



National Transportation Safety Board

Atmos Energy Corporation
Natural Gas-Fueled Explosion
Dallas, Texas
February 23, 2018

Managing Director's Introduction

Sara Lyons	Investigator-in-Charge*
Rachael Gunaratnam	Emergency Response
Steve Jenner	Human Performance
Nancy McAtee	Fire and Explosion
Frank Zakar	Materials Laboratory
Michael Hoepf	System Safety
Gena Evans	Writer / Editor
Christy Spangler	Graphics

* The on-site Investigators-in-Charge were Ravi Chhatre and Roger Evans.

Managing Director's Introduction

Michael Hiller	Deputy Director, Office of Railroad, Pipeline and Hazardous Materials Investigations
Sean Lynam	Chief, Pipeline and Hazardous Materials Division
Dolline Hatchett	Director, Office of Safety Recommendations and Communications
Jim Ritter	Director, Office of Research and Engineering
Kathy Silbaugh	General Counsel
Scott Rainey	Safety Recommendations

Support Staff for Virtual Board Meeting

James Anderson	SRC-60
Michael Anthony	CIO-1
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Carl Perkins	AD-10
Kelley Romeo	CIO-60
Rahiq Syed	CIO-60
Brian Young	MS-10



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Investigation Overview
Dallas, Texas
February 23, 2018

Sara Lyons
Investigator-in-Charge

Explosion at 3534 Espanola Drive



Timeline

Event 1

February 21, 2018 – 5:49 a.m.
Explosion and fire reported



3527 Durango Drive
One injury - second-degree burns

Event 2

February 22, 2018 – 10:21 a.m.
Fire reported



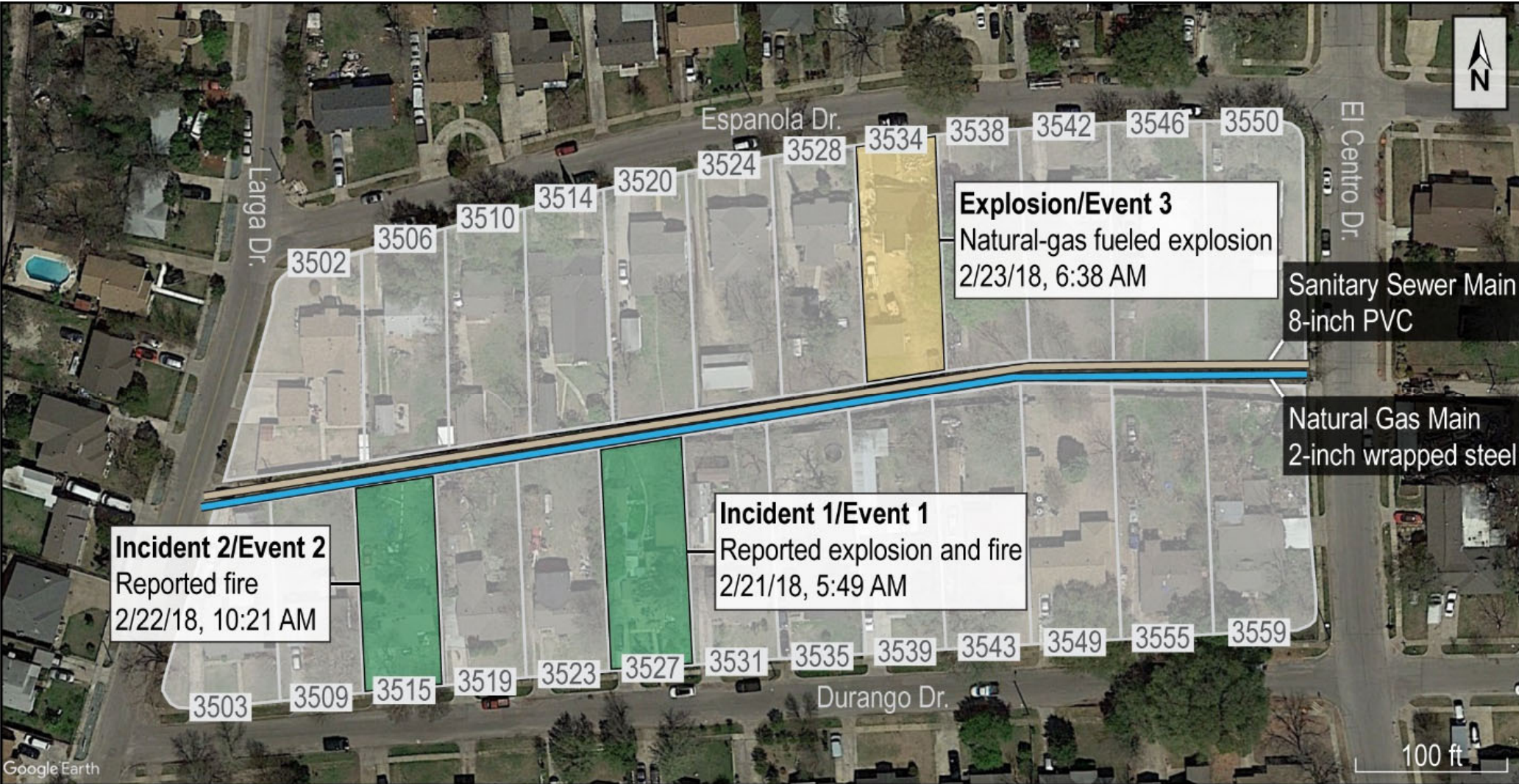
3515 Durango Drive
One injury - second-degree burns

