National Transportation Safety Board

Natural Gas Building Explosion
New York City, NY
March 12, 2014

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New York City, NY
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Opening Statement

Ravi Chhatre, PE

Investigator-in-Charge

Buildings Before Explosion

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Buildings After Explosion

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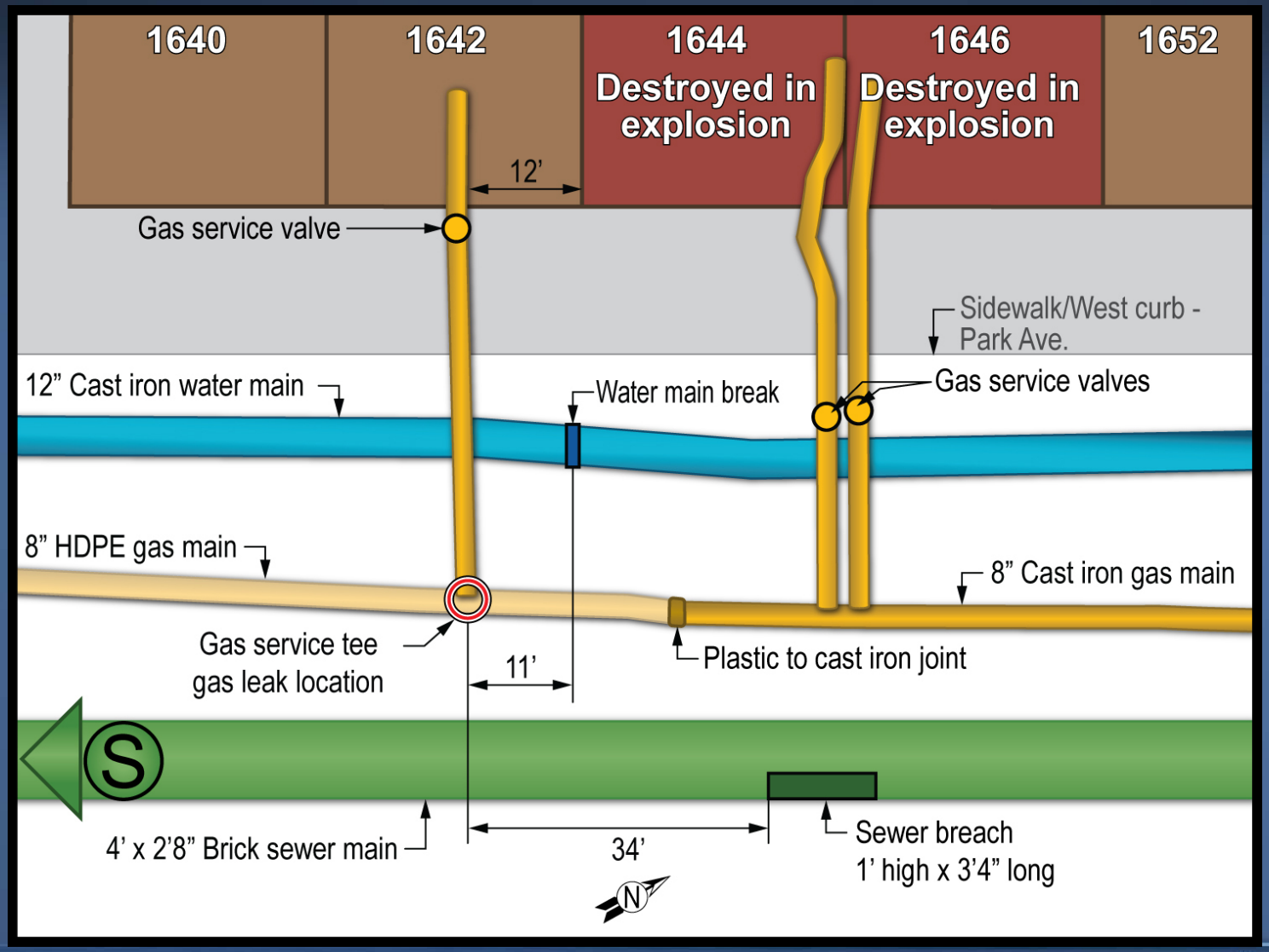
Utilities in the Accident Block



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Background

- Many street repairs from 2004 until a few days before the accident
- The previous internal inspections of sewer main showed 12″ x 40″ hole
- Excavation 8 feet wide by 19 feet deep in front of 1642 Park Avenue in 2011

Background (continued)

- Water main leak surveys at 45−55 psig; no leaks detected
- No water leaks or flooding calls
- Cold weather related gas main leak surveys; no leaks detected
- Gas odor on March 11, 2014
- Water main break occurred after the explosion

Event Timeline

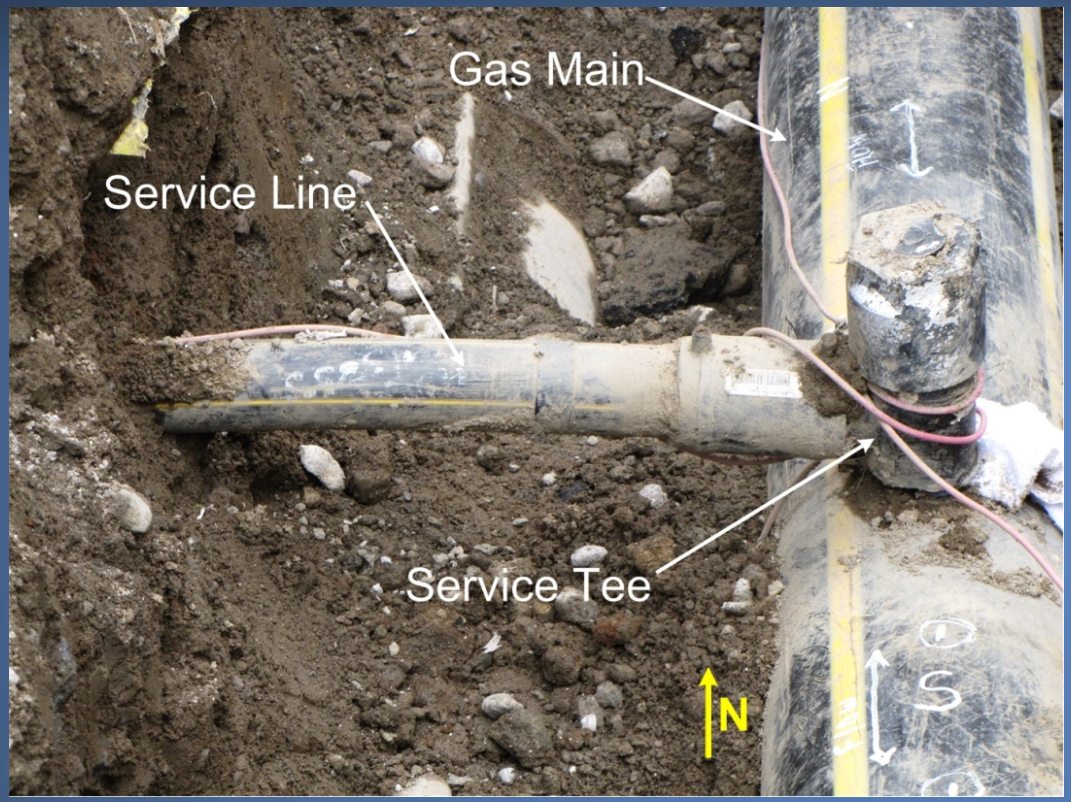
9:06 a.m.	Gas odor call to Con Edison
9:15	Service mechanic dispatched
9:19	Con Edison called the fire department but withdrew the call
9:30	**Explosion on Park Avenue**
9:31	First 911 call notification

