTICA

- MORE THAN 400 MILES OF GATHERING PIPELINE CONSTRUCTED SINCE 2011

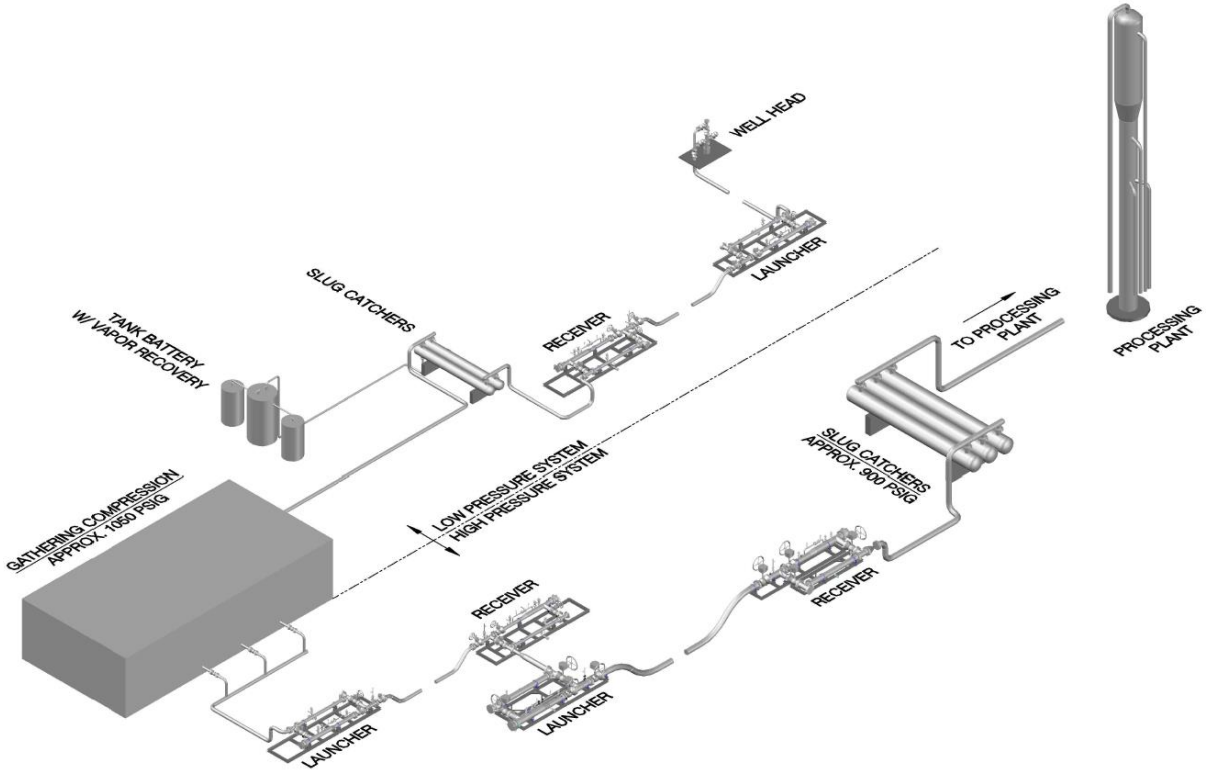


MARCELLUS

- MORE THAN 500 MILES OF GATHERING PIPELINE CONSTRUCTED SINCE 2009

~ 2.8 BCF/d GATHERING

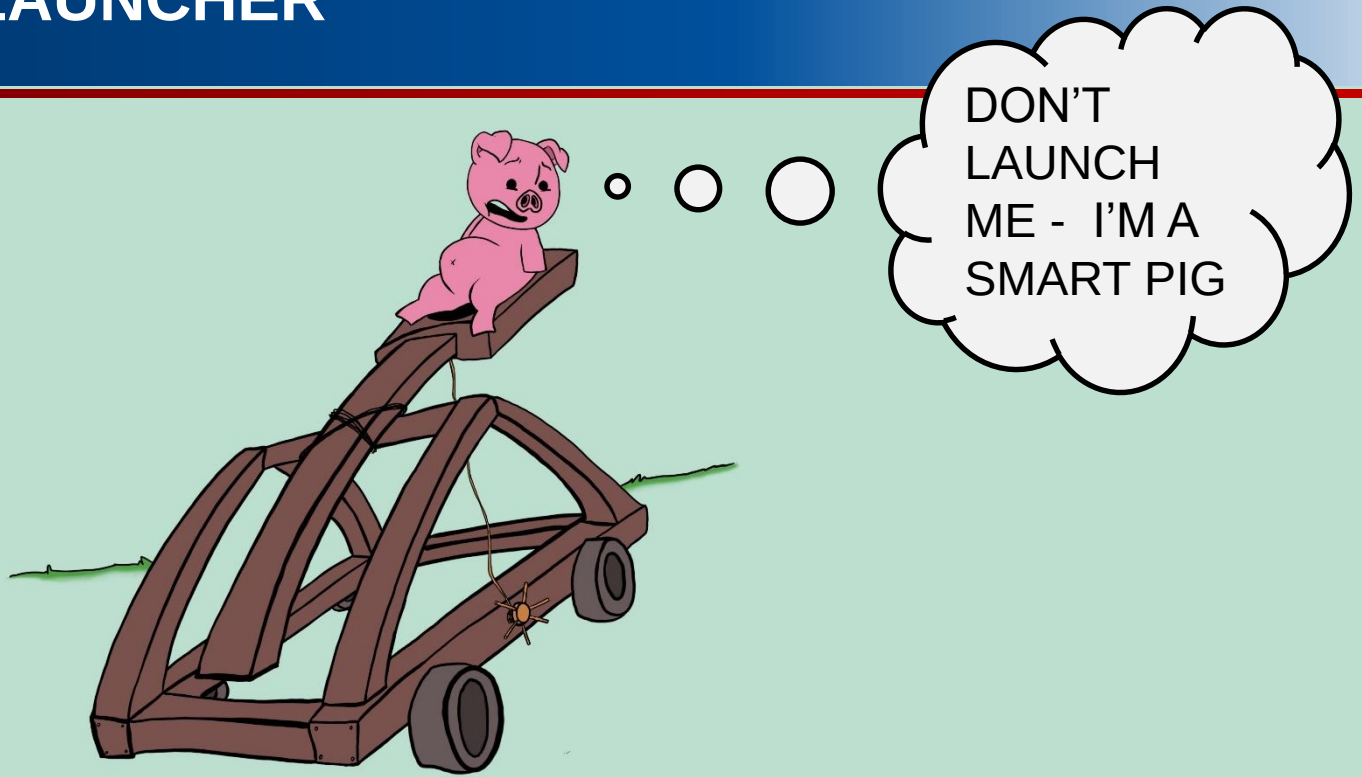
WELLHEAD TO PROCESSING PLANT



WHY PIG PIPELINES?