Event 3

February 23, 2018 – 6:38 a.m.
Explosion reported



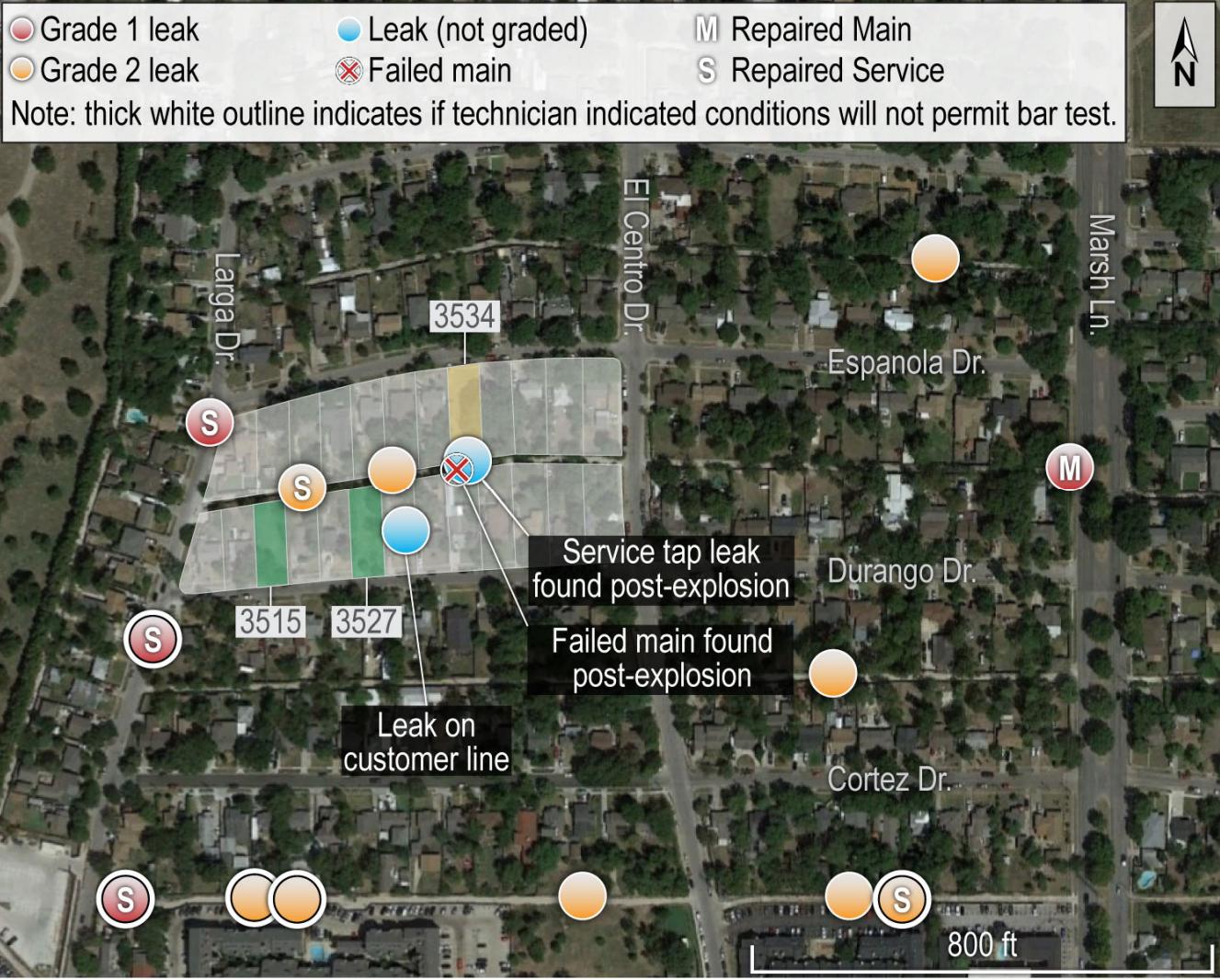
3534 Espanola Drive
Five injuries - one fatal



Weather Conditions

- Significant rainfall observed prior to the explosion
- Temperature ranged between 34-52°F





