Failure Investigation Forum

Partners In Pipeline Safety

December 13, 2022

Speakers

- Accident Trends and Recent Lessons Learned
  Brian Pierzina, PHMSA AID Accident Investigator
- NAPSR Overview
  Jon Wolfgram, NAPSR Chair
- Pipeline Safety Trust Update
  Bill Caram, Executive Director
- NTSB Update
  Sara Lyons, NTSB Accident Investigator
- Enforcement of Incidents and Accidents
  Rob Burrough, PHMSA Eastern Region Director

Accident Trends and Lessons Learned

Accident Investigation Division

December 13, 2022

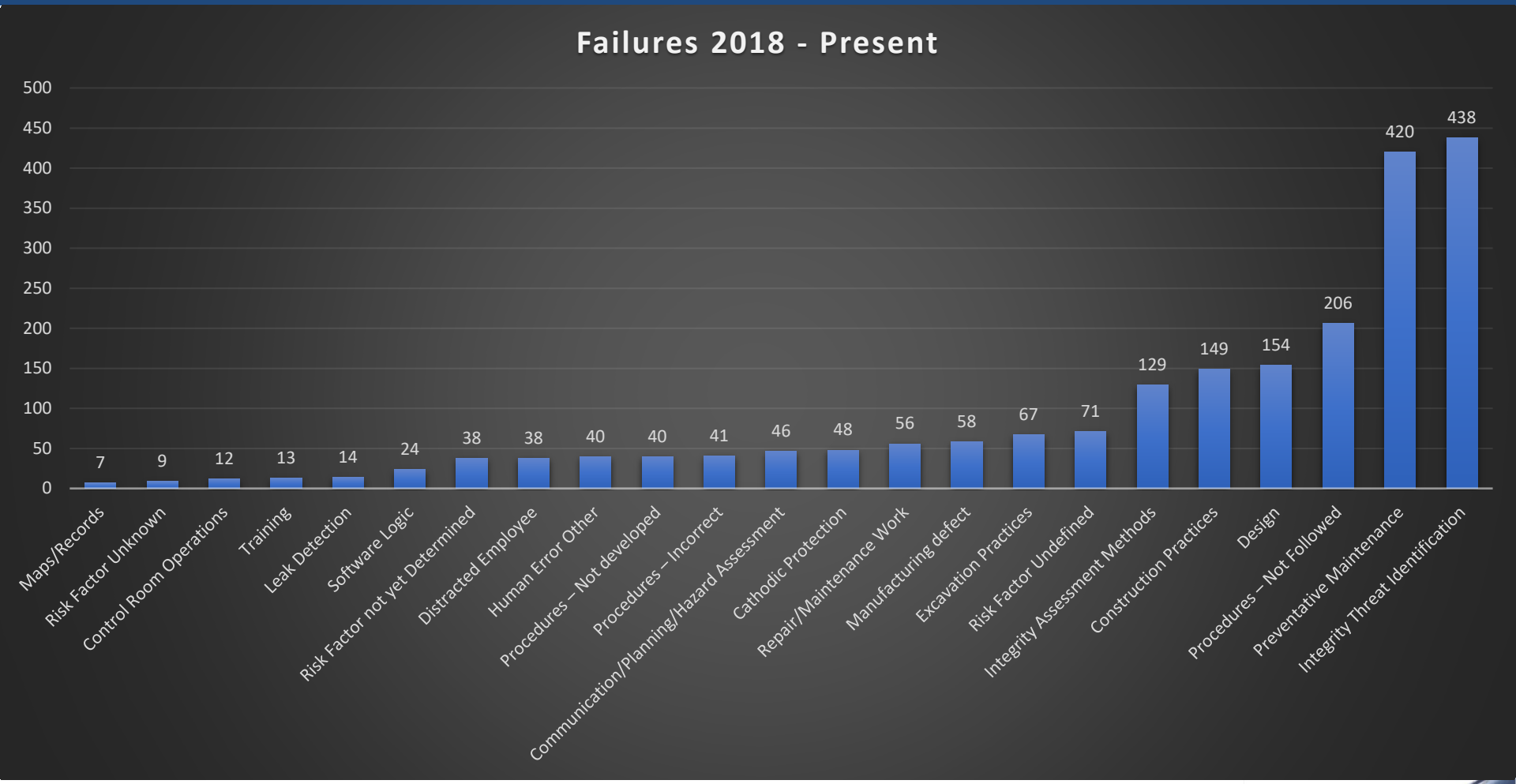
Discussion Topics

- Cause and Risk Factor Analysis – HELP TARGET RESOURCES
- Control Room Issues – THINK LEAK FIRST
- Integrity Assessment Concerns – ADD CONSERVATISM
- Excavation Damages – UNIQUE ISSUES WITH HDD

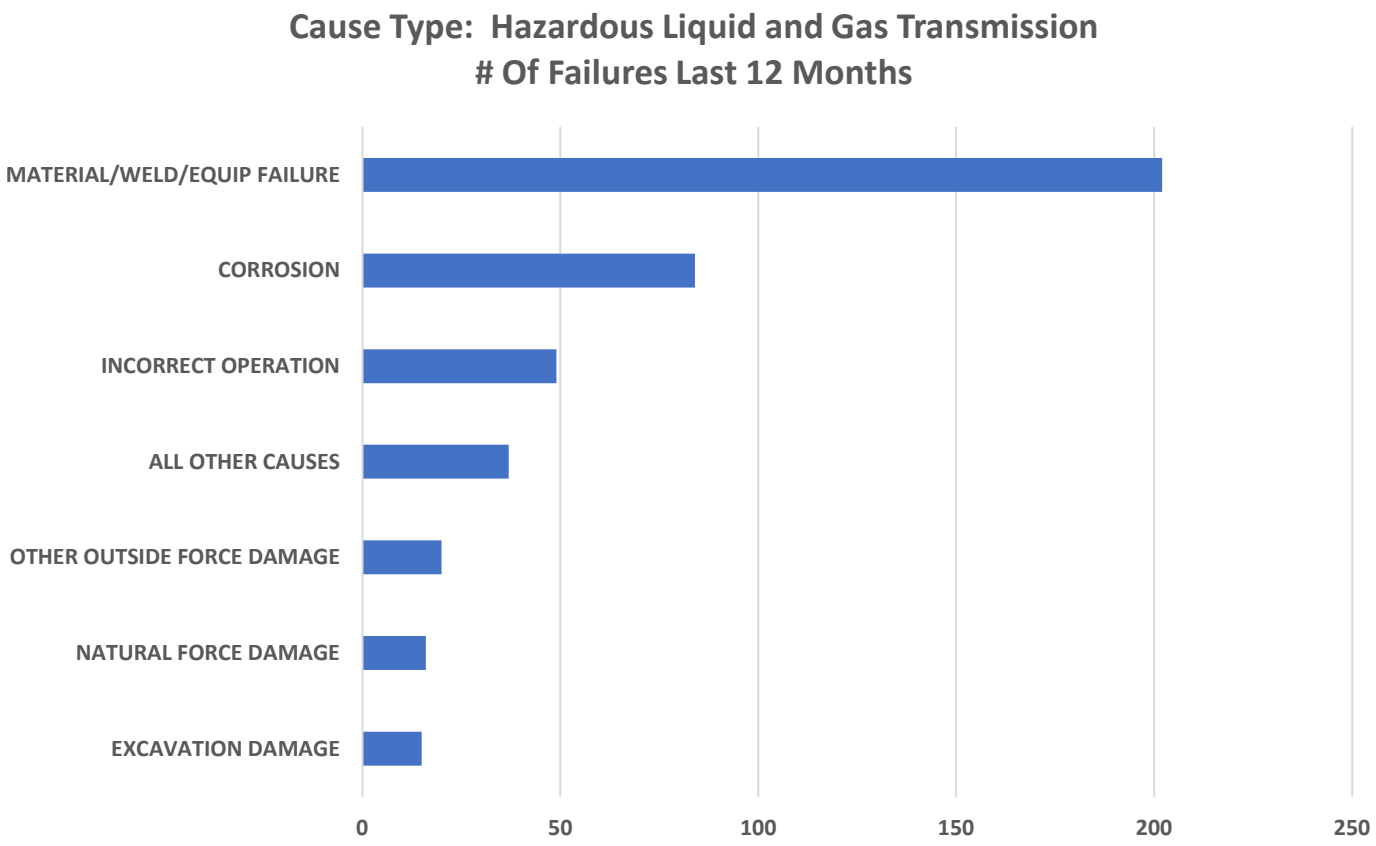
Risk Factors

Cathodic Protection	Communication/Hazard Assessment
Construction	Control Room
Design	Distracted Employee
Human Error	Integrity Assessment Methods
Integrity Threat Identification	Leak Detection
Manufacturing Defect	Maps/Records
Preventative Maintenance	Training
Repair/Maintenance Work	Software Logic
Procedures – Incorrect, Not Developed, or Not Followed	Risk Factor – Undefined, Unknown, or Not Yet Determined