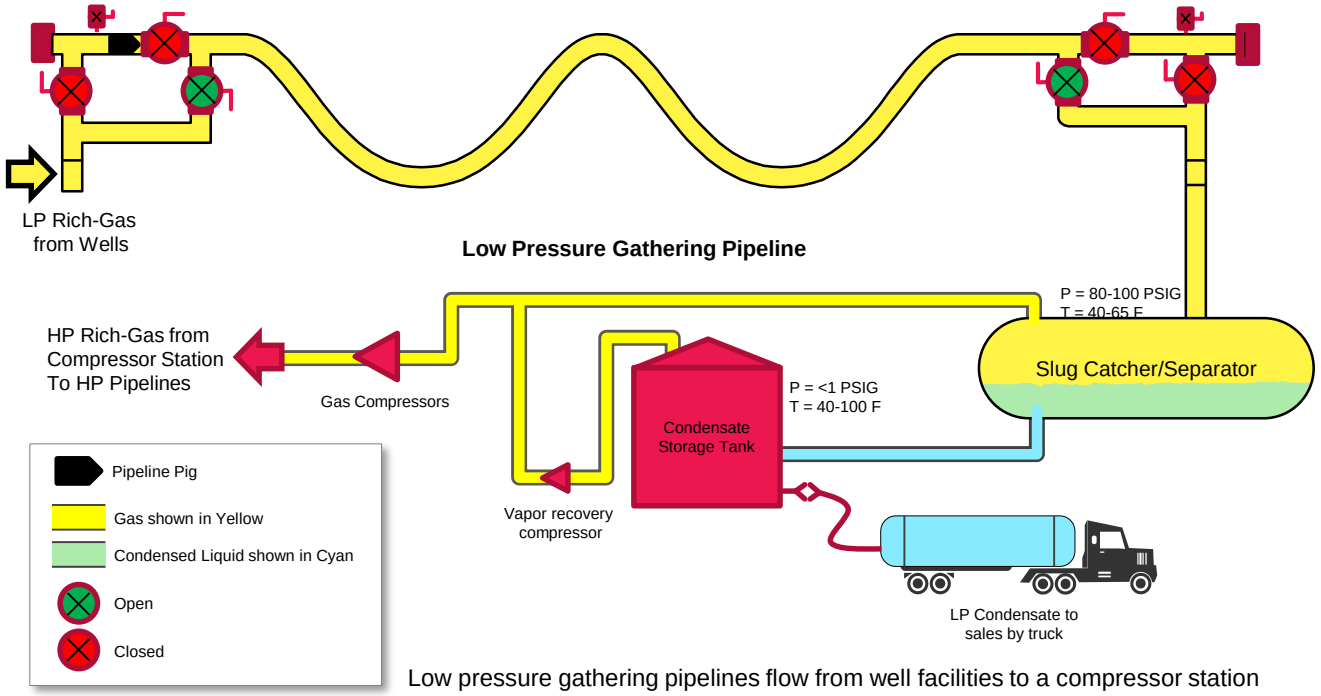
- Reduces pipeline pressure drop
- Sweeps valuable natural gas liquids into slug catcher and processing plant for processing and fractionation
- Prevents internal pipeline corrosion
- Prevents paraffin buildup in the pipeline

PIG LAUNCHER



TYPICAL LOW PRESSURE PIGGING OPERATIONS

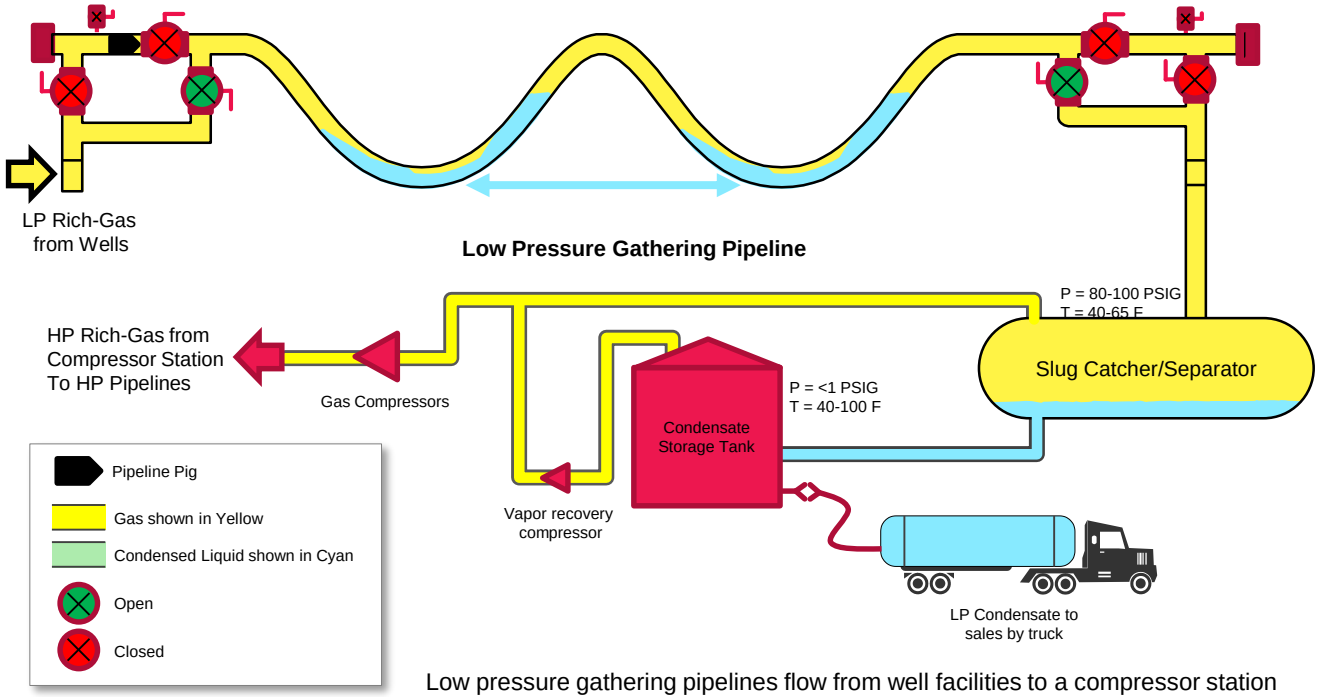
PIPELINE JUST PIGGED AND FLOWING GAS – NEW PIG READY TO LAUNCH



Low pressure gathering pipelines flow from well facilities to a compressor station

