

# INTERNAL CORROSION Considerations

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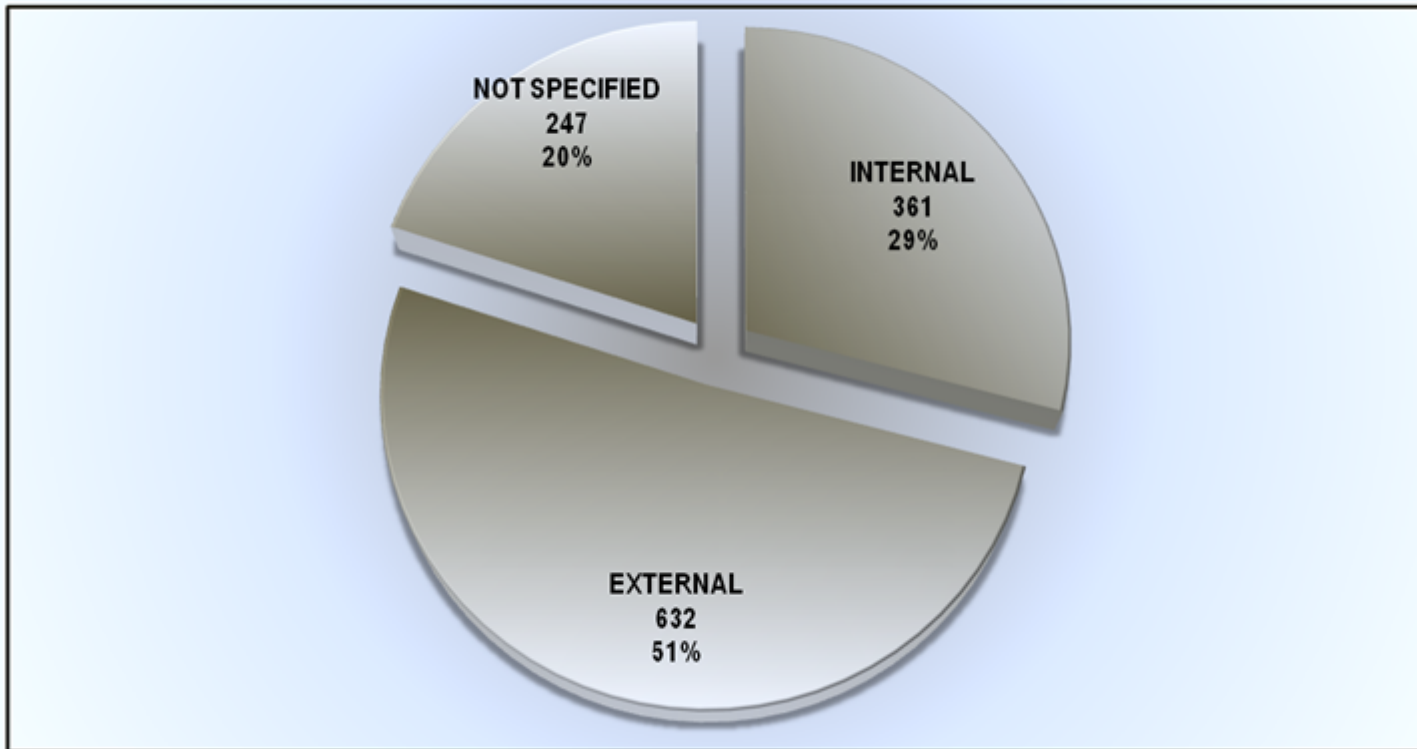
# REPORTED INTERNAL CORROSION ACCIDENTS 1988-2008

- 361 internal corrosion accidents
  - 29 percent of all corrosion accidents
  - 7 percent of all HL accidents
  - \$45.4M property damage
- Possible internal corrosion accidents
  - 20 percent all corrosion accidents type was not specified
  - 18 percent all accidents defined “other”



