MPLX® ENERGY LOGISTICS

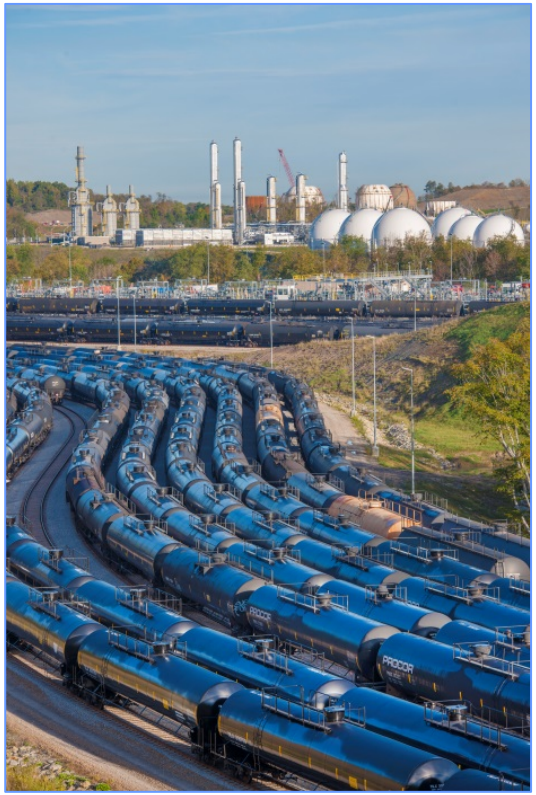
INNOVATIONS IN PIGGING

Nathan M. Wheldon, PE

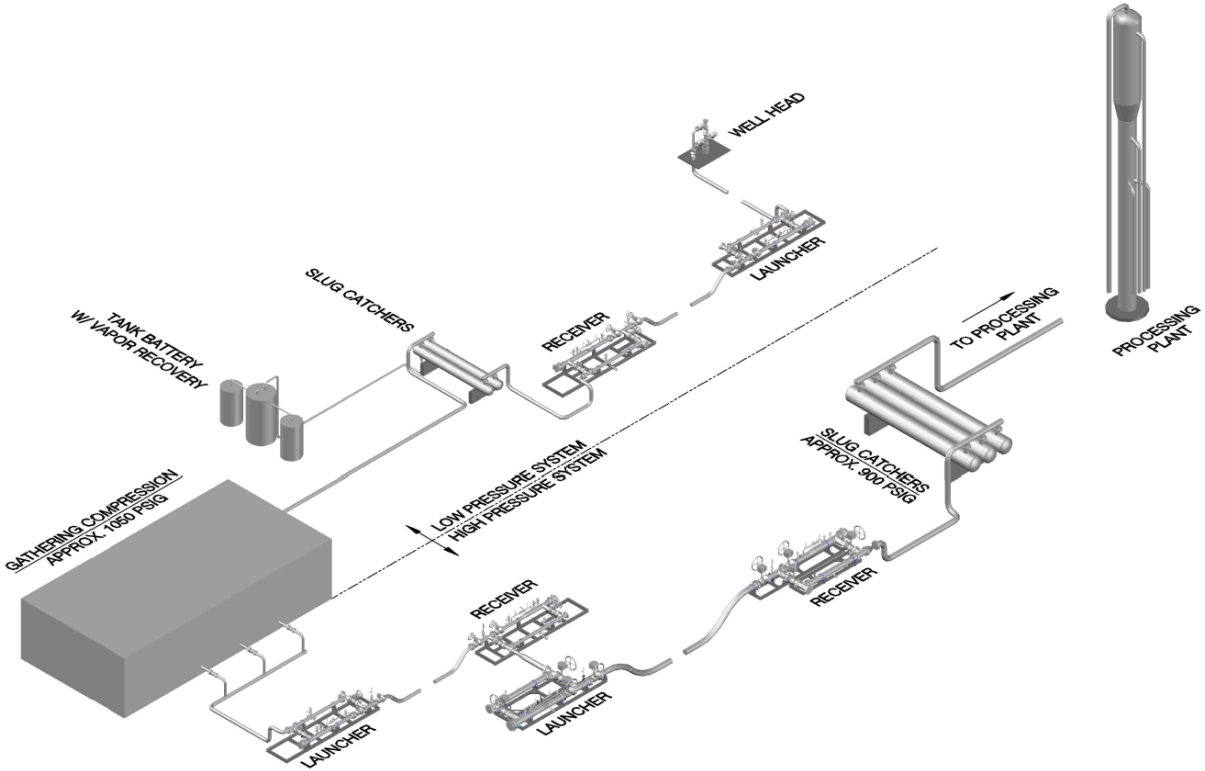
MARKWEST Energy Partners, L.P.