TYPICAL LOW PRESSURE PIGGING OPERATIONS

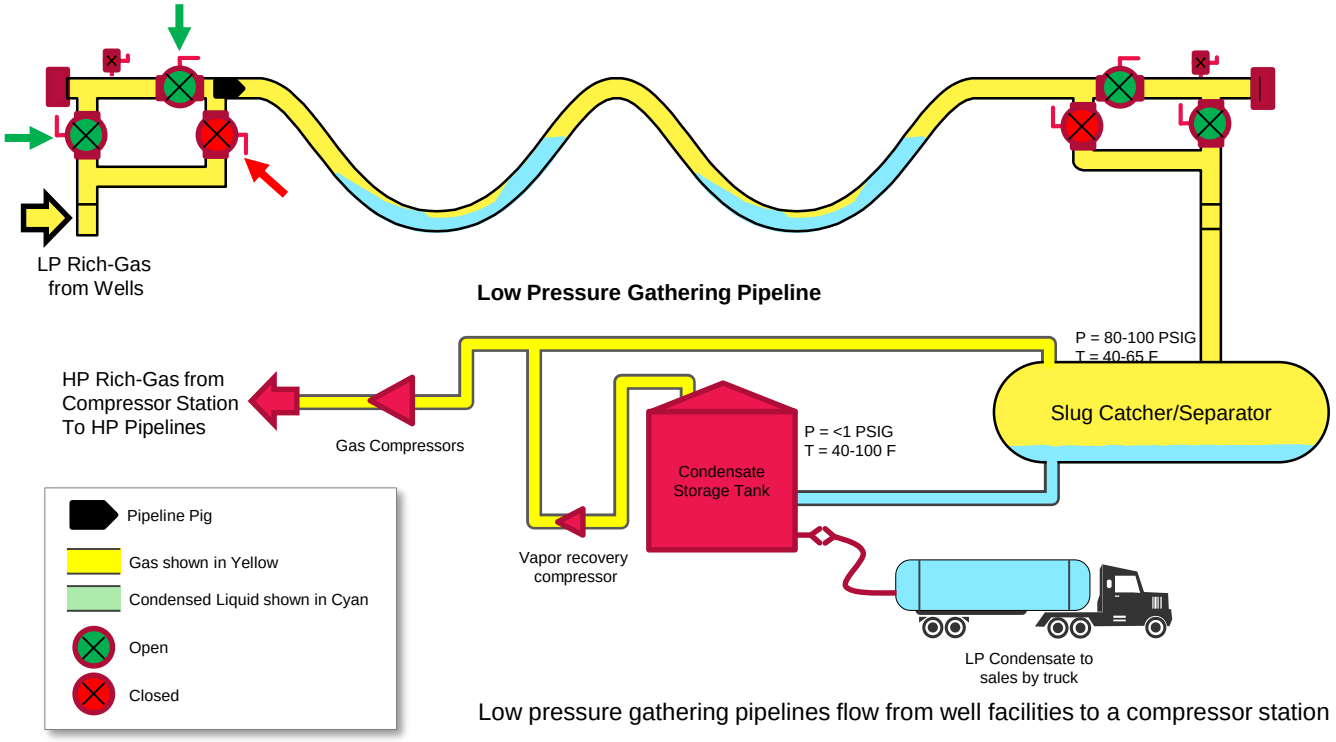
LINE ACCUMULATING CONDENSED LIQUIDS



Low pressure gathering pipelines flow from well facilities to a compressor station

TYPICAL LOW PRESSURE PIGGING OPERATIONS

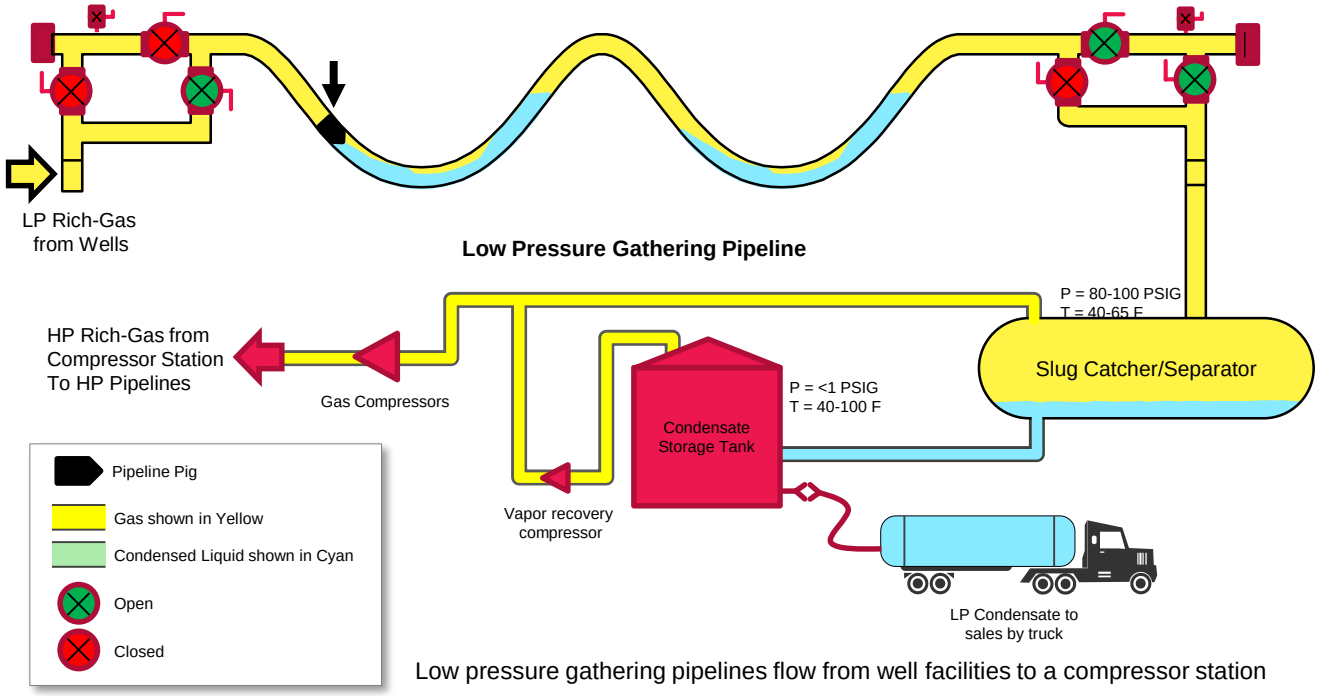
TIME TO PIG PIPELINE – OPEN LAUNCHER VALVES, CLOSE BYPASS



Low pressure gathering pipelines flow from well facilities to a compressor station