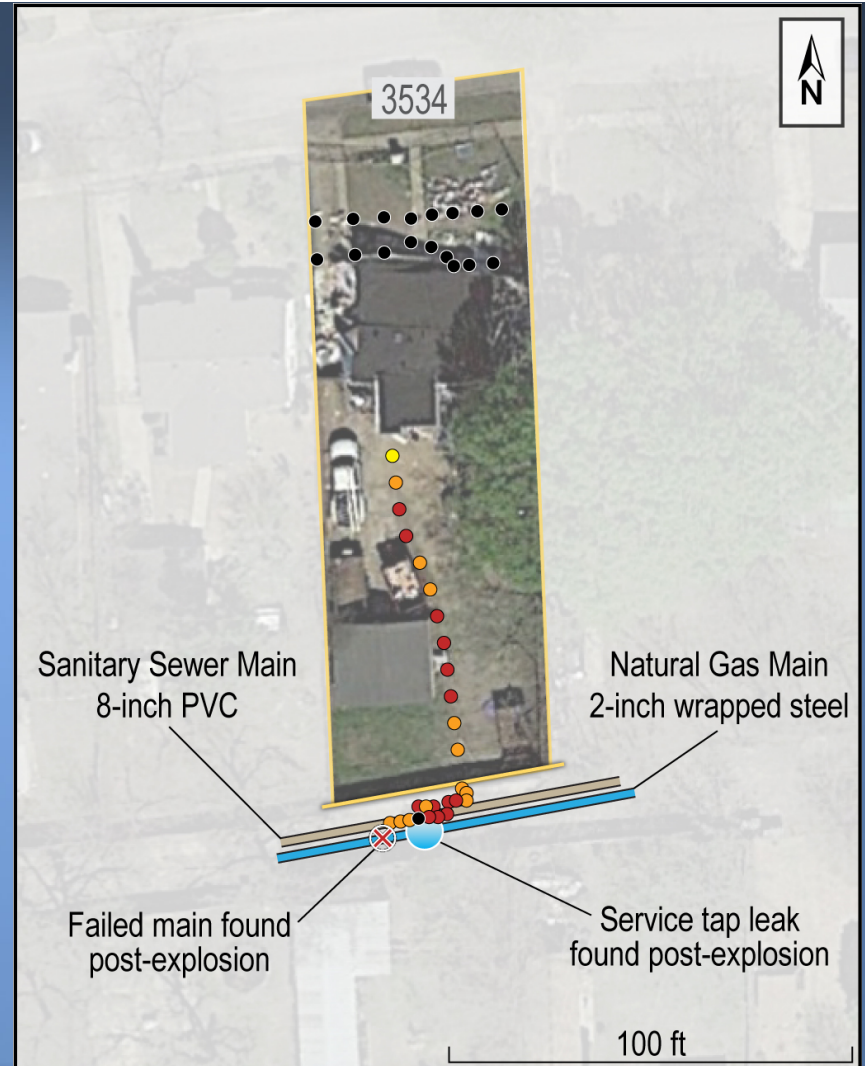
Cracked Gas Main

- Gas main leaking below sewer lateral
- Sandy embedment surrounded sewer lateral



Gas Migration

- Gas indicated
 - between cracked main and explosion home
 - over sewer main
- Accumulated within home
- Ignited by an unknown source



Parties to the Investigation

- Pipeline and Hazardous Materials Safety Administration
- Railroad Commission of Texas
- Dallas Fire-Rescue Department
- Atmos Energy Corporation

Safety Issues

- Incident investigation
- Leak investigations and repairs
- Methane detection
- Incident reporting
- Integrity management



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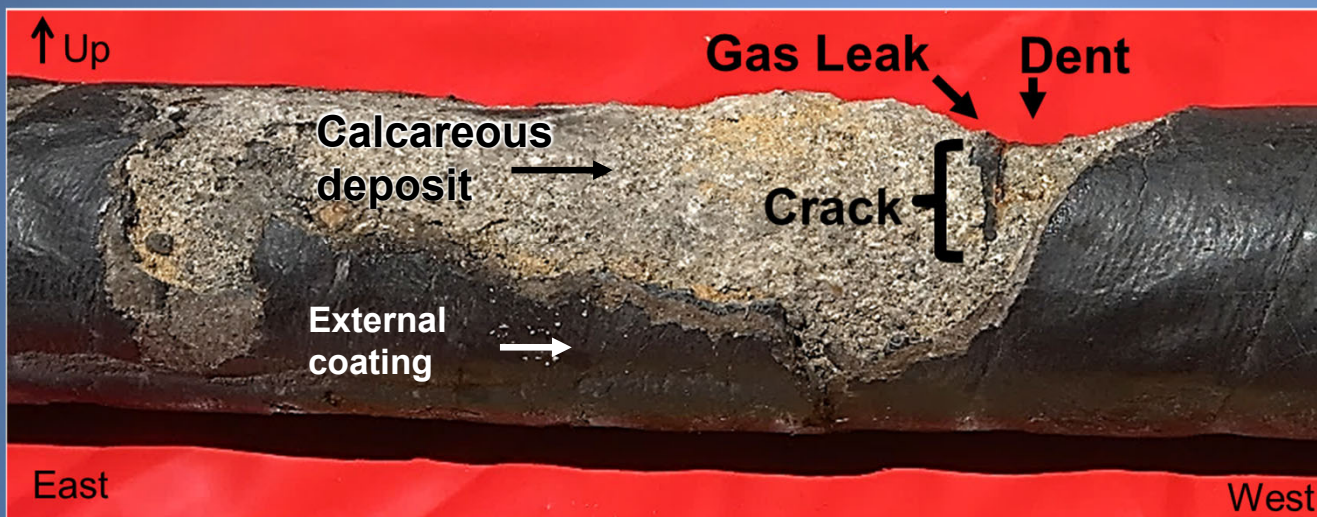
Examination of Gas Main

Frank Zakar

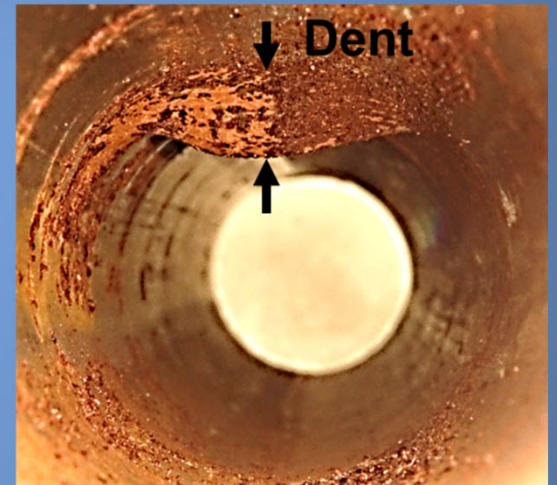
Gas Main

- API 5L Grade C seamless pipe
- Protected against corrosion
 - Exterior coating: coal-tar enamel spiral wrap
 - Cathodic protection: sacrificial anode