All Risk Factors – All Products



30-Day Report Cause

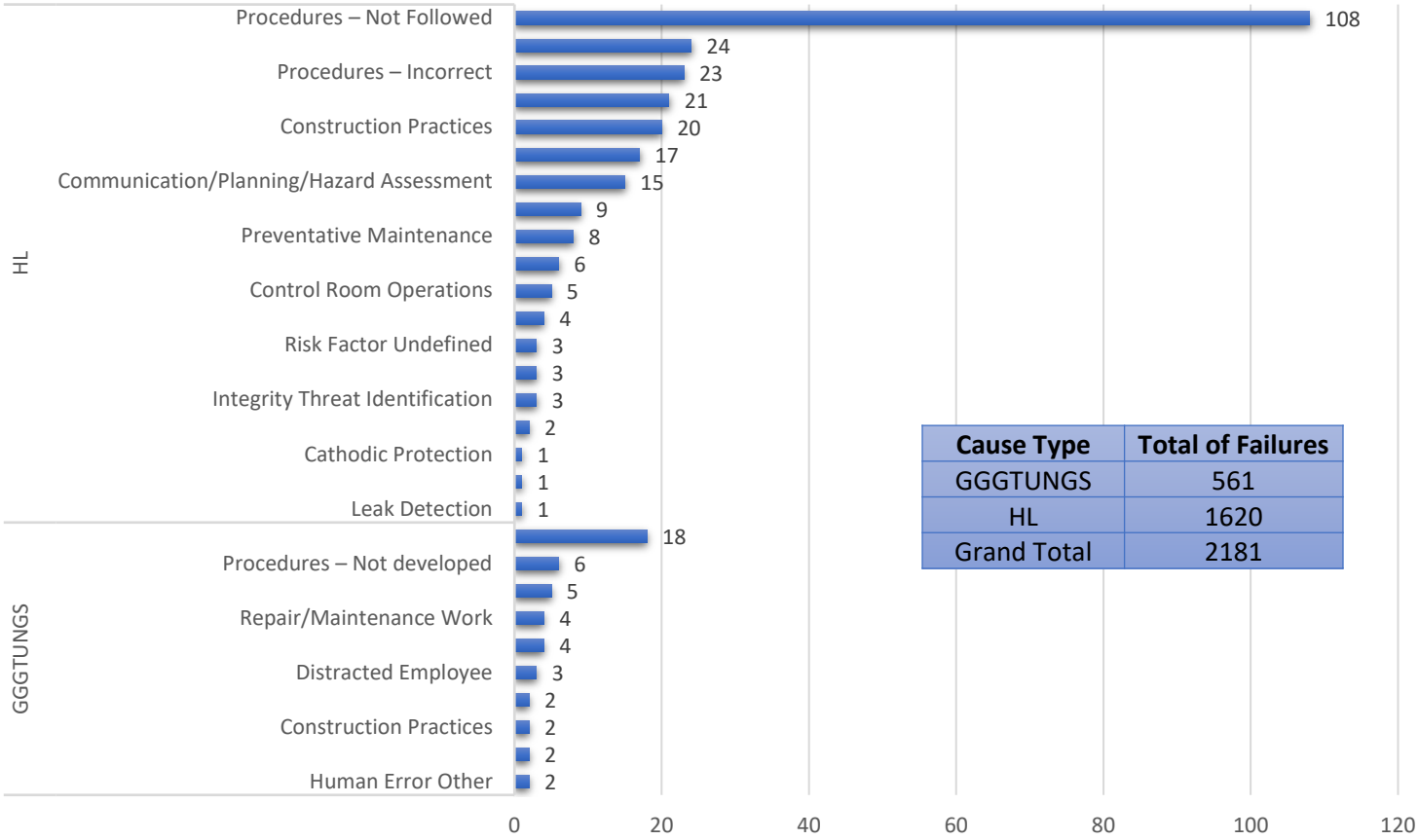


Drilling into the Risk Factors

While covering these please consider the following:

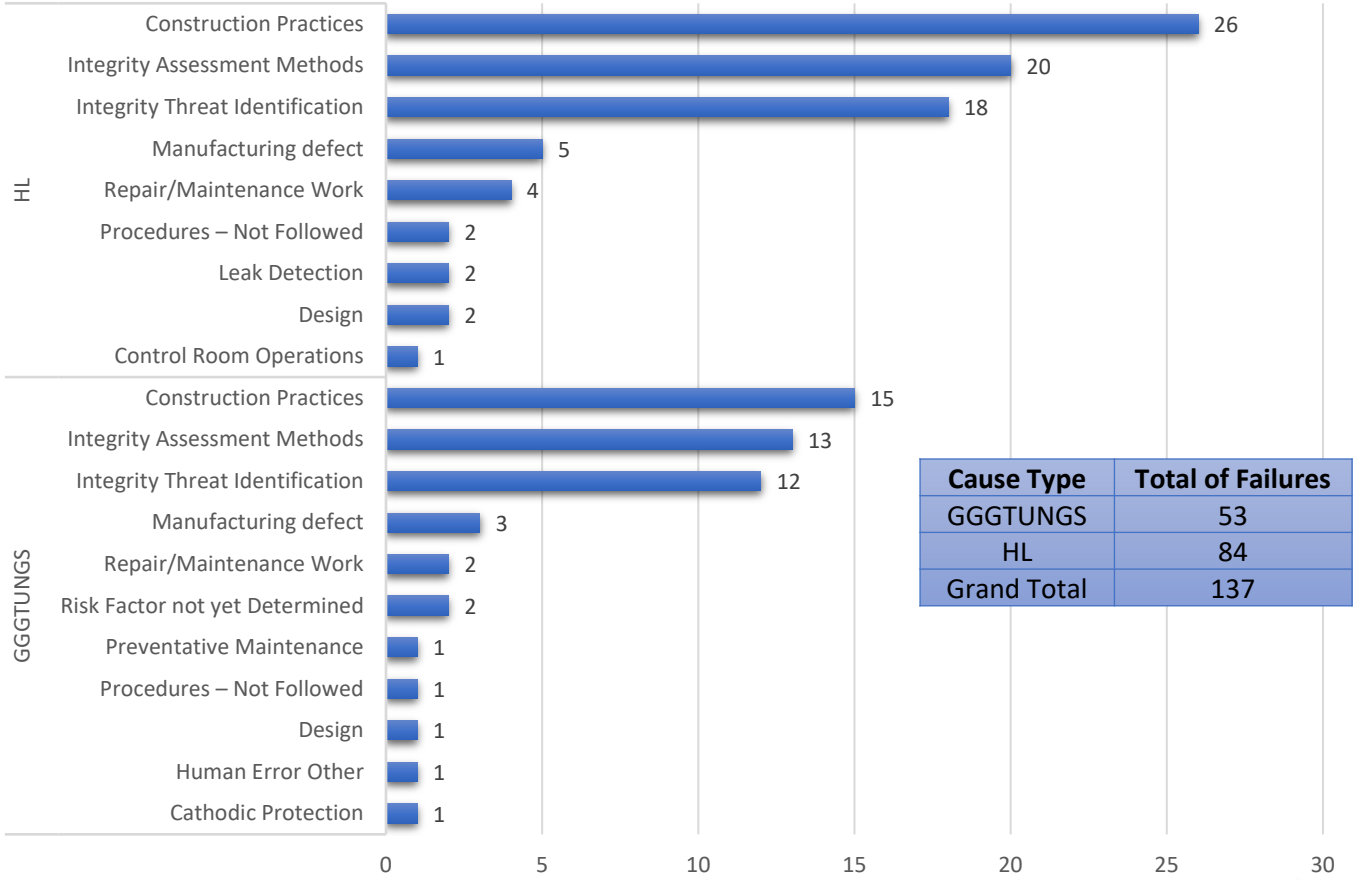
- How can we identify these Risks?
- Does the code address them adequately?
- Do established processes help identify these issues?
- Does your training teach employees to look for these?