TYPICAL LOW PRESSURE PIGGING OPERATIONS

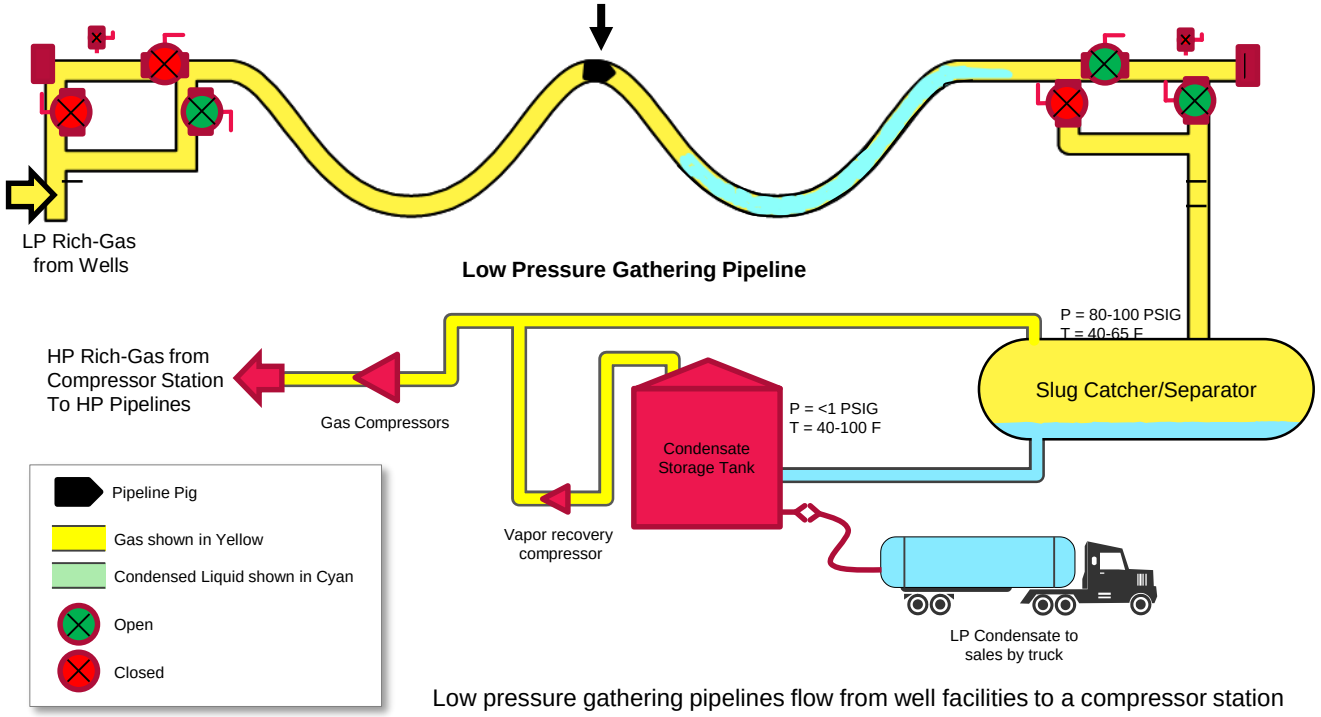
PIG REACHES FIRST LOW POINT BEGINS PUSHING LIQUIDS



Low pressure gathering pipelines flow from well facilities to a compressor station

TYPICAL LOW PRESSURE PIGGING OPERATIONS

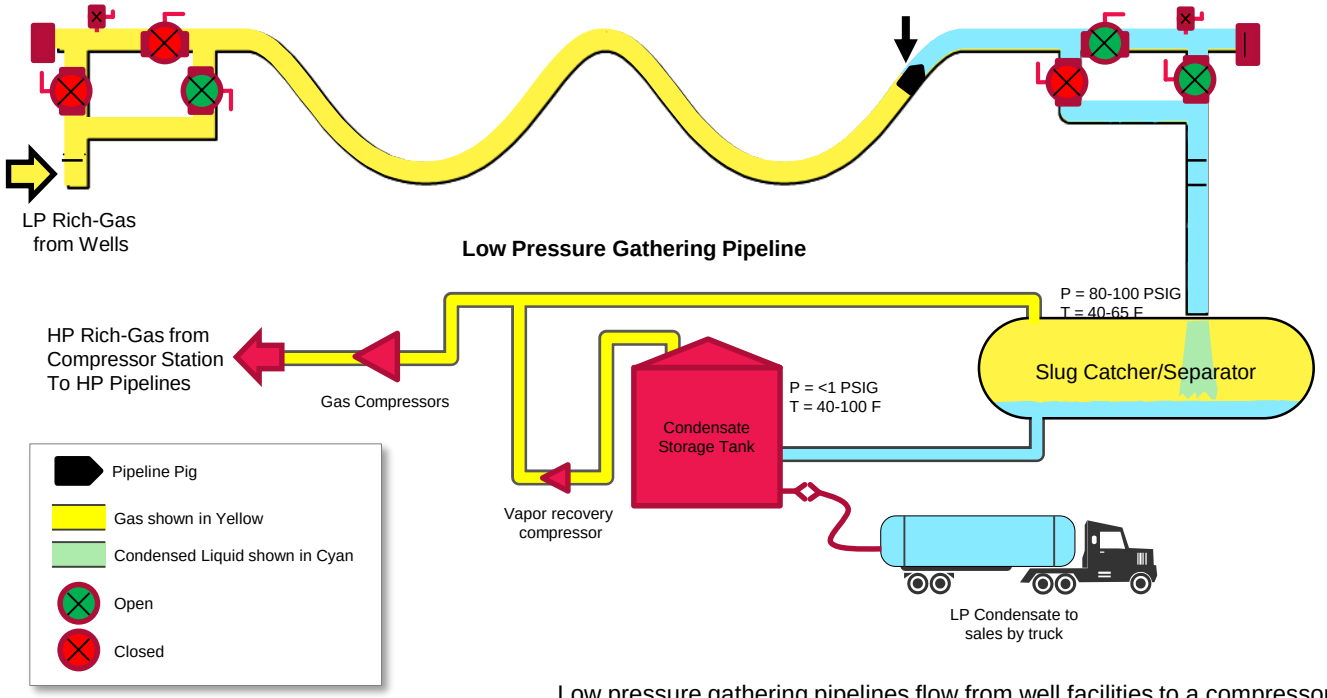
PIG PUSHES LIQUIDS TOWARDS RECEIVER



Low pressure gathering pipelines flow from well facilities to a compressor station

TYPICAL LOW PRESSURE PIGGING OPERATIONS

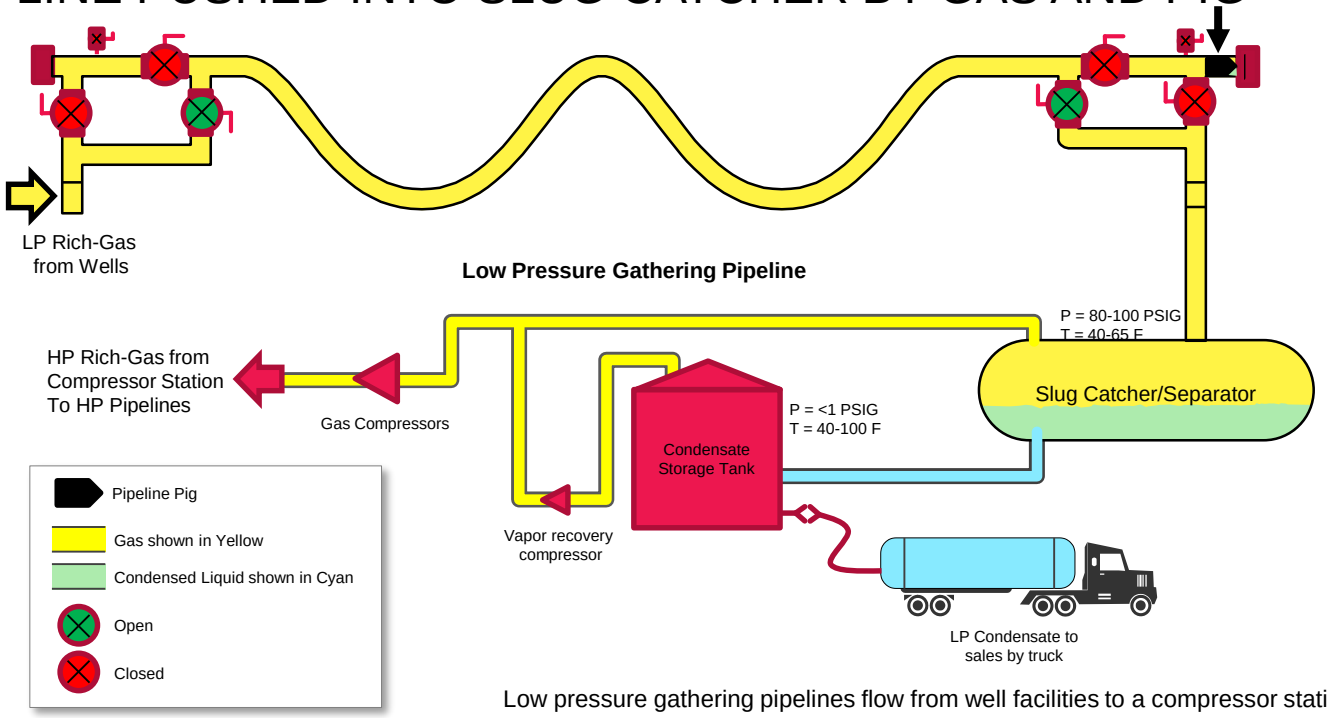
PIG PUSHES LIQUIDS THRU BYPASS AND RECEIVER AND INTO SLUG CATCHER



Low pressure gathering pipelines flow from well facilities to a compressor station