Gas Main

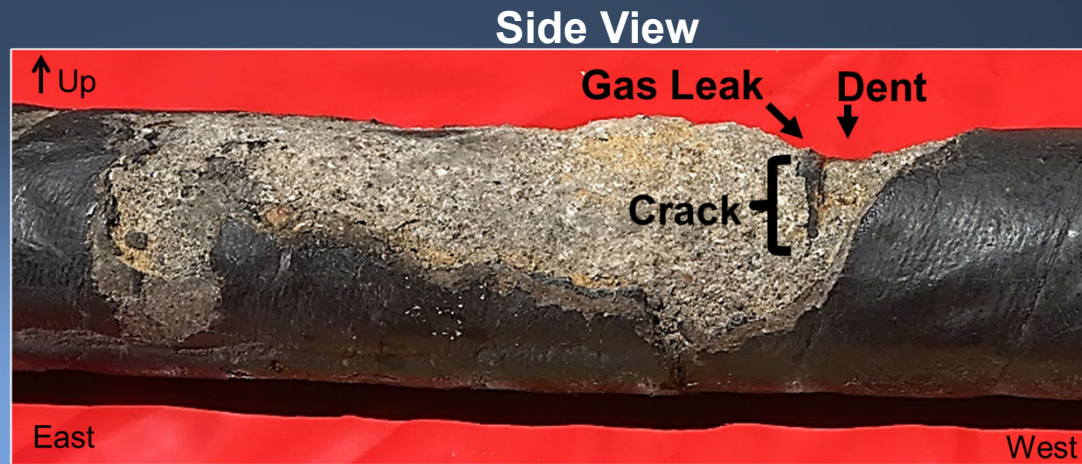


Side Profile

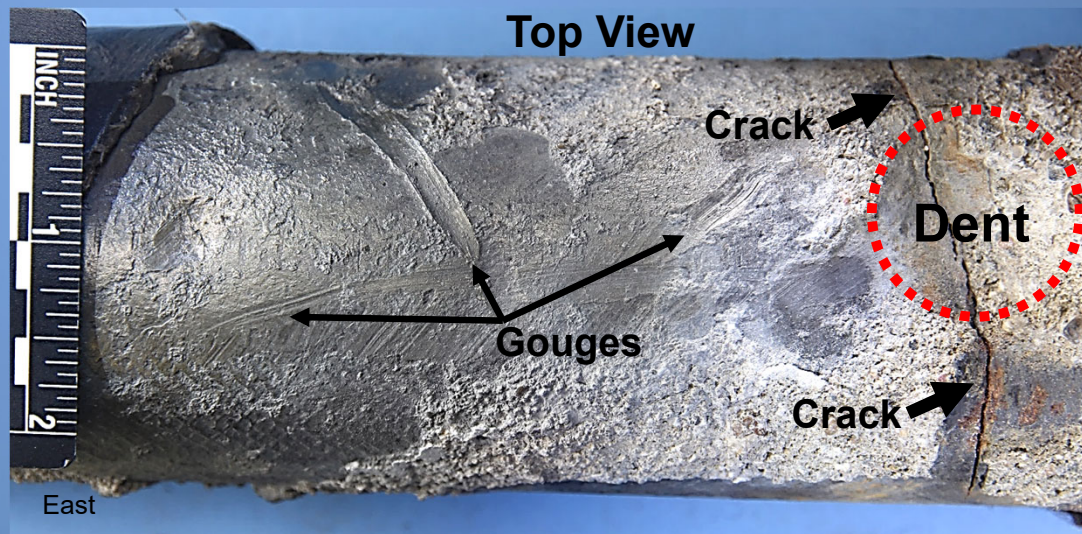


Internal View

As-received



Post-cleaning



Gas Main

Dent and gouges

- Typical of damage from digging operation
- Consistent with those caused by excavation equipment (not from a shovel)
- Most likely resulted when sanitary sewer lateral was replaced in 1995

Pressure Testing at NTSB Materials Laboratory

Cracked gas main

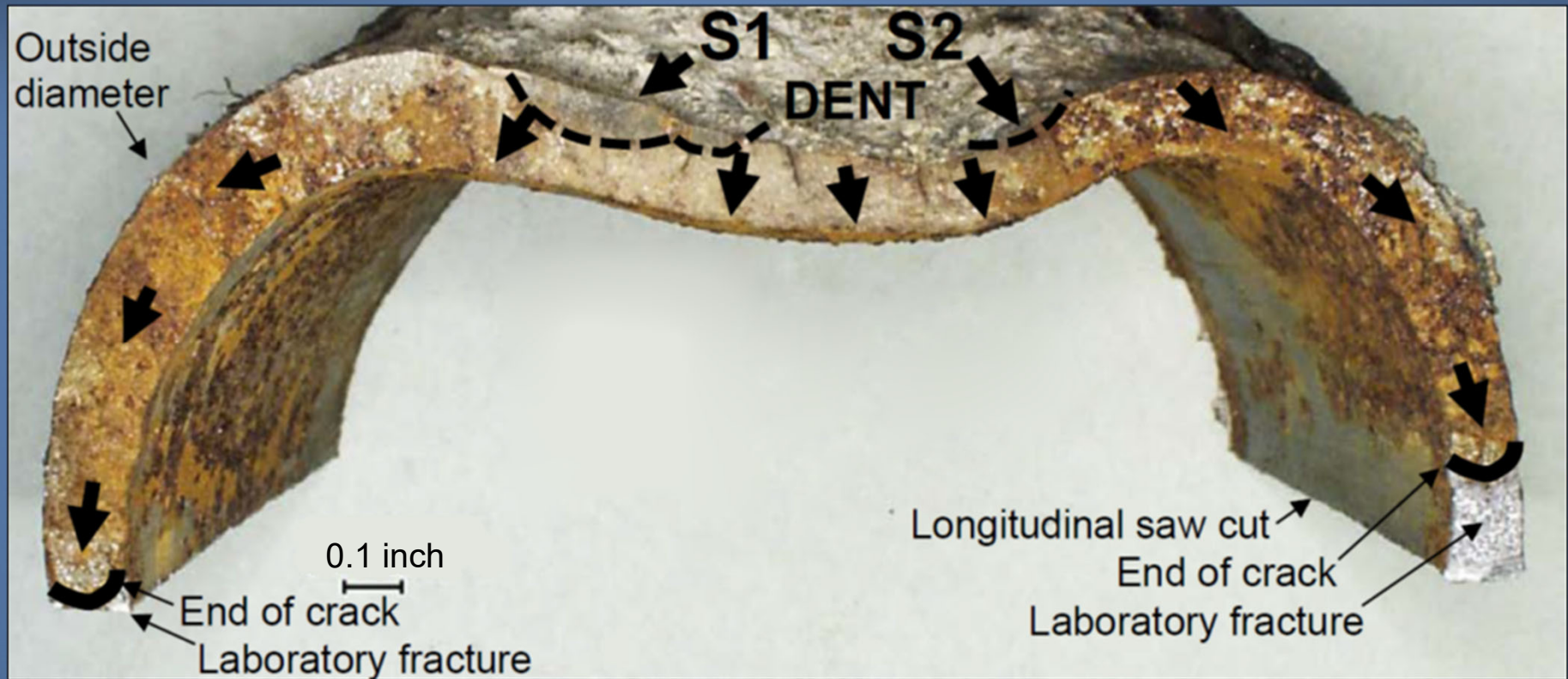
- Operating pressure: 17- 45 psig
- Leak rate: 8 - 14 CFM

