



Wisconsin Incidents 1986 - Present

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Wisconsin Pipeline Safety Seminar

February 6th, 2026

Public Service Commission of Wisconsin

Madison Apartment Fire



December 16th, 2000

Overview and Response



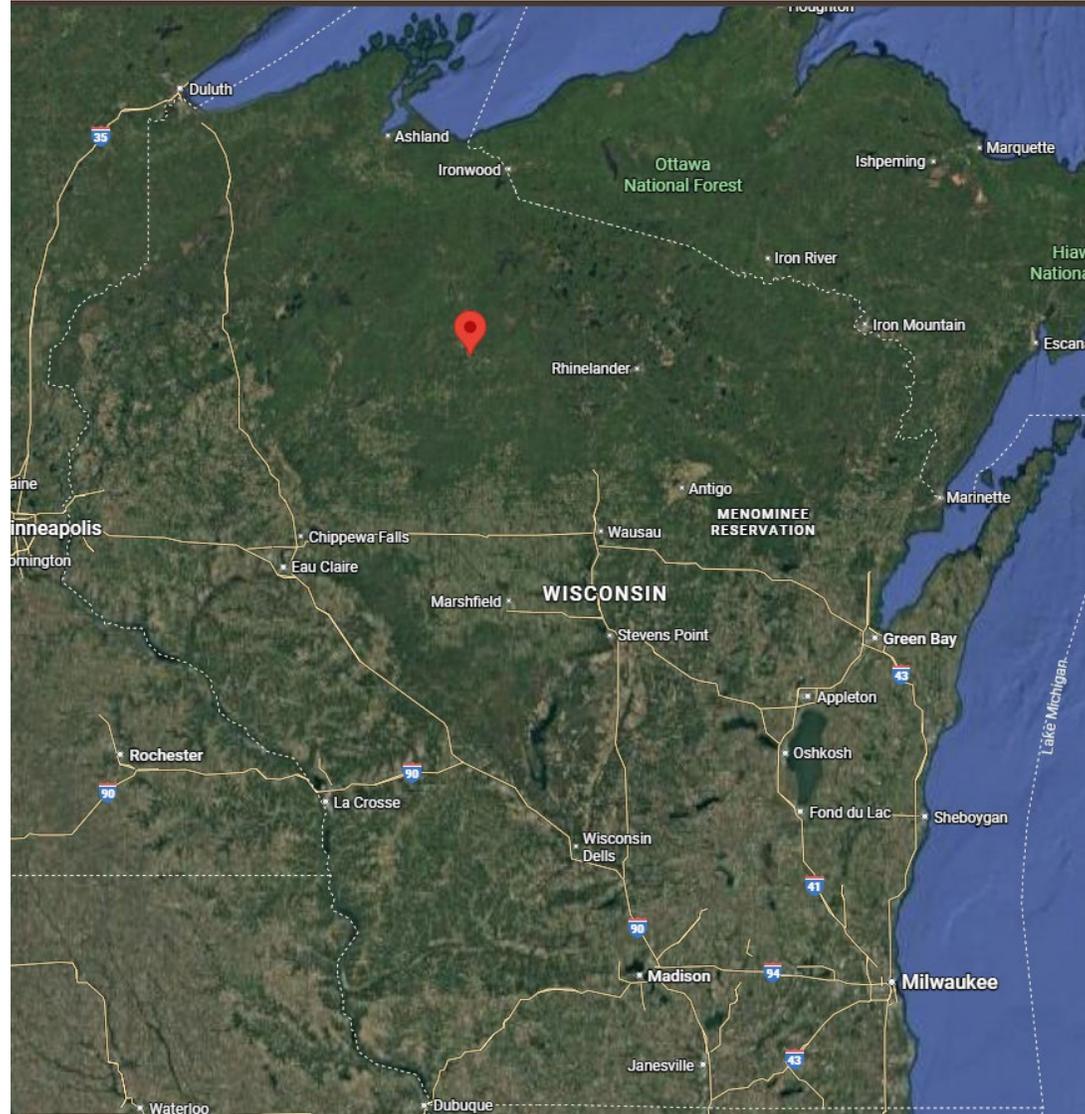
Investigation