TYPICAL LOW PRESSURE PIGGING OPERATIONS

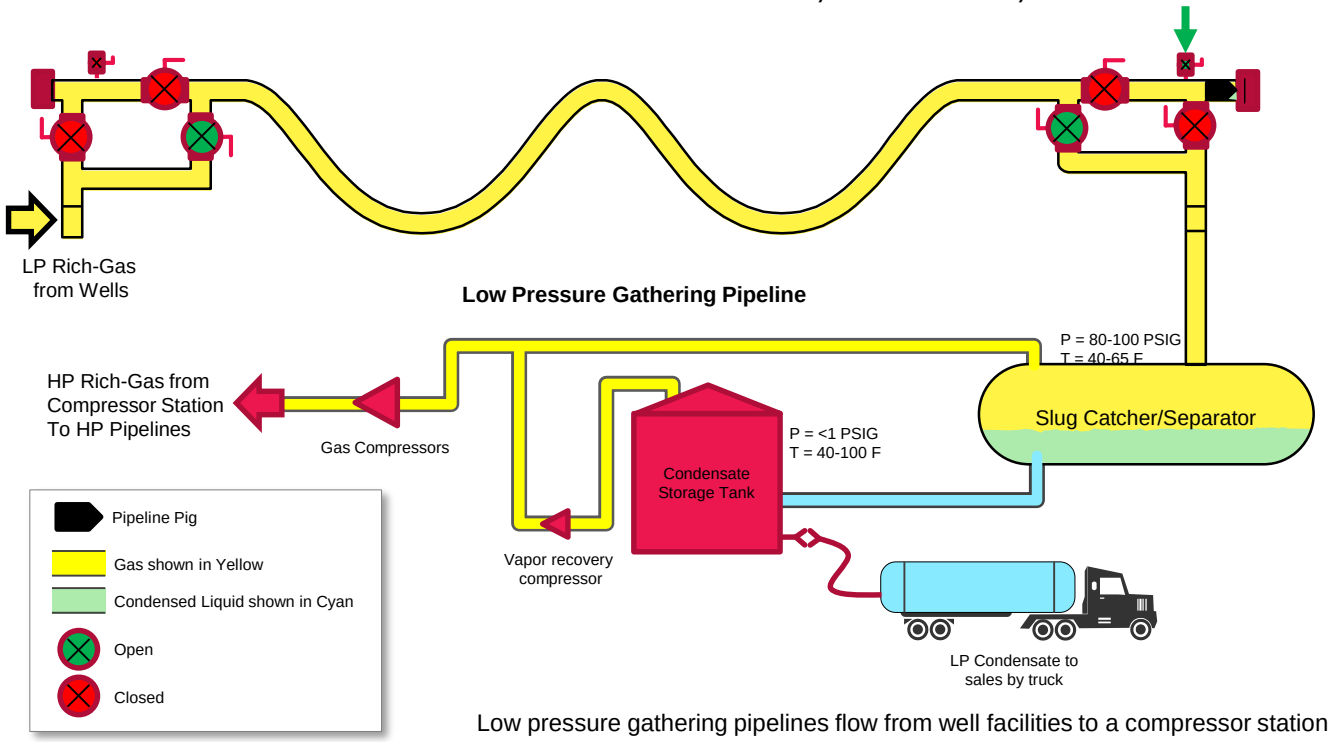
CLOSE BYPASS TO PUSH PIG INTO RECEIVER – REMAINING LIQUID IN BYPASS LINE PUSHED INTO SLUG CATCHER BY GAS AND PIG



Low pressure gathering pipelines flow from well facilities to a compressor station

TYPICAL LOW PRESSURE PIGGING OPERATIONS

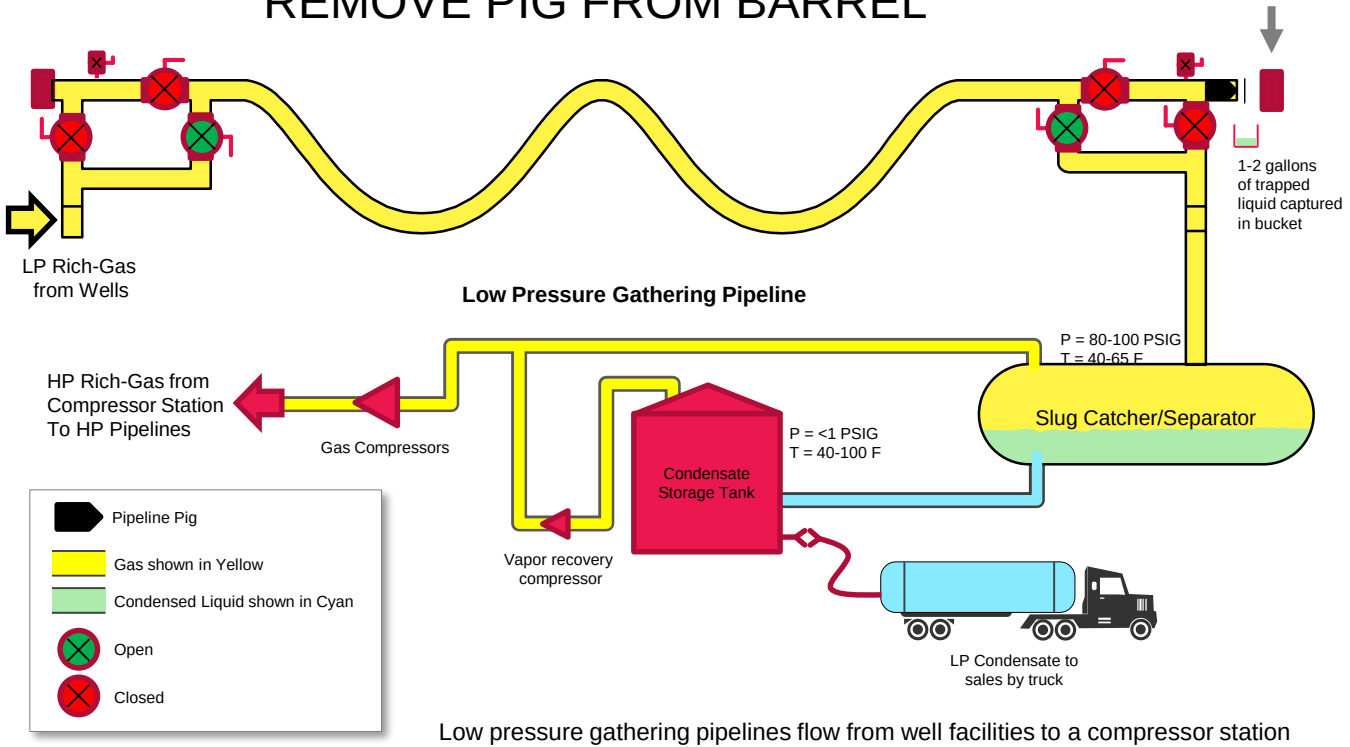
TIME TO REMOVE PIG FROM RECEIVER-BYPASS, ISOLATE, AND DEPRESSURIZE



Low pressure gathering pipelines flow from well facilities to a compressor station