Service tee assembly

- Started to leak at: 55 psig
- Leak rate: 0.2 CFM

The maximum allowable operating pressure (MAOP) was 55 psig.

Gas Main Fracture Sequence of Events



Timing of Through-wall Crack

- Fracture surface contained corrosion and calcareous deposits
- Through-wall crack was present for an extended period of time
- Fracture preceded all three fire/explosion events



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Fire and Explosion Evaluation

Nancy McAtee

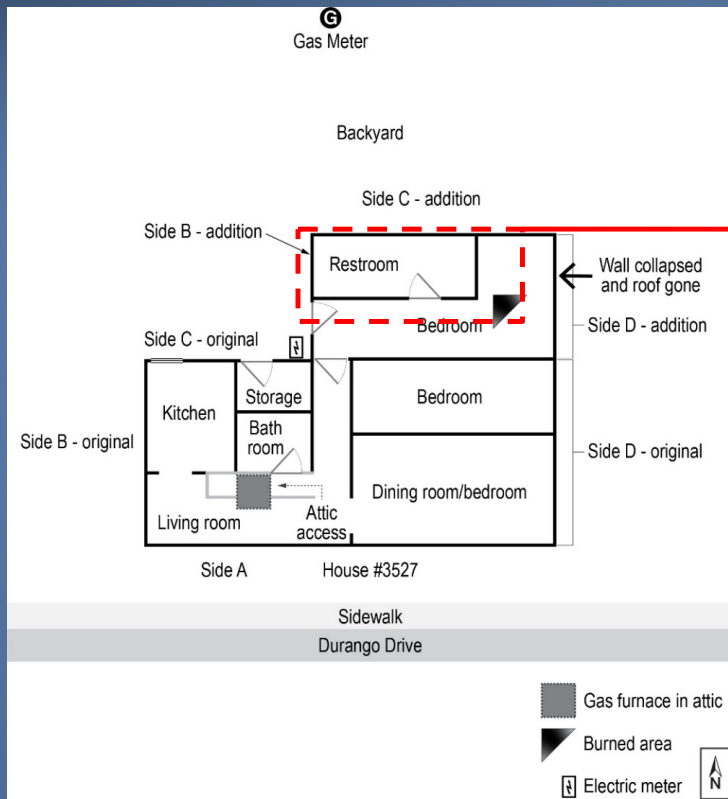
Overview of Incidents

- 3527 Durango Drive
- 3515 Durango Drive

3527 Durango Drive (Incident 1)



3527 Durango Drive (Incident 1)



3527 Durango Drive (Incident 1)



3527 Durango Drive (Incident 1)

- Damage consistent with a fuel gas/air mixture explosion
- Gas entered the structure through the new addition and spread up into the attic
- Most likely source of gas was Atmos-owned gas lines
 - Gas range, hot water heater, customer piping excluded
- HVAC the most likely ignition source

3515 Durango Drive (Incident 2)



3515 Durango Drive (Incident 2)



- Gas range sooted and exhibited thermal damage
- Although not tested, no obvious signs of failure or malfunction found during visual examination
- Neighbor reported similar incident

3515 Durango Drive (Incident 2)

- Kitchen most likely origin of fire
- Damage not consistent with structure fire
 - Firefighting efforts not ruled out
- Exact cause of the incident could not be determined
 - Evidence that natural gas existed within the structure
 - Not all accidental causes could be excluded

Incidents and Explosion Likely Related

- Natural gas was involved in both incident homes
- Insufficient evidence to exclude Atmos's system as the source
- Leaks on Atmos's system present prior to first two incidents
- Low likelihood of multiple structure fires/explosions occurring independently on the same block during the same week



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Emergency Response

Rachael Gunaratnam

Emergency Response on February 21-23

- Dallas Fire-Rescue (DFR) and Atmos responded to February 21-23 incidents
- Firefighters requested utility companies and arson investigators on-scene
- Firefighters response was timely and effective

Emergency Response on February 21-23

- DFR did not conduct gas monitoring
- Relied on Atmos to conduct gas monitoring
- DFR Hazardous Materials Response Team (HMRT) was not requested
- DFR procedures not consistent for gas-related events

DFR Fire Investigation

- On-scene work
 - Take photos and interview witnesses
- Fire Investigation Reports
 - Classified as “undetermined”
 - Concluded both Durango home fires were related to a gas-fueled appliance