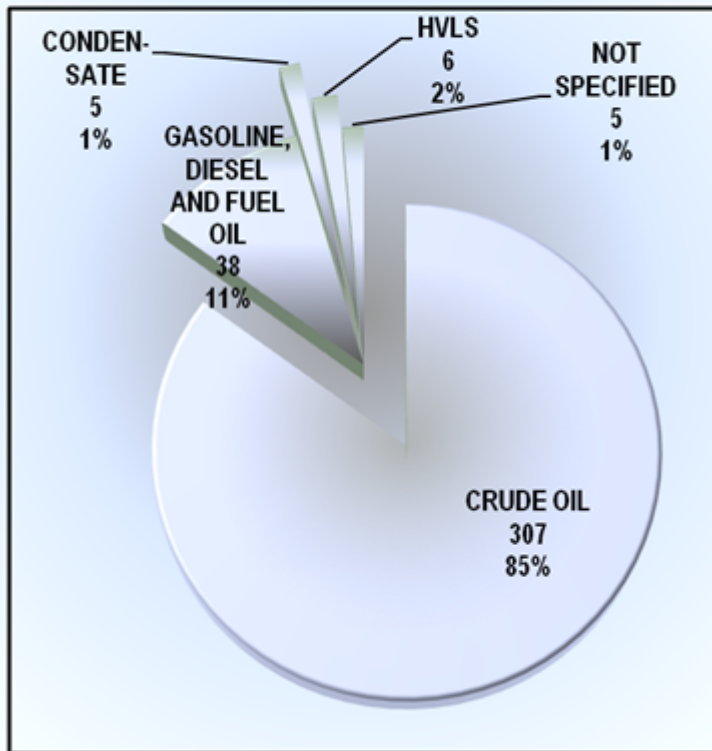
# CORROSION ACCIDENTS 1988-2008

ALL CORROSION ACCIDENTS  
TOTAL NUMBER ACCIDENTS: 1,240 1988-2008

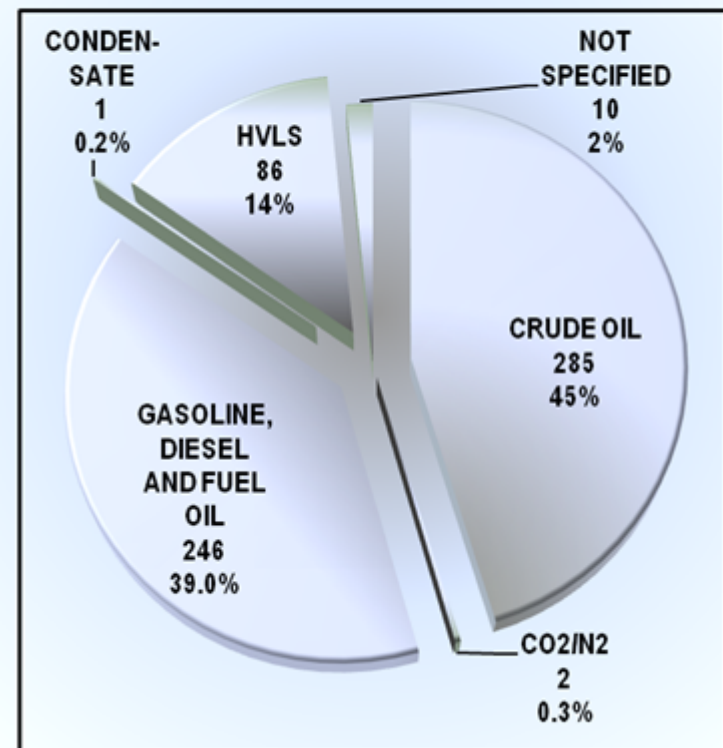


# CORROSION ACCIDENTS COMMODITY TRANSPORTED

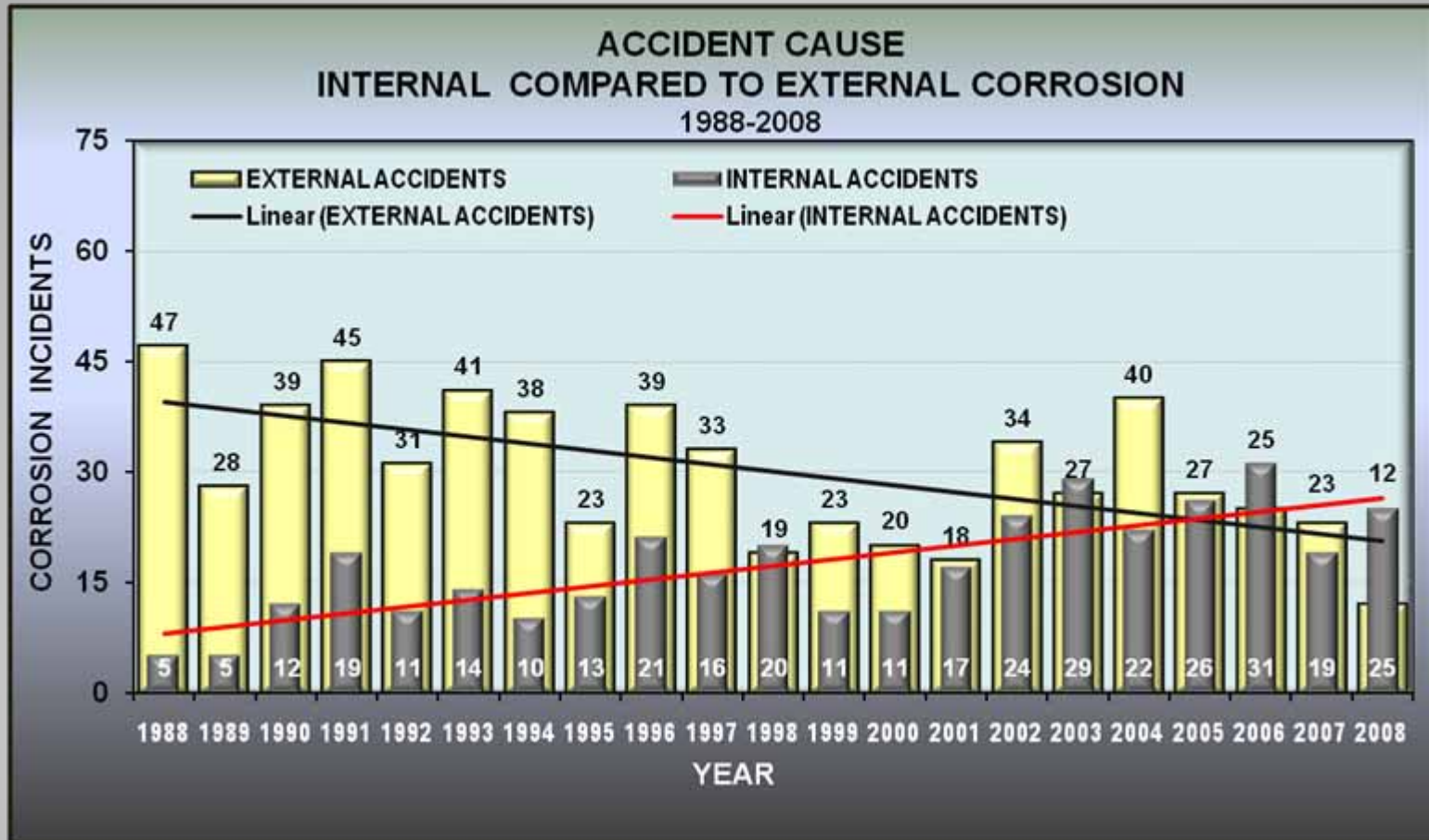
**INTERNAL CORROSION INCIDENTS  
COMMODITY TRANSPORTED  
