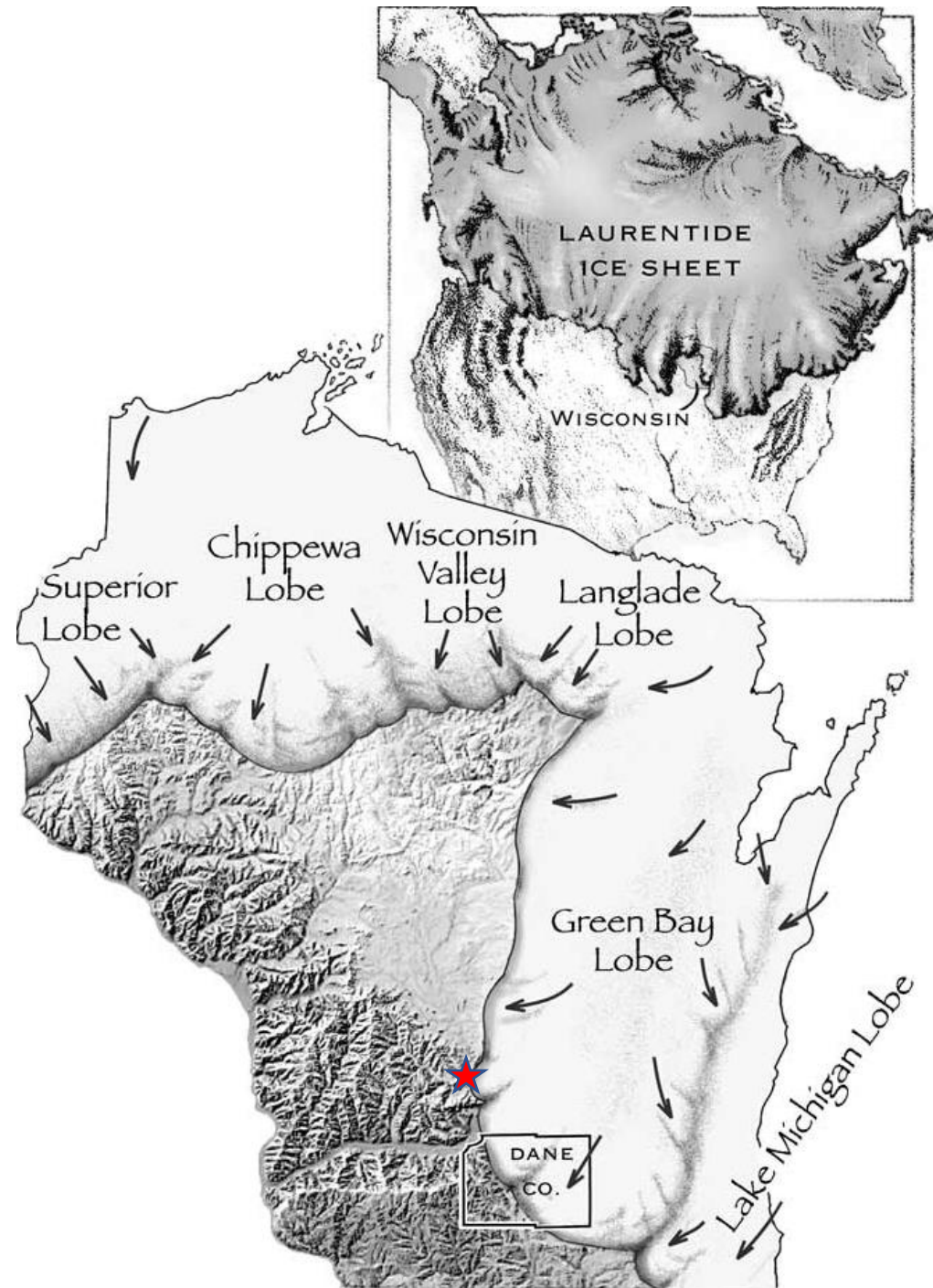


WI-PSC Conference February 2024

Accident Investigation
Division (AID)

Darren Lemmerman,



Outline

- **Who is AID?**
- **State of the State**
- **National Accident/Incident Trends**
- **Atmos Dallas Case Study**



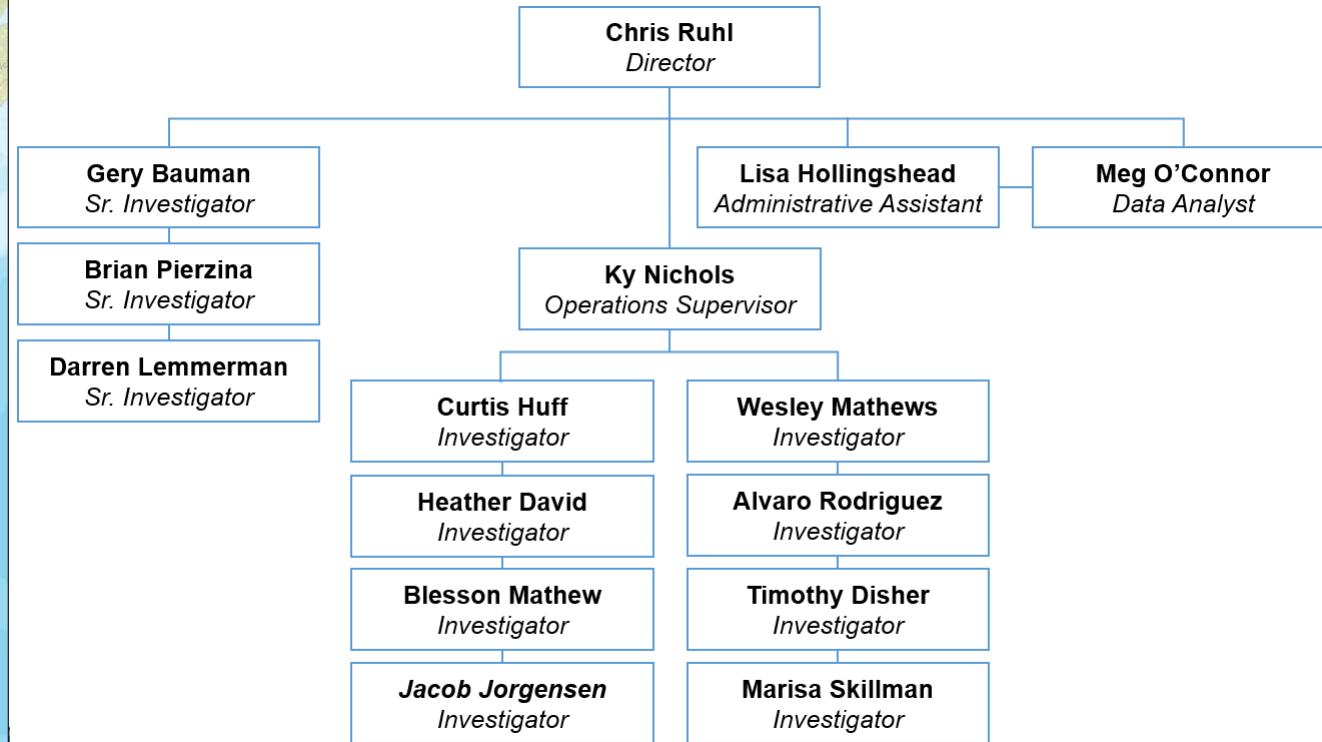
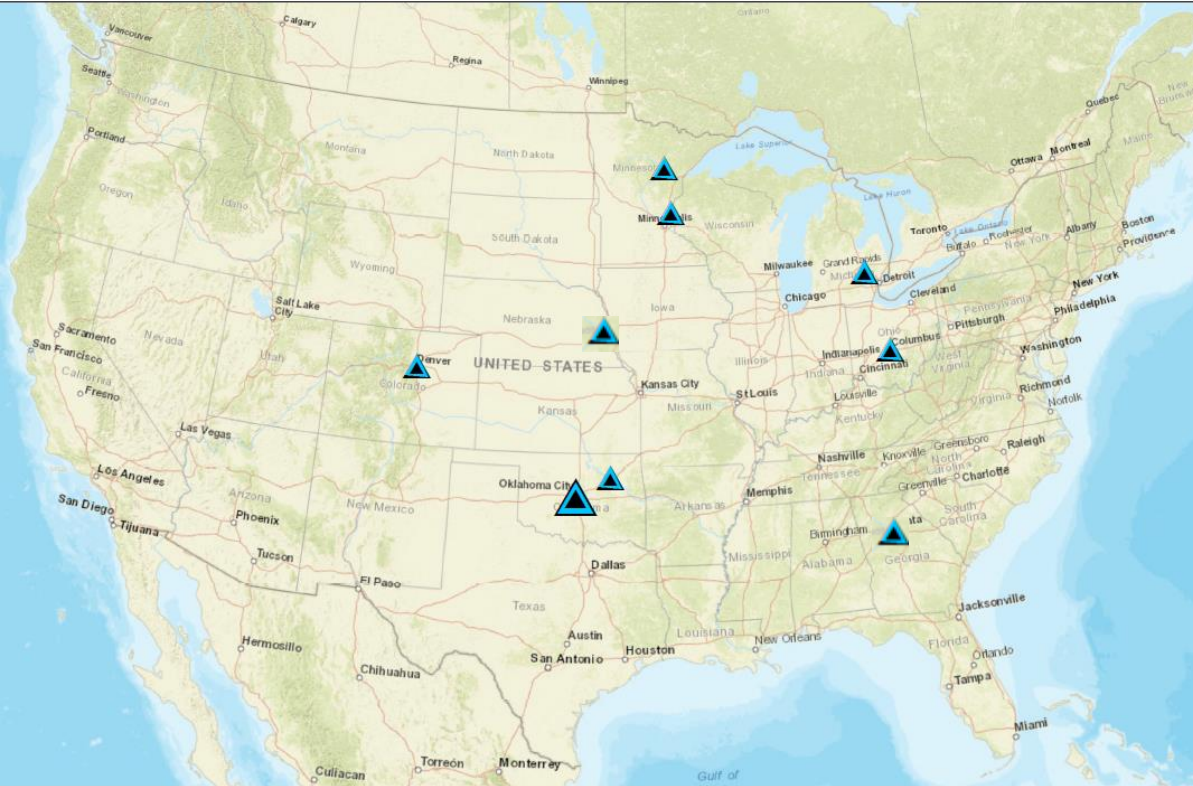
Accident Investigation Division



- Director, Chris Ruhl
- Operations Supervisor, Ky Nichols
- Investigators:
 - Brian Pierzina (MN)
 - Darren Lemmerman (MN)
 - Gery Bauman (OH)
 - Curtis Huff (OK)
 - Wesley Mathews (OK)
 - Alvaro Rodriguez (CO)
 - Heather David (MI)
 - Timothy Disher (NE)
 - Besson Mathew (GA)
 - Jacob Jorgenson (MN)
 - Marisa Skillman (MI)
- Data Analyst, Meg O'Connor
- Administrative Assistant, Lisa Hollingshead