Meter Protection



Phillips Explosion



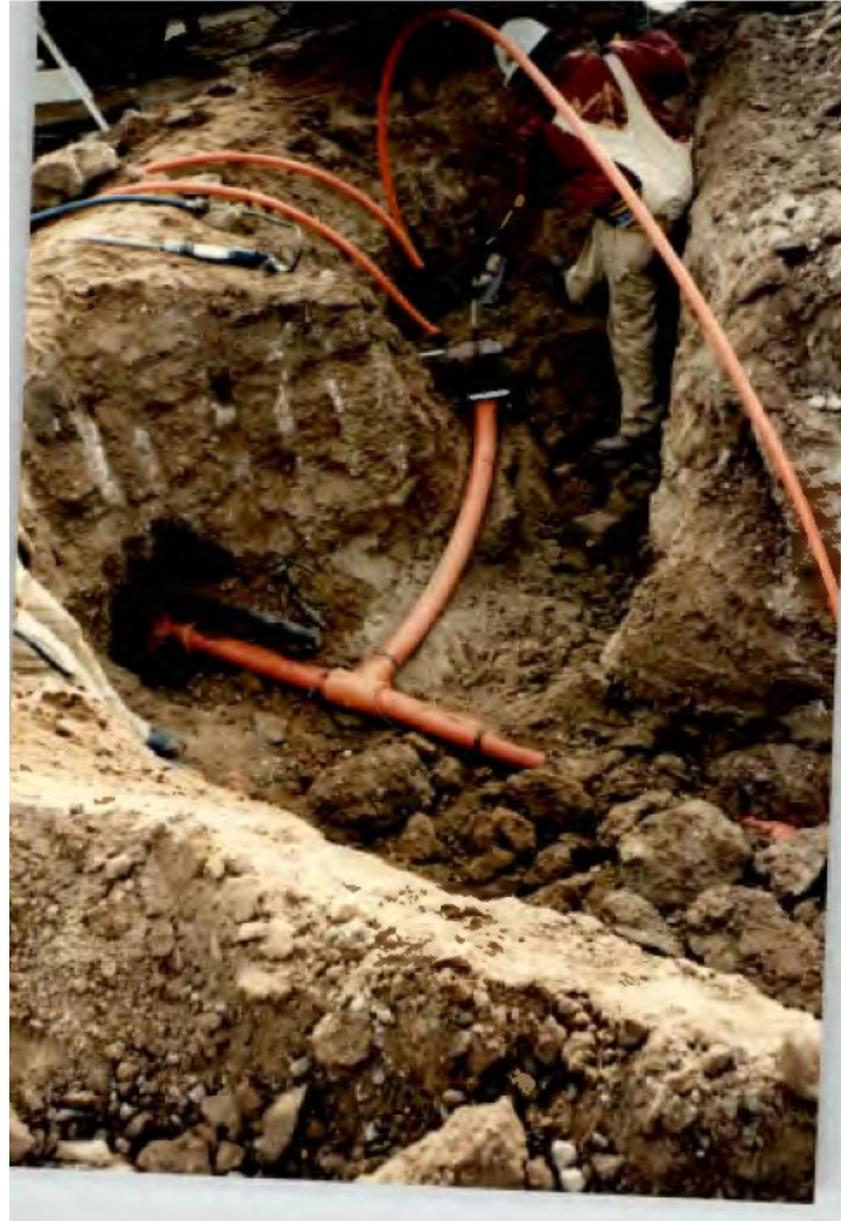
February 2nd, 1993

Overview

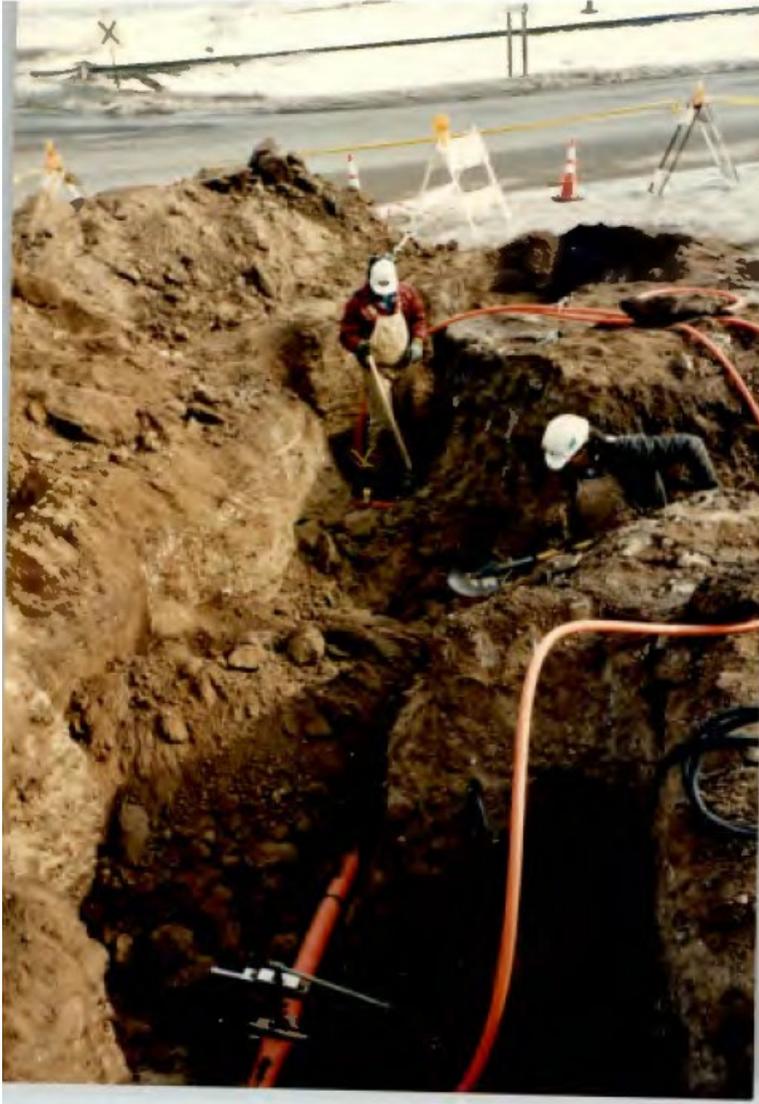


- At approximately 2:00pm on 2/2/1993 an explosion occurred at the Harbor View Taven.
- One individual was injured and hospitalized.
- Initial damage estimate was over \$50,000.