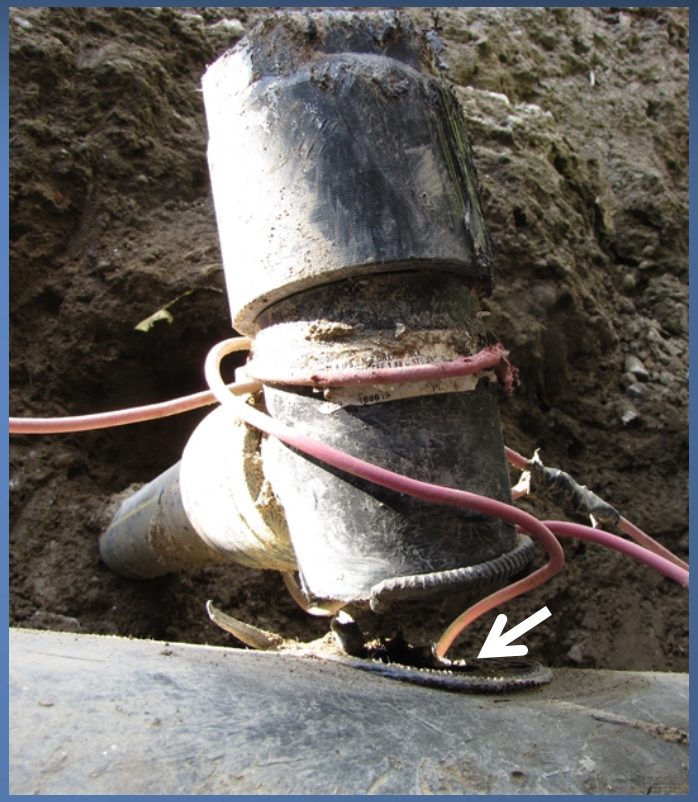
Event Timeline (continued)

9:34 a.m.	Fire department on scene
1:44 p.m.	Gas flow in the accident block stopped
2:00 p.m.	A void in the street observed

On March 18, more than 6 days later, the fire department concluded operations

On-Scene Activities - Service Tee





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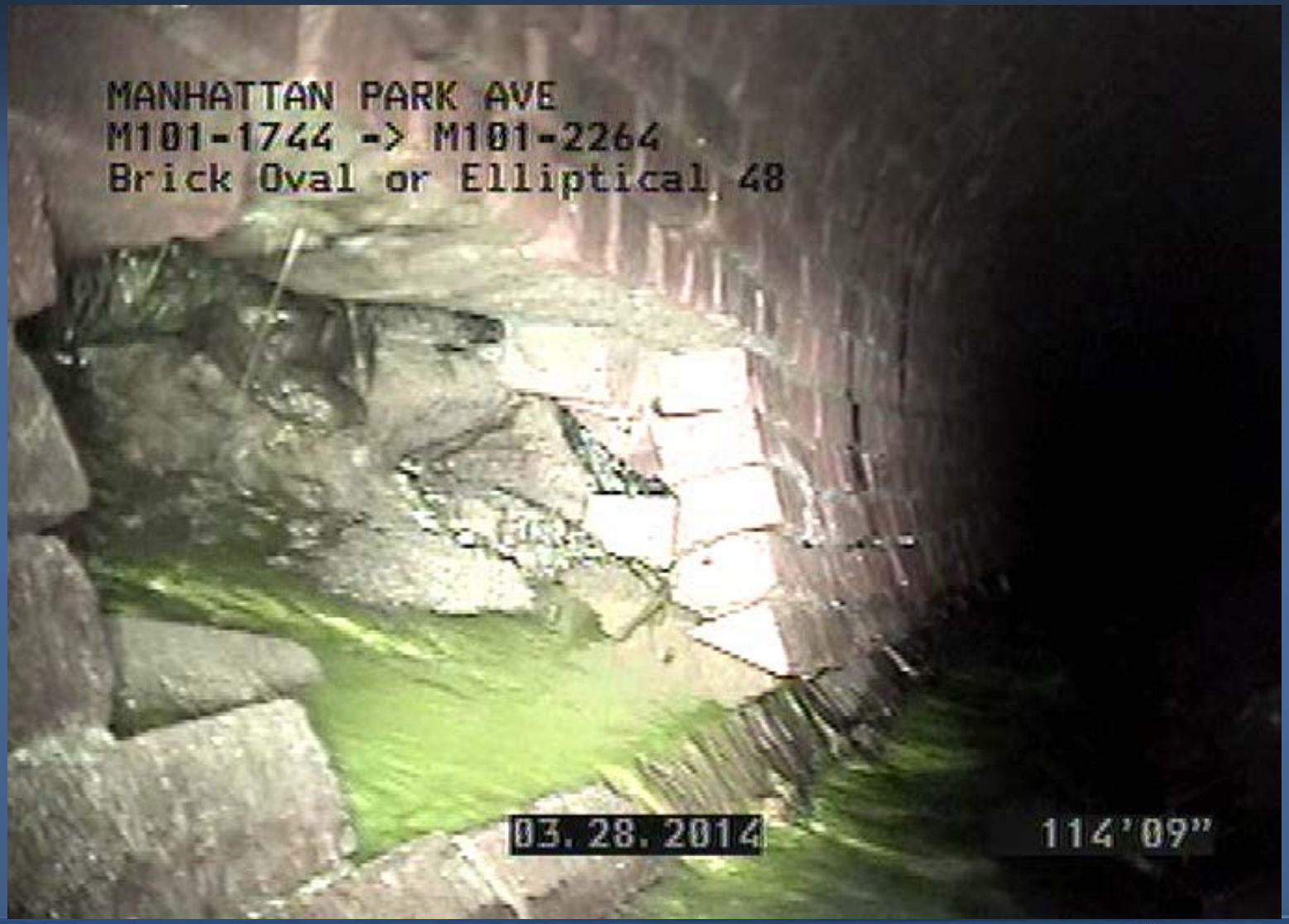
On-Scene Activities - Dye Test



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Safety Issues

- Adequacy of Con Edison's quality assurance and quality control procedures for joining plastic pipes
- Effectiveness of Con Edison's public awareness program
- Adequacy of Con Edison's response to gas odor reports

Safety Issues (continued)

- Effectiveness of the New York City Department of Environmental Protection sewer integrity program
- Effectiveness of regulatory oversight

Parties to the Investigation

- Pipeline and Hazardous Materials Safety Administration
- Public Service Commission of the State of New York
- City of New York
- Consolidated Edison Company
- Georg Fischer Central Plastics

Investigation Team

• Ravindra Chhatre	Investigator-in-Charge
• Kalu Kelly Emeaba	Operations
• Richard Downs	Survival Factors, Emergency Response
• Frank Zakar	Materials Laboratory
• Xiaohu Liu	Finite Element Analysis
• Erik Grosof	Senior Advisor for the ROC
• Benjamin Allen	Assistant General Counsel

Investigation Team (continued)

• Margaret Athey	Writer/Editor
• John Vorderbrueggen	Chief, Pipeline and Hazardous Materials
• Joe Scott	Chief, Report Development
• Bob Beaton	Chief, Human Performance and Survival Factors
• Michael Budinski	Chief, Materials Laboratory
• Carl Schultheisz	Chief, Vehicle Performance