1988-2008**



**EXTERNAL CORROSION INCIDENTS  
COMMODITY TRANSPORTED  
1988-2008**



# ALL CORROSION ACCIDENTS INTERNAL VS EXTERNAL 1988-2008



# INTERNAL CORROSION ACCIDENTS BARRELS RELEASED 1988-2008

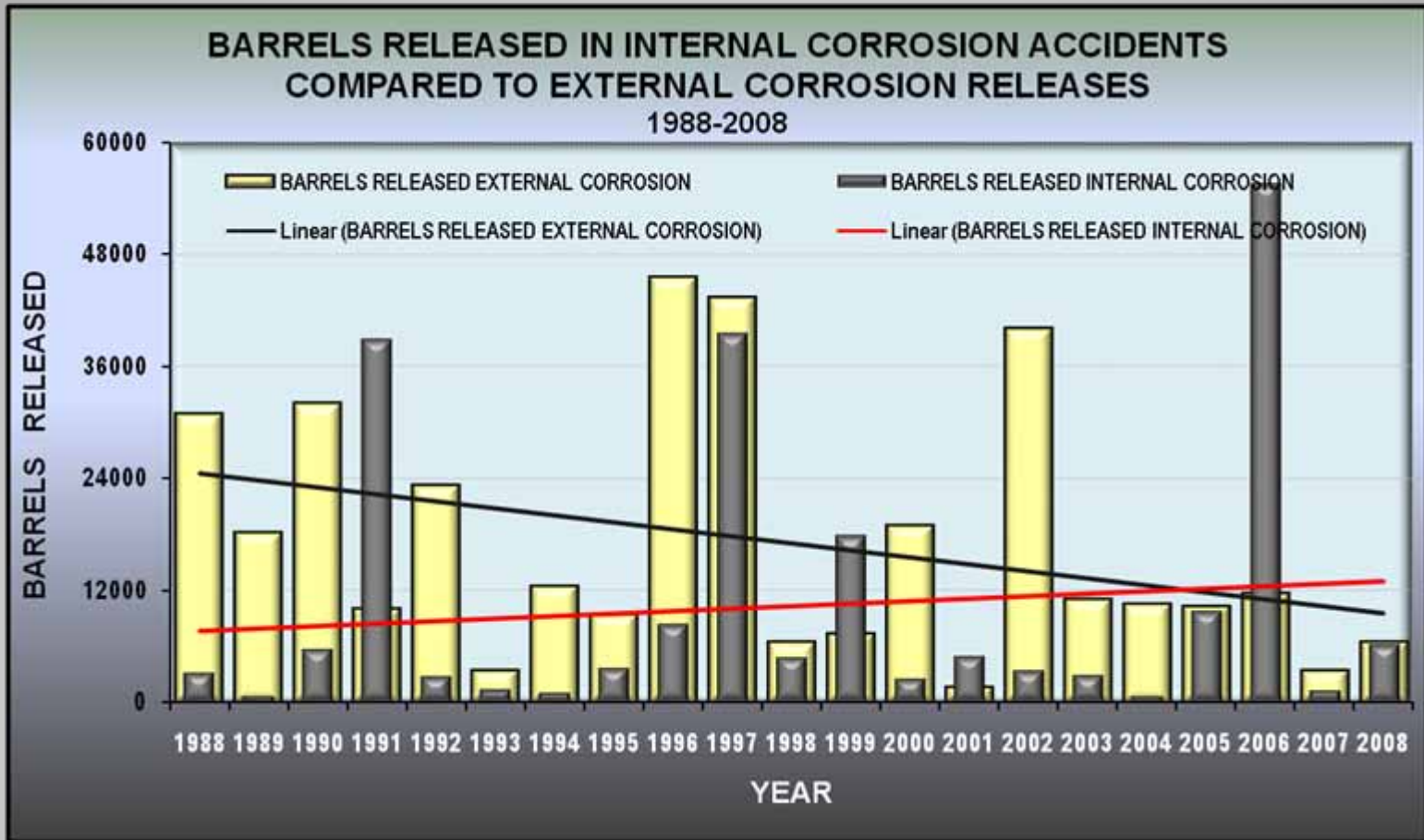
Over 217,000 barrels released as a result of internal corrosion accidents