Incorrect Operations – Risk Factors



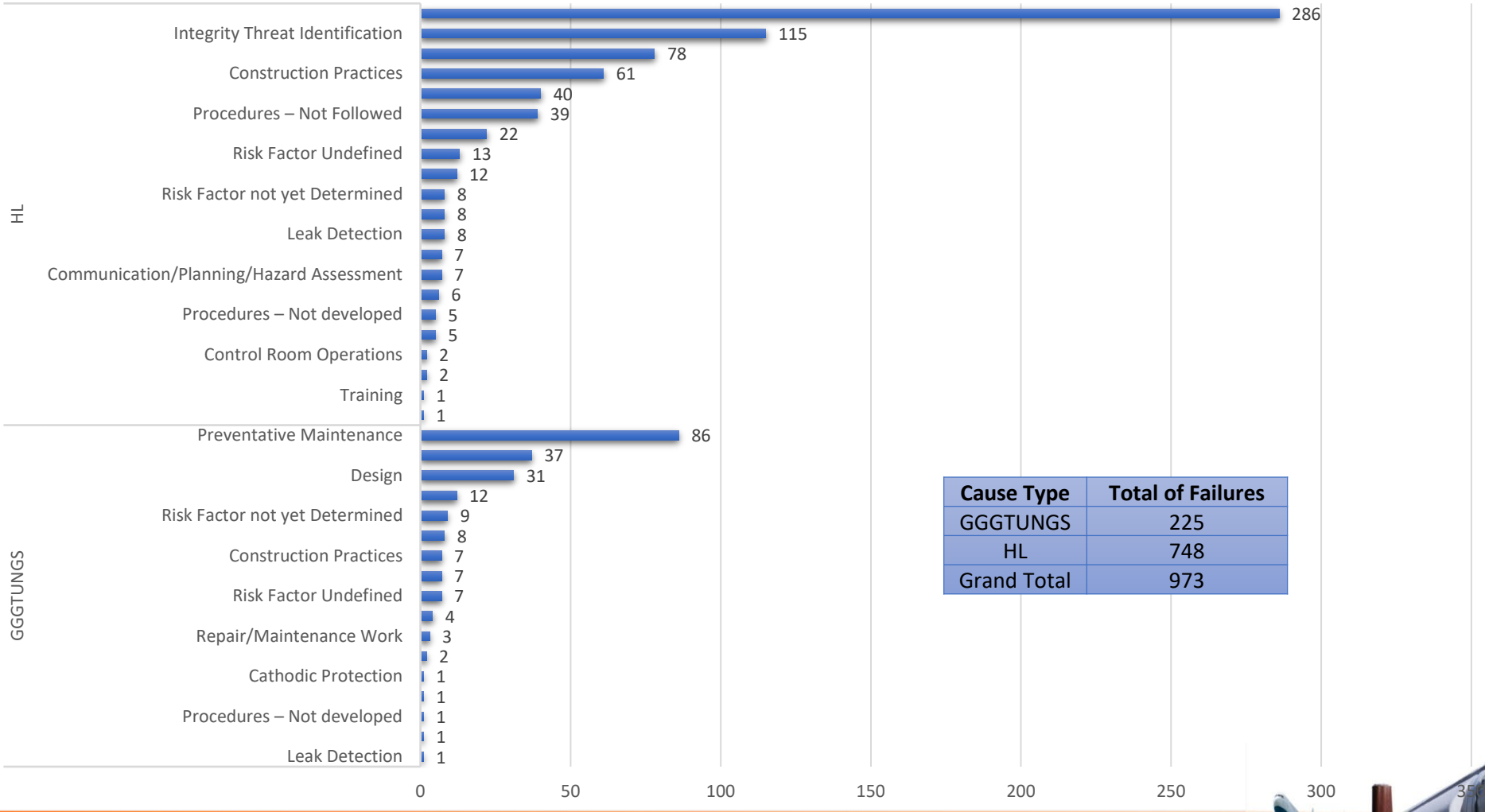
Cause Type	Total of Failures
GGGTUNGS	561
HL	1620
Grand Total	2181

Material Failure – Risk Factors

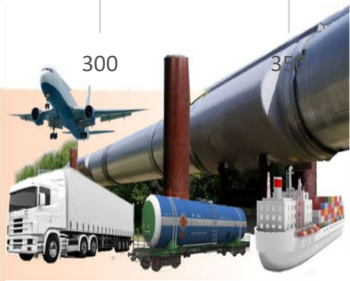


Cause Type	Total of Failures
GGGTUNGS	53
HL	84
Grand Total	137

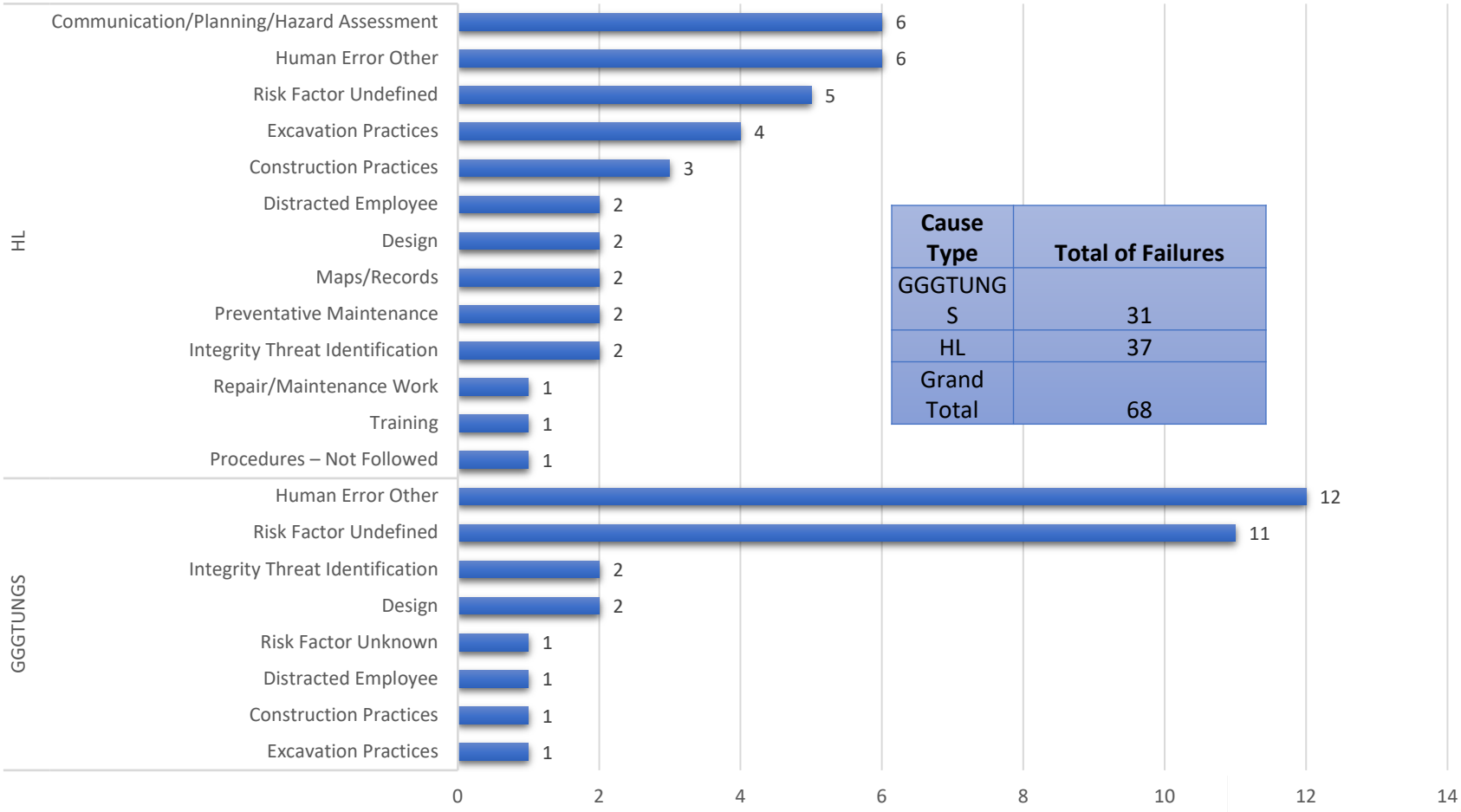
Equipment Failure Risk Factors



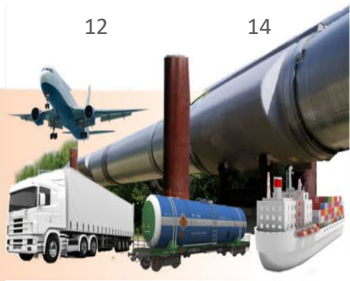
Cause Type	Total of Failures
GGGTUNGS	225
HL	748
Grand Total	973