Investigation Team (continued)

• Jane Terry	Chief, Government Affairs
• Kelly Nantel	Chief, Public Affairs
• Eric Weiss	Public Affairs Specialist
• Mike Brown	Safety Recommendations
• Ed Komarnicki	Engineering Technician
• Rachael Gunaratnam	Technical Support

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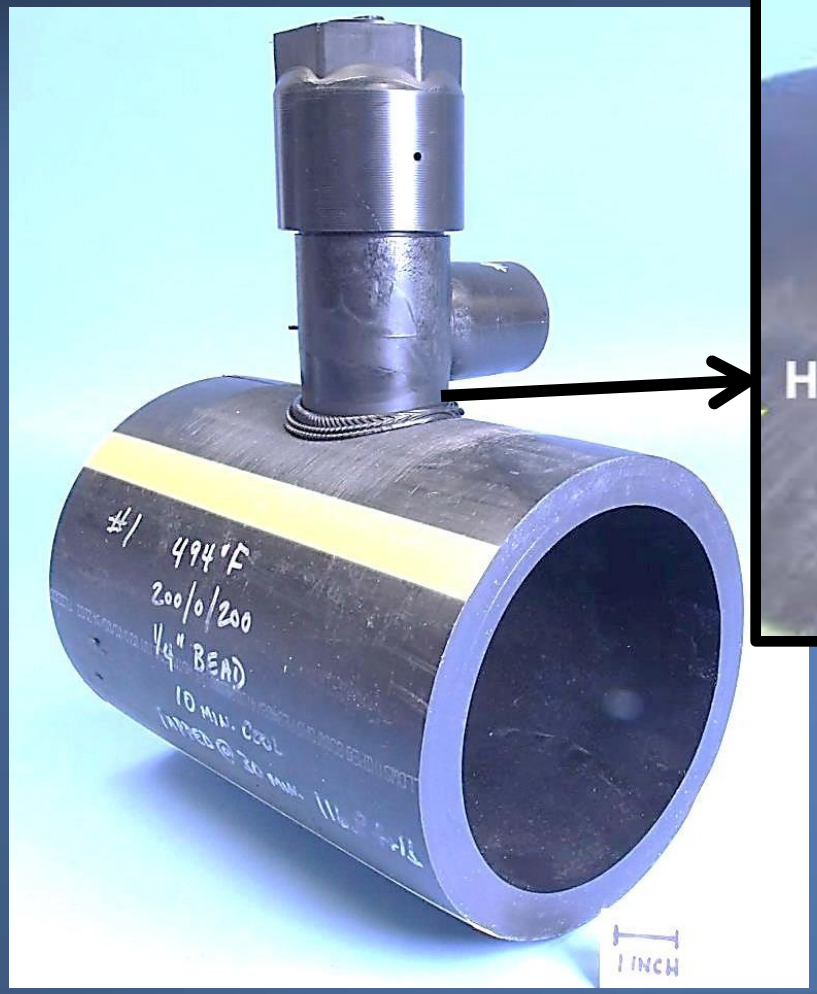
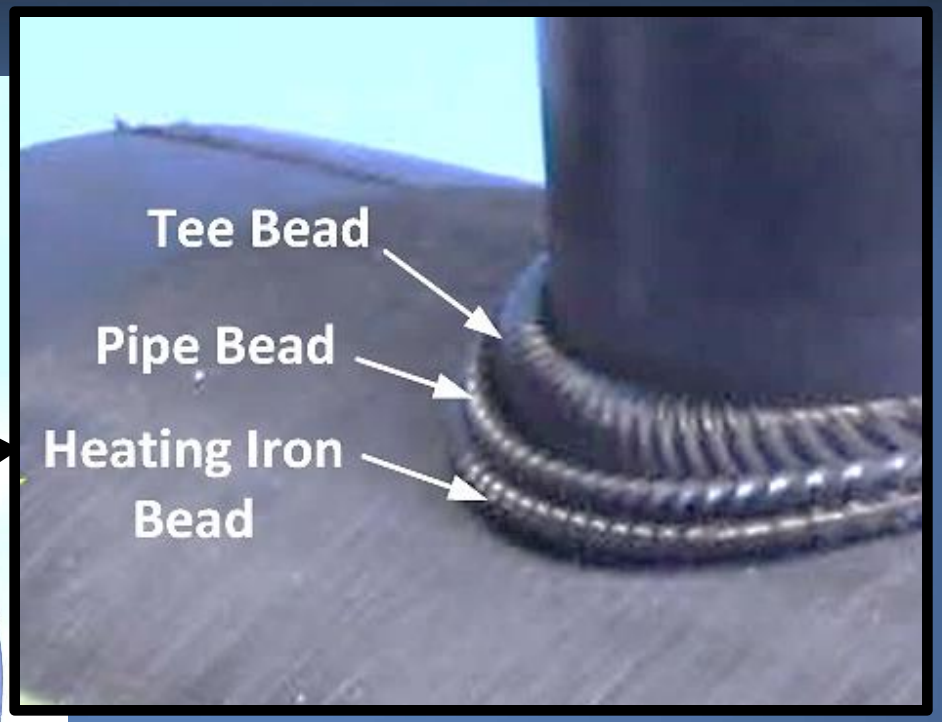
Fractured Service Tee Examination

Frank Zakar

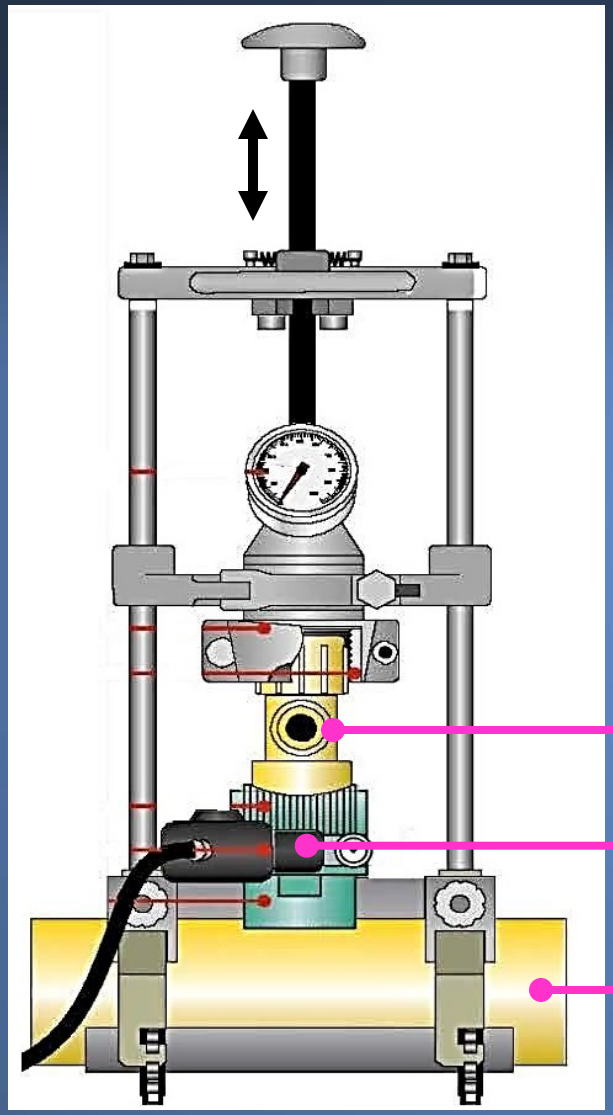
Senior Metallurgist
Materials Laboratory