Accident Investigation Division



Accident Investigation Division

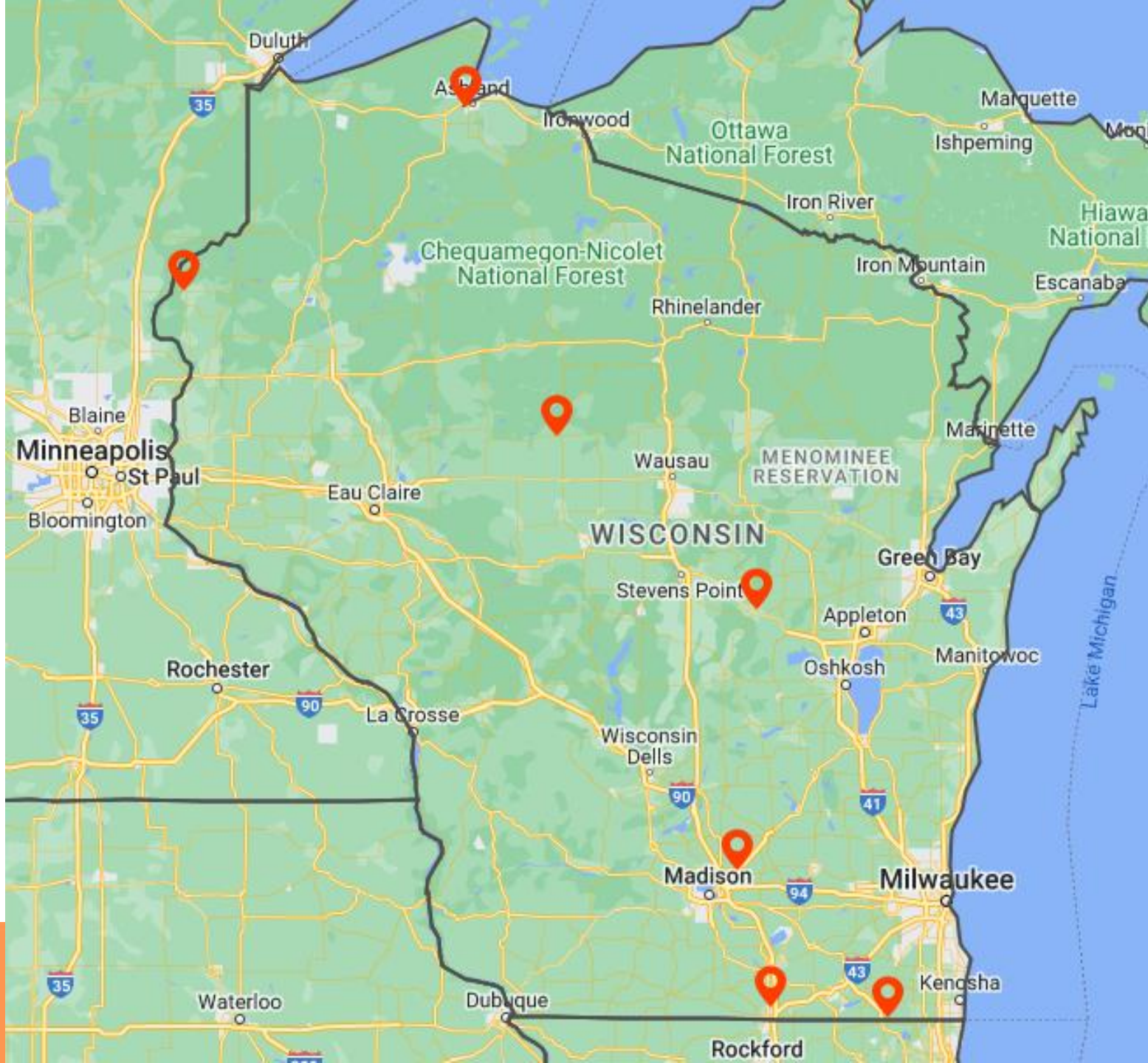
- AID was established on April 1, 2017
- Review, Evaluate, and Circulate NRC Notifications
- Manage Investigation from Initial NRC Notification through Cause Determination
- Conduct Onsite Accident Investigations: Support NTSB and State Investigations
- Oversee Operator 30-Day Accident/Incident Reports
- Publish State and Federal Monthly Accident Report Summaries (SMARS/MARS)
- Analyze Data to Identify Emerging Trends
- Capture and Share Lessons Learned (SAFE Bulletins, State Conferences, etc.)



State-of-the-State

- **Wisconsin has had 7 reportable events in the last 13 years.**
- **Normalized by the number of services, Wisconsin has the BEST safety record for reportable incidents in the USA!!!!!!!**
- **You should applaud yourselves for this GREAT feat.**





State-of-the-State

WI-Stats – normalized

- **No Cast Iron!!!!**
- **28th for the most unknown service line materials**
- **7th for the most unknown main material**
- **7th for the least number of unfixed main leaks (good)**
- **35th for the least number of unfixed service leaks**

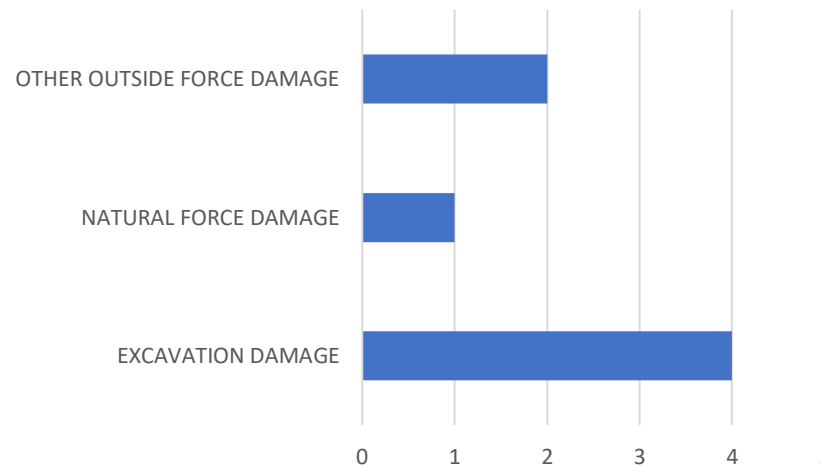


State-of-the-State

WI-Stats

- **Whats does a house fire, lightening, vehicle impact and no excavation notices have in common?**

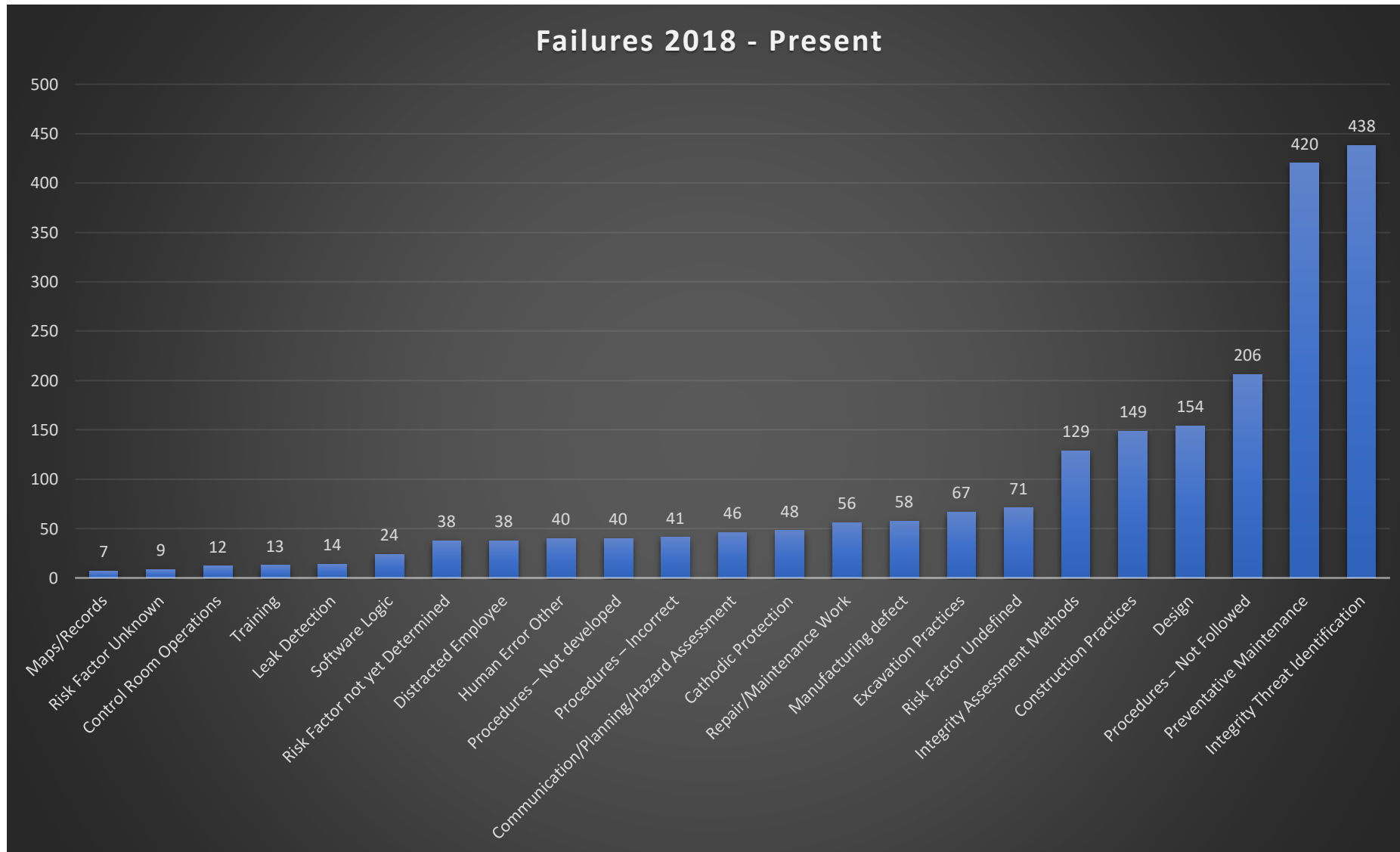
2010-2023 Distribution Incident Causes



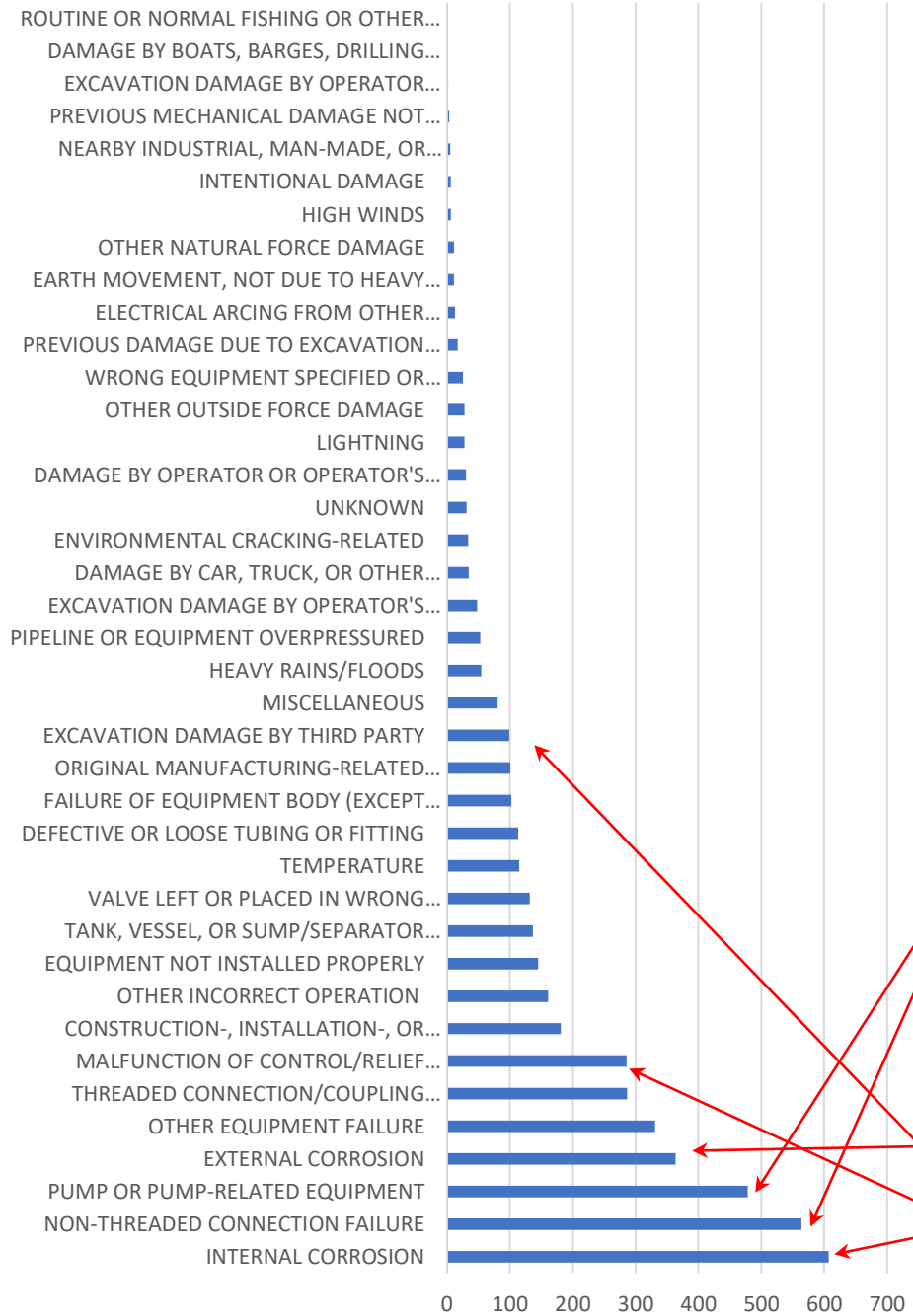
Outside the Box - Assigning Risk Factors