TYPICAL LOW PRESSURE PIGGING OPERATIONS

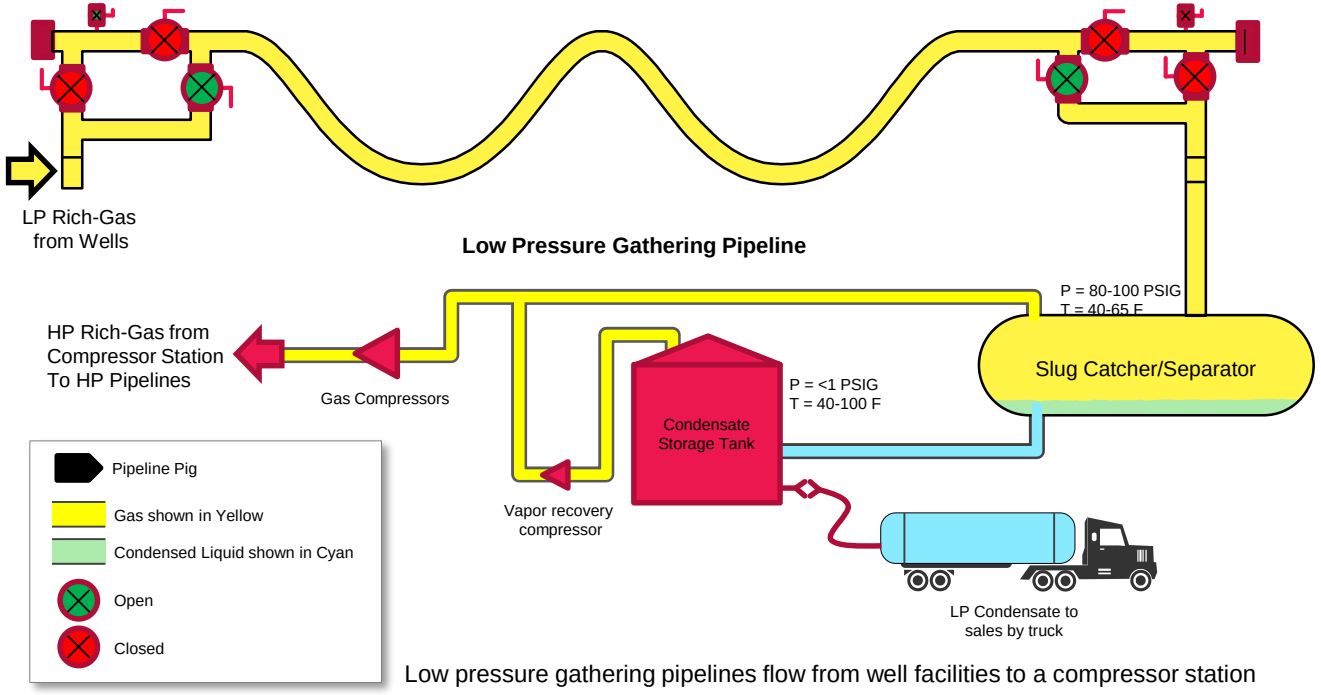
REMOVE PIG FROM BARREL



Low pressure gathering pipelines flow from well facilities to a compressor station

TYPICAL LOW PRESSURE PIGGING OPERATIONS

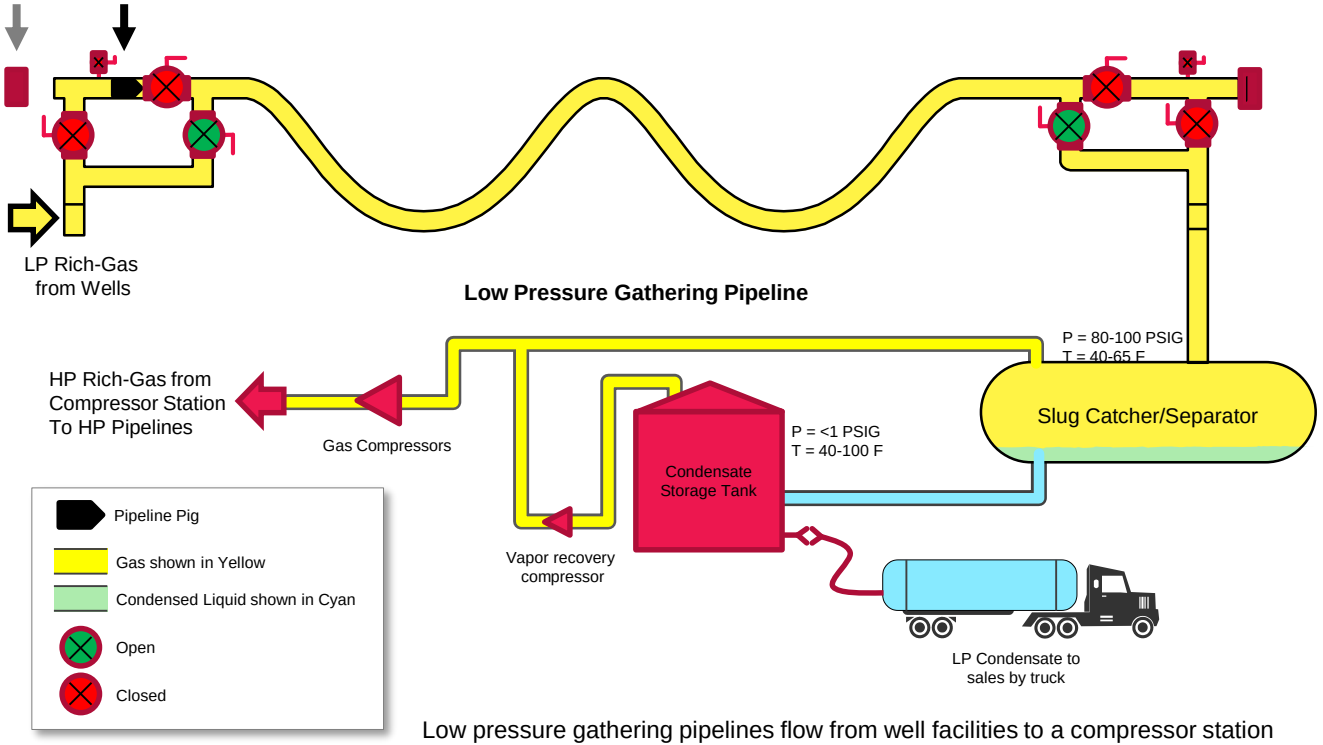
PREPARE LAUNCHER FOR NEXT CYCLE – BYPASS, ISOLATE, AND DEPRESSURIZE



Low pressure gathering pipelines flow from well facilities to a compressor station