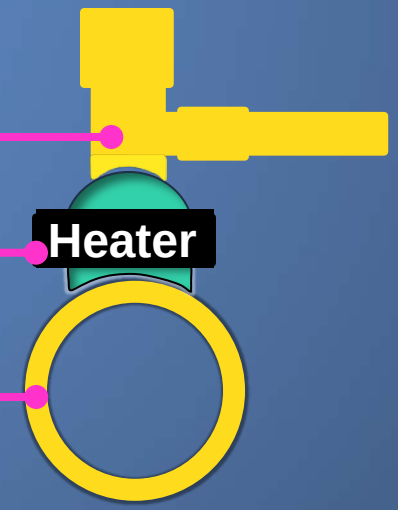
Saddle Fusion Joint Exemplar Test Piece





Portable Saddle Fusion Machine





Side Profile

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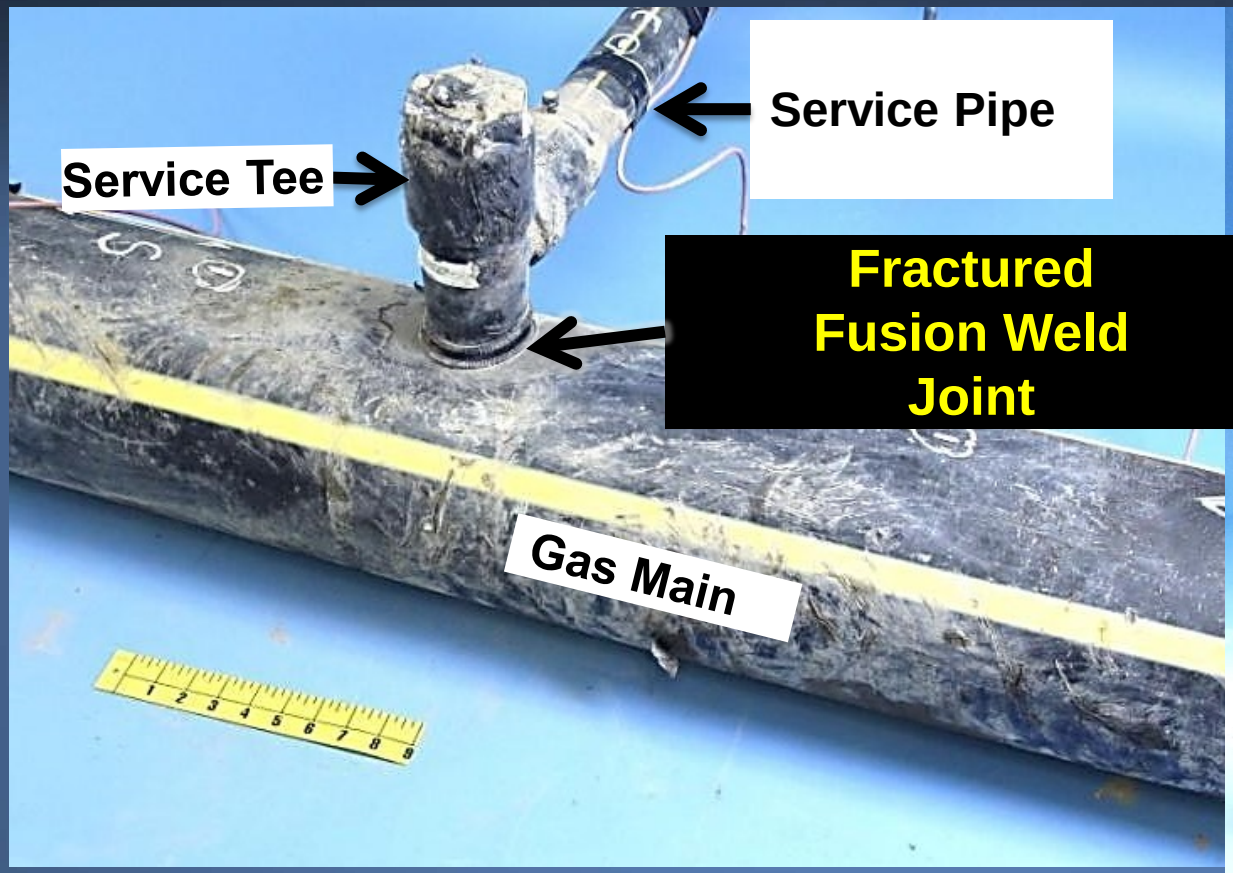
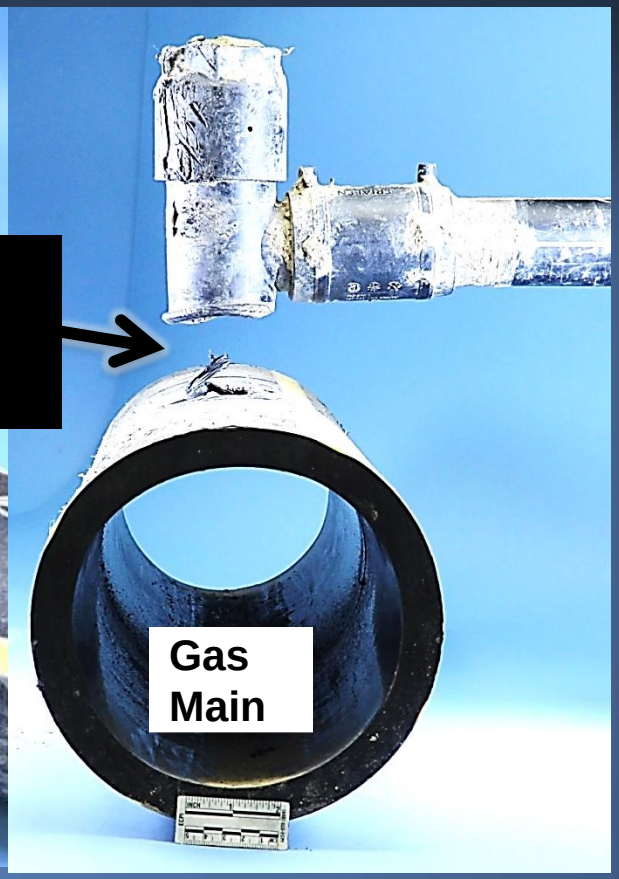
Video
Saddle Fusion Procedure

Source: Performance Pipe
Edited to shorten running time

HDPE Gas Main & Service Tee



Assembled orientation



Side Profile
(separated)