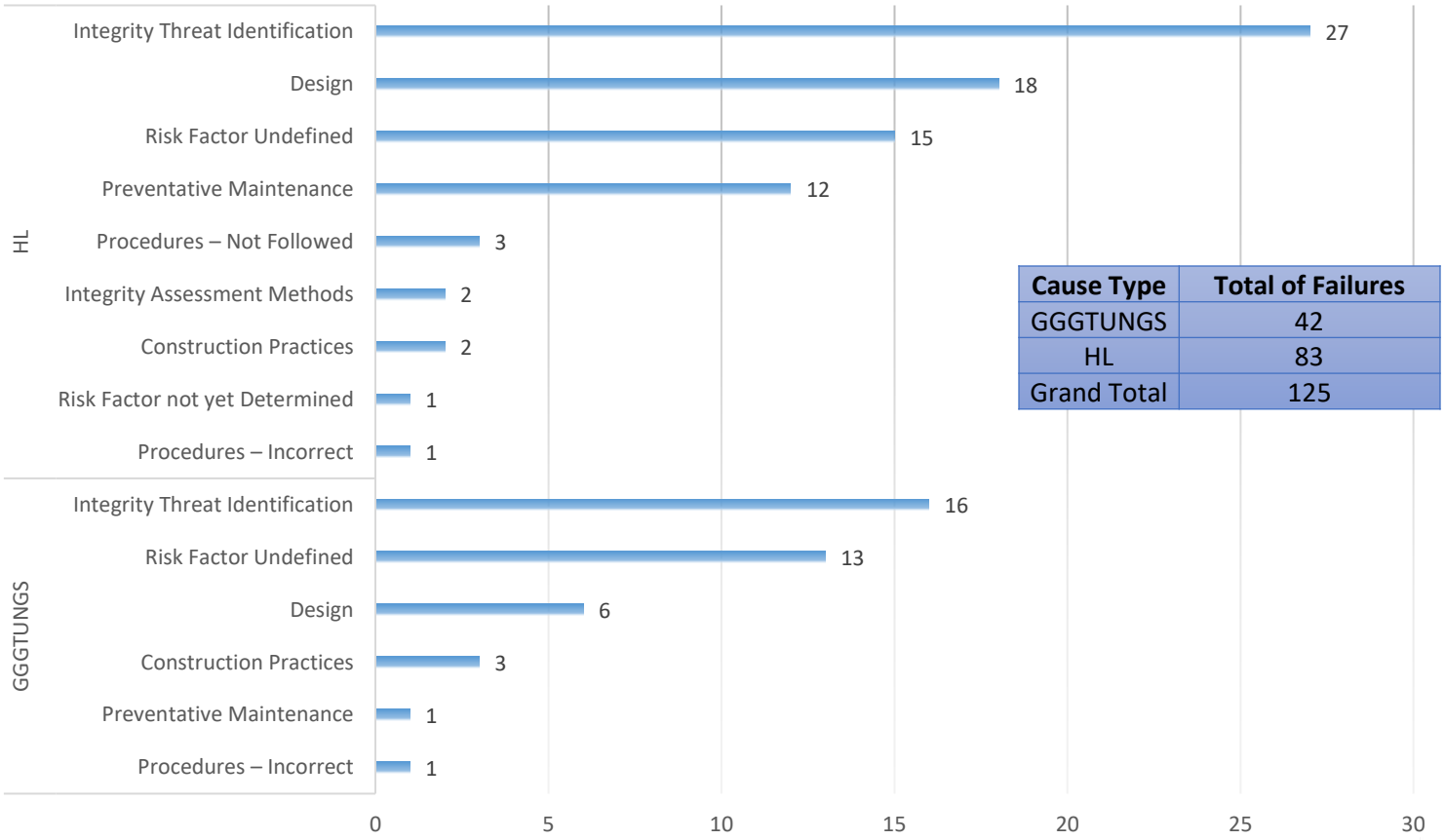
Outside Force Damage – Risk Factors



Cause Type	Total of Failures
GGGTUNGS	31
HL	37
Grand Total	68

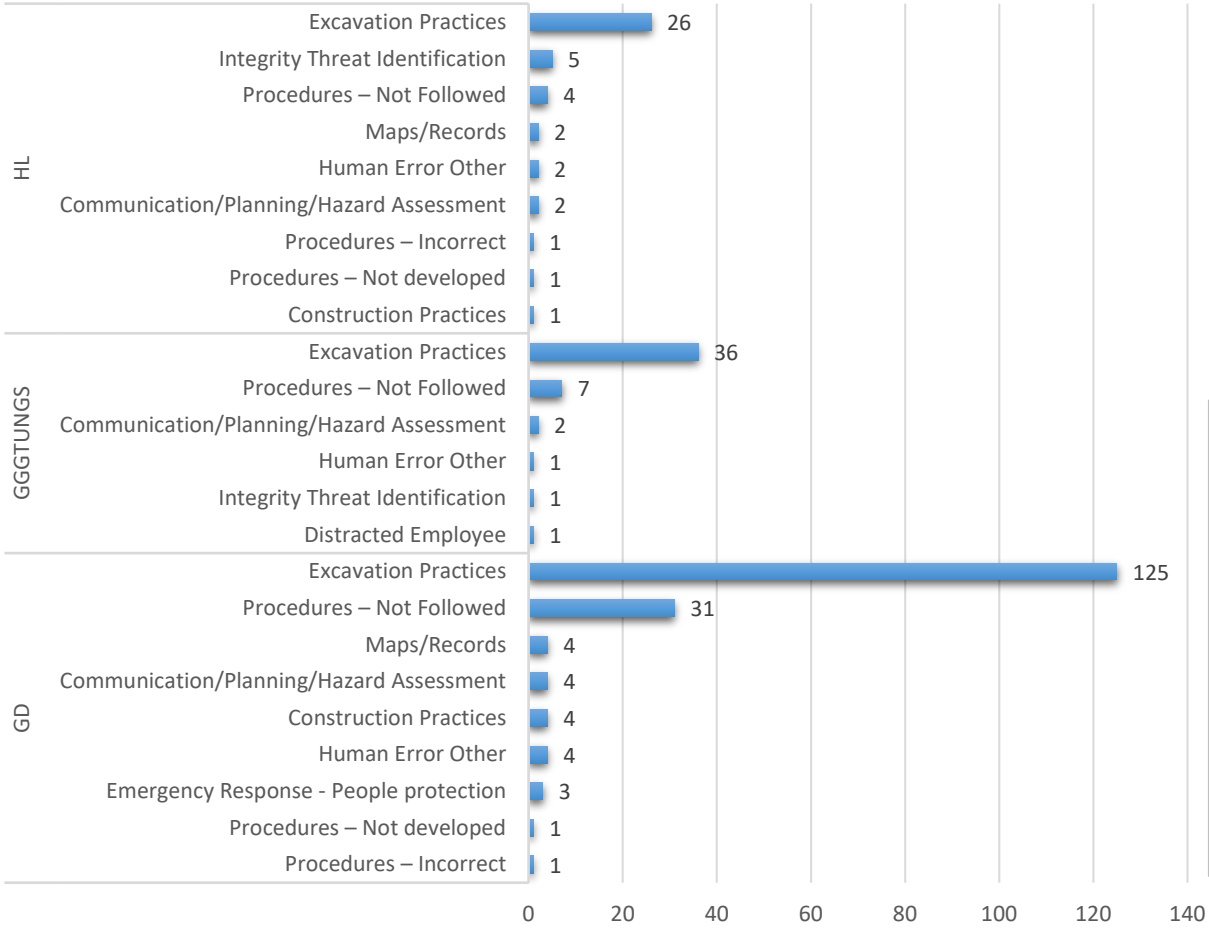


Natural Force Damage – Risk Factors

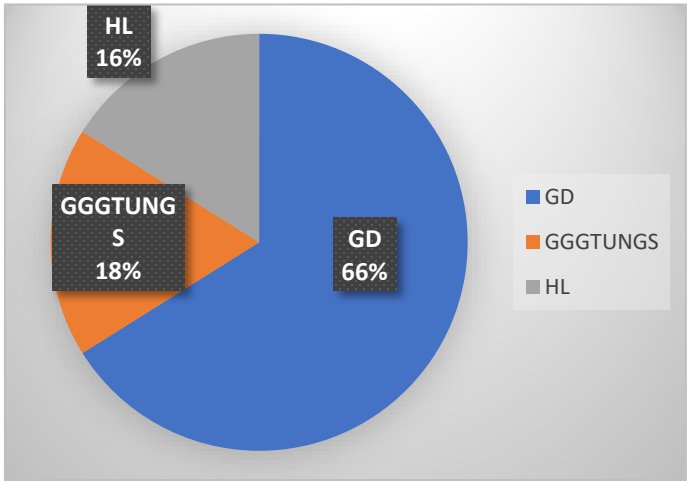