A WHOLLY-OWNED MPLX SUBSIDIARY

MPLX ENERGY LOGISTICS



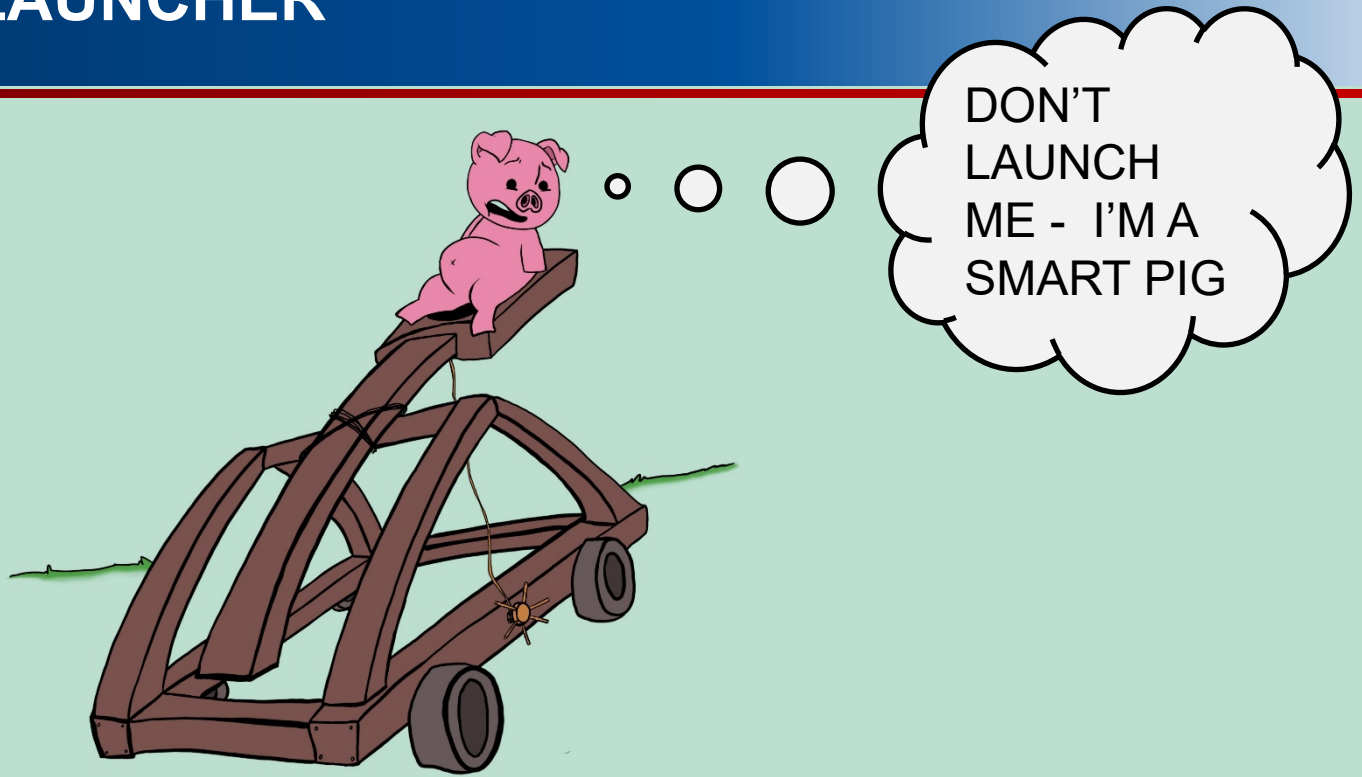
WELLHEAD TO PROCESSING PLANT



WHY PIG PIPELINES?

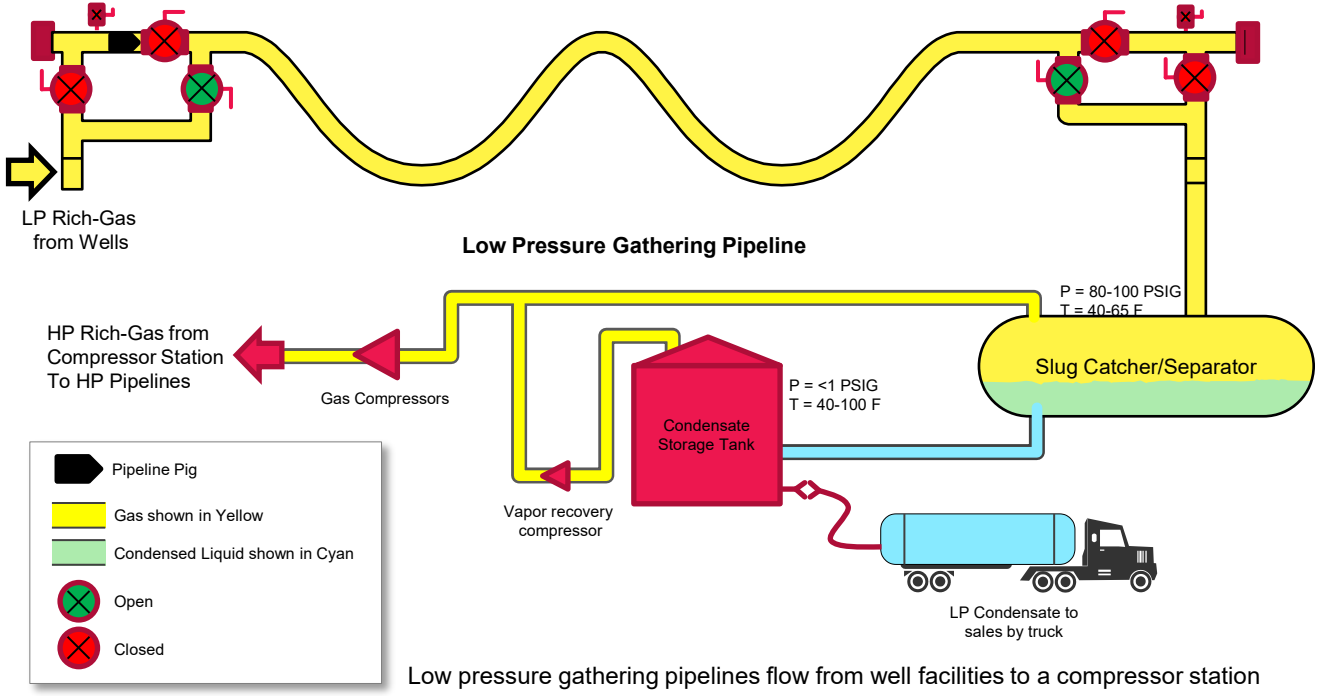
- Reduces pipeline pressure drop
- Sweeps valuable natural gas liquids into slug catcher and processing plant for processing and fractionation
- Prevents internal pipeline corrosion
- Prevents paraffin buildup in the pipeline