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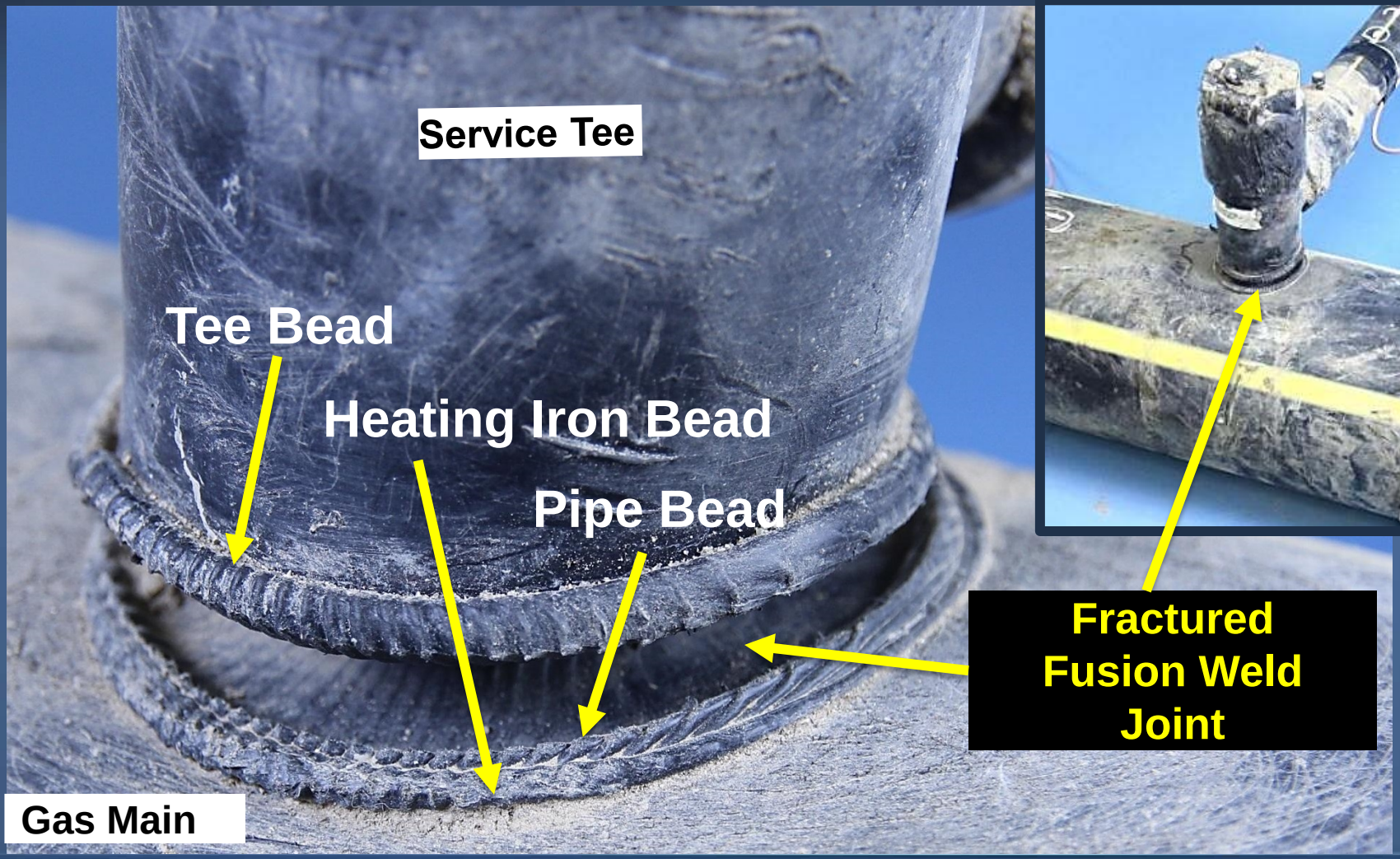
Fractured Saddle Tee Fusion Joint



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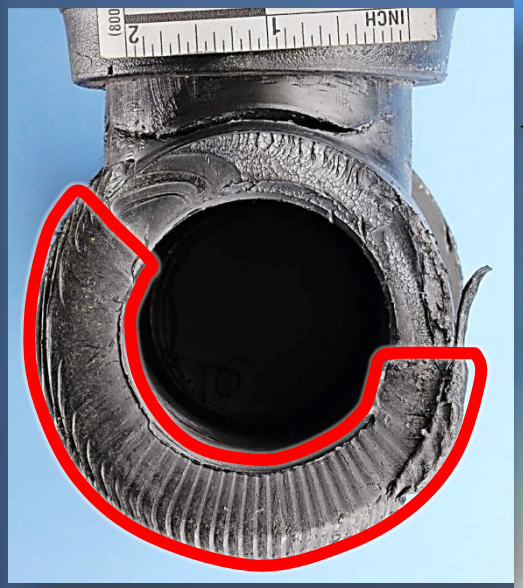
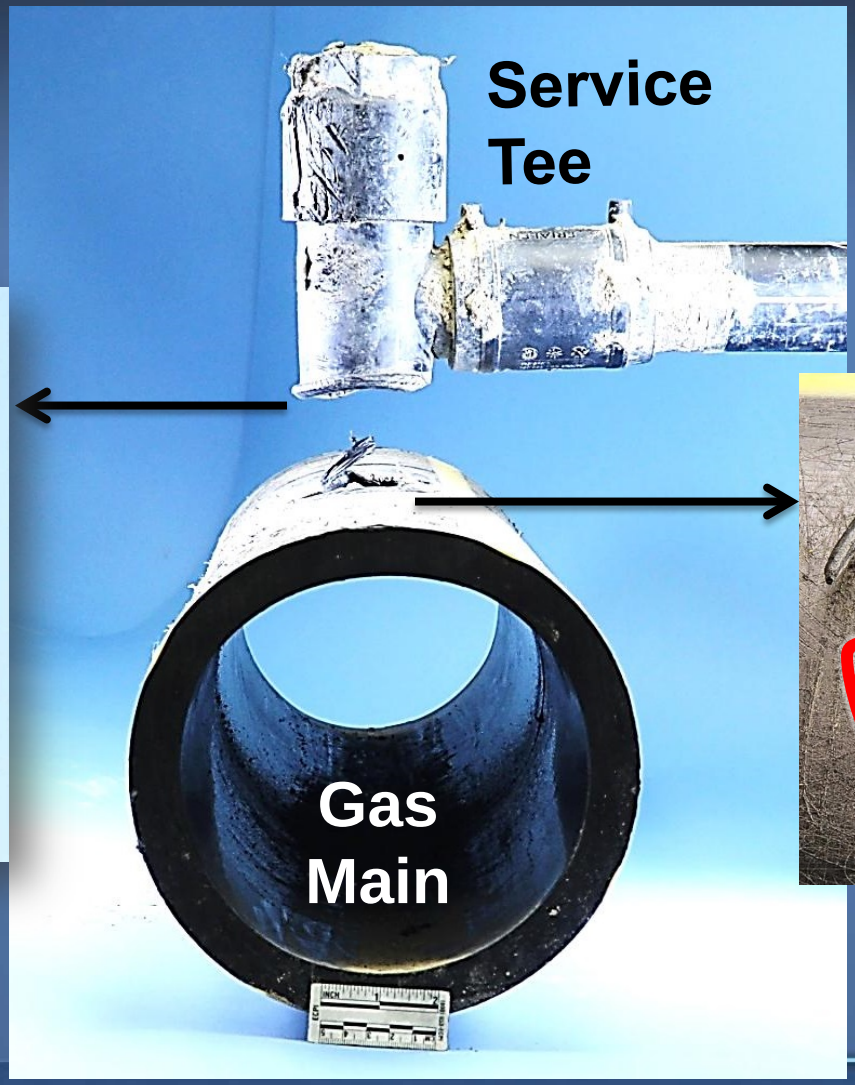
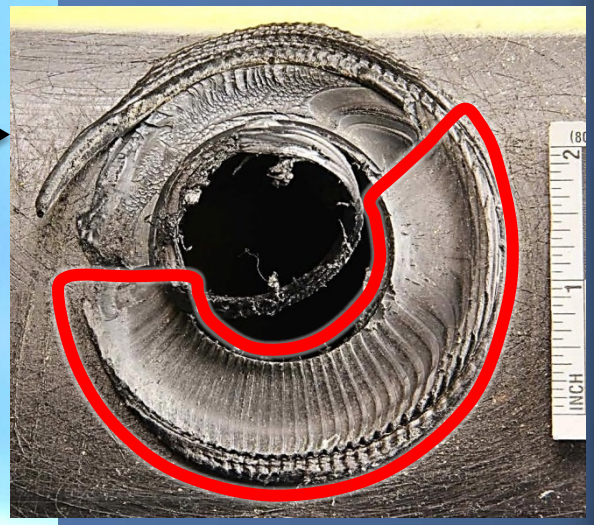
Fusion Joint Fracture Faces