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

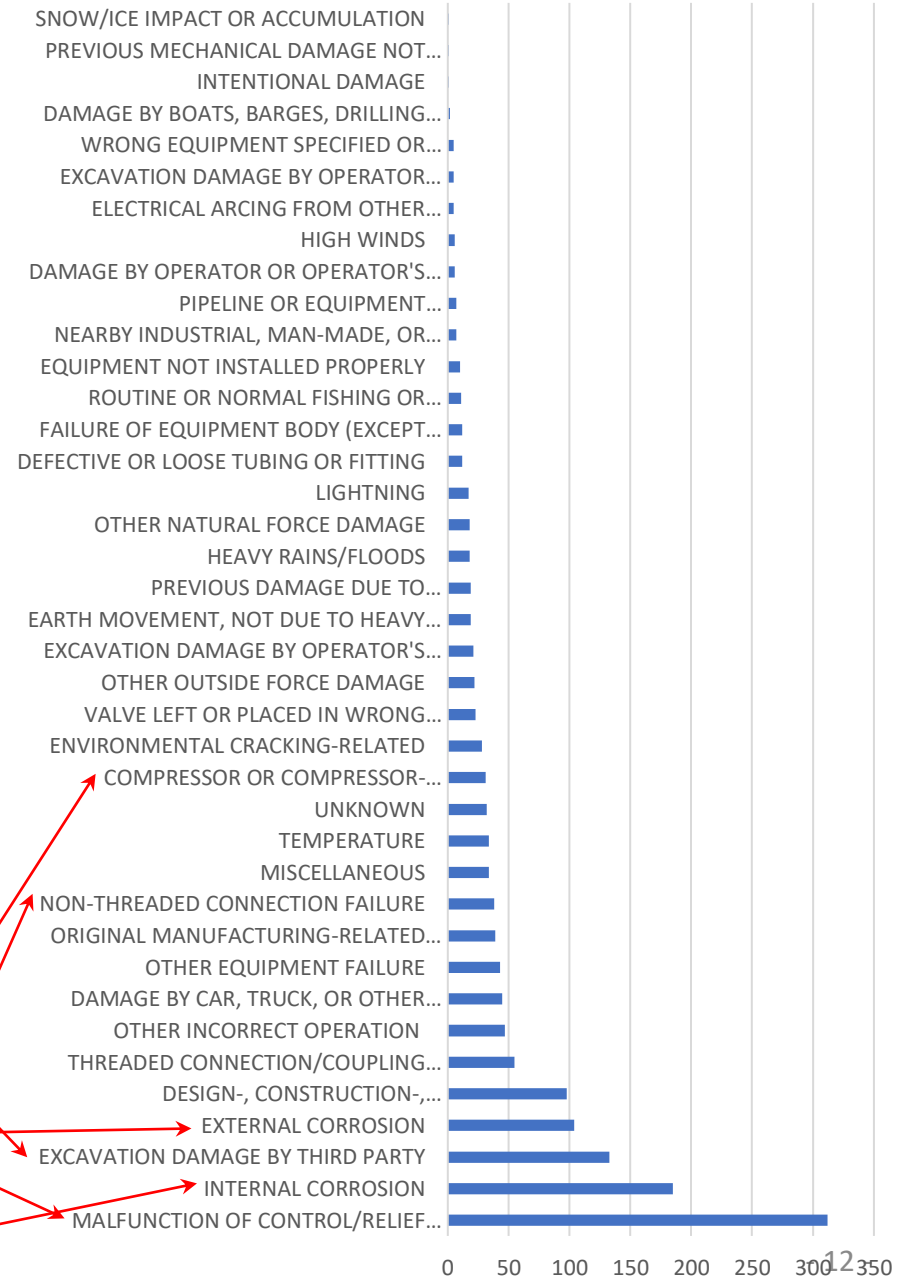
All Risk Factors - All Products



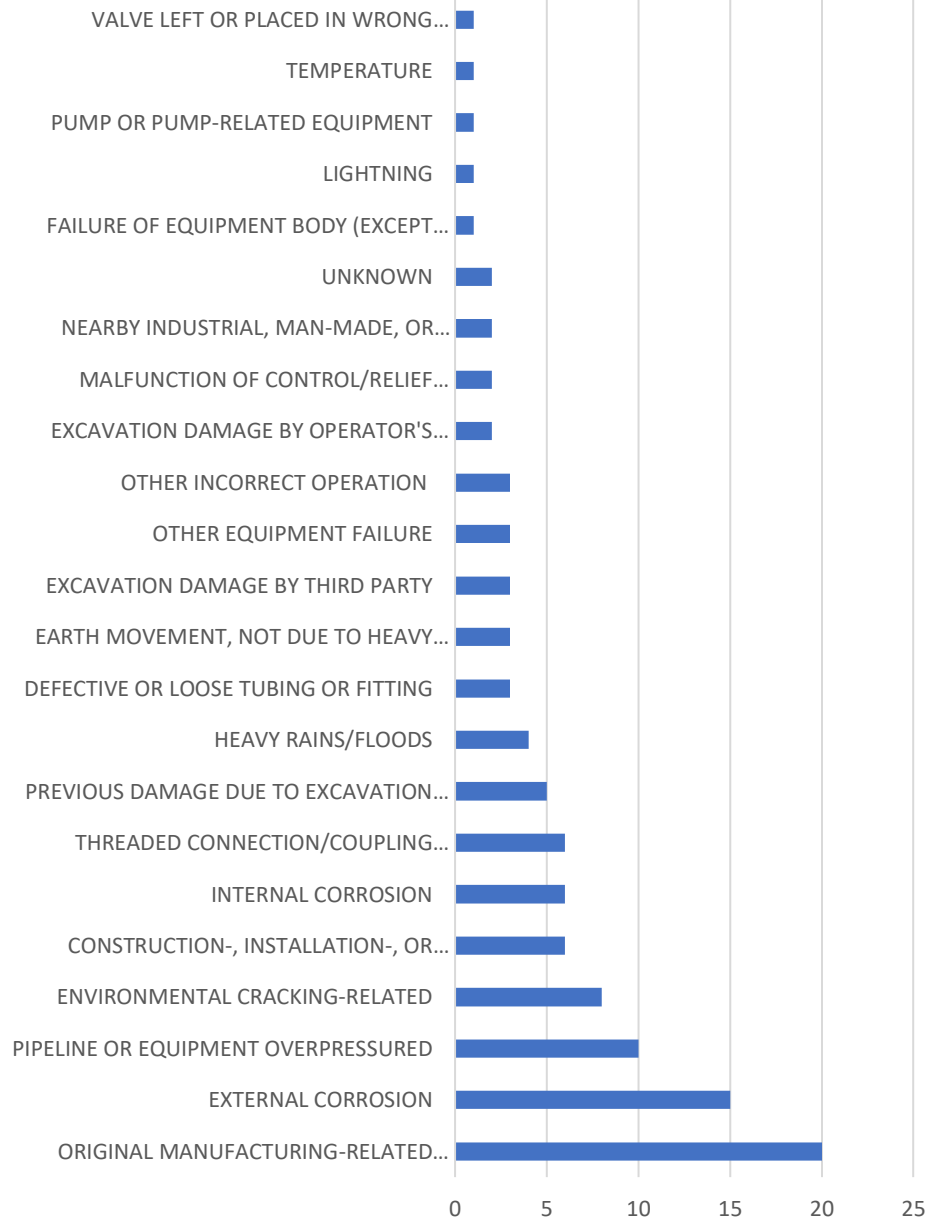
All Failure Mechanics for HL



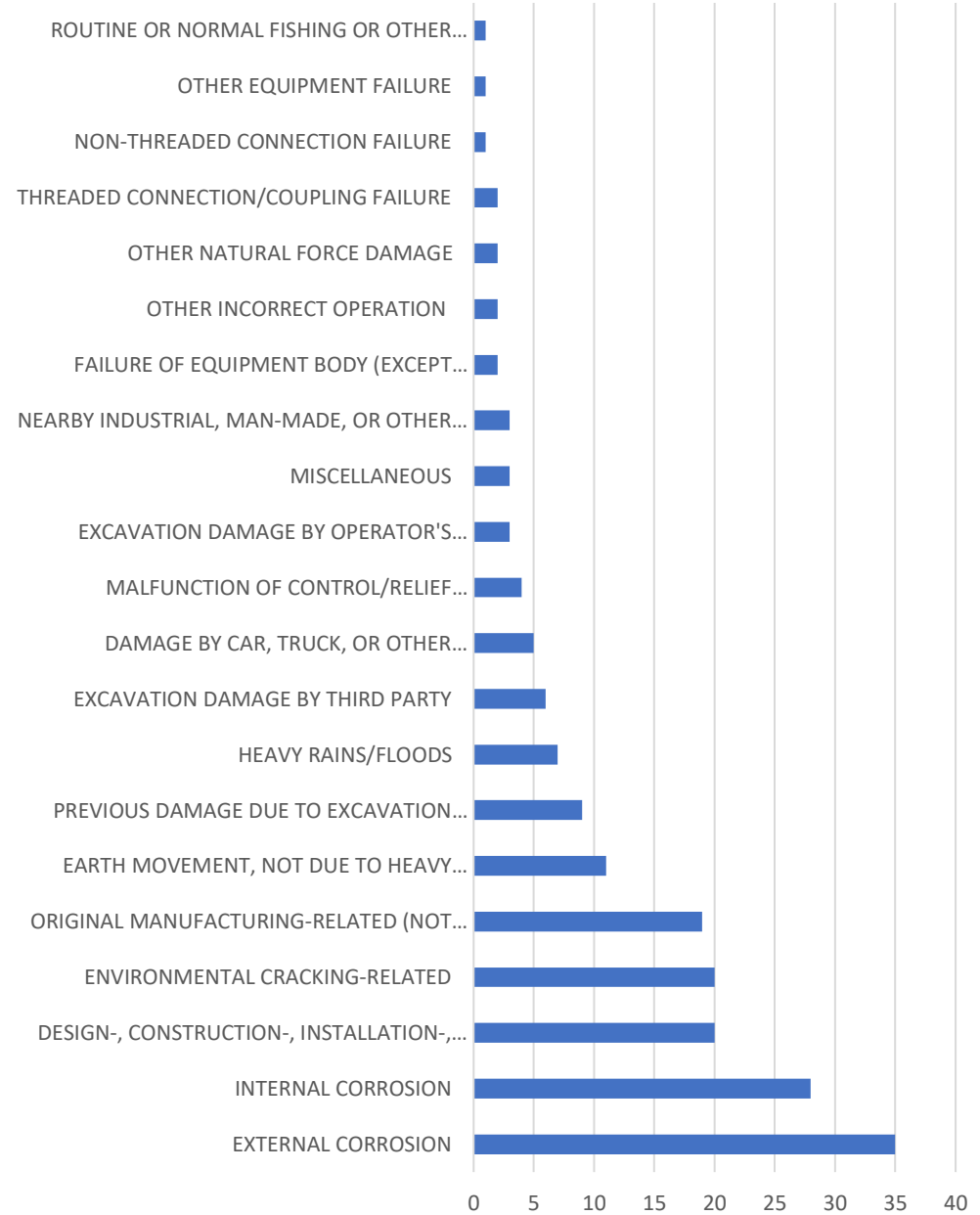
All Failure Mechanics for GT



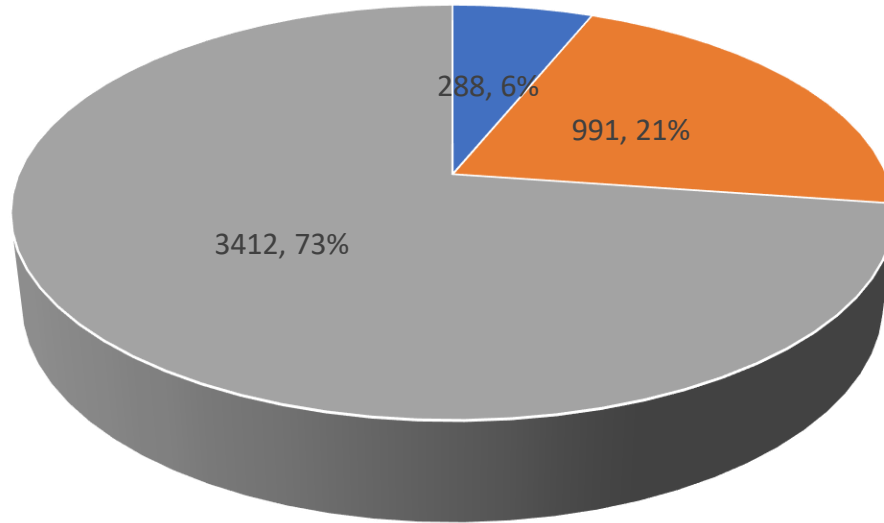
HL Failures Resulting in 108 Ruptures



GT Failures Resulting in 184 Ruptures

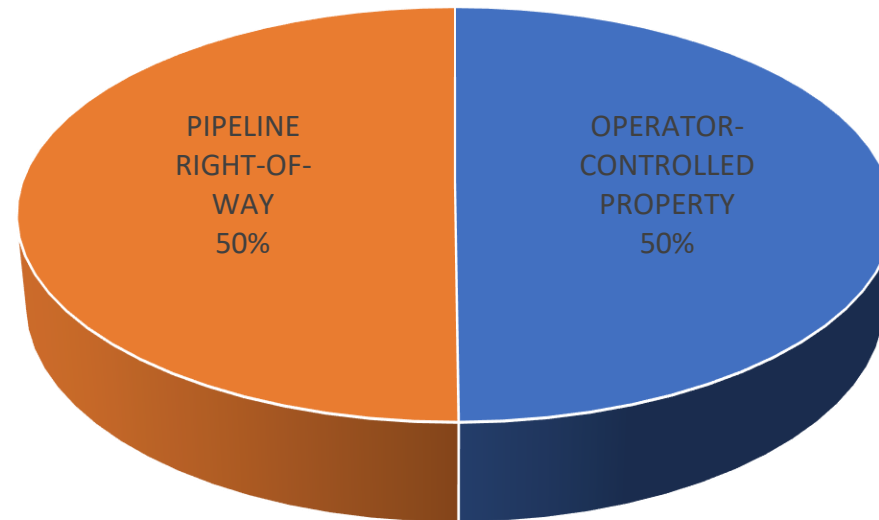


Where Do HL Failures Occur?



- ORIGINATED ON OPERATOR-CONTROLLED PROPERTY, BUT THEN FLOWED OR MIGRATED OFF THE PROPERTY
- PIPELINE RIGHT-OF-WAY
- TOTALLY CONTAINED ON OPERATOR-CONTROLLED PROPERTY

Where Do NG Failures Occur?