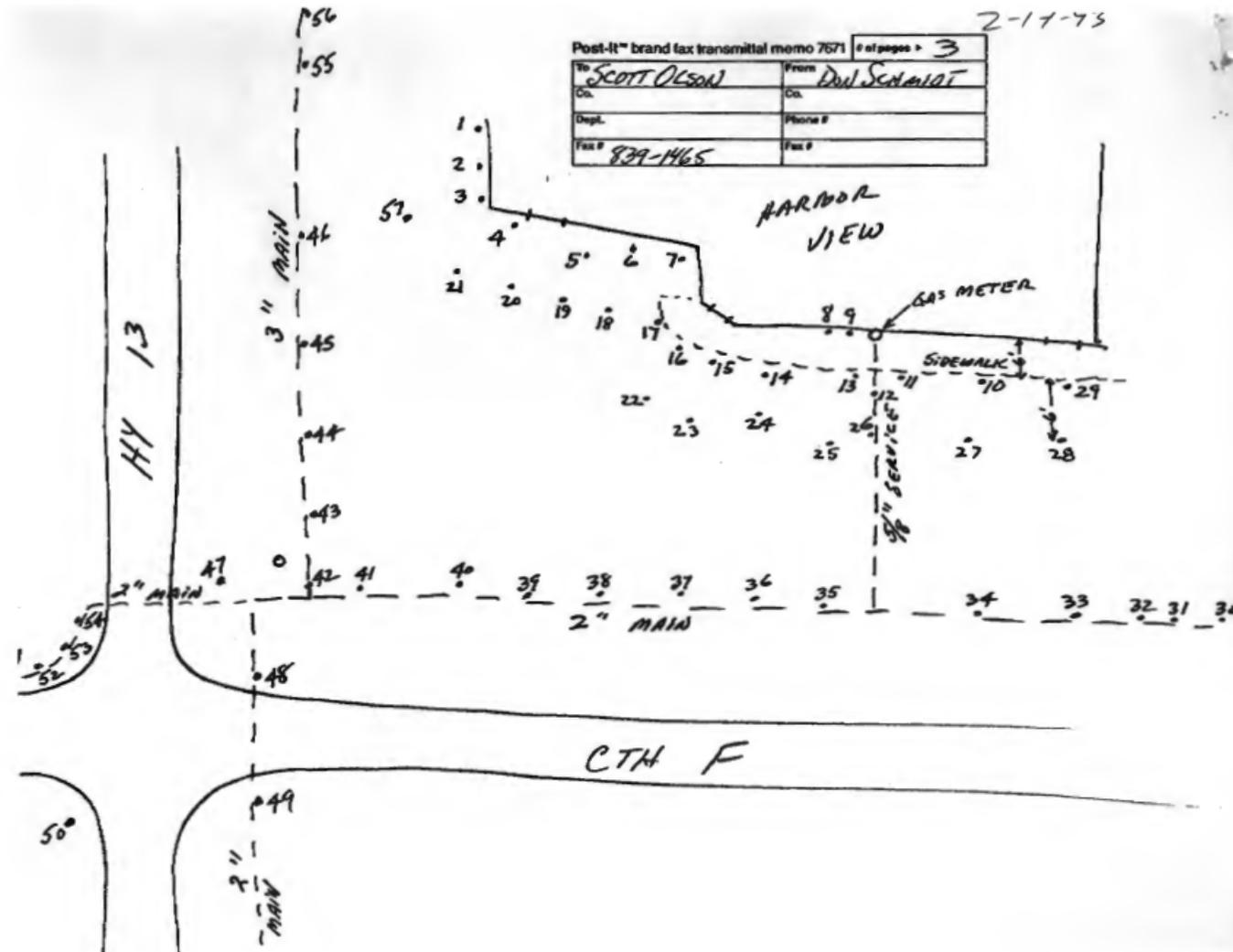
- Initial investigation indicated high concentrations of combustible gas in the ground around the building.
- Gas main in the local area was operating around 58psig, with 60psig MAOP.
- The local gas system was comprised of 3in socket fused plastic.



Response



Response



- Bar-holing in grid pattern around the building and then along main.

Investigation



Investigation

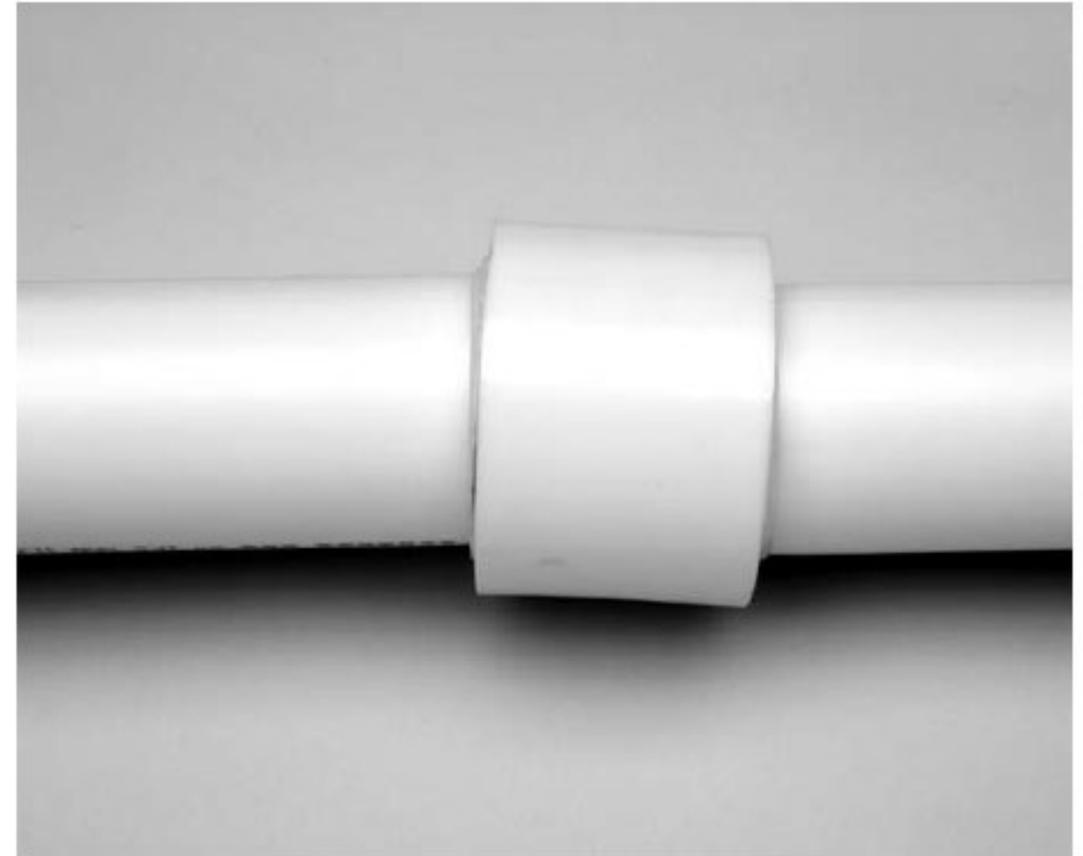


FIG. X2.3 Unacceptable due to angular misalignment

Investigation



- Portion of the main going into the 3x3x3in tee was at an angle.
- This portion of main was cracked next to the tee.
- Portion of damaged main was below parking lot, heavier frost effects.
- There had been recent third-party excavation work for a new sewer lateral in November 1992.

Today



Horicon Explosion



February 13th, 1988

Overview

- At approximately 5:30am on 2/13/1988 an explosion occurred at the 614 E Maple St, Horicon.
- Zero injuries or fatalities.
- One home destroyed, one home severely damage, multiple homes with minor damage.
- Initial damage estimate \$76,000.