PIG LAUNCHER



TYPICAL LOW PRESSURE PIGGING OPERATIONS

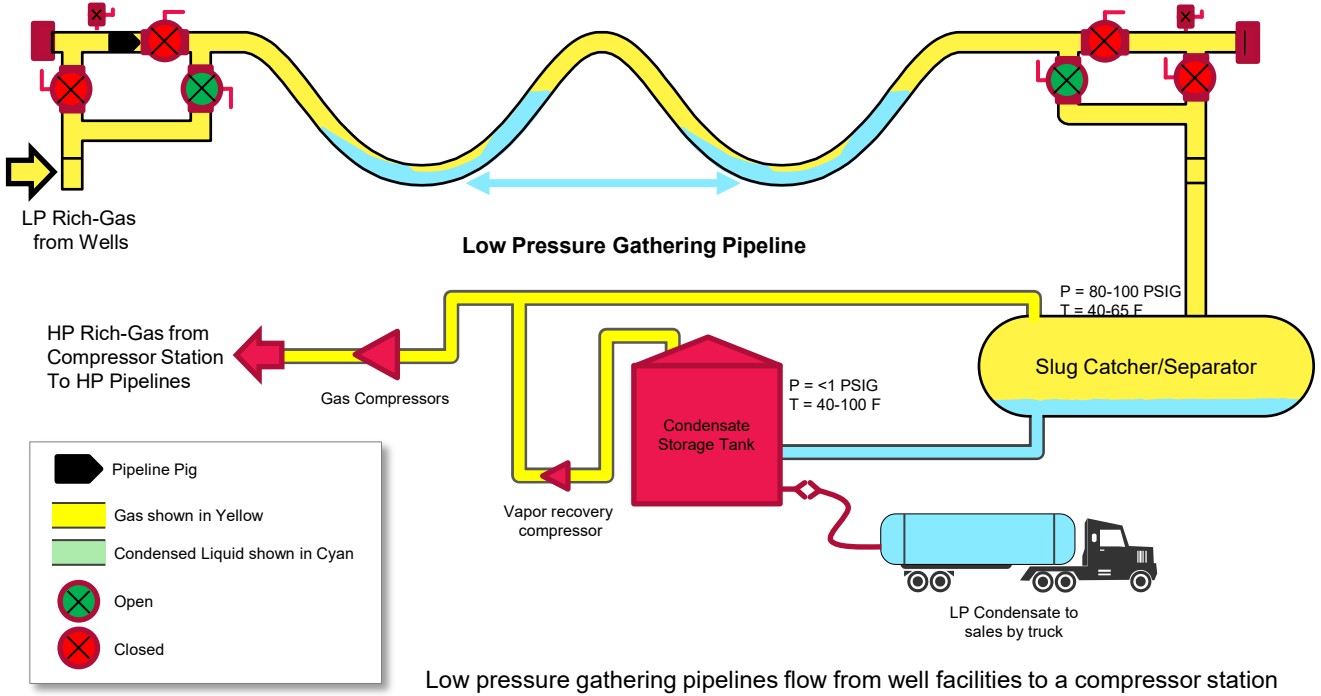
PIPELINE JUST PIGGED AND FLOWING GAS – NEW PIG READY TO LAUNCH



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

TYPICAL LOW PRESSURE PIGGING OPERATIONS

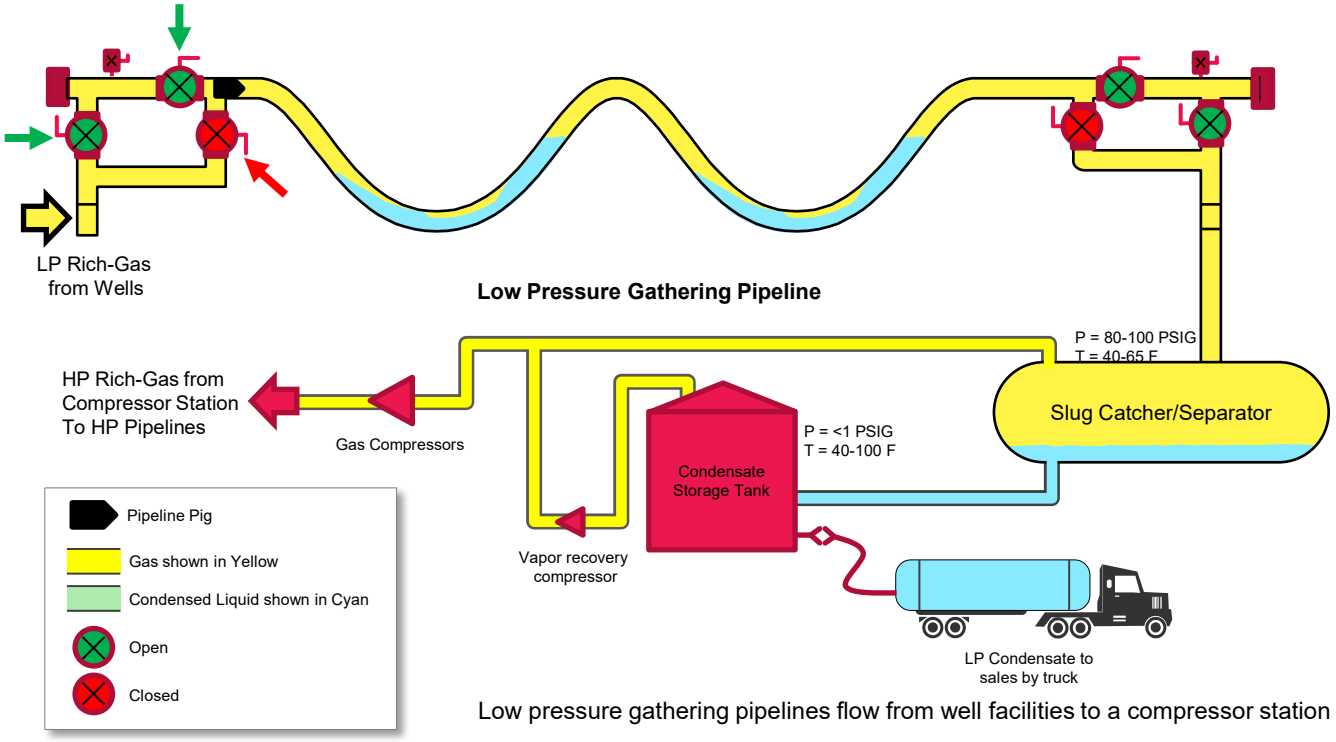
LINE ACCUMULATING CONDENSED LIQUIDS



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

TYPICAL LOW PRESSURE PIGGING OPERATIONS