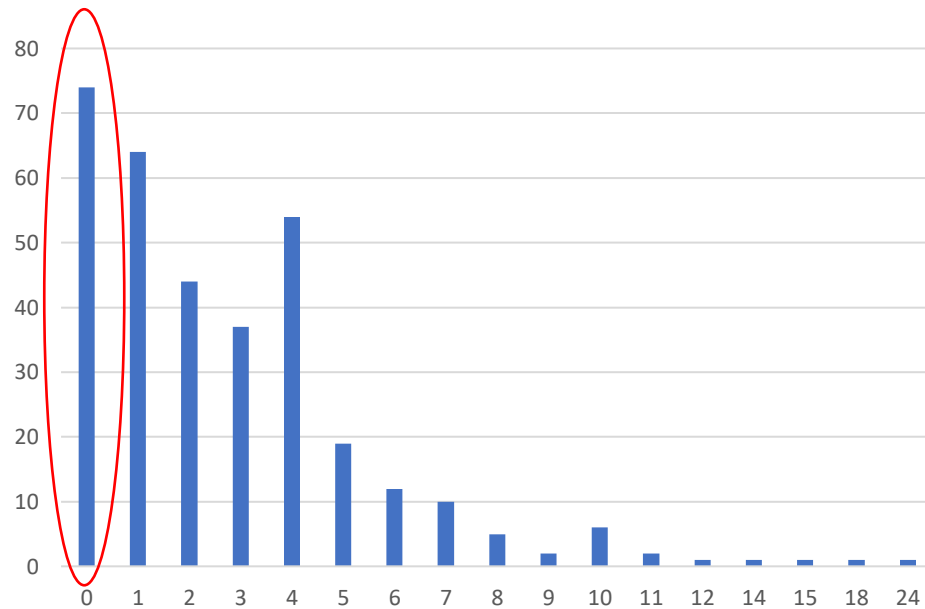


- OPERATOR-CONTROLLED PROPERTY
- PIPELINE RIGHT-OF-WAY

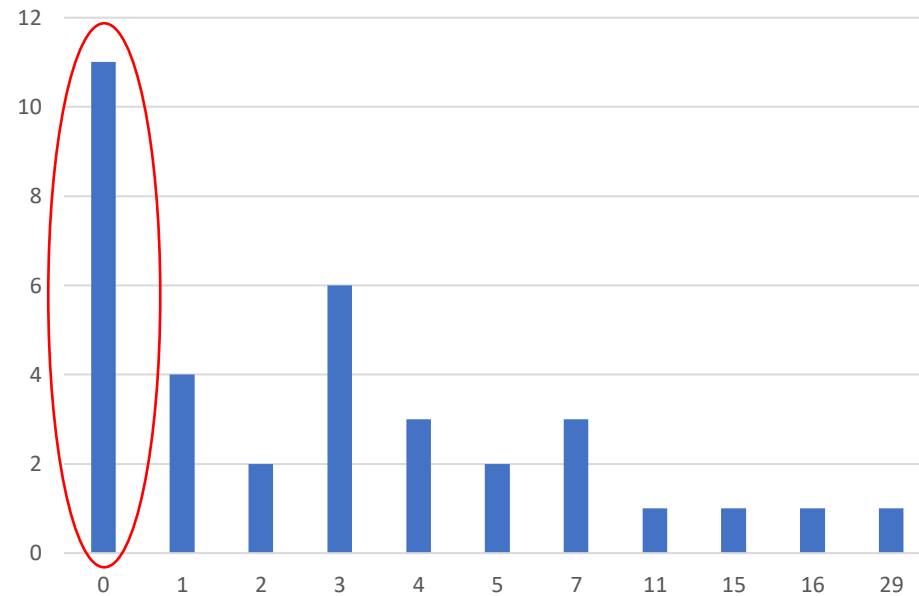


External Corrosion after Tool Run

HL Reportable External Corrosion Failures after Tool Run

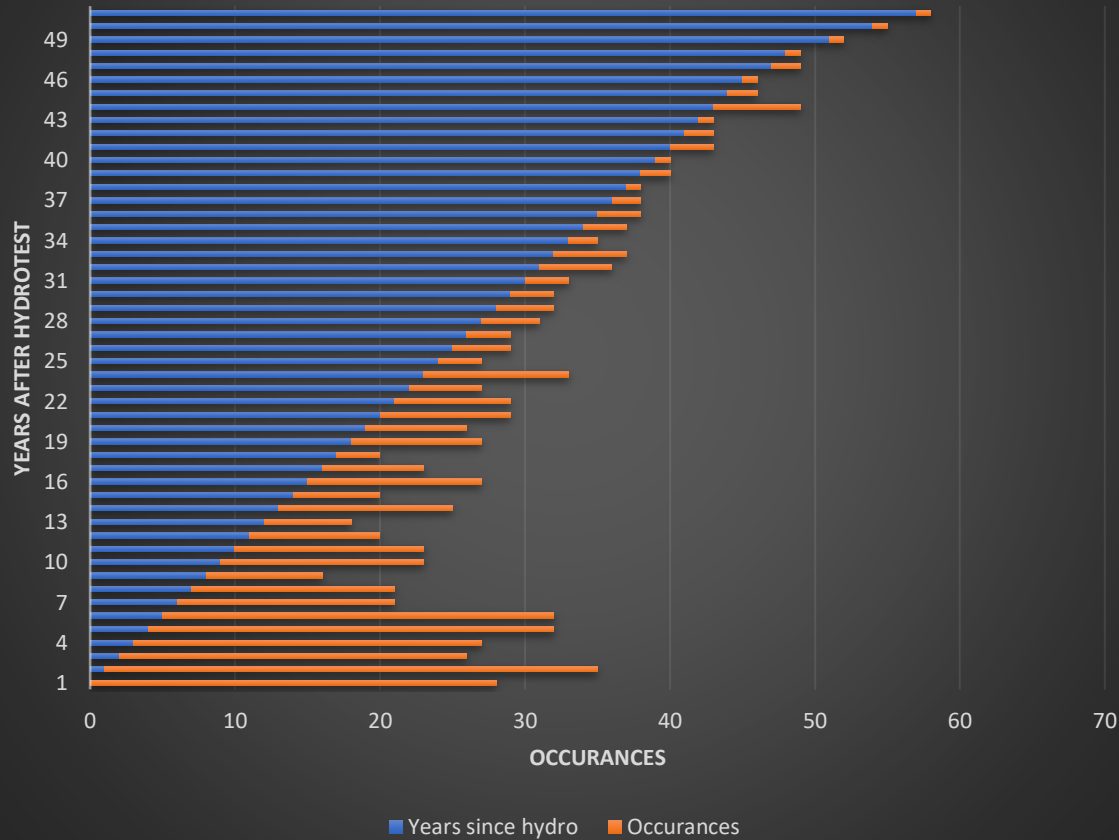


GT Reportable External Corrosion Failures after Tool Run

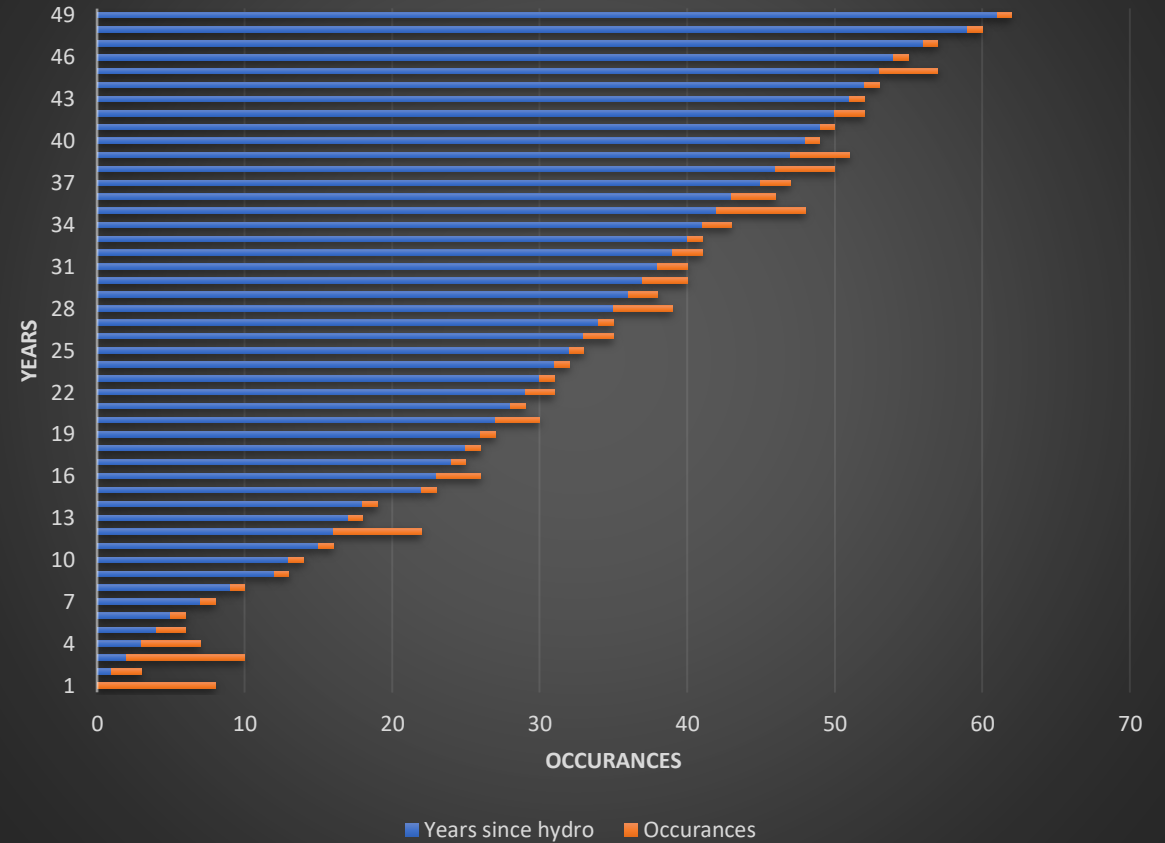


External Corrosion after Hydrotesting