Cause Type	Total of Failures
GGGTUNGS	42
HL	83
Grand Total	125

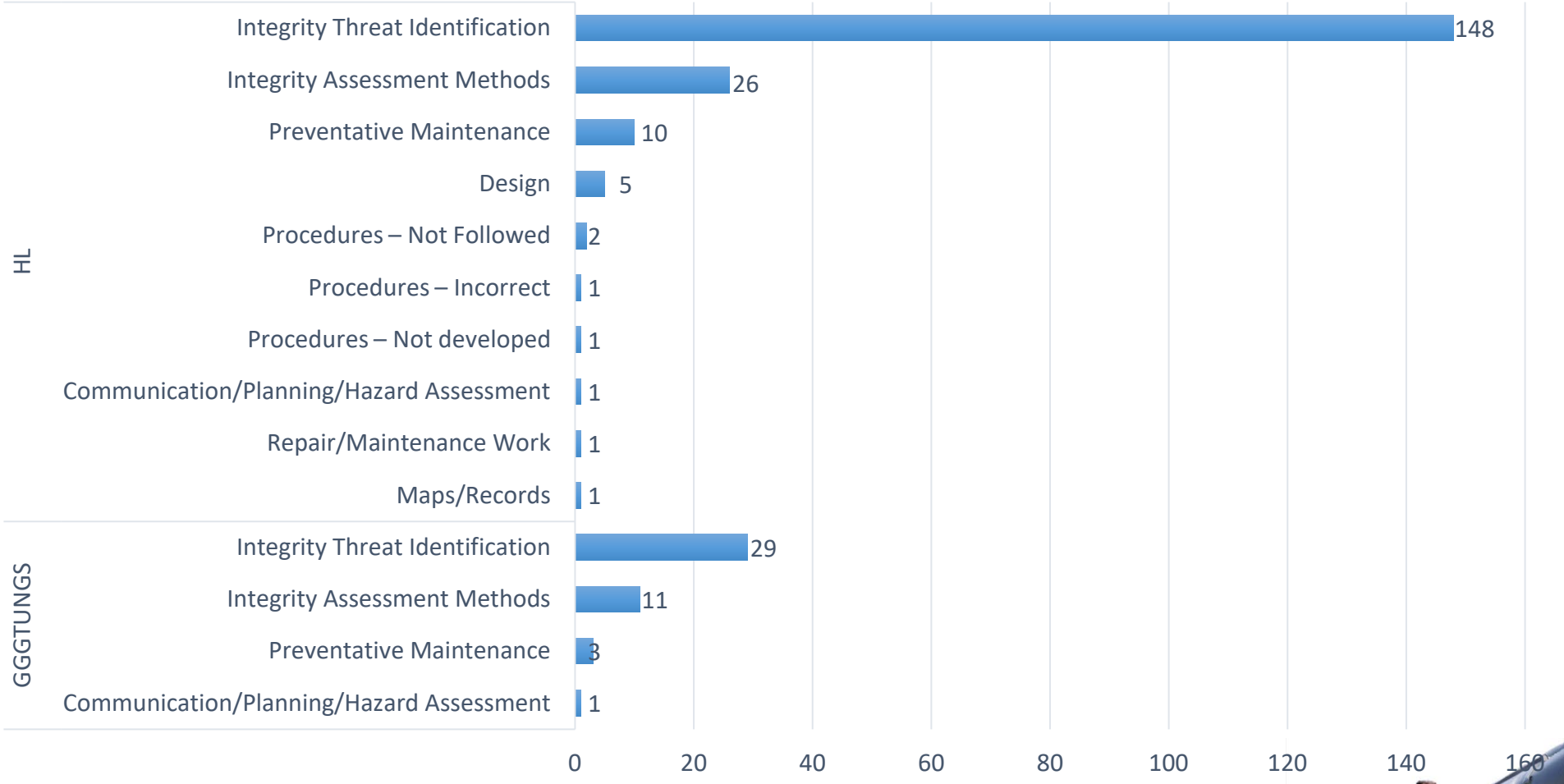
Excavation Damage Risk Factors



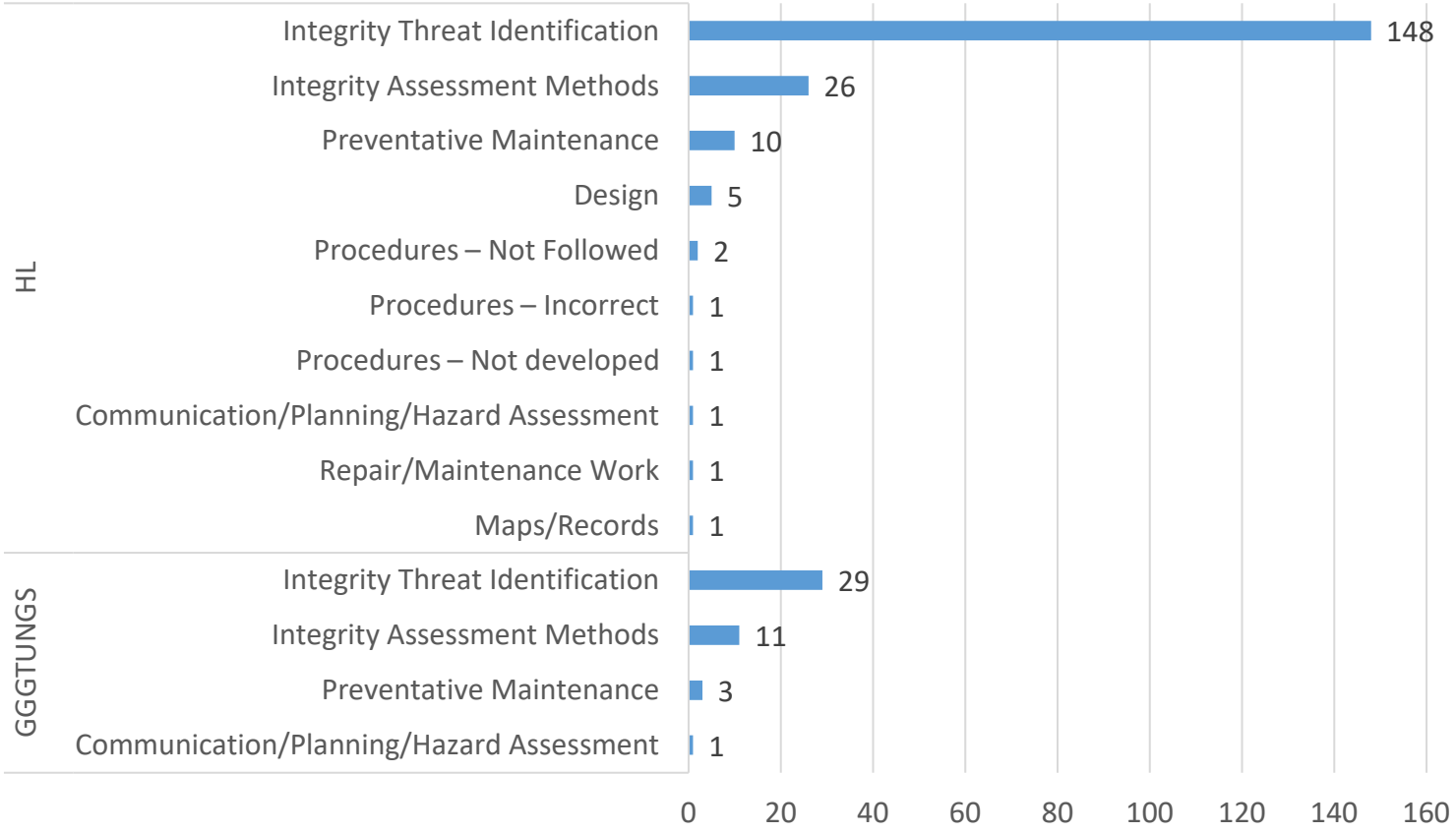
Cause Type	Total of Failures
GD	189
GGGTUNGS	51
HL	46
Grand Total	286