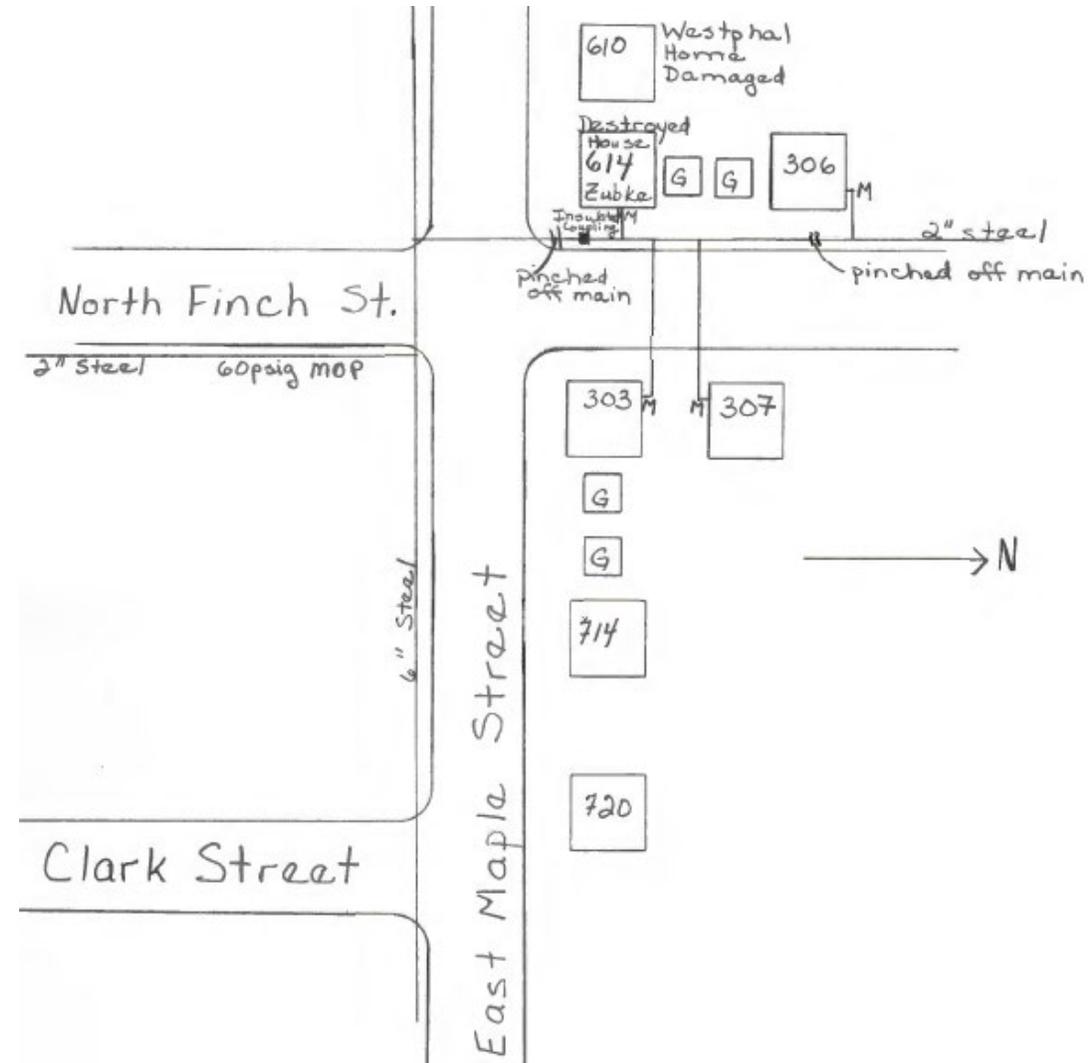




- Initial investigation indicated high concentrations of combustible gas in the ground around the building.
- Gas main in the local area was operating around 55psig, with 60psig MAOP.
- The local gas system was comprised of steel main and services.

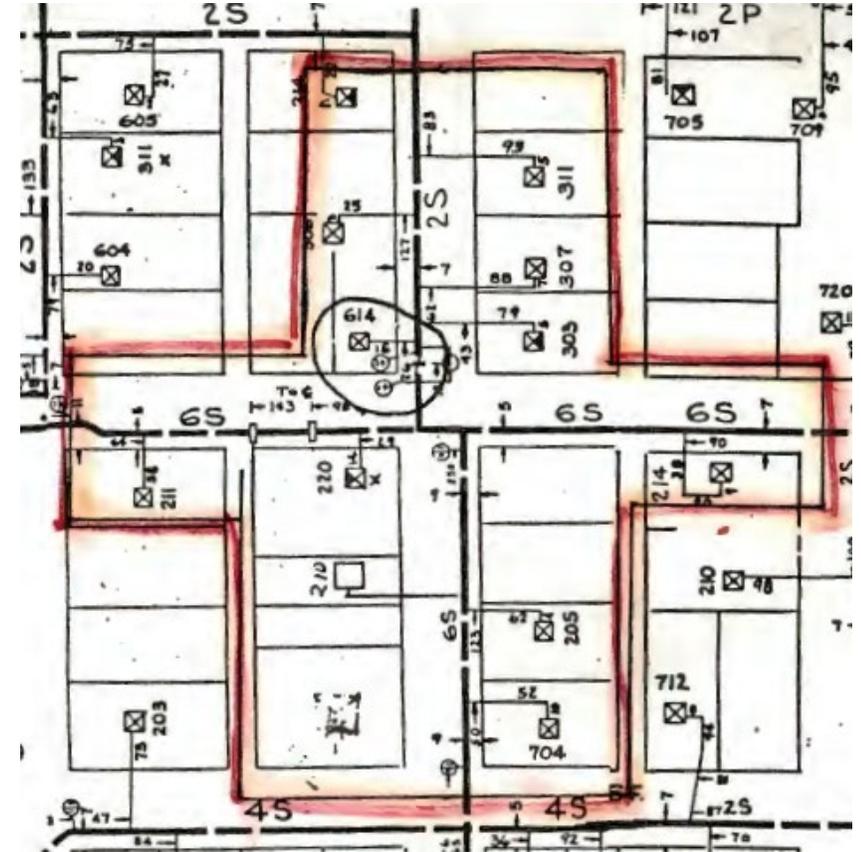
Response

- Explosion occurs at approximately 5:30am.
- Operator is notified at 5:45am and informed police and fire are on the scene.
- Operator arrives on scene to find service sheared off and gas fueling the fire.
- Operator works to squeeze off steel main.