HL Reportable External Corrosion Failures after Hydrotesting

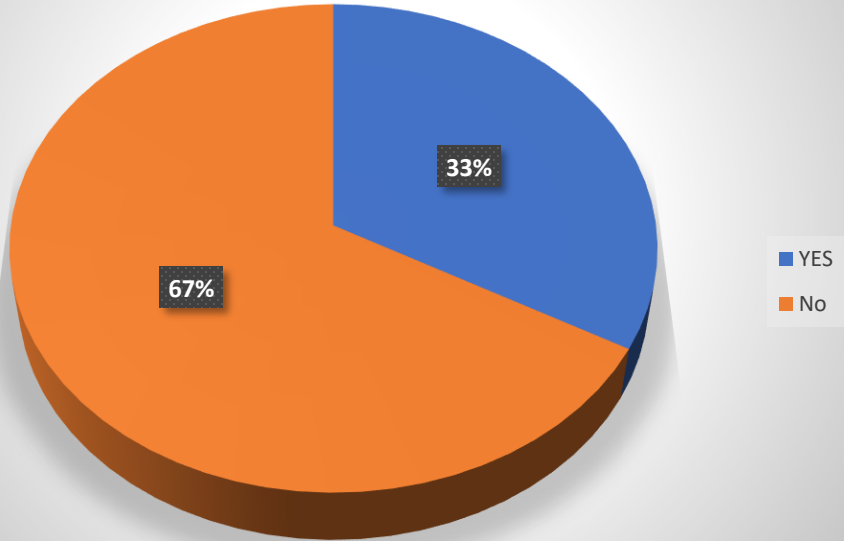


GT Reportable External Corrosion Failures after Hydrotesting

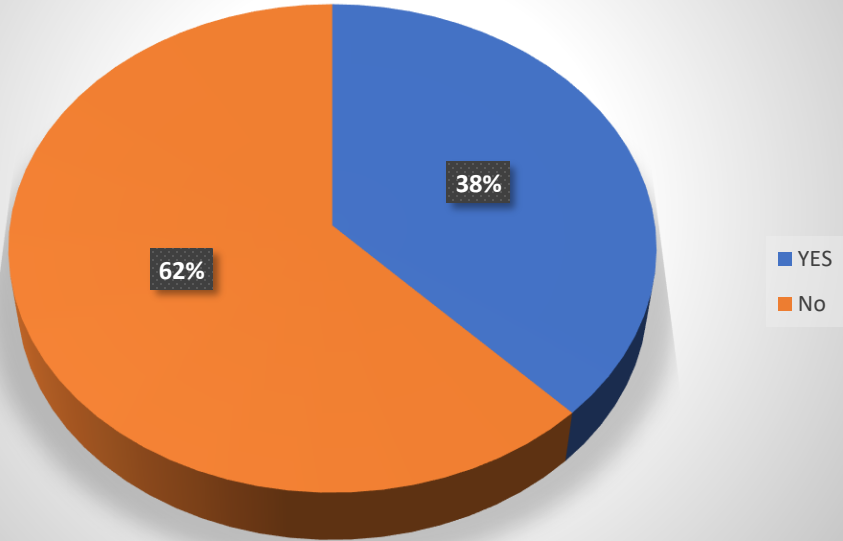


Close Interval Survey

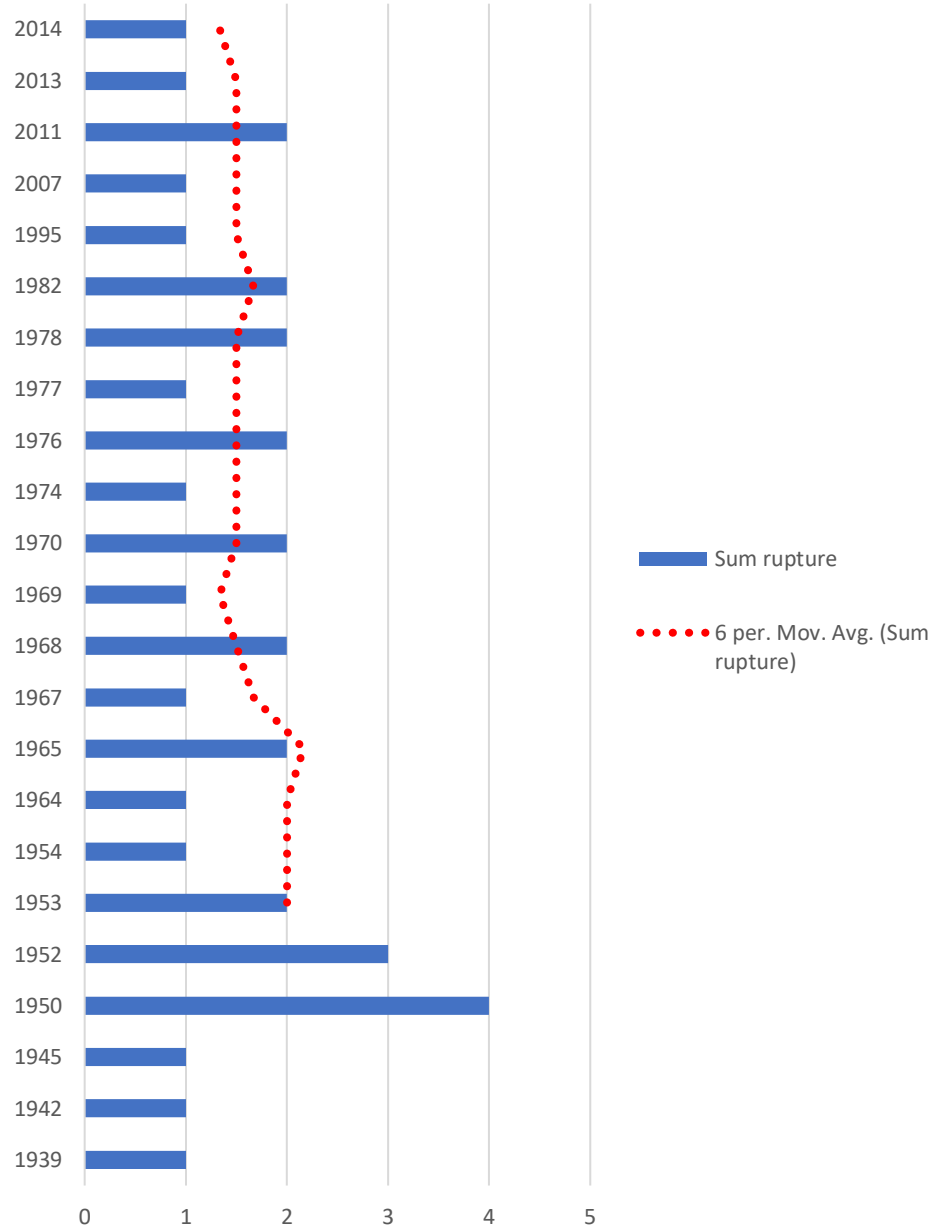
Was a CIS done on the HL pipeline with external corrosion failure?



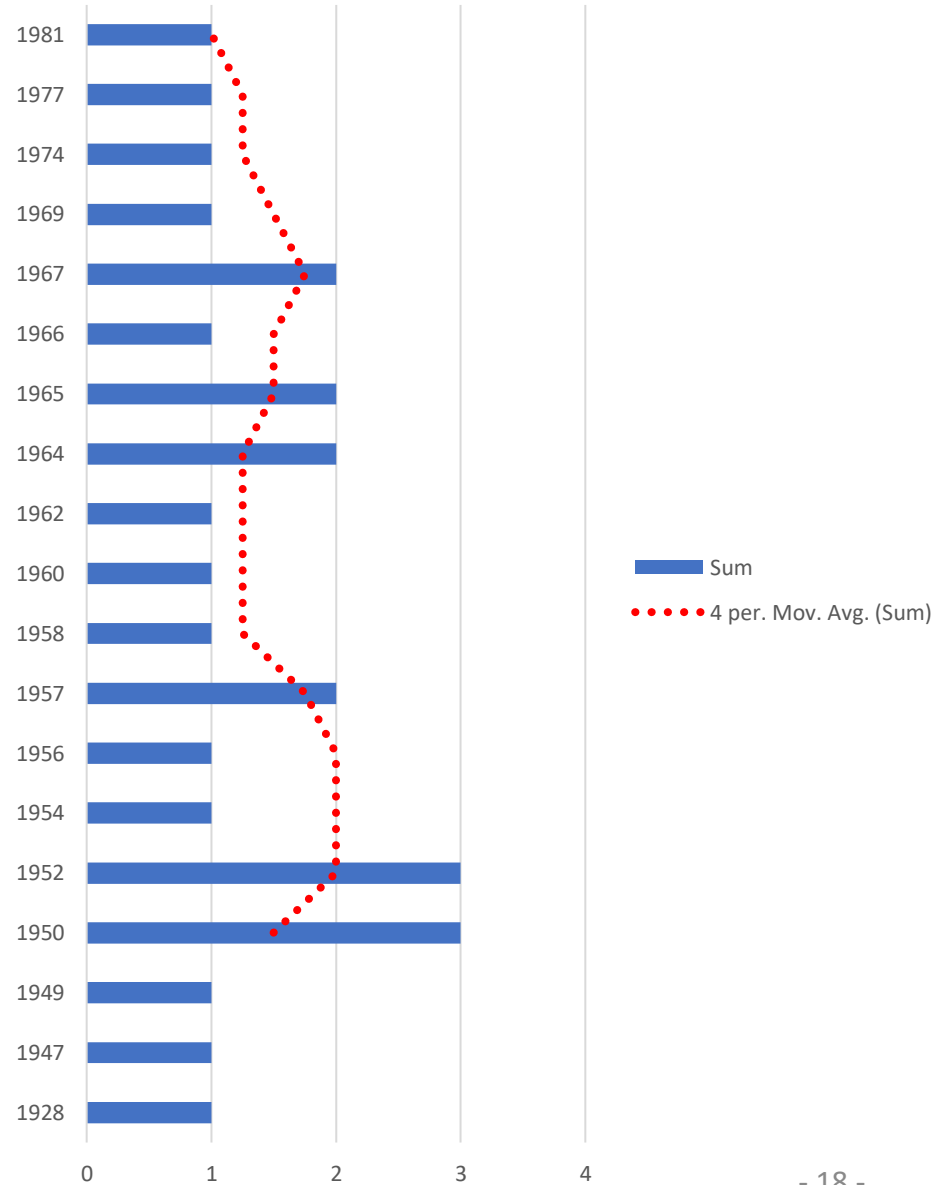
Was a CIS done on the GT pipeline with external corrosion failure?