TYPICAL LOW PRESSURE PIGGING OPERATIONS

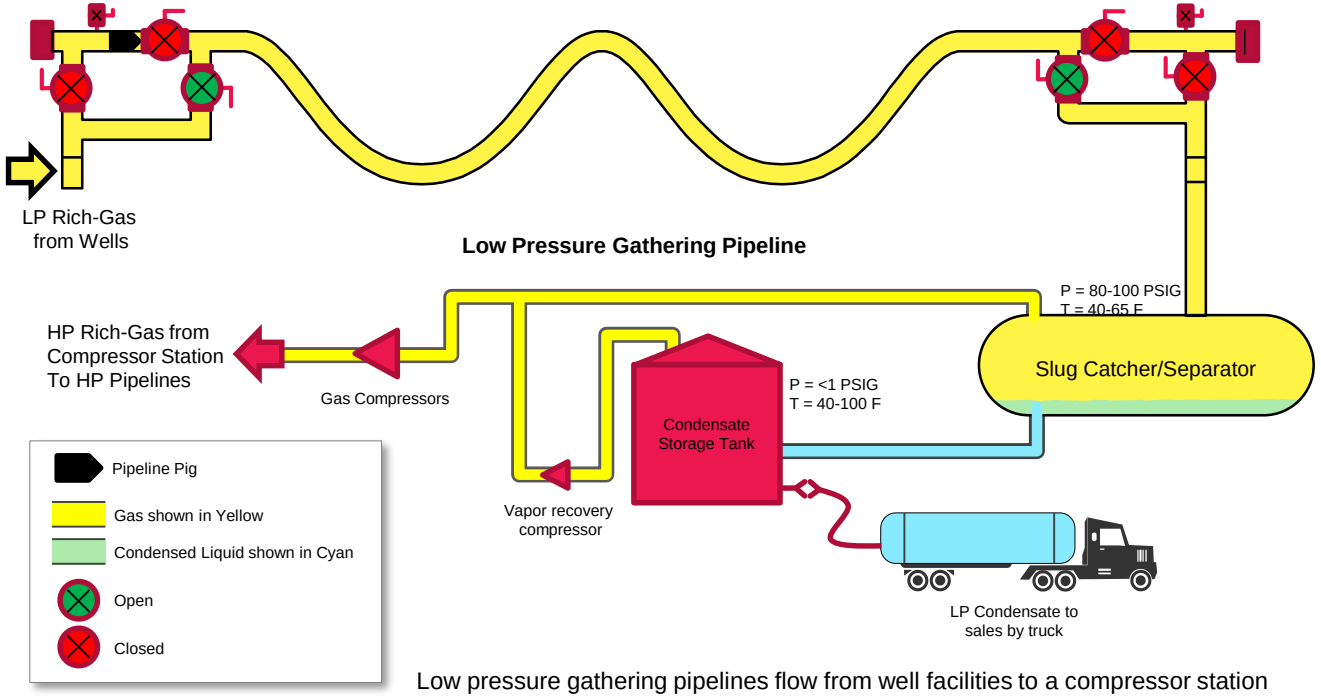
OPEN LAUNCHER AND INSTALL NEW PIG – SHUT VENTS



Low pressure gathering pipelines flow from well facilities to a compressor station

TYPICAL LOW PRESSURE PIGGING OPERATIONS

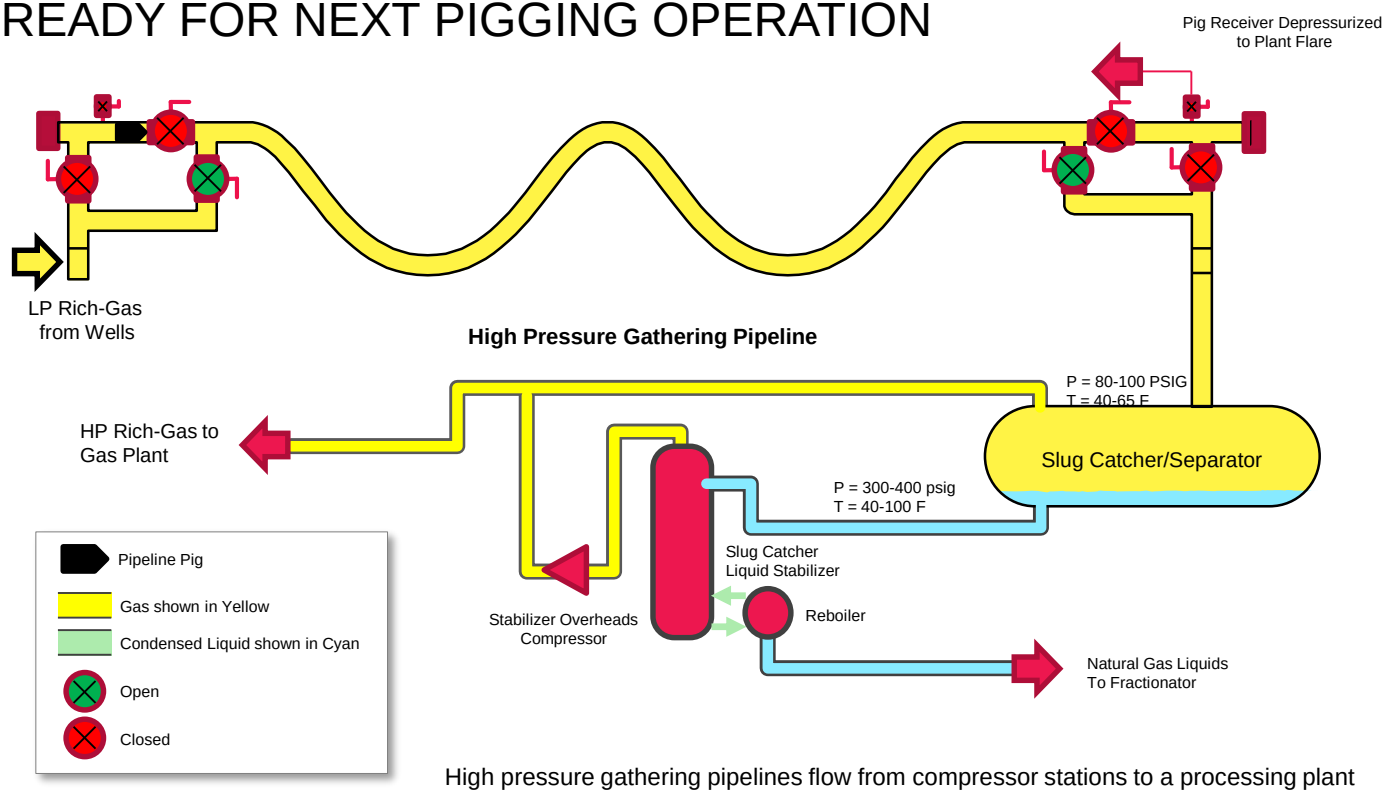
READY FOR NEXT PIGGING OPERATION



Low pressure gathering pipelines flow from well facilities to a compressor station