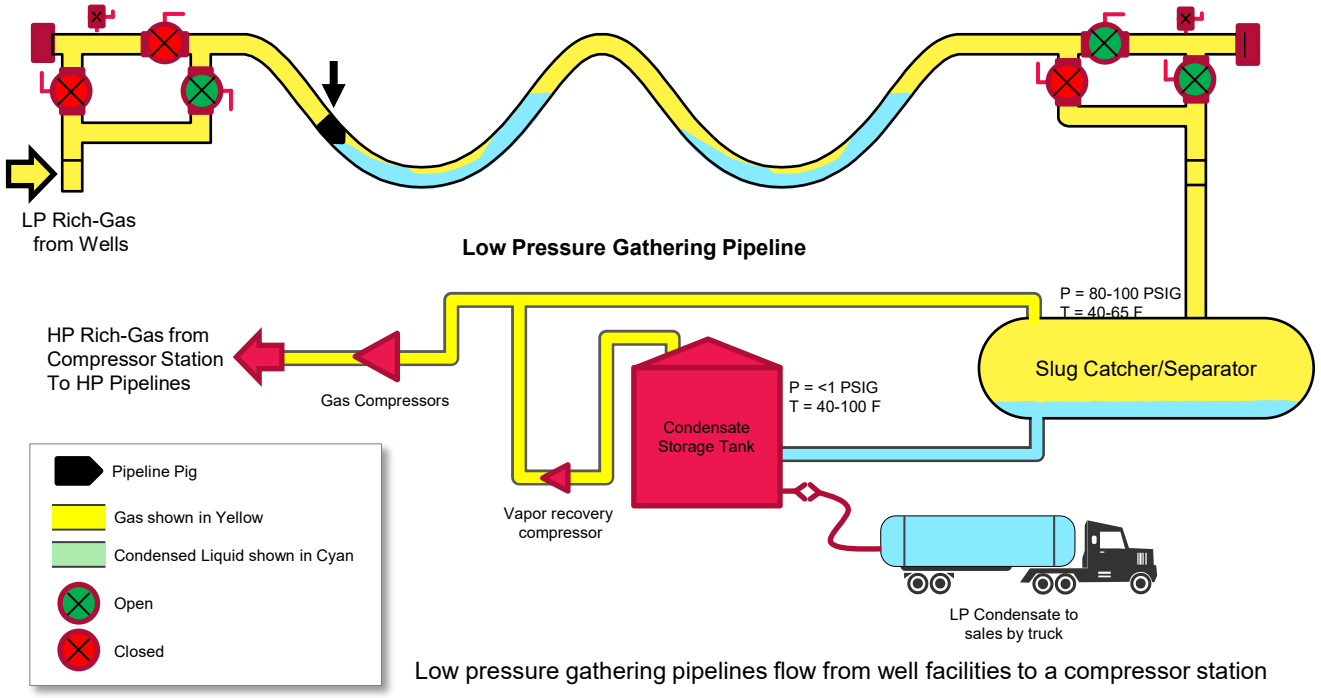
TIME TO PIG PIPELINE – OPEN LAUNCHER VALVES, CLOSE BYPASS



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

TYPICAL LOW PRESSURE PIGGING OPERATIONS

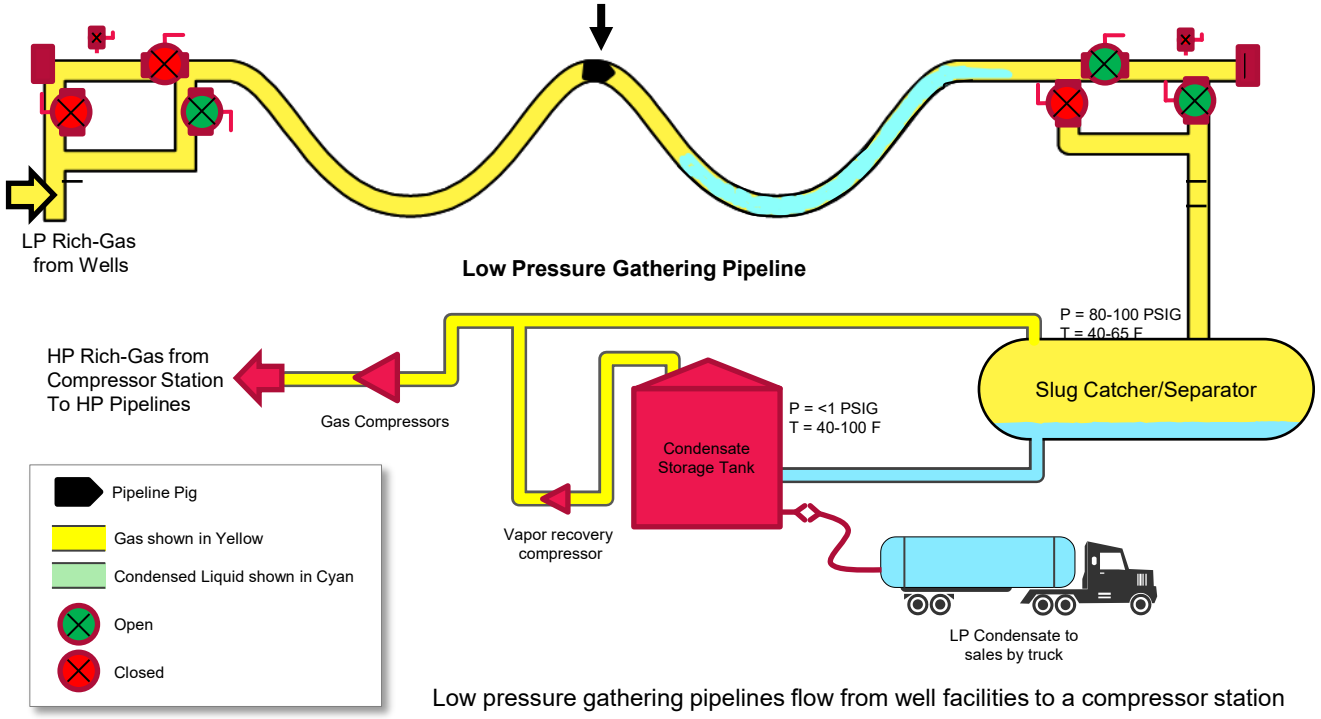
PIG REACHES FIRST LOW POINT BEGINS PUSHING LIQUIDS



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

TYPICAL LOW PRESSURE PIGGING OPERATIONS

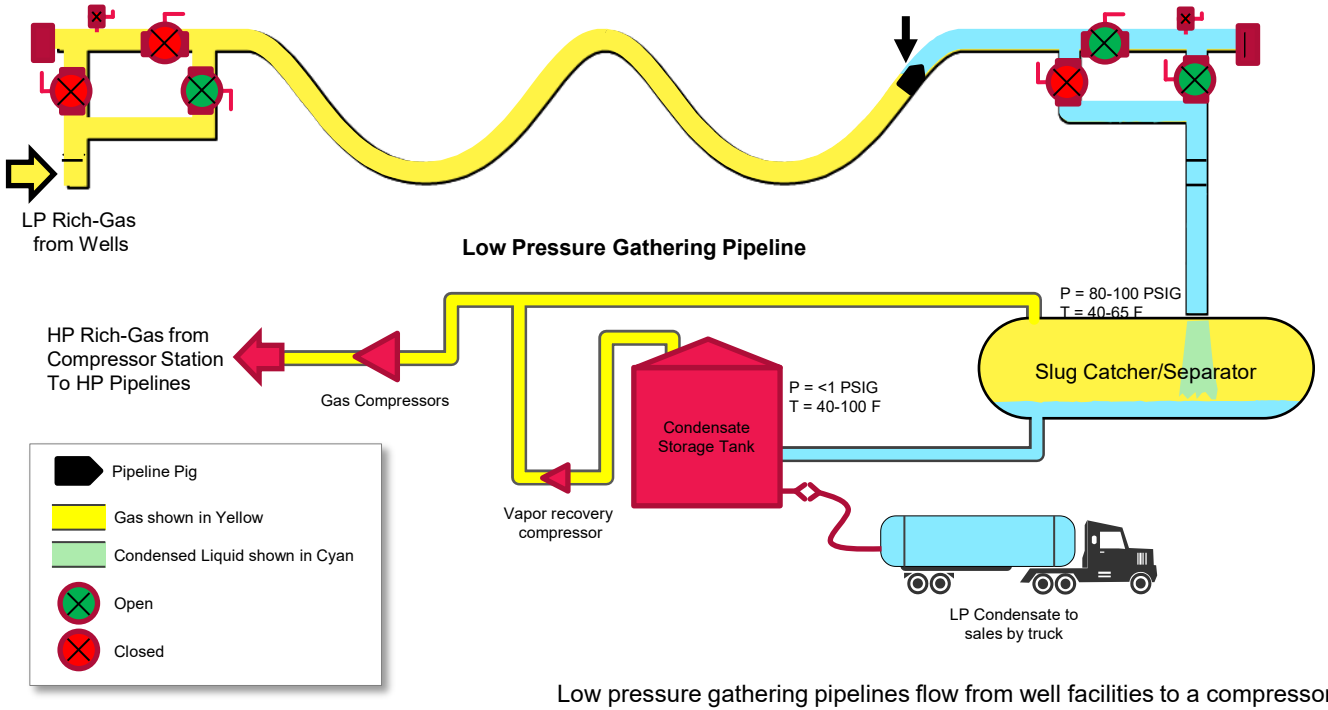
PIG PUSHES LIQUIDS TOWARDS RECEIVER