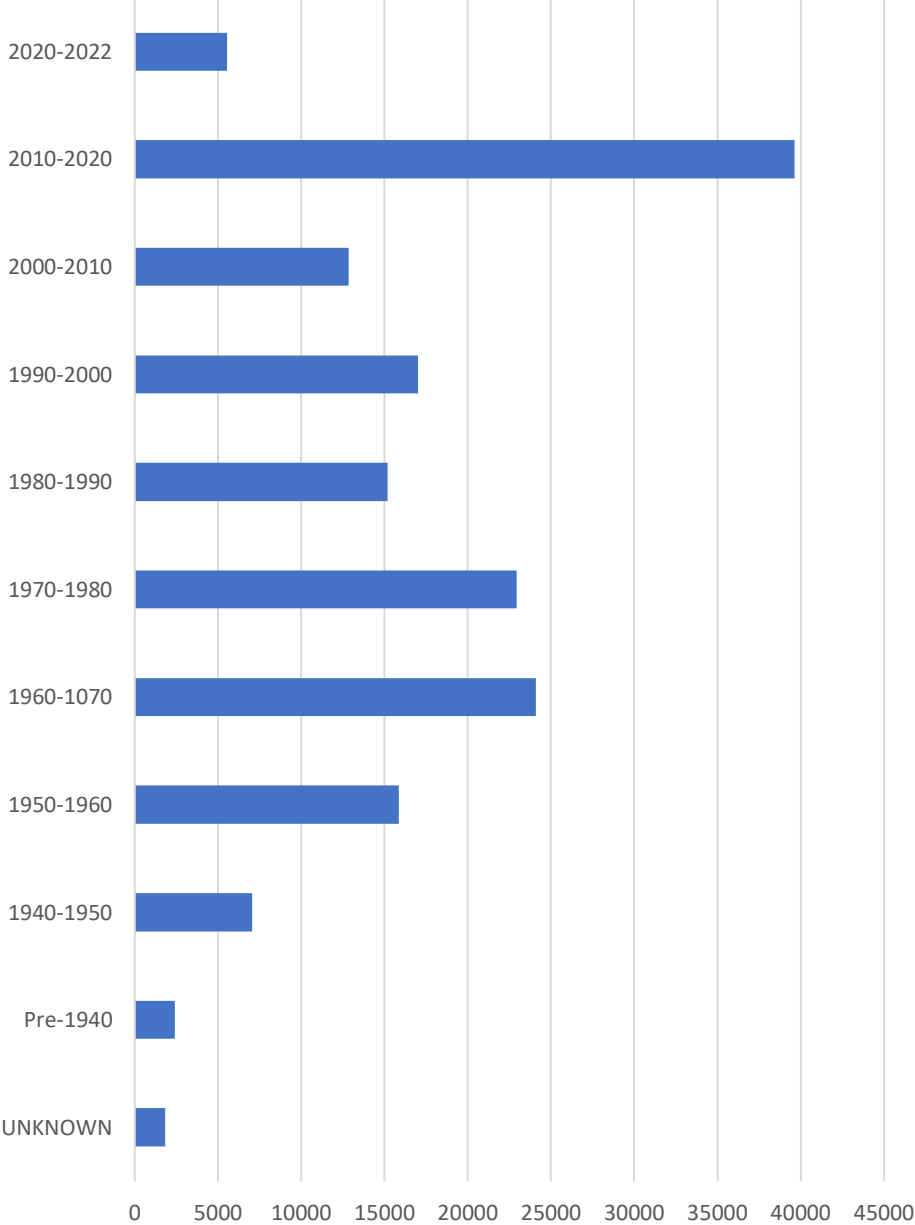
HL Ruptures from External Corrosion



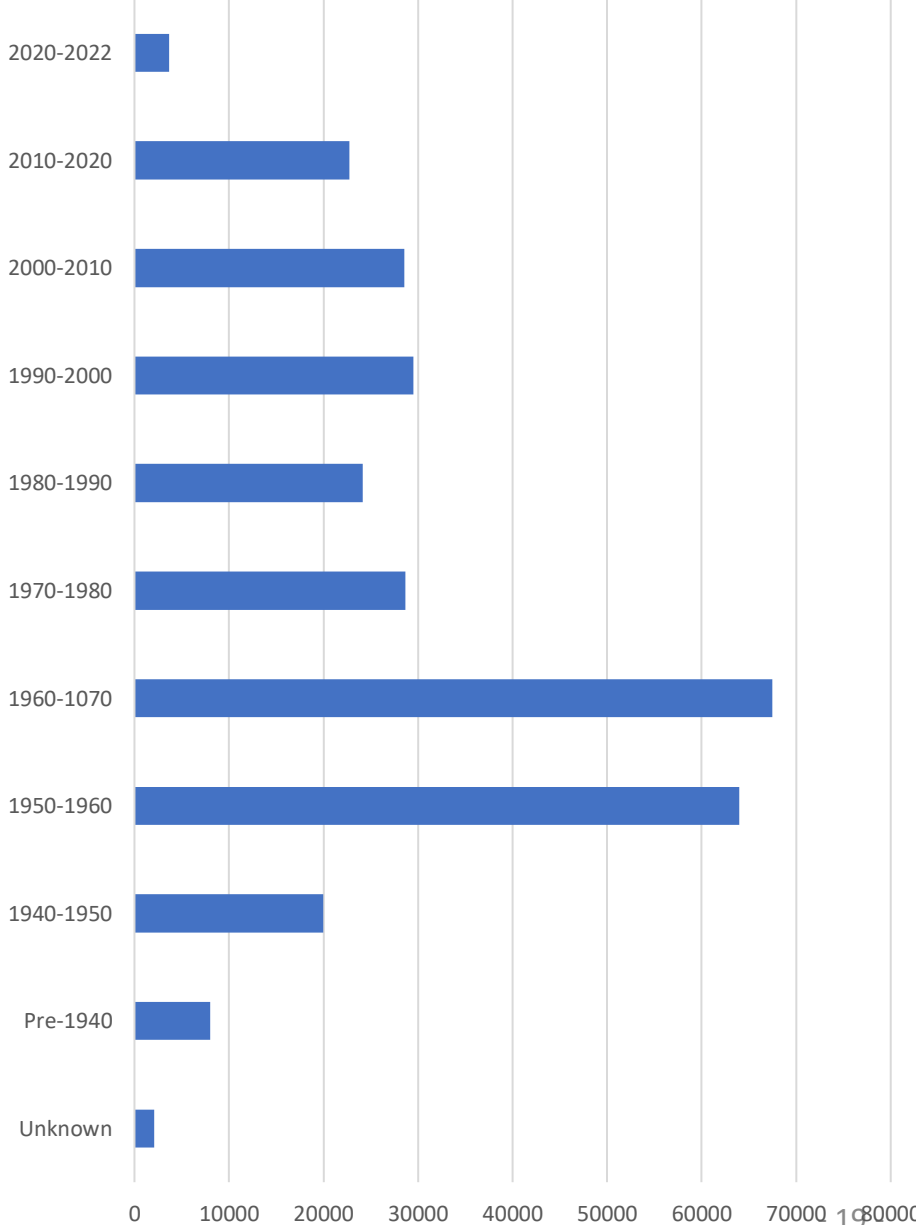
GT Ruptures from External Corrosion



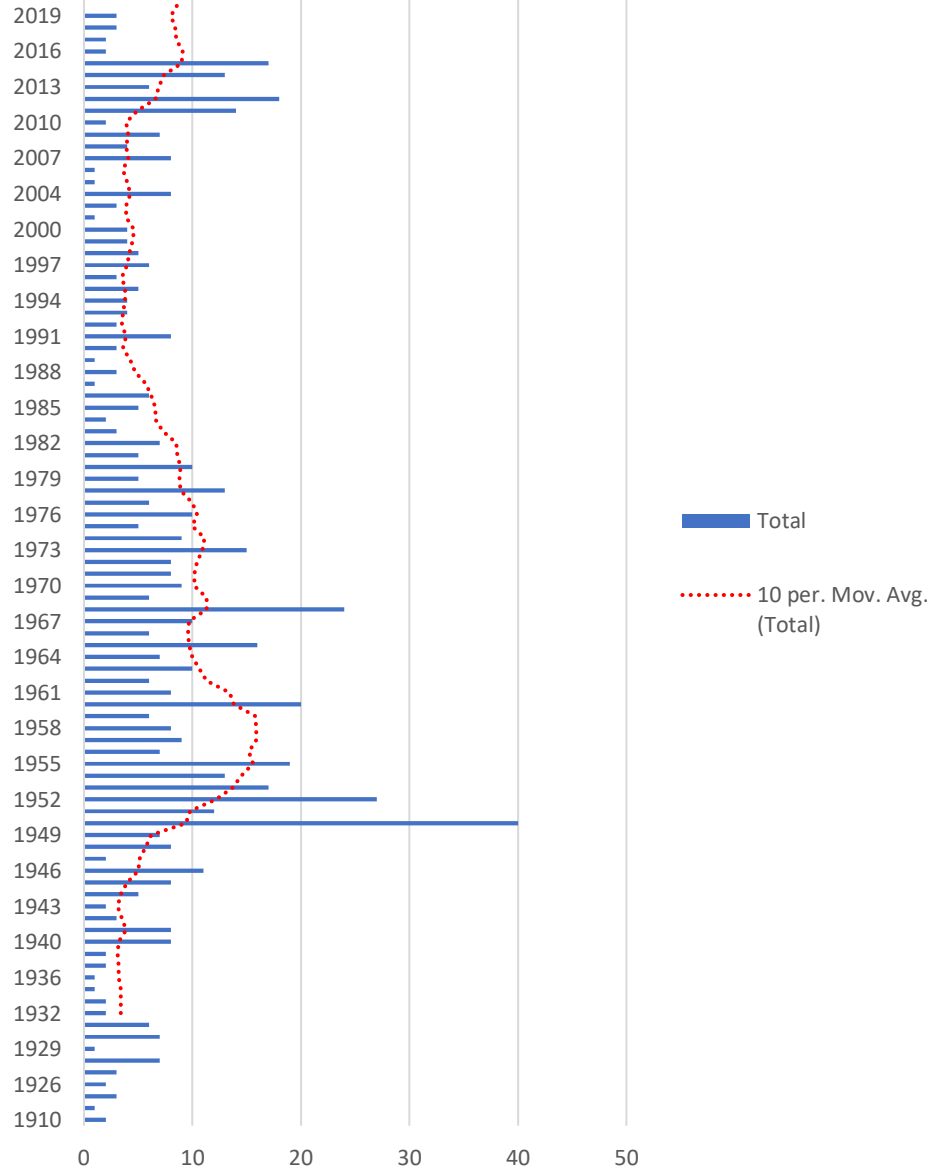
HL Miles of Pipe by Decade



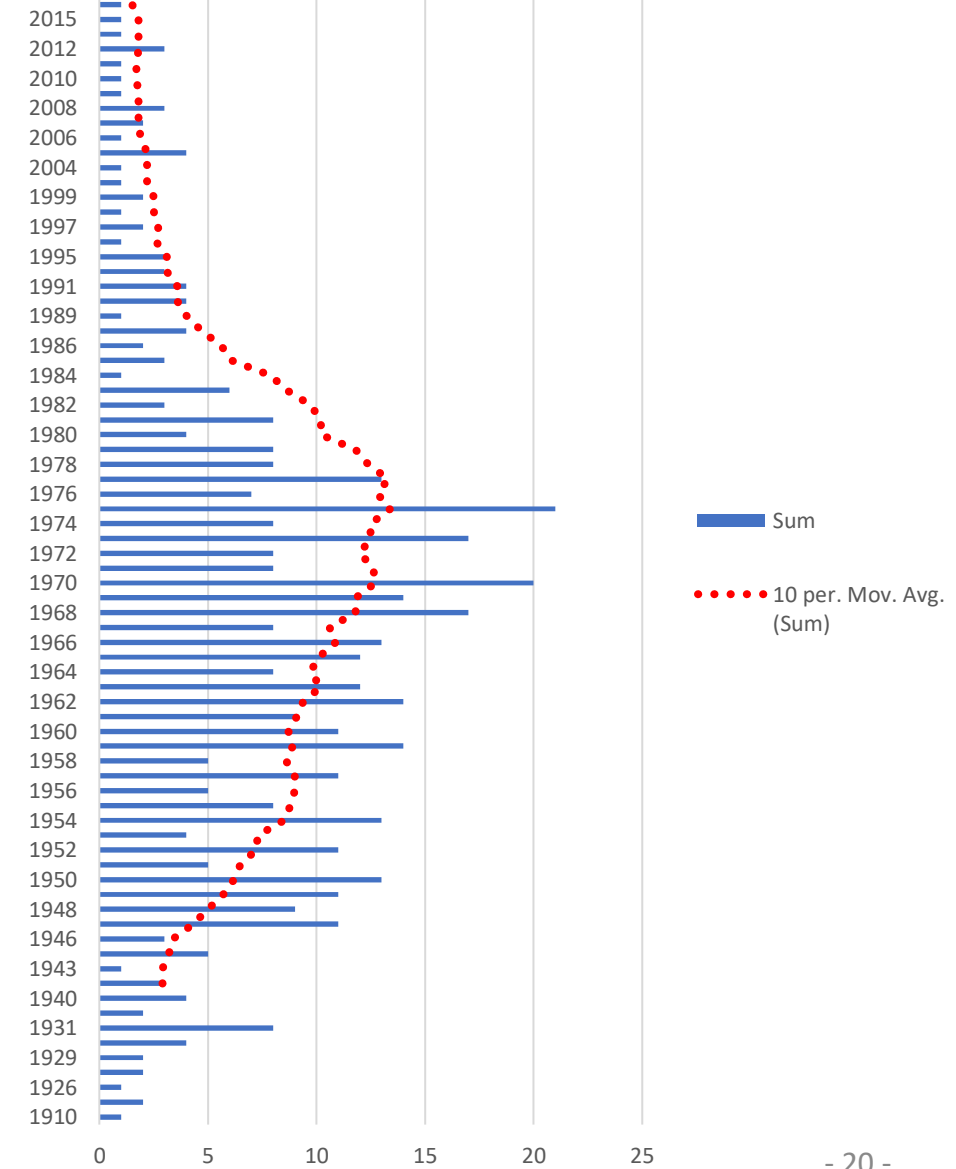
GT Miles of Pipe by Decade



HL Failures in Pipe Body with 10-Year Moving Average



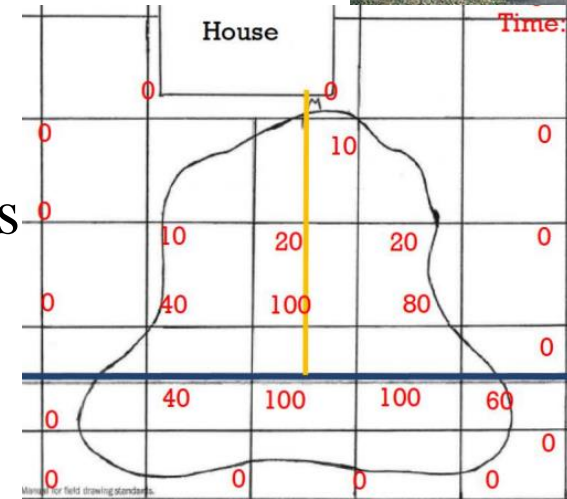
GT Failures in Pipe Body with 10-Year Moving Average



Leak Investigation



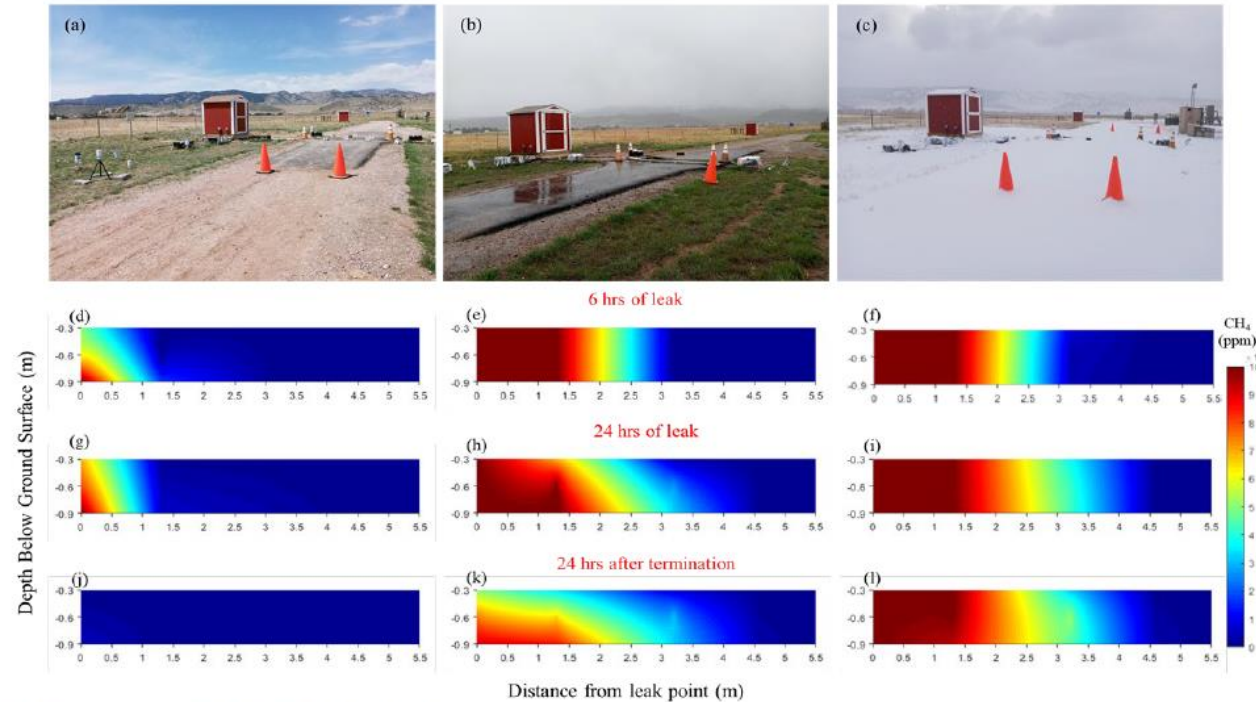
- Determine leak location using Flame Ionization (FI) Unit
- Pinpoint leak: determine leak spread by bar holing until 0% gas obtained in all directions