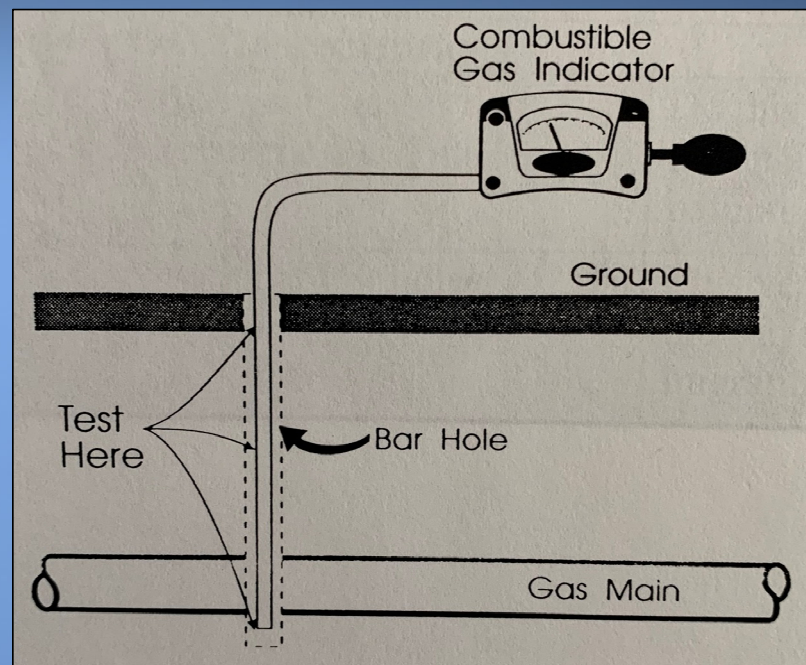


DFR Fire Investigation Report Conclusions

- Initially identified the wrong appliance for February 21 incident
- February 21 and February 22 reports drew conclusions before pressure testing the gas piping
- Lacked awareness and understanding of natural gas operations and hazards

Atmos's Investigation of the First Two Incidents

- Atmos technicians responded on February 21 and 22
- Bar hole made in ground
- Atmosphere in the bar hole sampled for gas



Atmos's Investigation of the First Two Incidents

First Incident (3527 Durango Dr.)

- One bar hole test
- Surveyed for gas over the top of the soil
- DFR arson investigator indicated gas-related fire from inside the house
- Customer piping not tested



Atmos's Investigation of the First Two Incidents

Second Incident (3515 Durango Dr.)

- Multiple bar hole tests
- Modified measurement technique
- Bubbles observed near meter
- Customer piping not tested



Atmos's Investigation of the First Two Incidents

- Atmos excluded its system from the February 21 and 22 incidents
- Atmos's investigations of the Durango homes were insufficient

Methane Detection

- None of the residents smelled gas
- Previous NTSB pipeline investigations found that soil can deplete gas odorant
- A methane alarm would alert residents to a gas release



Operator Incident Reporting

- Gas distribution incidents are reportable to PHMSA and the NRC under 49 CFR 191.3
- Atmos did not immediately report the first two incidents
- Lack of official reporting delayed a timely response by the RRC, PHMSA, and the NTSB

Operator Incident Reporting

- PHMSA does not specify investigation requirements for gas-related events
- GPTC guidance lists items for operators to “consider” to determine if a gas event is reportable (explosion, fire, evacuation, etc.)
- Atmos relied on its leak investigation data

DFR Incident Reporting

- DFR fire investigation reports can be elevated and reported informally
- No formal policy in place to report unusual circumstances
- Timely reporting prompts further investigation and oversight



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Operations and Integrity Management