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

TYPICAL LOW PRESSURE PIGGING OPERATIONS

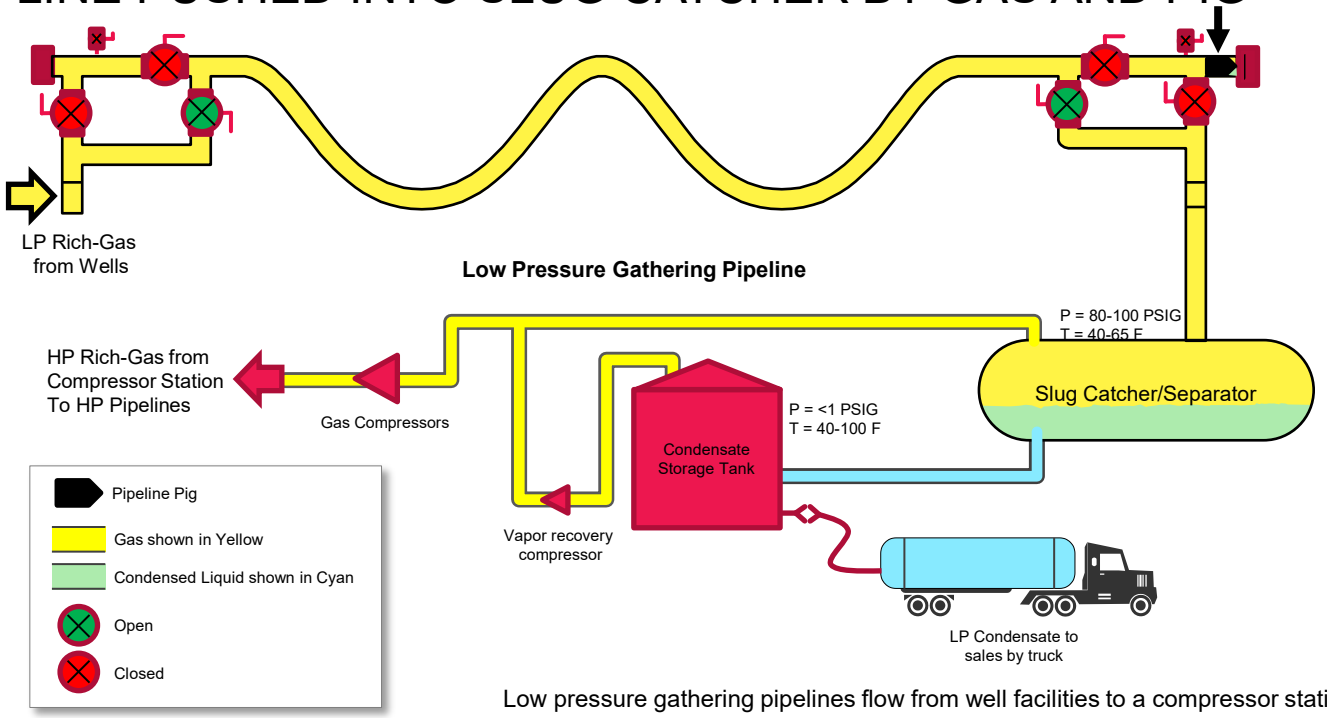
PIG PUSHES LIQUIDS THRU BYPASS AND RECEIVER AND INTO SLUG CATCHER



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

TYPICAL LOW PRESSURE PIGGING OPERATIONS

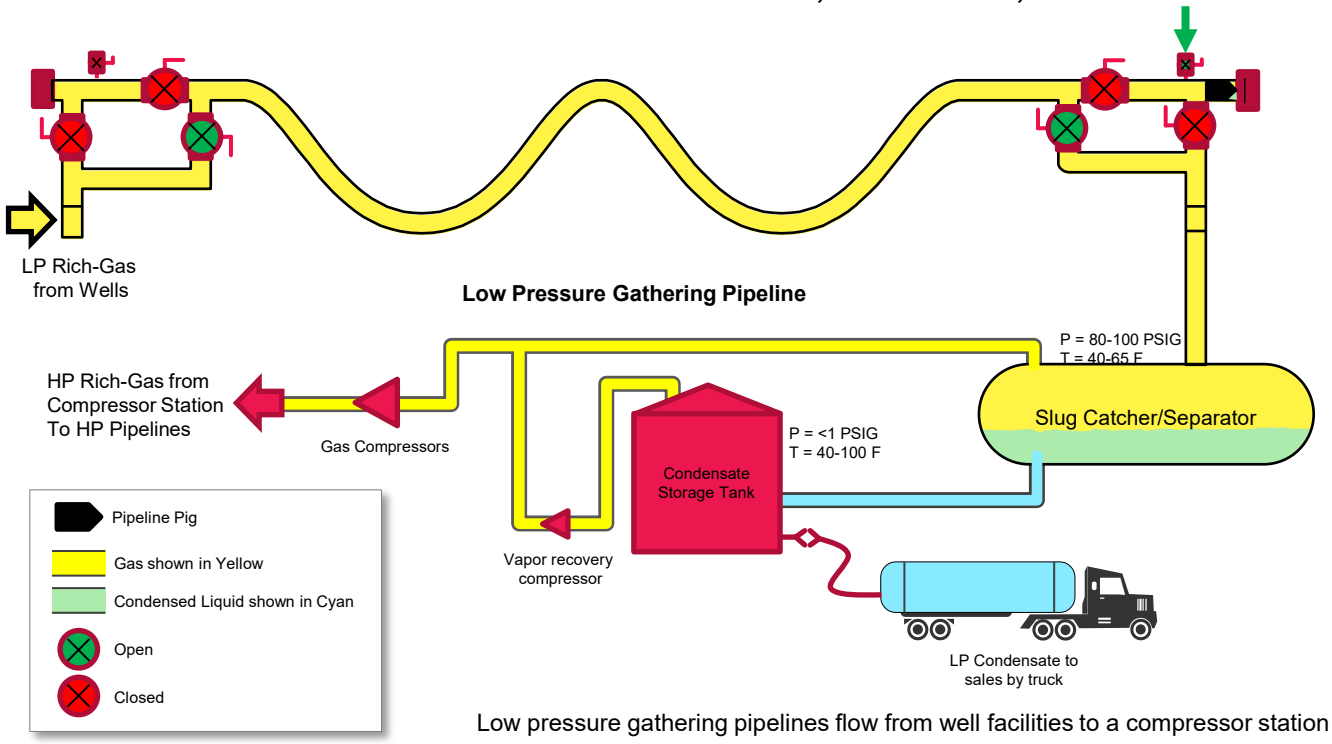
CLOSE BYPASS TO PUSH PIG INTO RECEIVER – REMAINING LIQUID IN BYPASS LINE PUSHED INTO SLUG CATCHER BY GAS AND PIG