- Check several nearby houses
 - If no one is home, check doors and windows
 - If a positive reading is obtained, evacuate
- Check nearby manholes
- If you find any positive gas reads, continue your investigation.



Leak Investigation



Current Understanding from Experiments Example: Effect of Surface Cover



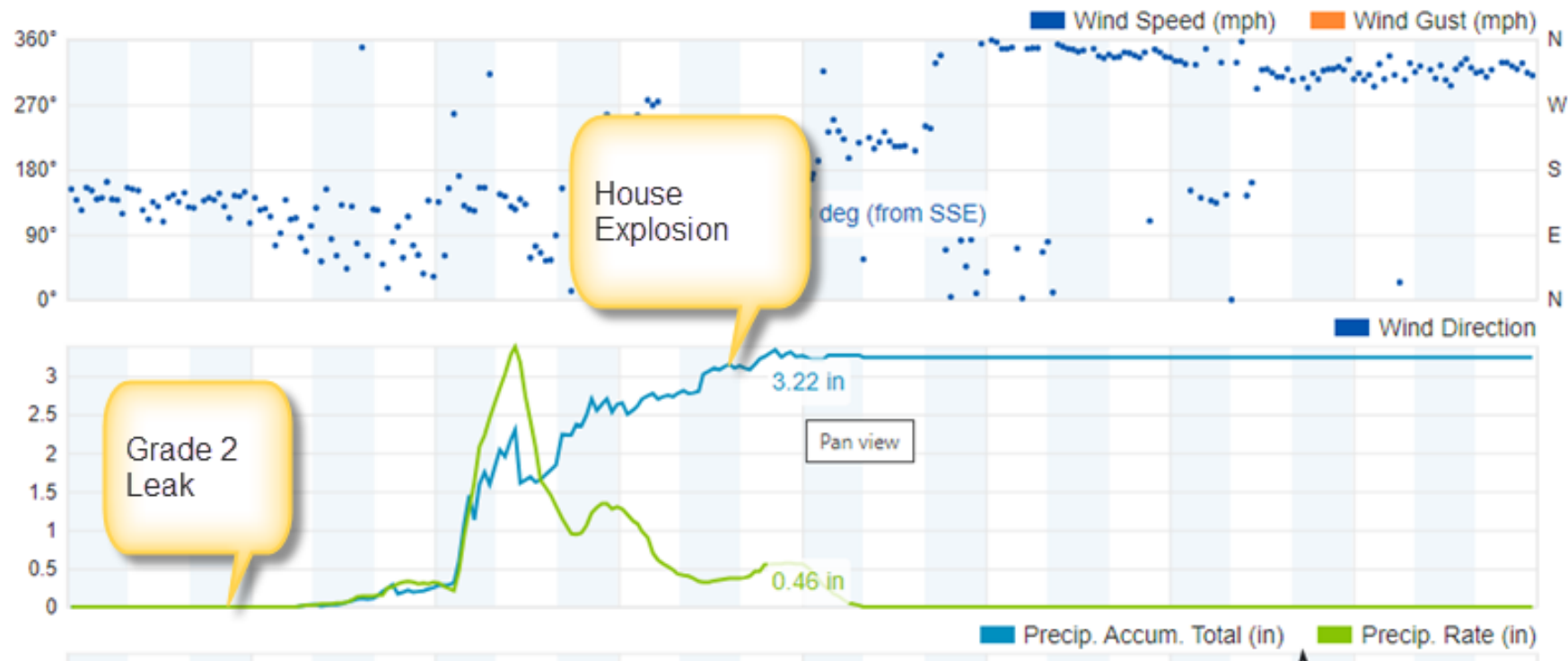
LEL = 50,000 ppm (5% CH₄ V/V)

14 UEL = 150,000 ppm (15% CH₄ V/V)

Jayarathne, Smits, Zimmerle., 2022, METEC Research Alert
Zimmerle, Smits, Jayarathne, 2022, METEC Research Alert



Leak Investigation



* Each bar represents 1-hour. 5 hours of heavy rain capped the gas plume. Leak was graded 3 months prior to explosion.