Sara Lyons

Leak Investigation Equipment

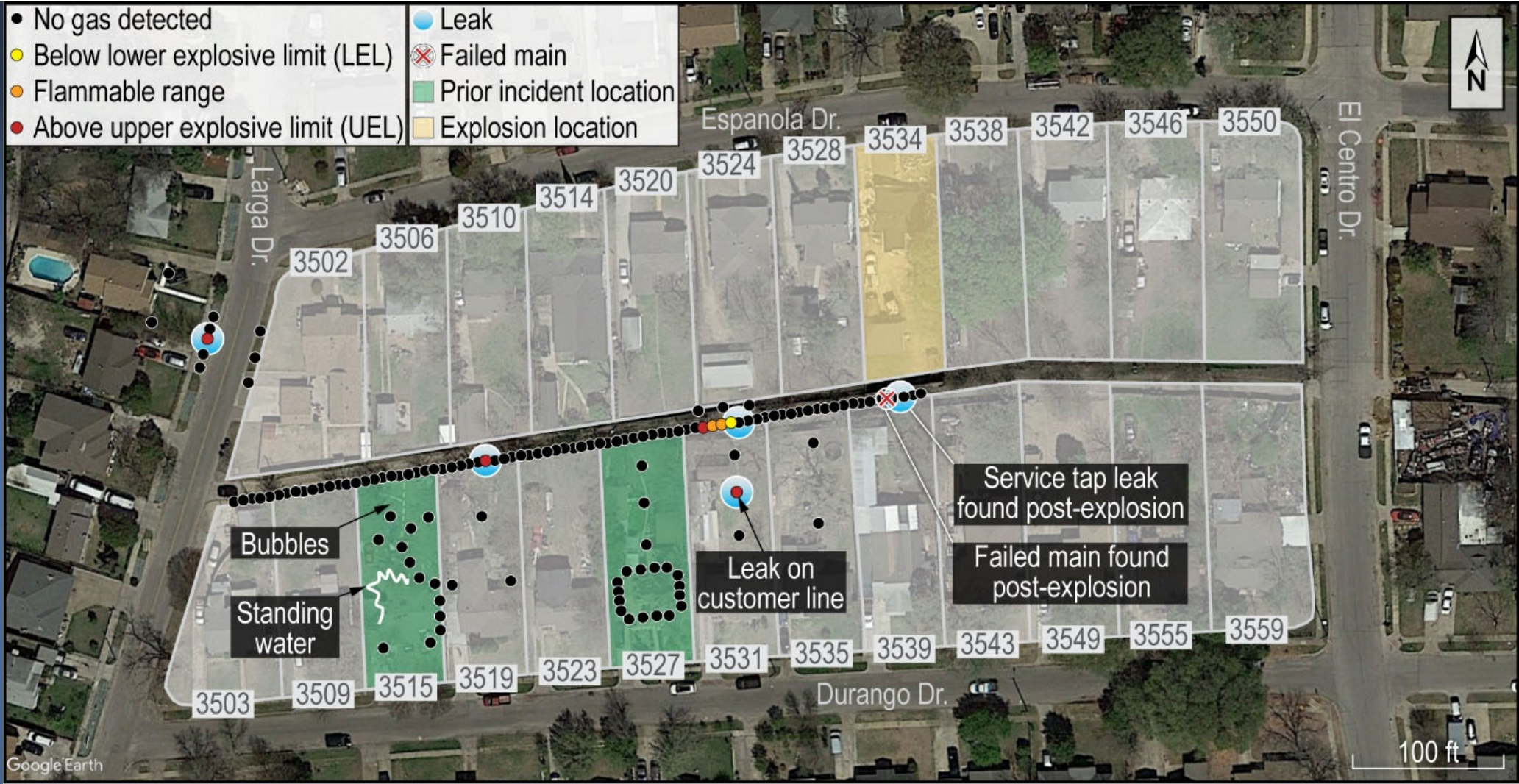
Remote Methane Leak Detector

- Used to detect gas above ground
- Not recommended in wet weather

Combustible Gas Indicator

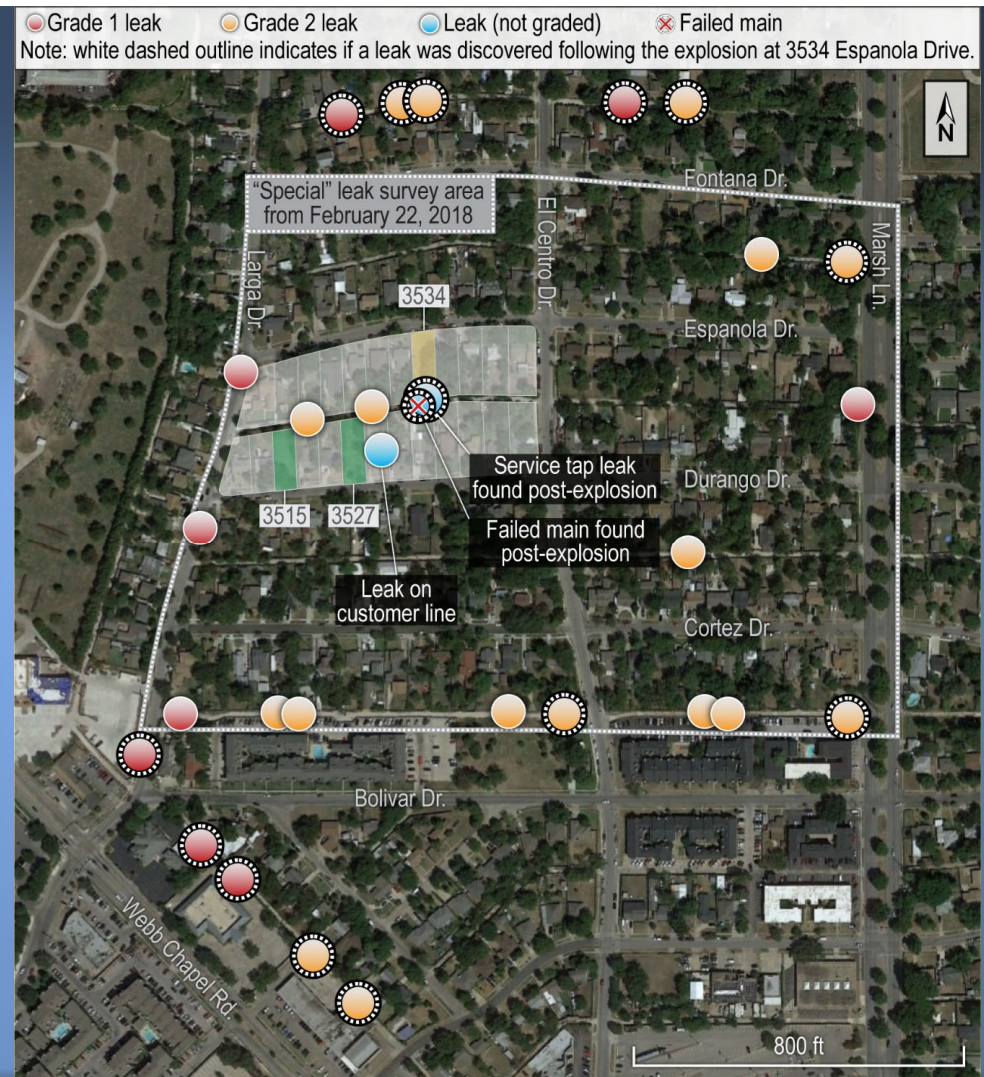
- Used to pinpoint the location of a gas leak
- Not recommended in wet weather
- Used in bar hole test