Response

- Operator begins bar-holing the highlighted area and checks street openings.
 - 5% gas-in-air found at the intersection's manhole
- Smell of odorant evident during excavation.
- At 7:45am the Commission is notified.
- At 8:30am the section of main is stopped.
- By 10:45am the fire is out and the Commission arrives onsite.



Initial Investigation



306 N. Finch St.

Hole where main was pinched off shown

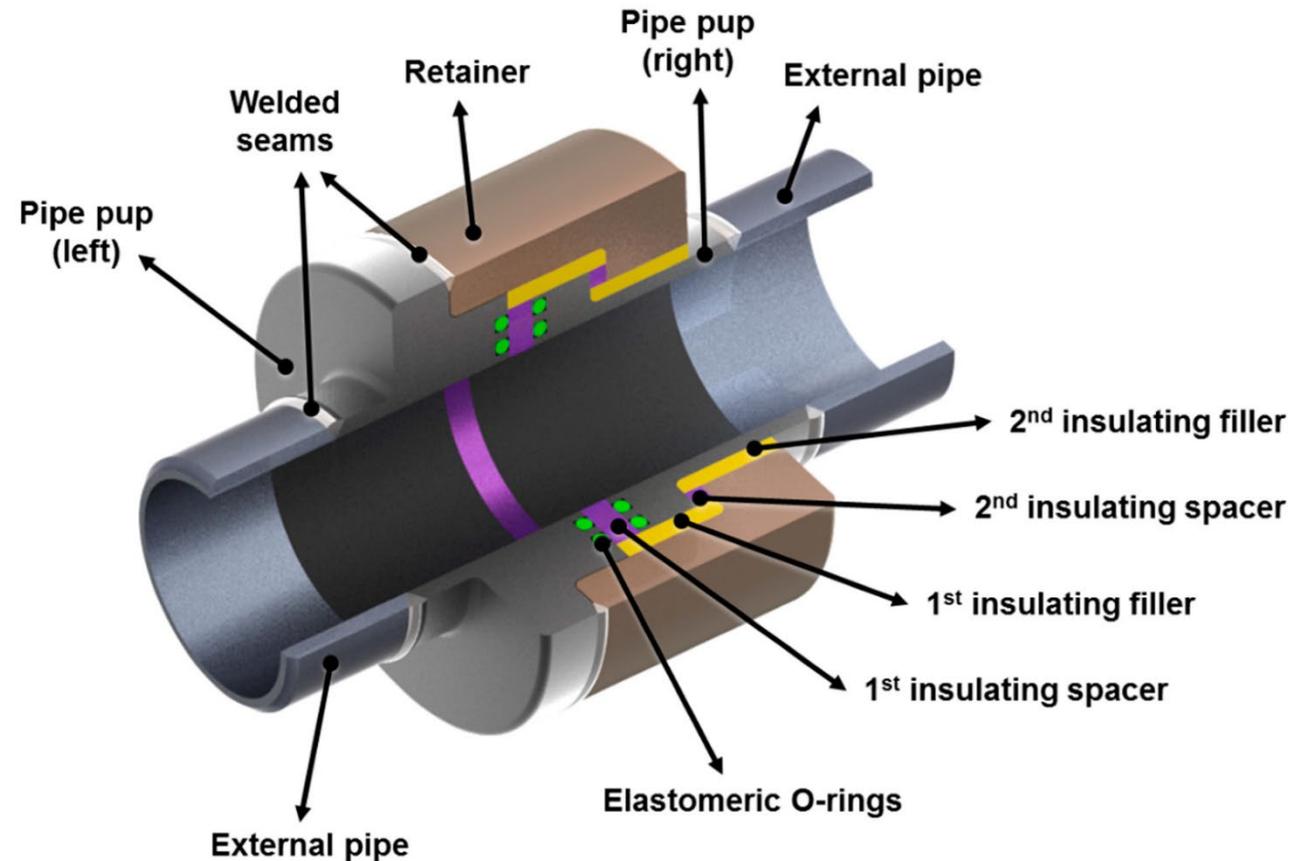
- Bar-holes found many indications of gas in the ground.
- Fire department noticed that the destroyed home had a dirt basement.
- Welds that had been exposed were leak checked.
 - No indications found.
- Main depth – 28in
Frost depth – 33in

Initial Investigation



- A weld-in coupling, used for isolating CP systems, was exposed in the Southern hole; it was visually cracked.
- Coupling, along with section of main was cut-out and sent to a metallurgical lab for further examination.

- Manufactured in 1982, installation date unknown.
- Coupling sent in for analysis was produced by Associated Flow Controls Manufacturing.
- Operator reviews system records to determine the extent of couplings installed in the system.
- A comprehensive review of the installation procedures for this style of coupling is conducted.