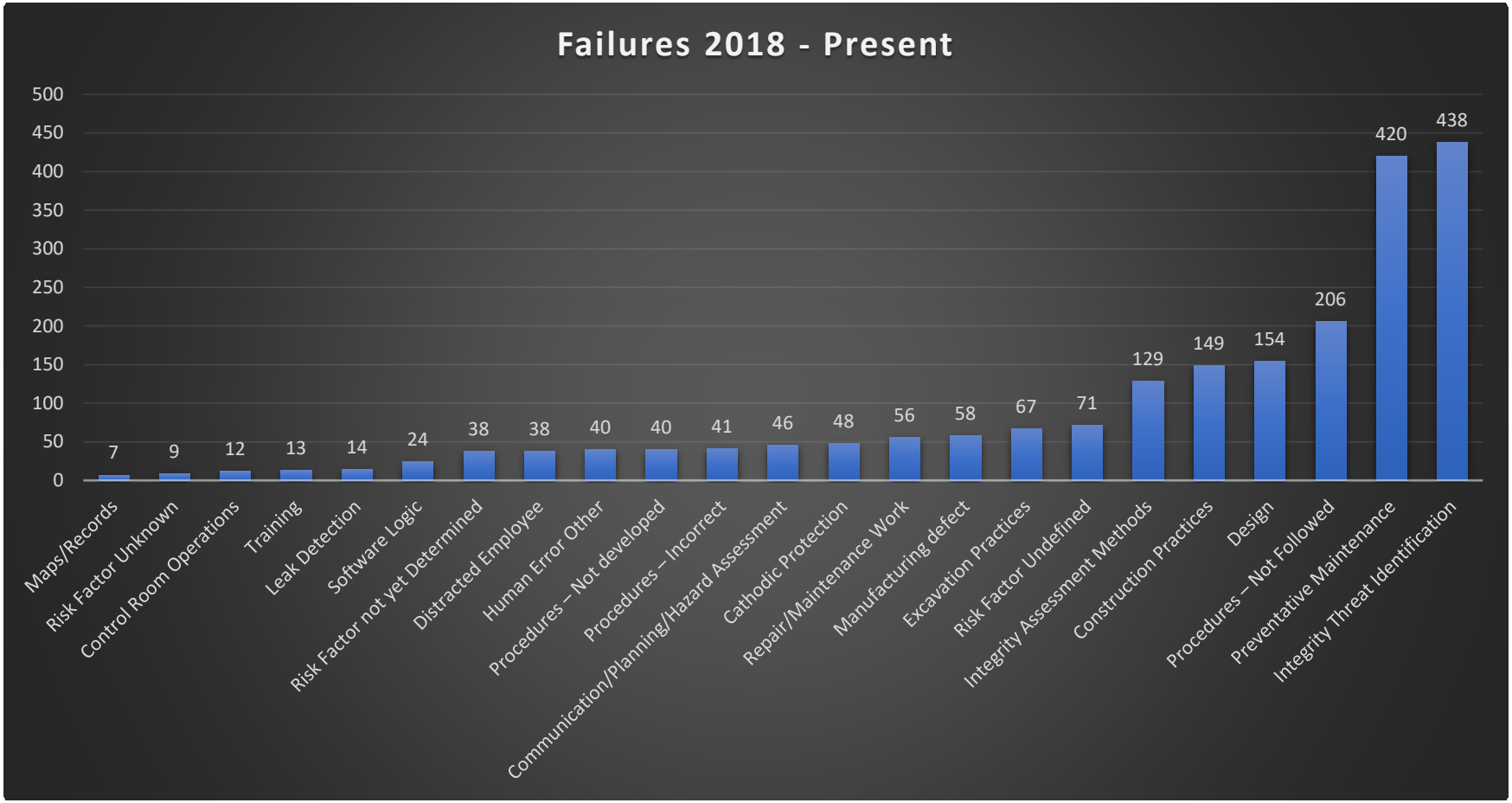
Internal Corrosion



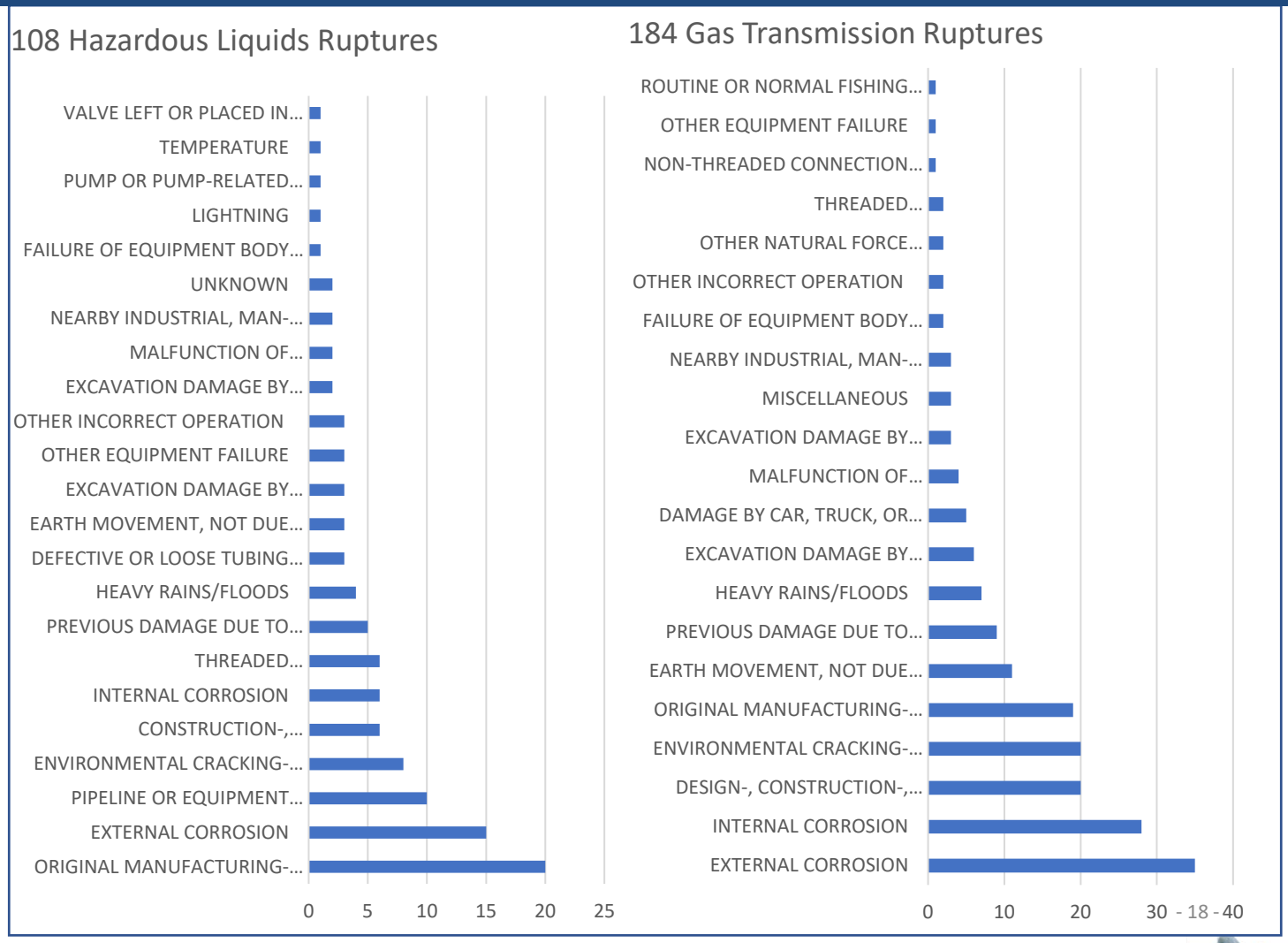
External Corrosion



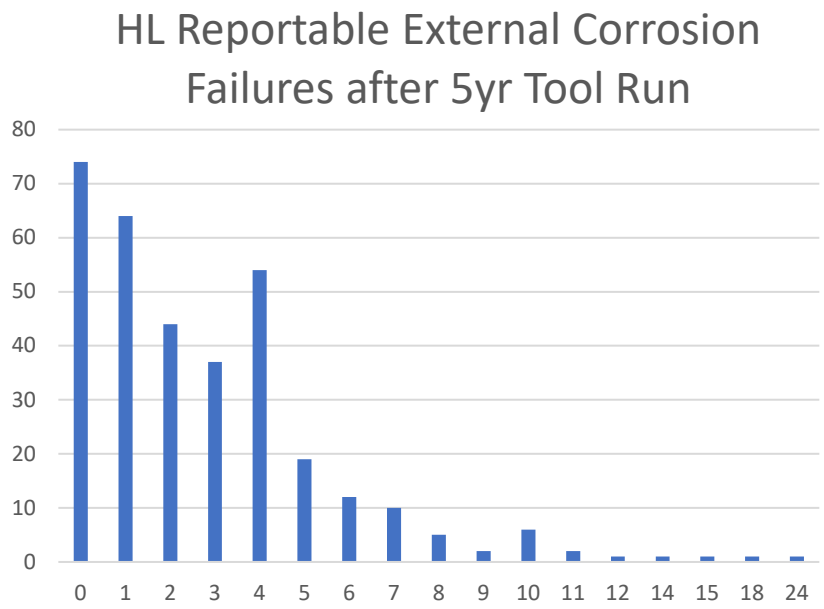
All Risk Factors – All Products

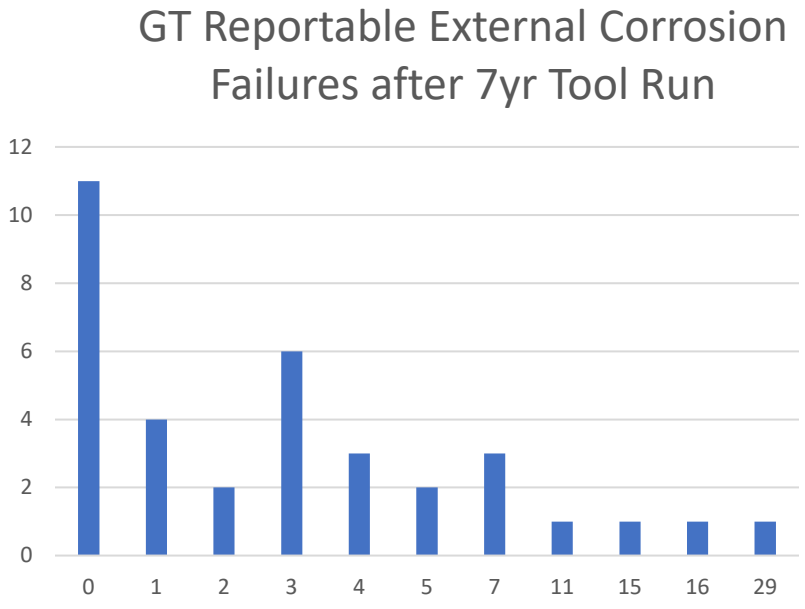


Evaluation of Failures that resulted in Ruptures