Service Tee Fracture Face





Gas Main Fracture Face



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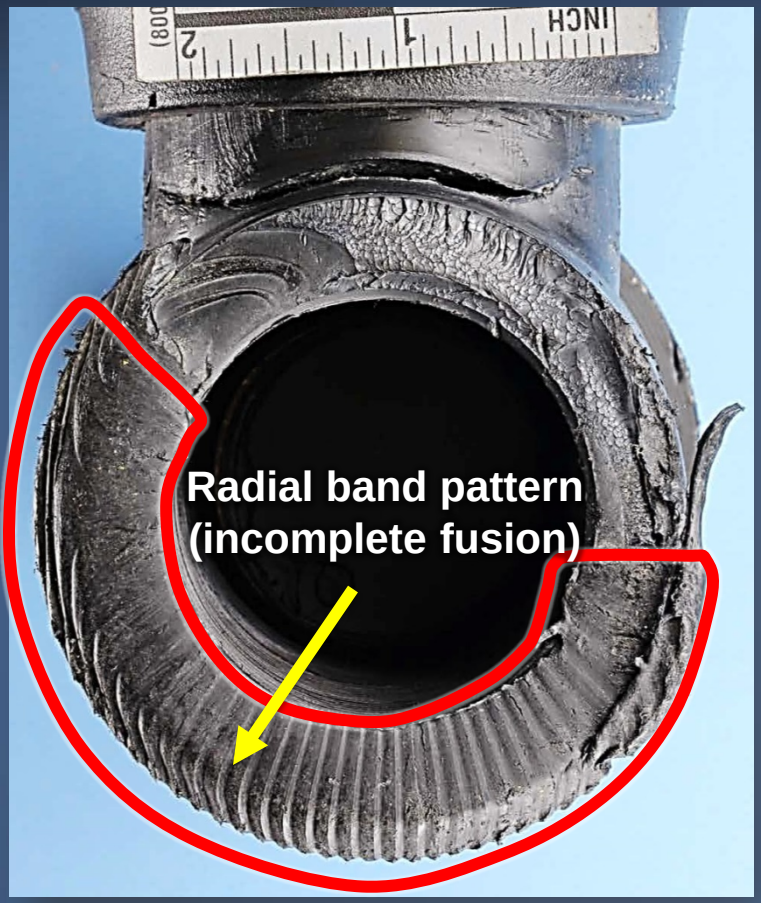
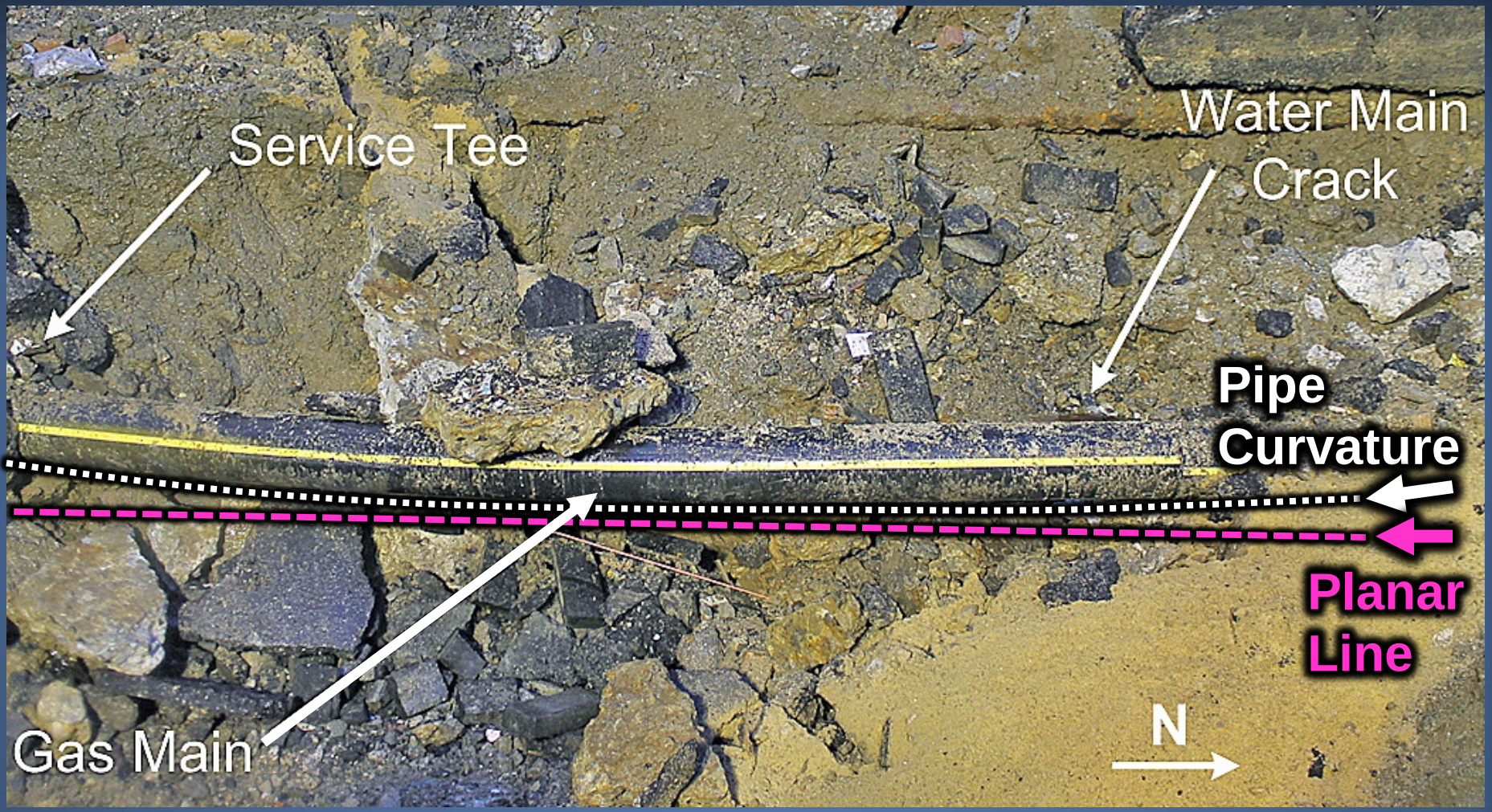
Fusion Joint – Incomplete Fusion



Service Tee Fracture Face

- Radial band pattern (60%)
- Is incomplete fusion
- Is a weld defect
- Weak bond strength
- Caused by contamination or inadequate surface preparation before fusion welding