Example of coupling

Metallurgical Report - June 1988

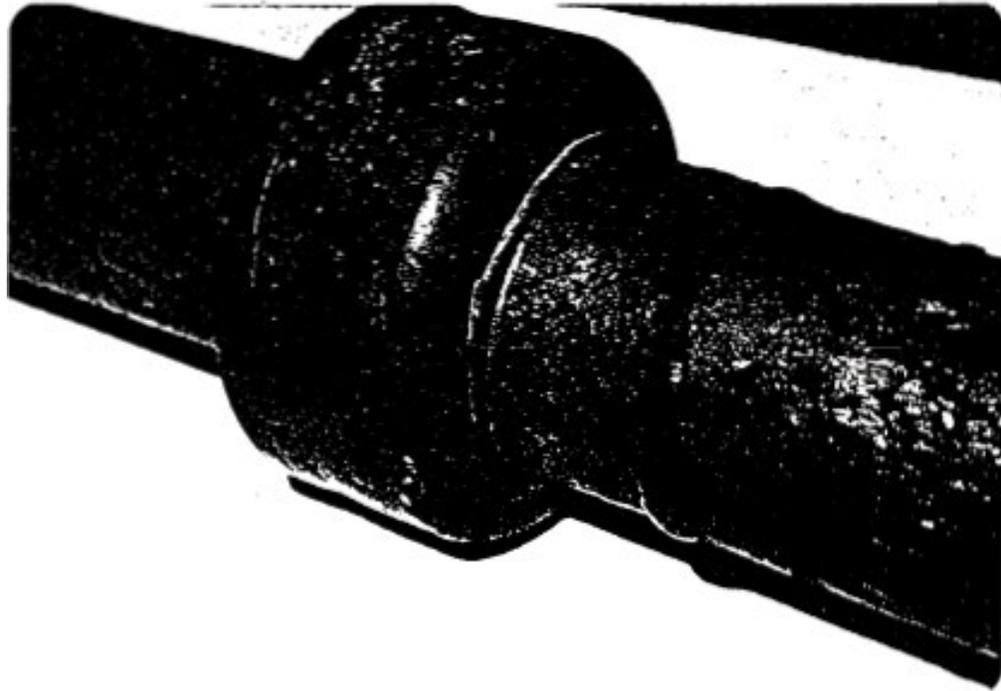
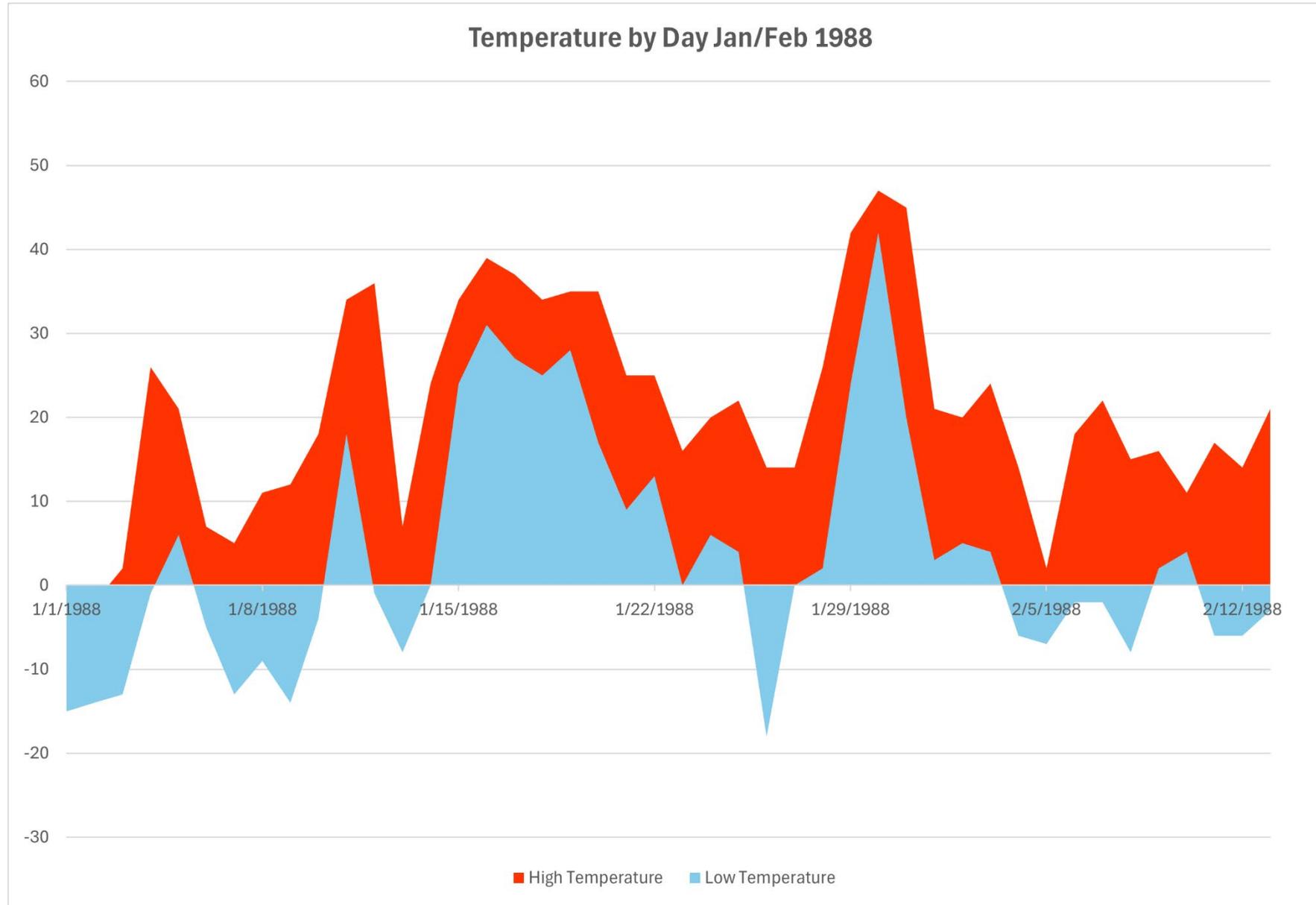


Fig. 3. Fracture at the radius of the forged flange.

- Corrosion found in the area of the fractured coupling surface.
- Cleavage Fracture mode – brittle failure.
- Coupling was forged.
- Chemistry of the low carbon steel coupling determined elevated levels of Phosphorus.

Investigation



1. Failure occurred due to stress overload, impact fracture or transition temperature fracture.
2. Stress for failure produced by ground surges due to freeze/thaw, or vehicles going over the road.
3. Coupling believe to not be stress relieved after forging.