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

TYPICAL LOW PRESSURE PIGGING OPERATIONS

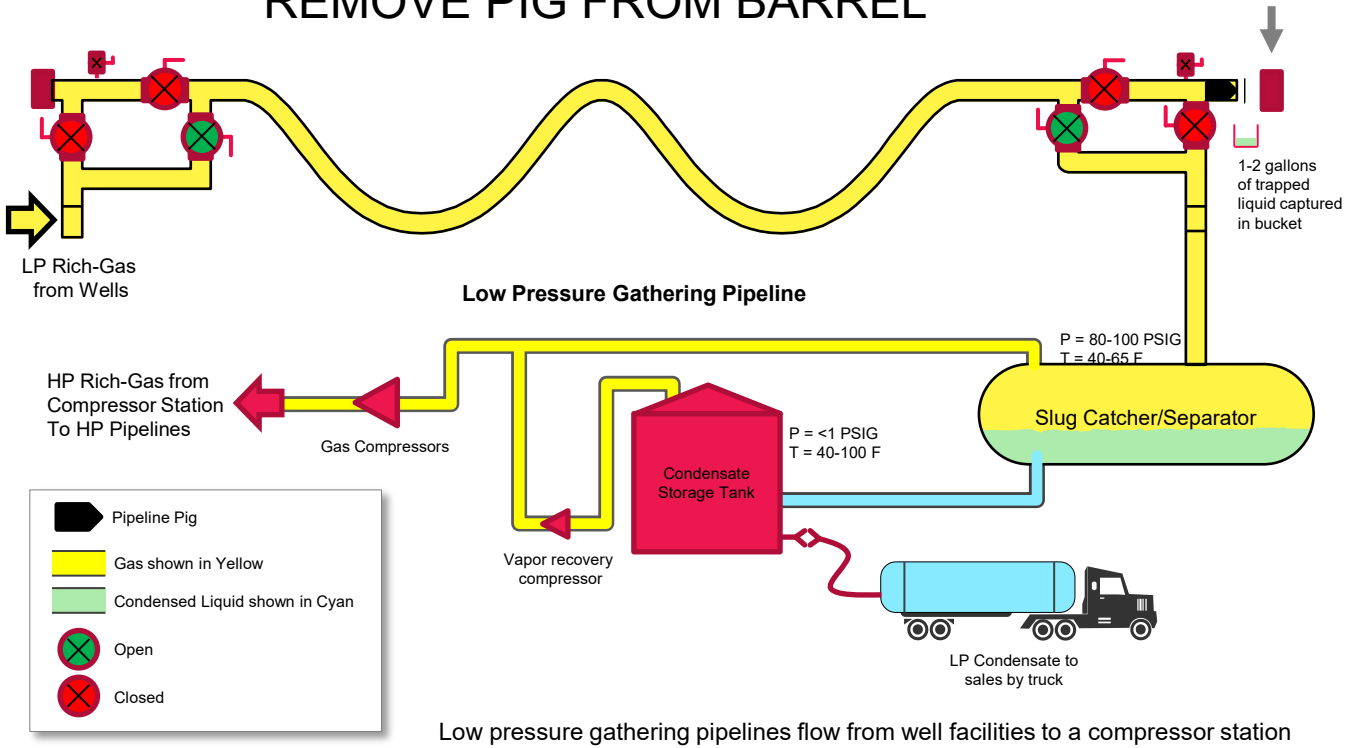
TIME TO REMOVE PIG FROM RECEIVER-BYPASS, ISOLATE, AND DEPRESSURIZE



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

TYPICAL LOW PRESSURE PIGGING OPERATIONS

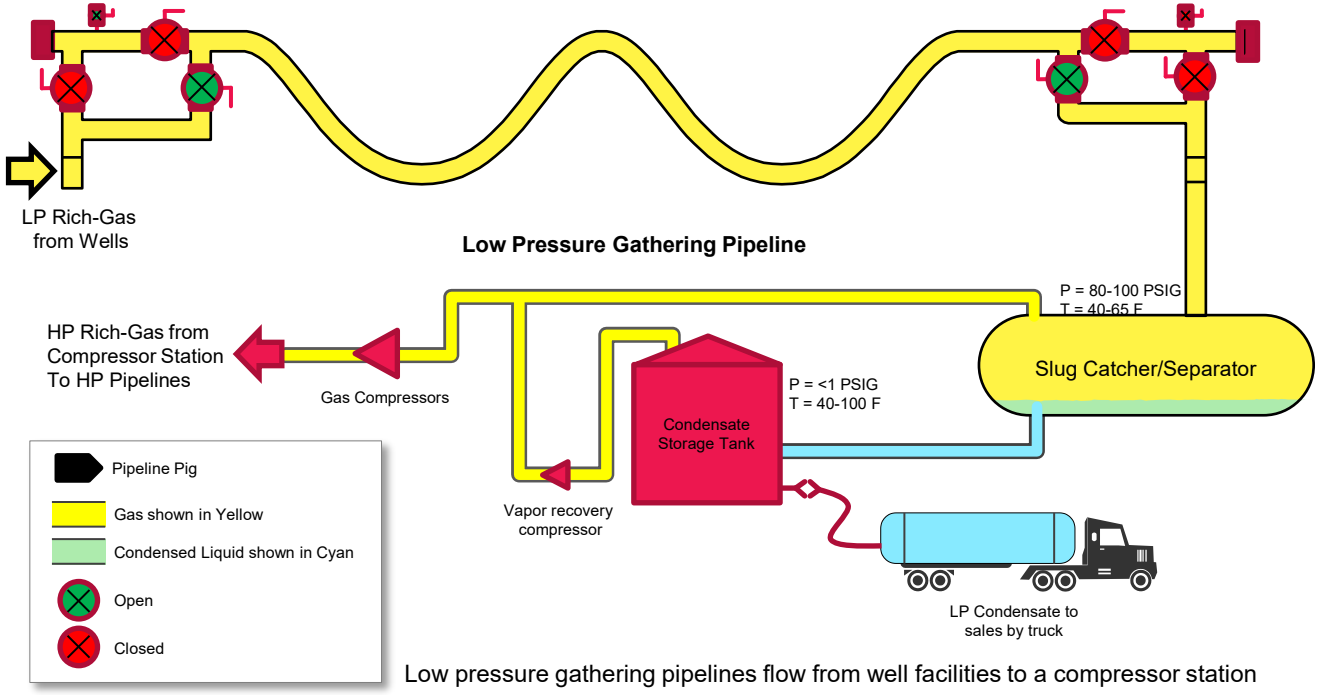
REMOVE PIG FROM BARREL



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

TYPICAL LOW PRESSURE PIGGING OPERATIONS

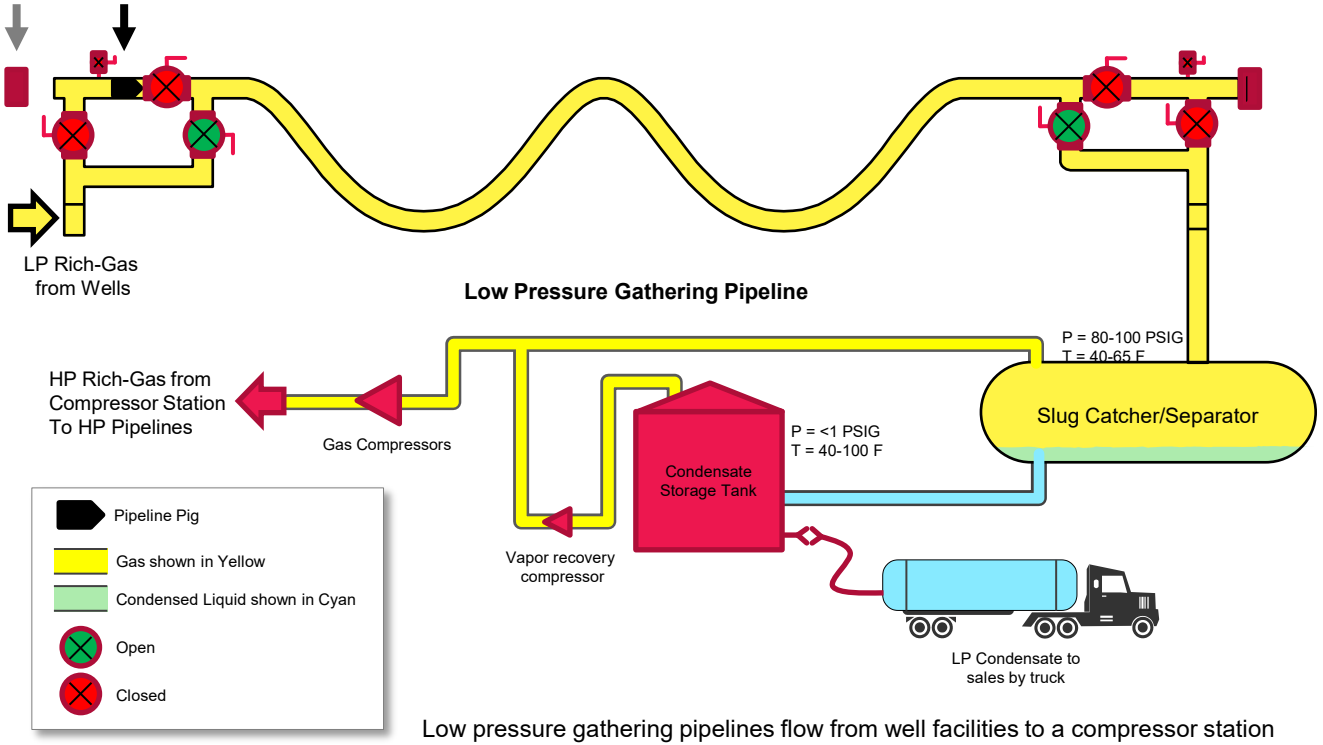
PREPARE LAUNCHER FOR NEXT CYCLE – BYPASS, ISOLATE, AND DEPRESSURIZE



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

TYPICAL LOW PRESSURE PIGGING OPERATIONS