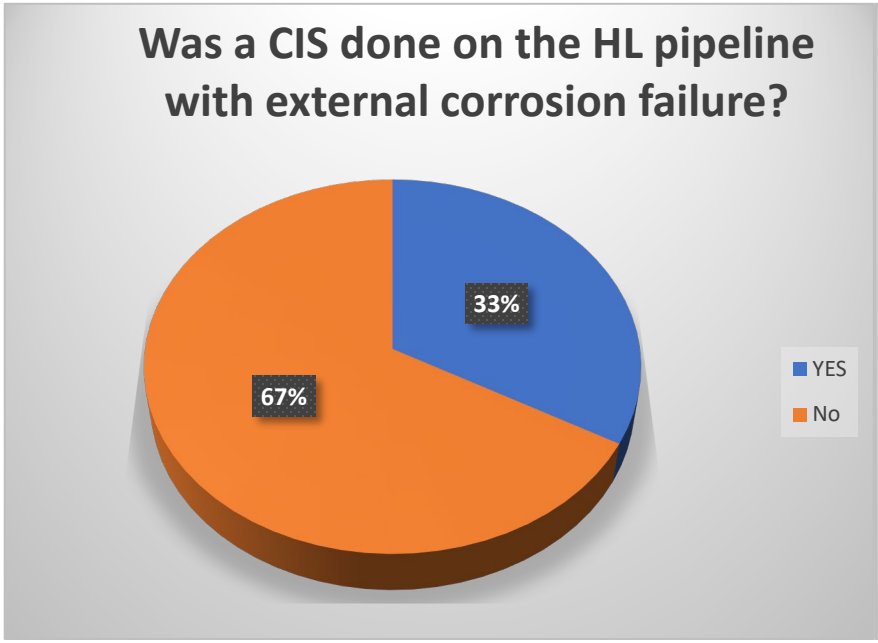


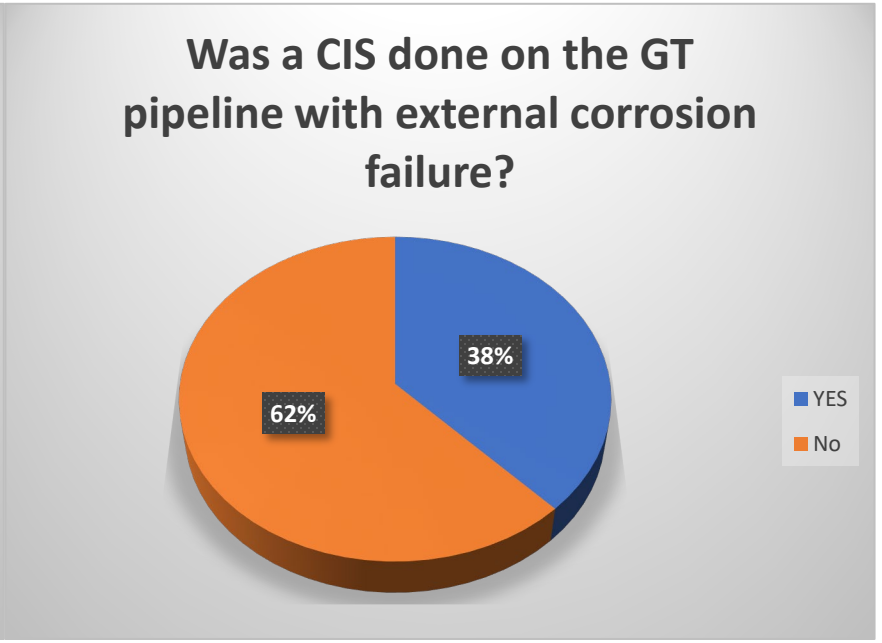
External Corrosion After Tool Run



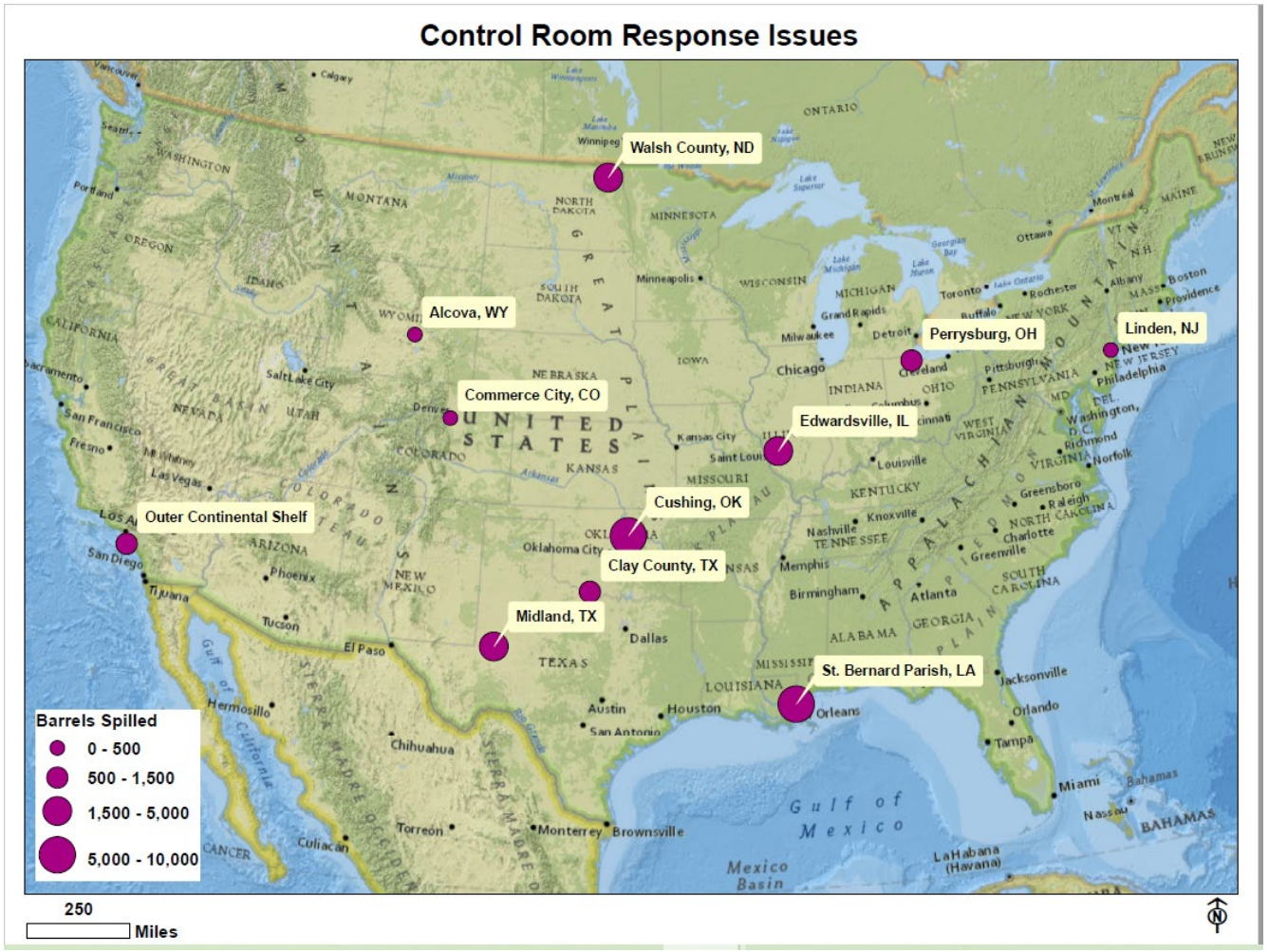


Close Interval Survey





Map of Recent Accidents were Control Room actions increase the consequence of the incident