Partially Excavated Sagging Gas Main



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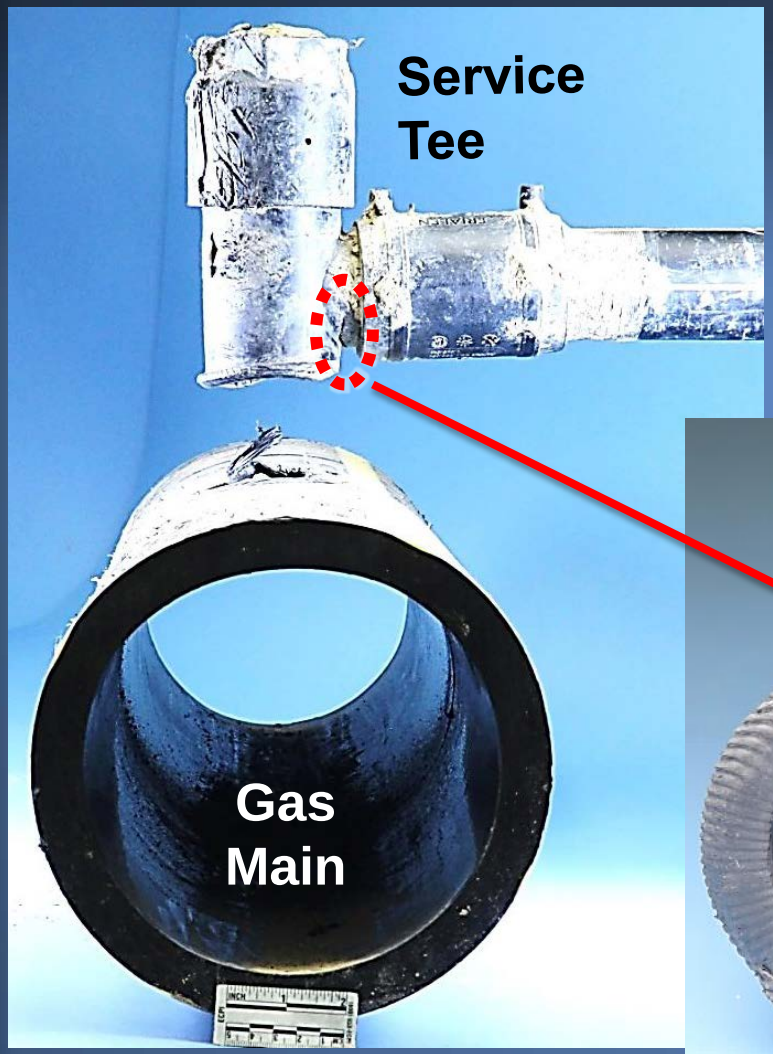
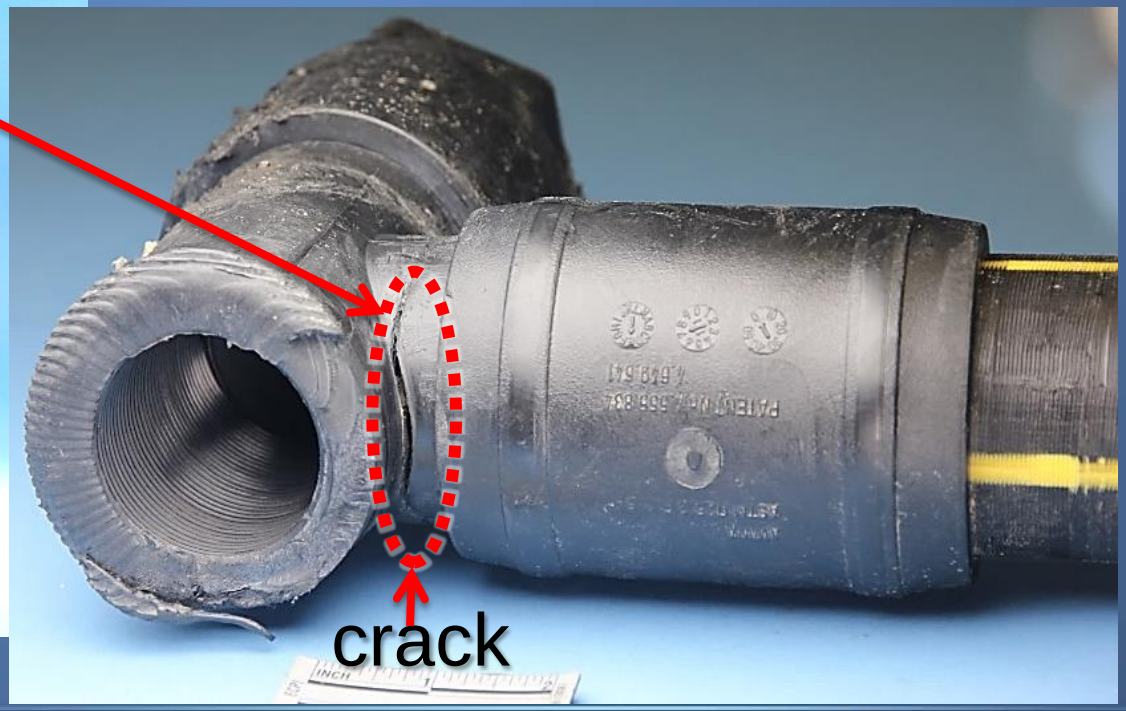
Service Tee – Crack at Outlet



- No evidence of pre-existing crack
- Rapid loading event from post-accident excavation



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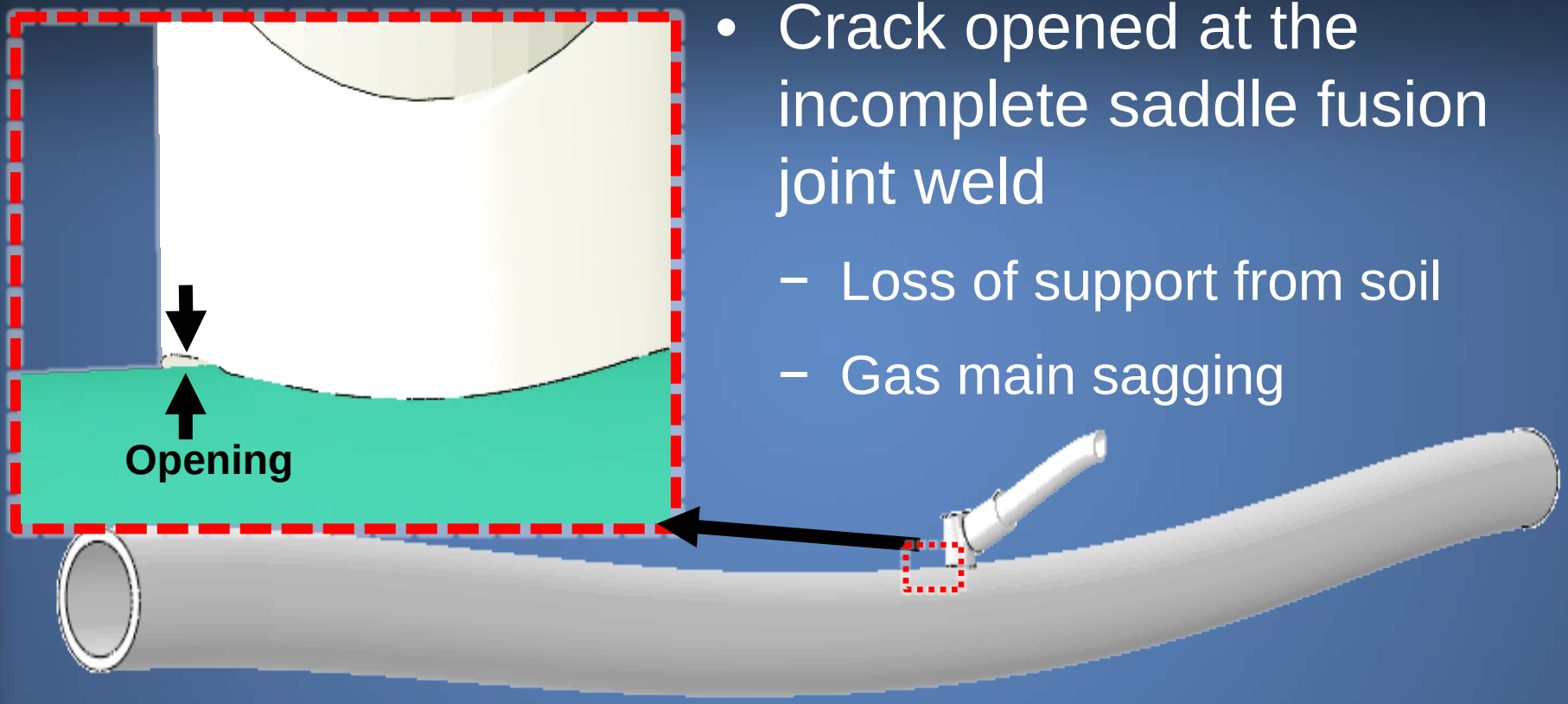
Finite Element Modeling