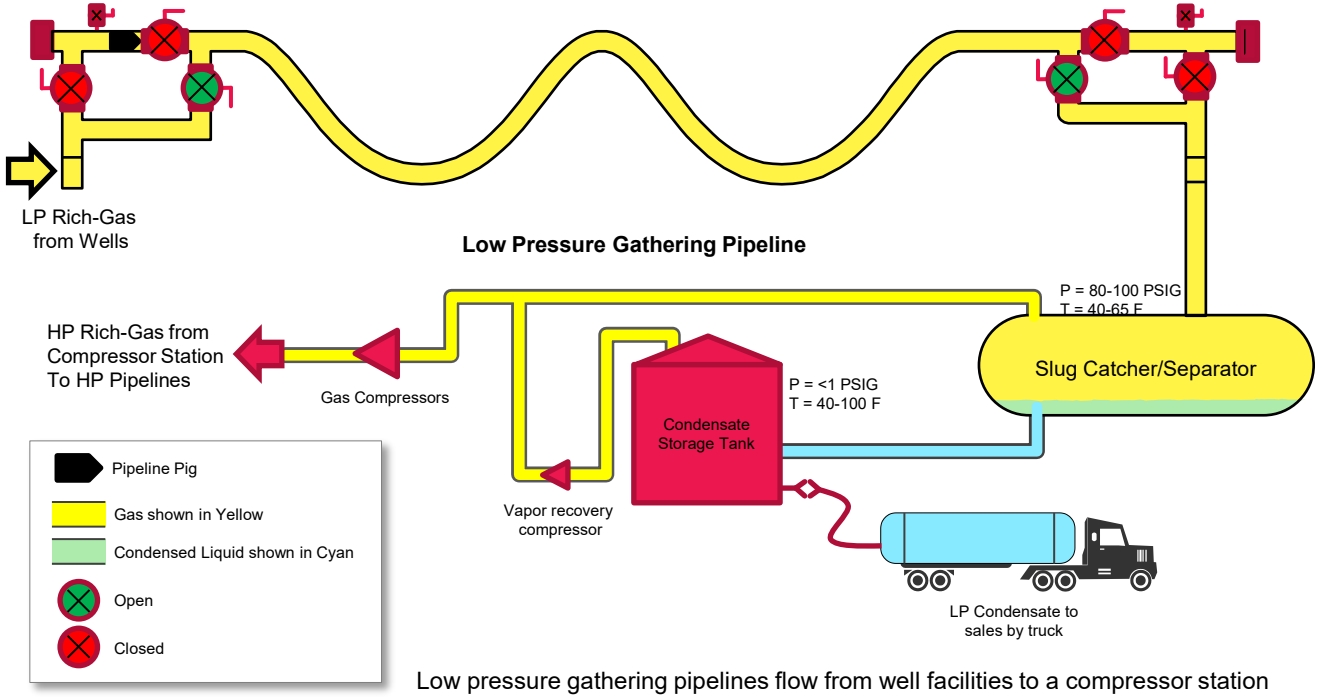
OPEN LAUNCHER AND INSTALL NEW PIG – SHUT VENTS



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

PIG LAUNCHER AND RECEIVER SITE

VOC PERMIT EMISSIONS LIMITS

- No federal limit
- State limits vary state to state

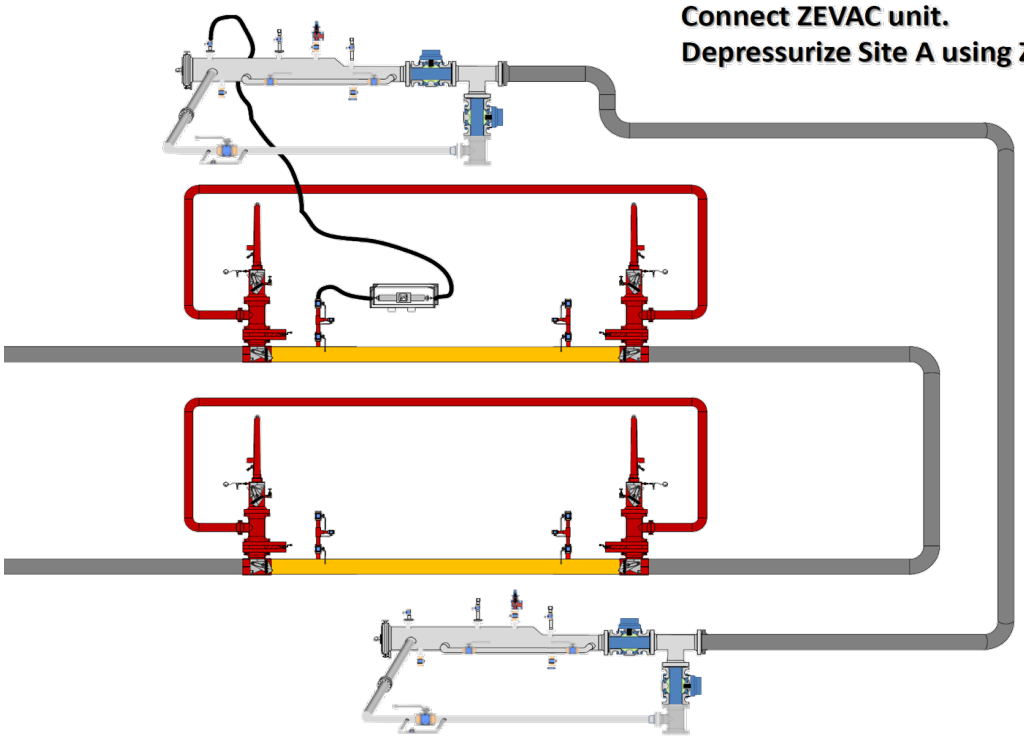
Calculated using the Real Gas Law

$$m = PVMw/(RTZ)*VOCwt\%$$

P = pressure inside the pipe (psia) pound per square inch 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 (10.73 psia*ft^3/lbmol*$^\circ$R)
T = temperature of mixture($^\circ$R)
Z = compressibility factor at given pressure (unitless)