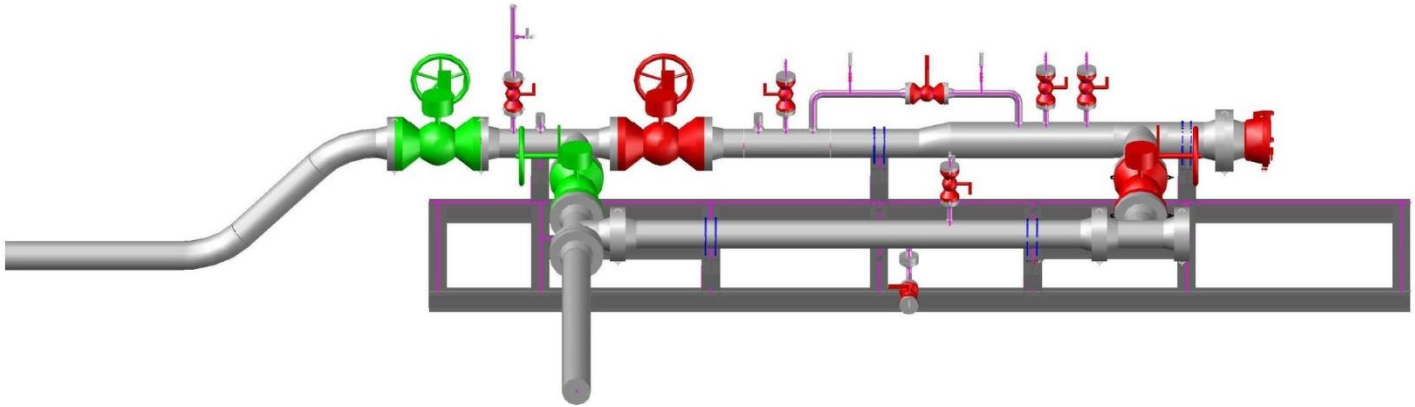
TYPICAL HIGH PRESSURE PIGGING OPERATIONS

READY FOR NEXT PIGGING OPERATION



High pressure gathering pipelines flow from compressor stations to a processing plant

PIGGING EMISSIONS CONTROLS



PIG LAUNCHER AND RECEIVER SITE

QUANTIFY EMISSIONS

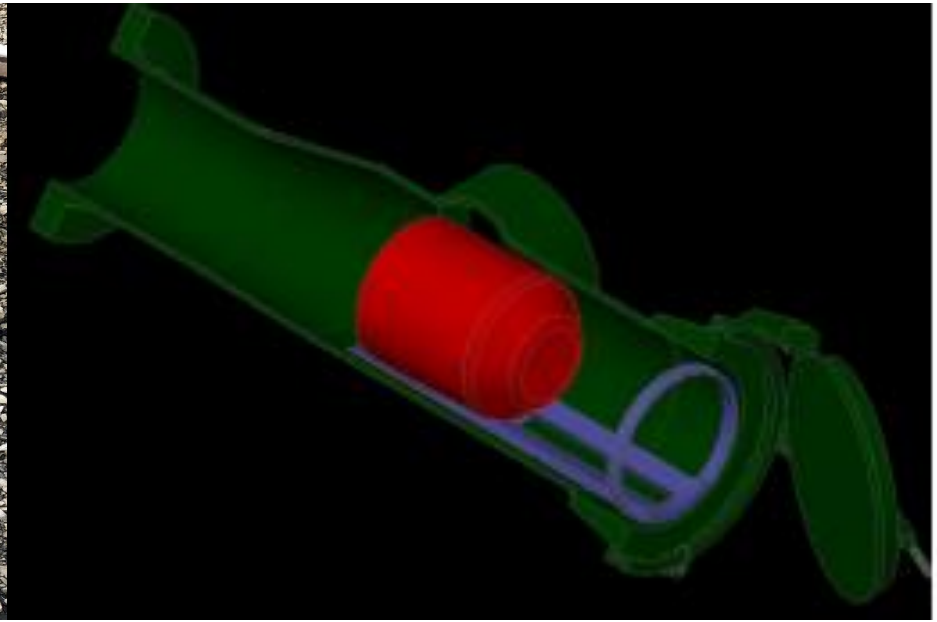
- Calculated using the Real Gas Law

$$m=((PVM_w)/RTZ)*Wt\%$$

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*$^\circ$R)
T = temperature of mixture($^\circ$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



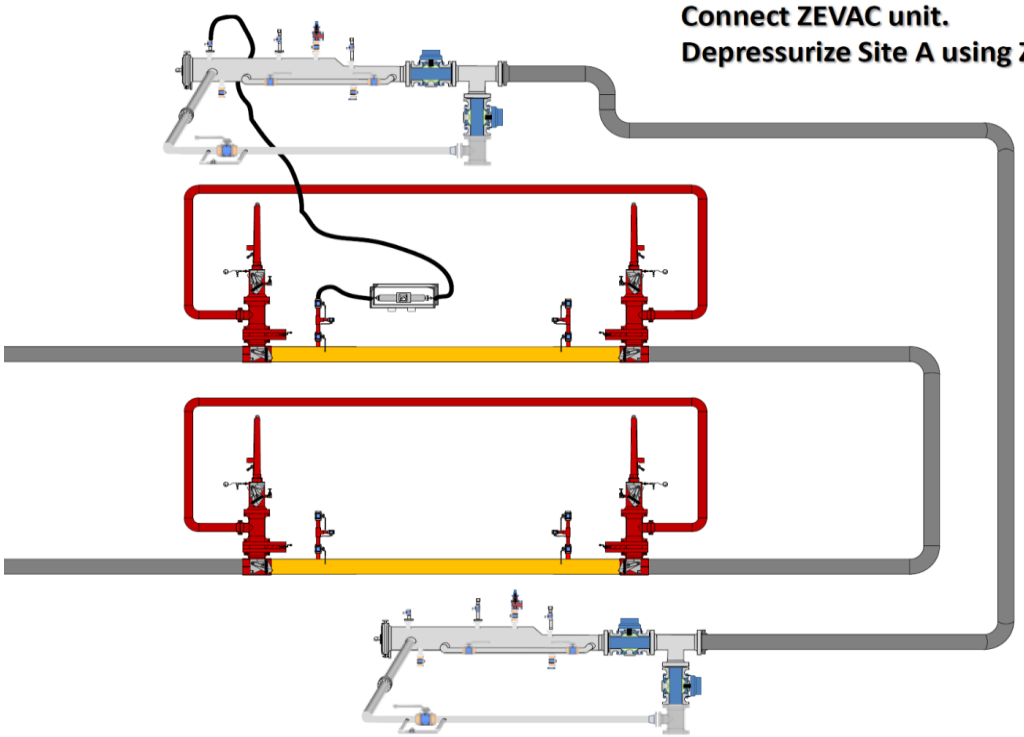
U.S. PATENT NUMBER 10012340

PIG RAMP INSTALLED

SHORT BARREL AND LIQUID CONTAINMENT

HYDROCARBON EMISSION REDUCTION DEVICE PORTABLE FLARE

HYDROCARBON EMISSIONS REDUCTION DEVICE



ZEVAC®

HYDROCARBON EMISSIONS REDUCTION DEVICE
ZEVAC

ZEVAC®

ZEVAC IN ACTION

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