- Crack opened at the incomplete saddle fusion joint weld
  - Loss of support from soil
  - Gas main sagging

- Outlet crack could occur with a partially opened saddle fusion joint

Service Tee Failure – Sequence of Events

- Service tee was improperly welded
- Gas main sagged due to loss of soil support
- Defective weld opened, allowing gas to escape and migrate into the building
- Post-accident excavation heavy equipment
  - Cracked the service tee outlet
  - Separated the service tee fusion joint

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Utilities Operations

Kalu Kelly Emeaba, B.Eng.-Sc., M.Sc.

Southbound Park Avenue Road Condition

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2006 Sewer Main Damage

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2014 Sewer Main Damage

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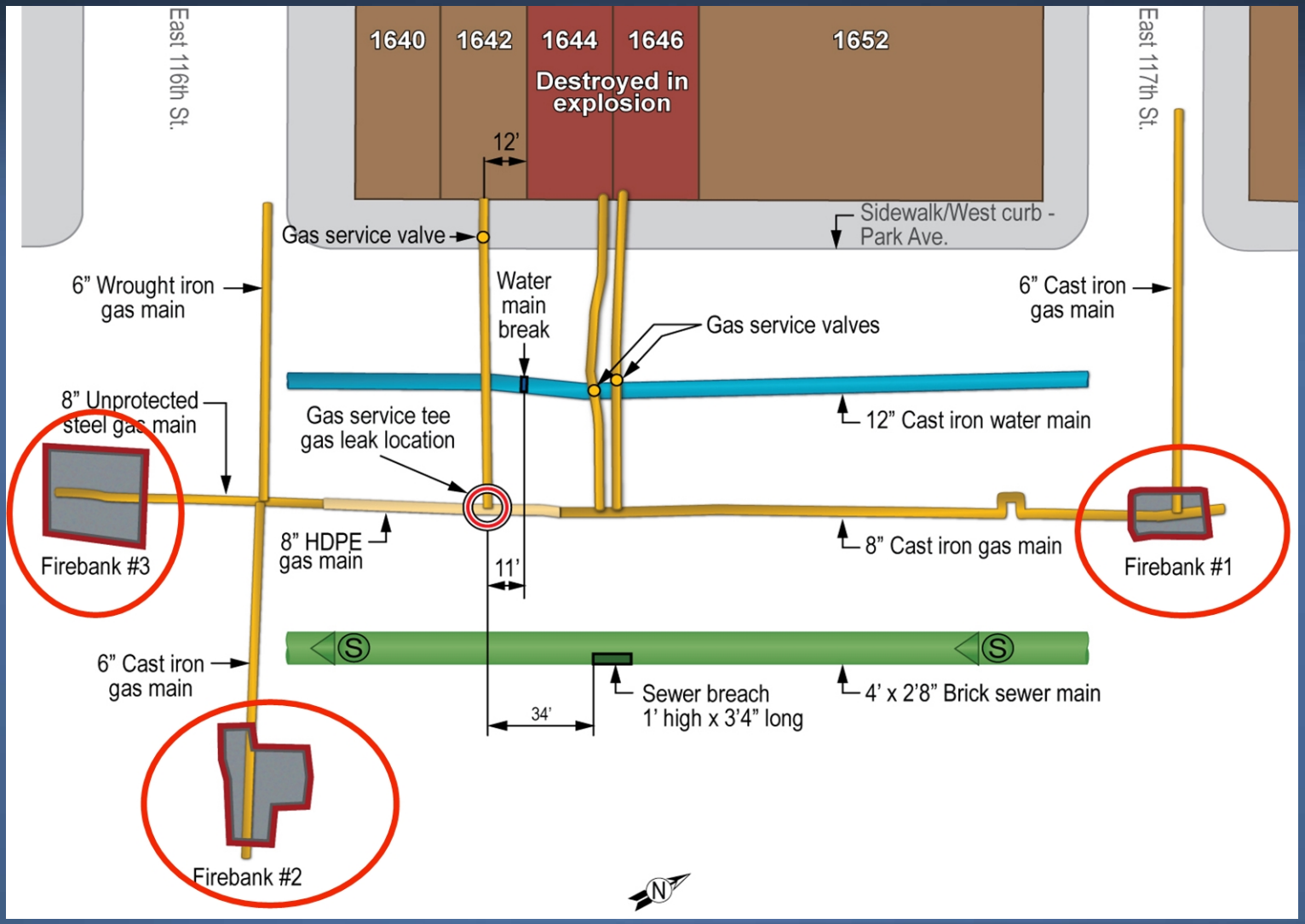
NYCDEP Sewer Damage Evaluation

- Believed the hole in the sewer was not significant
- Concluded a sewer main repair was not a priority

Natural Gas Distribution Main Isolation Valves

- No gas isolation valves were installed in accident area
- Gas flow continued for more than 4 hours after the explosion

Gas Main Firebank Excavations



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Con Edison Gas Mains Isolation Valve Installation Program

- Program requires isolation valves to be installed on new and replaced mains
- 2011 – HDPE pipe main installed at 1642 Park Ave without isolation valves

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Survival Factors – Emergency Preparedness and Response

Richard Downs, Jr., PE

Con Edison Gas Odor Emergency Call Response

- Smell of gas reported to Con Edison Call Center at 9:06 a.m.
- Reported gas odor both inside and outside the building
- Immediate notification to the fire department required

Con Edison Gas Odor Emergency Call Response (continued)

- Call Center follow-up call to Con Edison GERC at 9:12 a.m.
- Gas Distribution Service Mechanic responded to the gas emergency call
  - Dispatched by GERC at 9:15 a.m.
  - En route to accident site when the explosion occurred

Con Edison Gas Odor Emergency Call Response (continued)

- GERC called FDNY at 9:19
  - Requested FDNY response and provided address
  - GERC then said “Hold-up, no, sorry, … I’ll call you right back”
  - No follow-up call to FDNY occurred, thus cancelling the request

Optimal Response Analysis

- Upon conclusion of Customer Service call to GERC, immediately notify FDNY about 9:12 a.m.
- FDNY arrives at the scene about 9:15 a.m. and initiates an evacuation
- About 15 minutes remain before the explosion

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