Case Study
Atmos Energy
Dallas, Texas
Gas Migration
One Fatality and
Three Injuries
February 23, 2018

- February 21, 2018 – Day 1
- House 3527 has an incident at 5:49 a.m.
- Homeowner heard a popping noise in the attic where the heater unit is located. He investigated and found the steel cover to the furnace not on the unit.
- When the cover was reinstalled, the furnace operated the pilot-light igniter operated and an explosion occurred throwing him backwards. He never smelled any gas odor.
- Arson investigators responded and determined the cause as “undetermined”.
- Gas company was also on site but not allowed to test service due to structure damage.
- Ground saturated from exceptionally heavy rains





- February 22, 2018 – Day 2
- House 3515 has an incident at 10:21 a.m.
- Homeowner was alone and began to boil some water when the flames acted erratically and began to grow out of control and engulfed him.
- Fire traveled to attic causing additional damage.
- Arson investigators interviewed the witness and determined that it was an appliance issue.
- No gas odor detected by resident
- Rain continuing

- February 23, 2018 – Day 3
 - House 3534 has an incident at 6:38 a.m., with a fatality and 3 injured, 1 released
 - Lived in home one month after full renovation. Including new gas and sewer service lines to alley.
 - Homeowner heard a loud pop in kitchen around 11 p.m. but found no source.
 - No gas smell prior to explosion
 - TX-RRC, NTSB and PHMSA launched to investigate.



Leak surveys were performed after each explosion, with RMLD and CGI.



Pressure testing of mains and services with air will establish the integrity of the distribution piping, or not. Also, customer piping is often tested, but piping can be damaged during fires and explosions.

- Develop a pressure test protocol
 - Where to cut and cap main and services
 - Maximum test pressure and duration
 - If a leak is identified, then flow test to determine the size of the failure(s)
 - Large sections that fail test will need to be broken up



Mains and services capped and ready for pressure testing.





Leaks at service tee and stopcock. Some leaks will cause test pressure failures but are not hazardous. The flow rate will be inadequate to migrate any distance. Flow rate testing pipelines that fail pressure tests should be performed prior to exposing buried leaks.

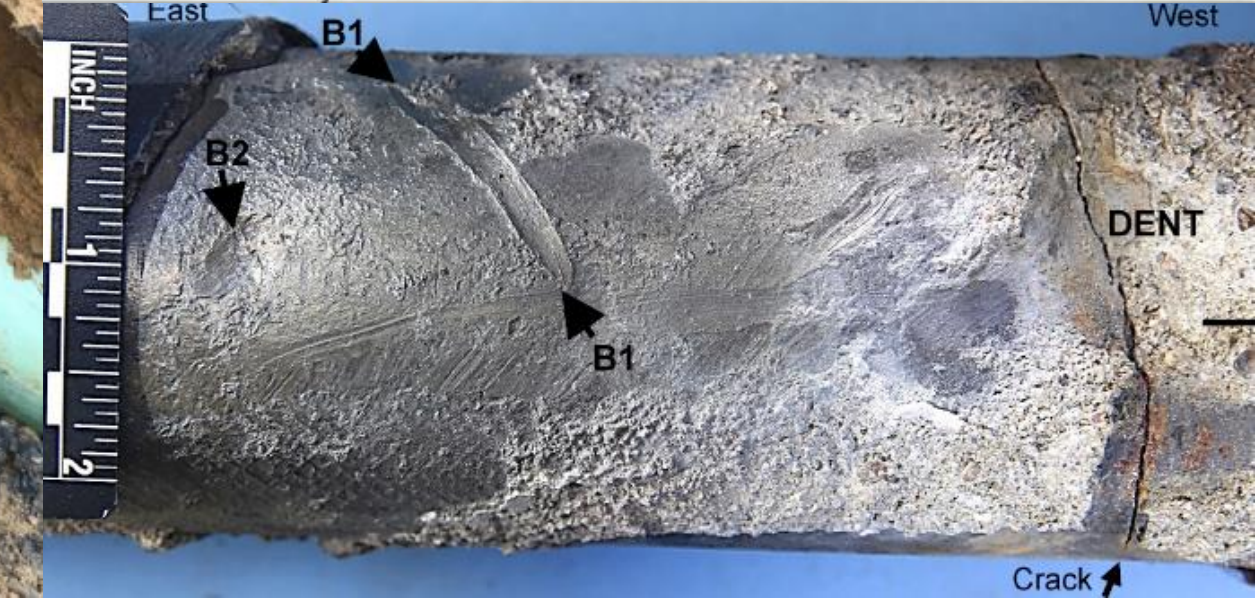
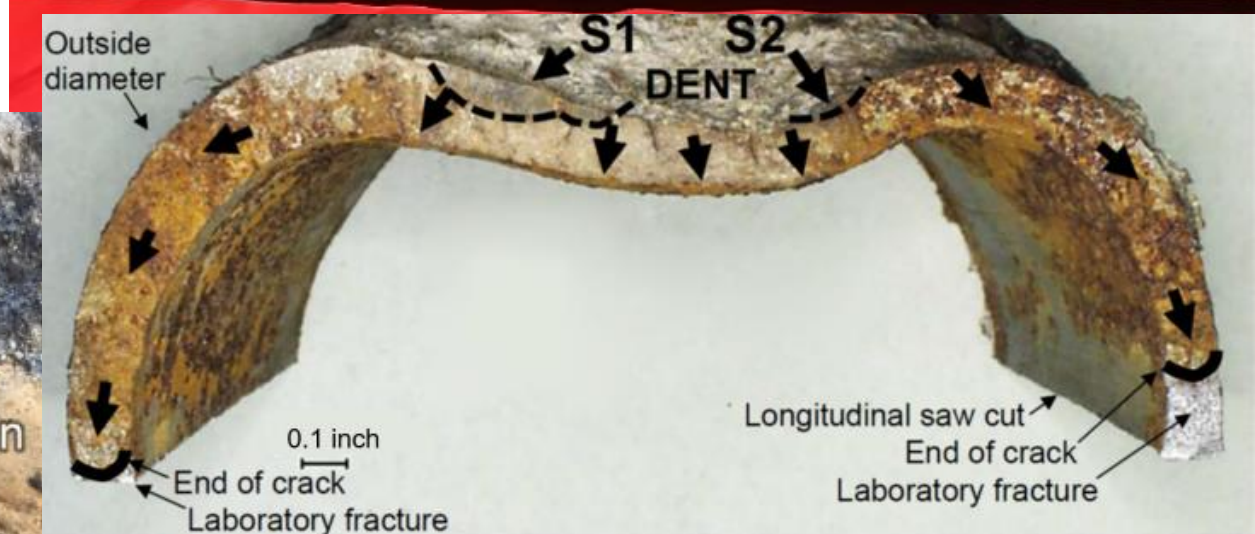
During excavation pay close attention to what is being dug up. Evidence can be anywhere. Sand bedding for sewer line was conduit for gas migration. Test and document to confirm theory. CGI shows 35% LEL, 9 days after the gas was shut-off.



Evidence can be anywhere. Soil will discolor from the release of natural gas, dry out and scrub odorant. A dated coke bottle found next to main failure. Date corresponds to sewer installation.

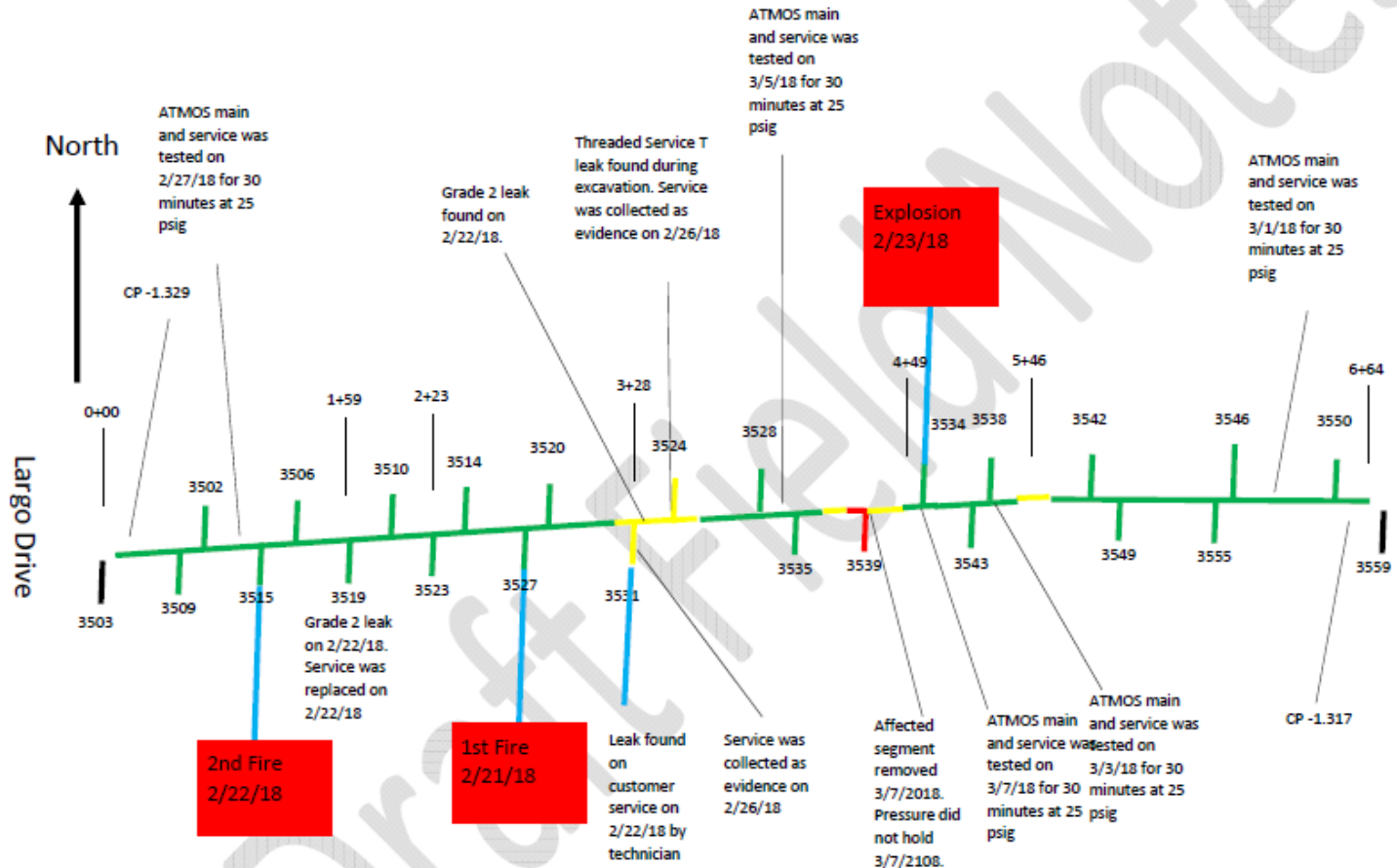


Source of the gas was identified at a location where a sewer main was installed in 1995, with only 2-inches of clearance. The line was dented and gouged with excavation equipment and failed 23 years later as a circumferential crack.



Overview of gas main and service in alley between Espanola and Durango Updated March 7, 2018

Document the details as it paints a picture. 664 feet of pipe tested with multiple leaks identified. Only one was large enough to result in the migration.



4 pieces of evidence collected on 2/26/18:
 Main/ tap and service to 3531 Durango;
 Leaking Main/tap and Service to 3524 Espanola;
 36" of main between both services.

2 pieces of evidence collected on 3/5/18:
 Segment of Main:
 (1) Between 3539 & 3535 Durango
 (1) Between 3539 Durango & 3534 Espanola

- 11 pieces of evidence collected on 3/5/18:
- 3534 Espanola Service Line
 - 3534 Espanola Segment E3
 - 3534 Espanola Segment W4
 - 3534 Espanola Segment W5
 - 3534 Espanola Riser
 - 3534 Espanola ABN Service South
 - 3534 Espanola ABN Service North
 - 3539 Durango Segment 1 (failed piping)
 - 3539 Durango Segment 3
 - 3539 Durango Segment 4
 - 3539 Durango Segment 2

Be safe while working, What is wrong with this picture. A pressure test cap will be welded on for pressure testing in a few minutes. A compression coupling can be seen by support block.





Questions



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