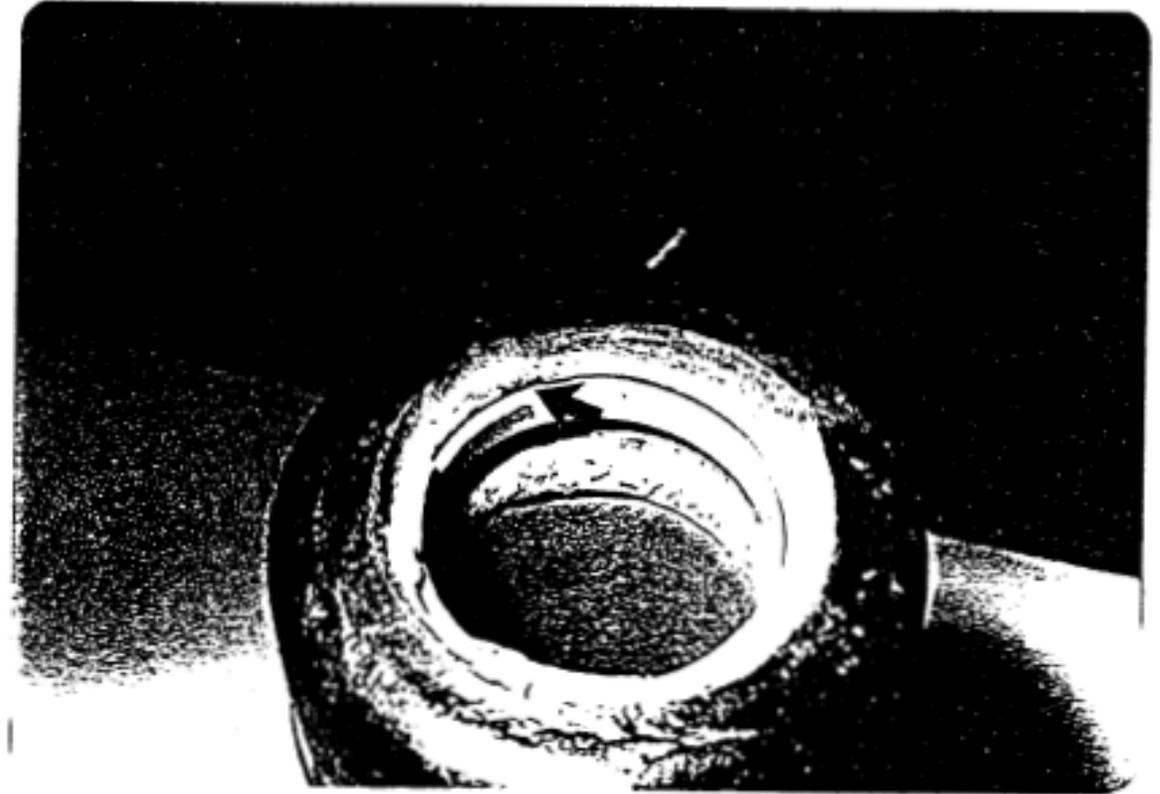
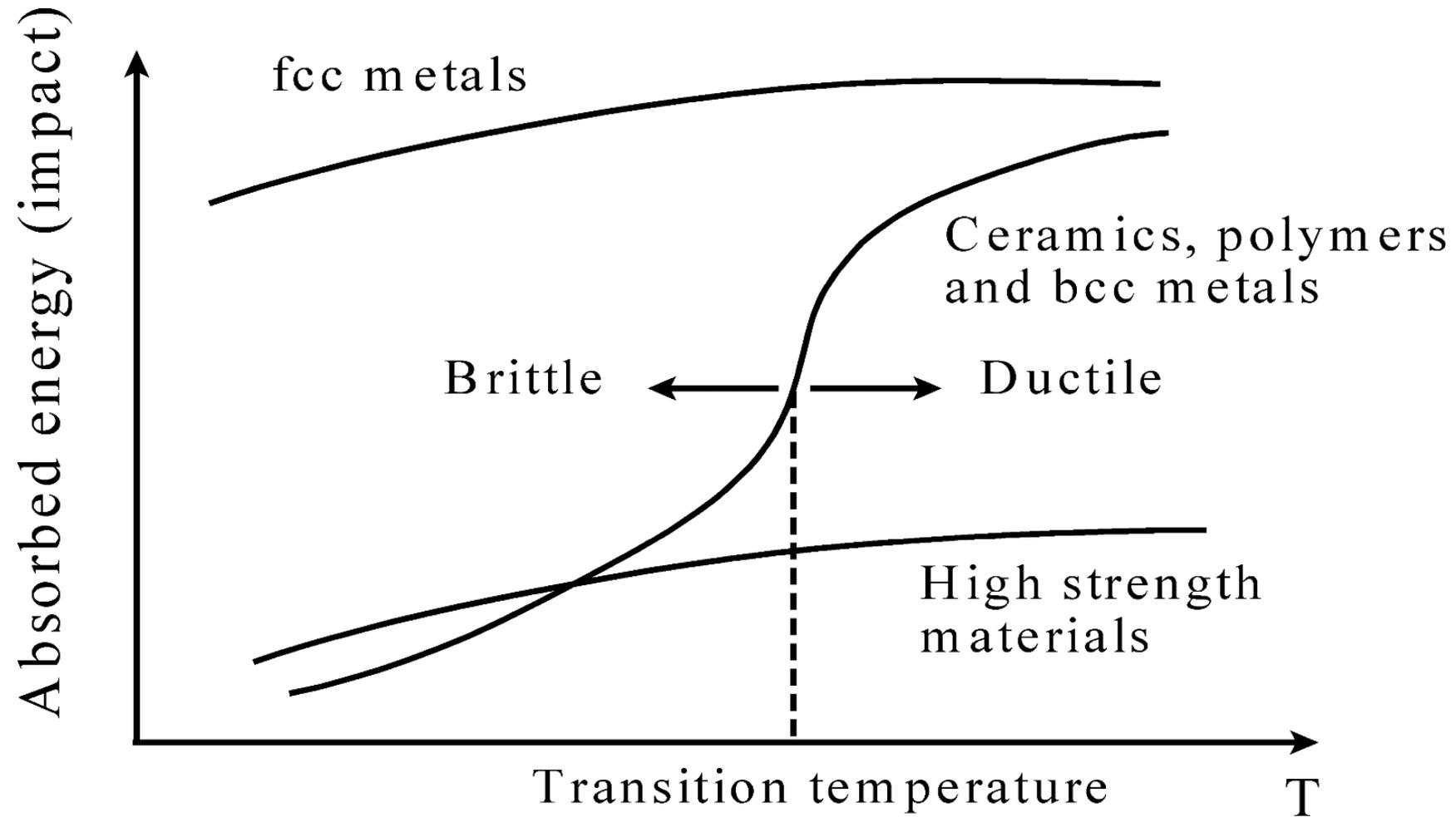


Fig. 7. Fracture as opened 90°CW rotation.