Recent Control Room Examples

- July 10, 2019 – Wichita Falls, Texas – 1100 Barrels of Crude
  - 12-Inch pipeline failure due to Selective Seam Weld Corrosion
  - Low suction pressure alarms – initially thought to be a power glitch
  - Booster pump was started and ran for 2 minutes and 16 seconds

- October 29, 2019 – Edinburg, North Dakota – 4515 Barrels of Crude
  - 30-Inch pipeline failure due to longitudinal seam weld fatigue crack
  - Pump station shut down on low suction pressure
  - Accompanied by discharge pressure drop and increased flow rate
  - Controller attempted restart but stopped after 5 seconds

Recent Control Room Examples

- December 4, 2020 – Commerce City, Colorado – 487 Barrel Diesel Spill
  - 6-Inch pipeline failure due to Selective Seam Weld Corrosion and fatigue cracking
  - Flow and pressure alarms along with unintentional shutdown of downstream pump station
  - Controller shutdown the pipeline, but then re-started for 8 minutes before shutting down again

- March 16, 2021 – Linden, New Jersey – 353 Barrels of Unleaded Gasoline Released
  - 12-Inch pipeline rupture due to external corrosion
  - Uncommanded shutdown due to low suction pressure
  - High-High flow rate alarm and LDS Alarm
  - Controller suspected a control valve issue
  - Controller started booster pump but stopped after 30 seconds

Recent Control Room Examples

- October 1, 2021 – Long Beach, California – 588 Barrel Crude Oil Release
  - 16-Inch pipeline rupture due to mechanical damage (anchor drag) sustained months earlier
  - Atmos LDS alarms were valid – Personnel thought issues were related to an operational upset
  - Multiple shutdowns and restarts were performed while attempting to troubleshoot

- December 27, 2021 – Chalmette, Louisiana – 8325 Barrel Diesel Spill
  - 16-Inch pipeline rupture due to external corrosion
  - Uncommanded shutdown due to low suction pressure, multiple alarms
  - Controller suspected a control valve issue
  - Operations and troubleshooting w/ multiple alarms and restarts continued most of the day
  - Pipeline was finally shutdown and rupture location was identified almost 3 hours later

Recent Control Room Examples

- March 11, 2022 - Edwardsville, Illinois – 3900 Barrel Crude Oil Release
  - 22-Inch pipeline rupture at a girth weld due to creek-bed subsidence
  - Uncommanded Unit shutdown on low suction pressure
  - 2nd pump was started for a short time

- April 12, 2022 – Perrysburg, Ohio – 1225 Barrel Gasoline Spill
  - 10-Inch pipeline rupture due to external corrosion
  - Uncommanded shutdown – Unexplained pressure drop – Immediate spike in flow rate
  - Controller was concerned with LPG flashing at the end of the pipeline
  - Controller restarted the pipeline for 5 minutes before shutting down and isolating the pipeline

Recent Control Room Examples

- May 15, 2022 – Midland, Texas – 4800 Barrels of Crude
  - 10-Inch pipeline rupture due to a fillet weld failure on a split tee – likely due to bending stress
  - Volume imbalance was detected, but operations continued for almost 7 hours
  - Controller eventually shutdown the pipeline based on SCADA data and LDS alarm

- June 19, 2022 – Alcova, Wyoming – 500 Barrels of Crude
  - Tubing failure on a pump unit for a 10-inch pipeline
  - Atmos LDS alarm was received on June 19– Controller thought it was a "false alarm"
  - Controller thought it was due to start-up of an intermediate pump
  - Pipeline was not shutdown until 8 hours later

Recent Control Room Examples

- July 7, 2022 – Cushing, Oklahoma – 5768 Barrel Crude Oil Release
  - 20-Inch pipeline rupture due to a longitudinal seam defect
  - Pipeline was restarted after an uncommanded shutdown on low suction pressure

High-Level Observations

- No apparent connection between
  - Operators
  - Procedures
  - Controllers

- Solution may include
  - Improve training and utilization of simulations
  - Better understanding of and response to abnormal operating conditions
  - One way or the other – get people to **THINK LEAK FIRST**

In-Service Rupture of an ILI Reported Defect

- ILI Reported Anomaly
- Downgraded Using Dig History
- Inadequate Pressure Reduction
- Rupture Prior to Repair

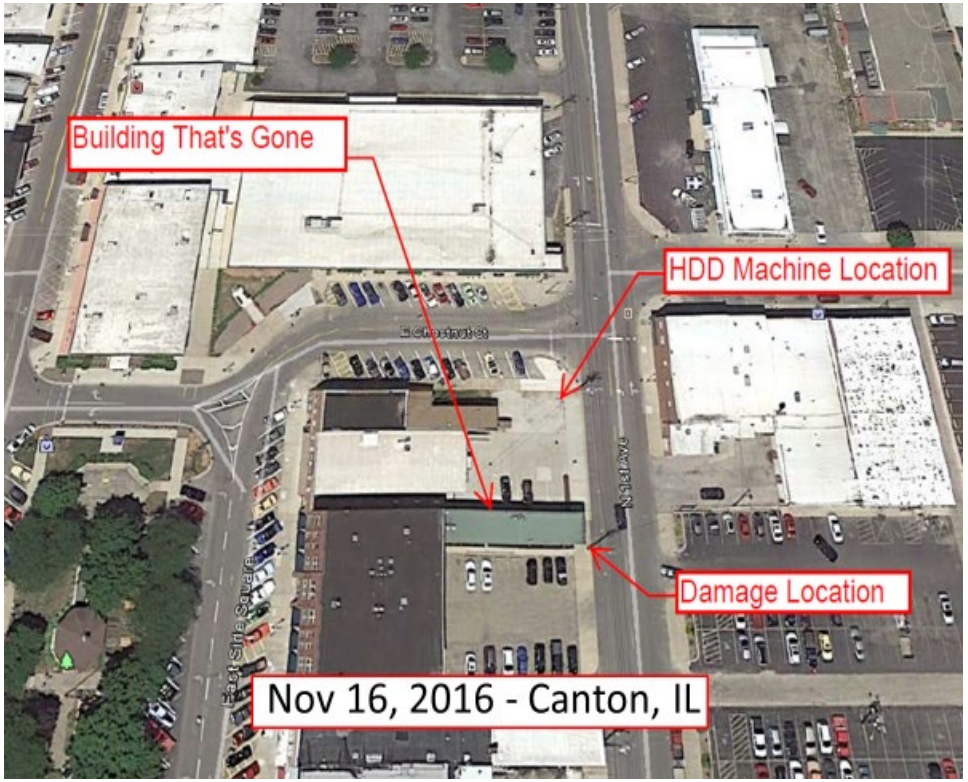
Natural Gas Transmission Rupture

- Rupture Defect Identified by ILI
- Not Actionable as Reported
- Corrosion Growth Rate Unknown
- Anomaly Interaction was Non-Conservative

Why Are We Missing These?

- Anomaly Interaction Criteria
  - Treated as Individual Defects When They Actually Combine
  - We Can Prevent Failures by Adding Conservatism
- Frequency
  - Are we Seeing a “Just in Time” Mentality?
  - Maybe Frequency Should Depend on What we Know/Don’t Know
- Outliers
  - What Affects ILI Accuracy?
- Overconfidence
  - Tool Accuracy
  - Failure Pressure Calculations

Excavation Damage Due to HDD



A Small Service Line!

- Damage to a 1-inch PE service line
- 911 Not Contacted Immediately
- Gas Company was On-site
- 1 Fatality - 12 Injuries
- Approximately 2-Hours until Explosion

Excavation Damage Due to HDD

THERE'S A LOT OF THIS GOING ON!

- Cable installation using HDD
- Damaged 2-inch main
- 2 Fatalities, 5 Reportable Injuries
- Over $20 million in damages
- Approximately one hour from damage to ignition

Trenchless Technology

- Unique characteristics of HDD increase the potential consequences of damage
  - Typically, congested areas/pavement
  - Gas migration vs. direct to atmosphere
  - Release isolation complexity increases
  - Are emergency procedures adequate? Isolation Plan?

Considerations

- Require visual verification (Daylighting) of crossings
- Evaluate one-calls for HDD – Know Where They're Crossing You – Know Who's Doing the Work – Know They Excavate Safely
- Pre-Plan Emergency Response for Each Known Crossing
- Treat Every Single Crossing Knowing Lives Are in the Balance
- Train Personnel on the Special Concerns with HDD

Emergency Response – Lessons Learned

- Many High Consequence Failures Show Ineffective Emergency Response
- The Cause of the Release isn't always the Story – 80,000 vs 50
- Does the Inherent Safety of Gas result in Complacency? Bad Practices? Overconfidence?
- Are Your Procedures Clearly - Written?? Understood?? Followed??
- TWO BIG THINGS - Use your CGIs – Isolate a Safe Distance From the Release