VOCwt% = percentage of gas that is VOC on weight basis

HIGH PRESSURE TO LOW PRESSURE JUMPER LINE

VOC EMISSIONS REDUCTION DEVICE

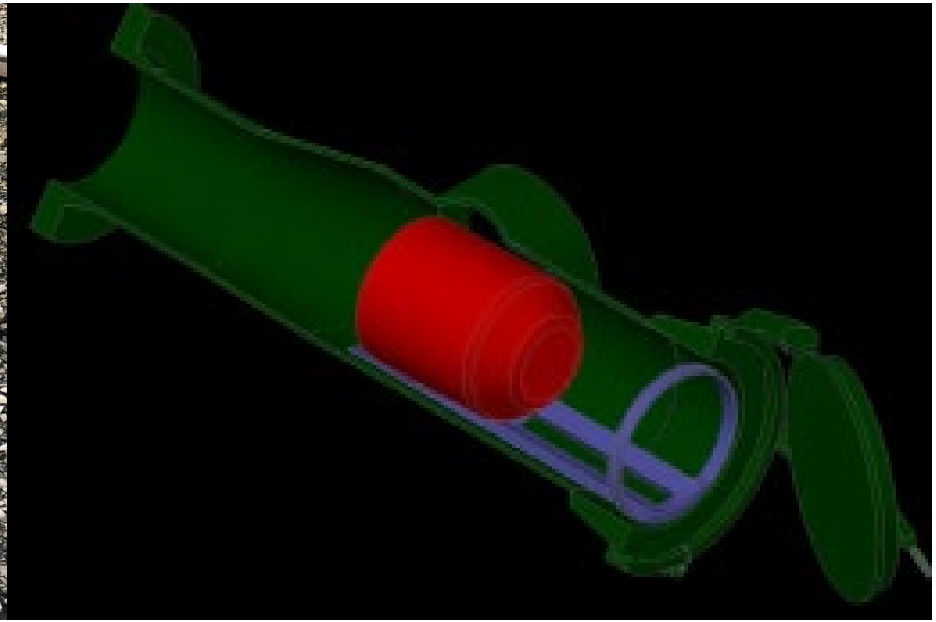


ZEVAC®

VOC EMISSIONS REDUCTION DEVICE
ZEVAC

ZEVAC®

PIG RAMP AWAITING INSTALLATION



U.S. PATENT NUMBER 10012340

PIG RAMP INSTALLED

SHORT BARREL AND LIQUID CONTAINMENT

VOC EMISSION REDUCTION DEVICE
PORTABLE FLARE

MARKWEST VOC EMISSION REDUCTIONS

- **0.02% of total volume** estimated emitted from launcher and receiver loading operations prior to enhancements of adding jumper lines where feasible, flares at 7 of 223 locations and pig ramps.
- **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