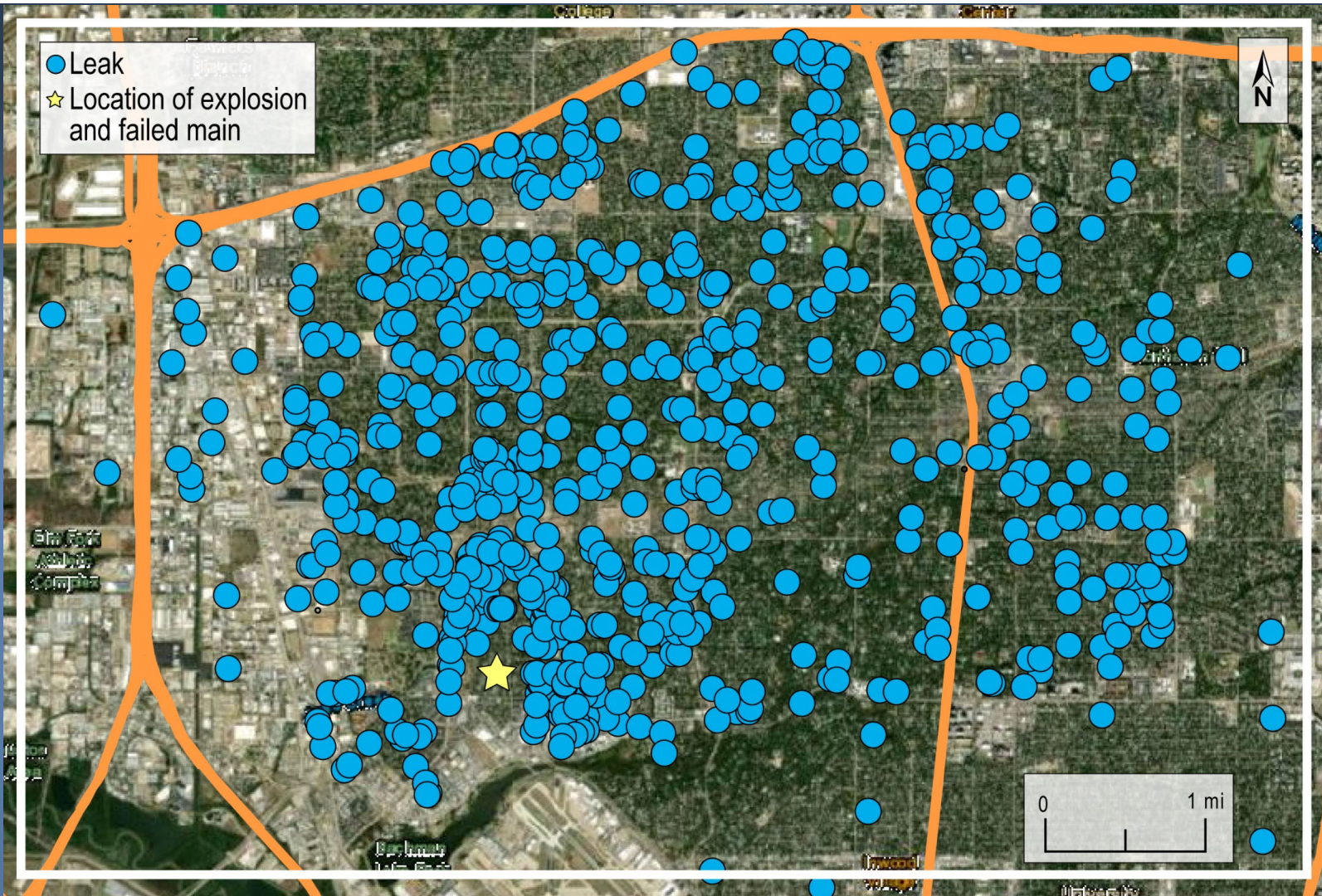
- No gas detected
- Below lower explosive limit (LEL)
- Flammable range
- Above upper explosive limit (UEL)
- Leak
- Failed main
- Prior incident location
- Explosion location



Leak Surveys

- 26 Grade 1 or 2 leaks
 - 13 found before explosion
 - 13 found after explosion
- Disconnected natural gas service to 2,800 homes





Geotechnical Evaluations

Atmos

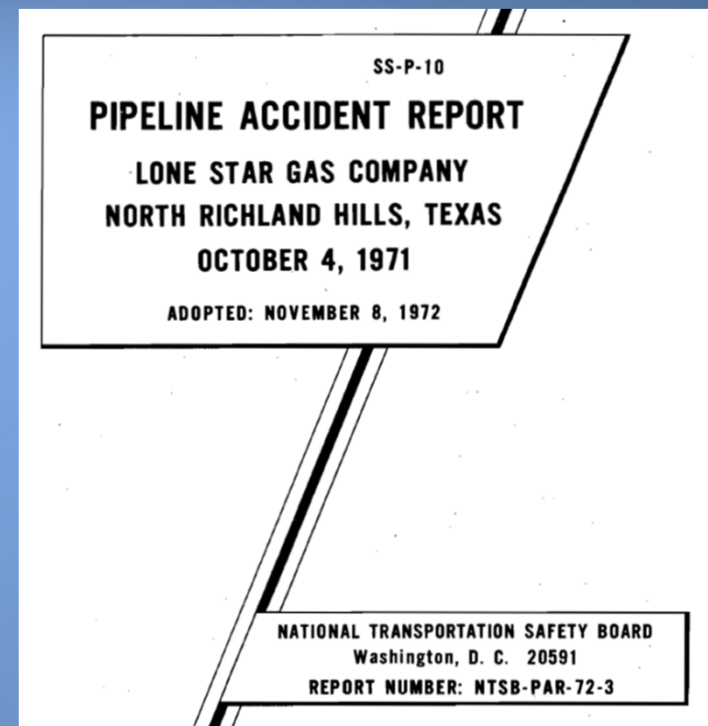
- Large number of leaks was “abnormal, sudden, and unexplained”
- Rain caused unanticipated external loading

US Army Corps of Engineers

- Wet/dry cycles cause clay to shrink and swell, distressing buried piping
- No evidence of unanticipated external loading

High Plasticity Clay Soils

- US Army Corps of Engineers indicated that soil loading can distress buried piping
- Similar observations
 - Previous NTSB investigation
 - Foundation inspection at 3534 Espanola Drive



Integrity Management Requirements

- DOT Inspector General recommended PHMSA require pipeline integrity management for the gas distribution sector in 2004
- Requirements promulgated in 2009, effective August 2011
- Purpose was to enhance safety by identifying and reducing pipeline integrity risks

Integrity Management

- Threats must be identified and understood
- Safety resources are to be applied commensurate with the importance of each threat
- Leak survey methodology and frequency did not identify the degraded condition



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