Prudhoe Bay pipeline leak in March 2006, 4800 barrels released and 2 acres of tundra were affected



# BARRELS RELEASED

## INTERNAL VS EXTERNAL 1988-2008



# CURRENT REGULATIONS

## Subpart H

195.579 What must I do to mitigate internal corrosion?

- (a) General. If transporting corrosive product, must investigate effect and take adequate steps to mitigate.
- (b) Inhibitors. Does not require use of inhibitors. Requires use of coupons or other monitoring if inhibitors are used.





# CURRENT REGULATIONS

## Subpart H

195.579 What must I do to mitigate internal corrosion?

(c) Removal of pipe. Inspect for IC whenever pipe is removed.

Investigate further if 195.585 would require corrective action.

(d) Breakout tanks. Standards for tank bottoms.



# CURRENT REGULATIONS

## Subpart H

195.585 What must I do to correct corroded pipe?

Action required if remaining strength is insufficient for MOP or pitting is likely to result in leakage



# DETERMINATION OF CORROSION

- Required by 195.579(a)
- Need to consider other factors
  - Foreign material: water, contaminants, microbes
  - Impurities: sulfur, salts, acids, H<sub>2</sub>S
  - Pipeline design: flow, topography, low points
  - Upstream environment
- Document per 195.589(c)

# PHMSA EXPECTATIONS

## “Investigate” Corrosive Effect

- Investigate All Internal Corrosion Risk Factors
- Material being transported
  - Commodity
  - Foreign material/contaminants
    - Sand/silt
    - Water
    - Other contaminants that could cause IC
  - Sulfur, salts, acids, CO<sub>2</sub>
  - Microbes



# PHMSA EXPECTATION

## “Investigate” Corrosive Effect

- Investigate All Internal Corrosion Risk Factors
- Operating environment
  - Flow rate/ velocity
  - Operating pressure
  - Topography
  - Temperature
  - Pipe configuration, design, and material specifications

# PHMSA EXPECTATION

## “Investigate” Corrosive Effect

- Operating Conditions
  - Steady state
  - Slack line
  - Upsets (in pipeline and in upstream facilities)
- Any other circumstance or condition that could cause, promote, or increase the likelihood of internal corrosion

# PHMSA EXPECTATION

## “Investigate” Corrosive Effect

- Any significant change in risk factor must result in re-investigation of potential for internal corrosion
- Investigation results must be
  - Valid for current state of pipeline internal corrosion risk factors
  - Documented in accordance with 195.589(c)
  - Available for inspection

# PHMSA INSPECTION EXPERIENCE: OPERATOR INVESTIGATION OF CORROSIVE EFFECTS

- Lack of documentation
- Weak or nonexistent technical analysis
- No consideration for internal corrosion risk factors
- Does not consider ILI results that identify internal corrosion anomalies



# WORKSHOP GOALS

- Update on standards development
- Discussion on causes and history of internal corrosion accidents
- Current practices in managing internal corrosion threats
- Improving management of internal corrosion to better understand threat mechanisms and risk factors