Subsequent Actions

- Operator began removing this manufacturer of coupling from their system.
- 20 removed by July 1989, 5 were found to have similar cracks and leaking.
- Switching to another manufacturer for this style of coupling.
- Changed installation procedures to included cribbing joints with couplings in place.

Questions?

Broadhead Pipe Failure



February 19th, 1986

Early Warning Signs Missed

- House plants died a month earlier
- Three fish had died in the last week
- Two cats were lazy and sleeping a lot
- Occupant noticed a bad smell twice that day
- Occupant had a headache



February 19, 1986 @ 11PM

- Resident was cooking venison brats in the kitchen.
- He saw an orange flash and was blown outside.
- Found his partner and got her outside.
- Man was released from the hospital on Feb.21.
- Woman was released from the hospital on March 2.
- Other side of duplex had three occupants with minor injuries



February 19 Emergency Response

- Fire Department arrived on the scene.
- The supply valve on LP tank was immediately turned off.
- Fire crews extinguished several fires in the duplex.



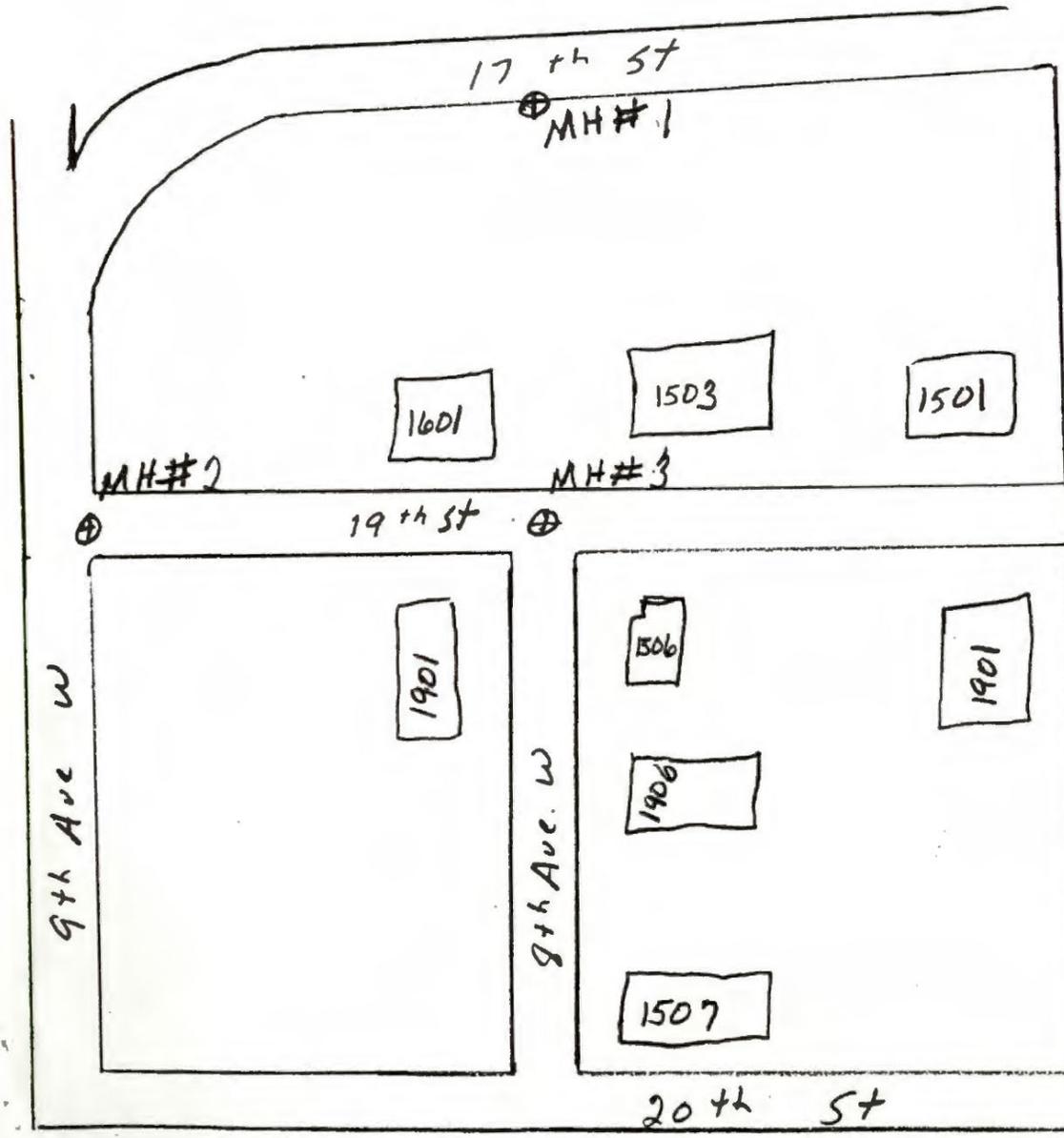
February 20 Operator Response

Operator employee was in town performing routine leak inspections. He heard about the explosion and decided to investigate. He asked firemen on site if they were positive this was an LP explosion and not natural gas.



February 20 Manhole Inspection

The manhole closet to the house had 60% gas to air ratio. The manhole was left open several minutes to vent and resampled at 0%. Manhole was left open to vent leaking gas.



This shows the location of manholes probed with JW5159: 100% scale.

MH#1 - 0%

MH#2 - 0%

MH#3 - 60%. I then removed the cover and within 3 minutes concentration had dissipated to 0% we contacted the city and got 2 barricades and opened to allow ventilation.

MH#4 - 0%

* after testing the manholes and venting hole #3 I climbed down hole #3 and tested the four tiles going out of hole and found 0% in South-East and West and found 2% in tile going North.

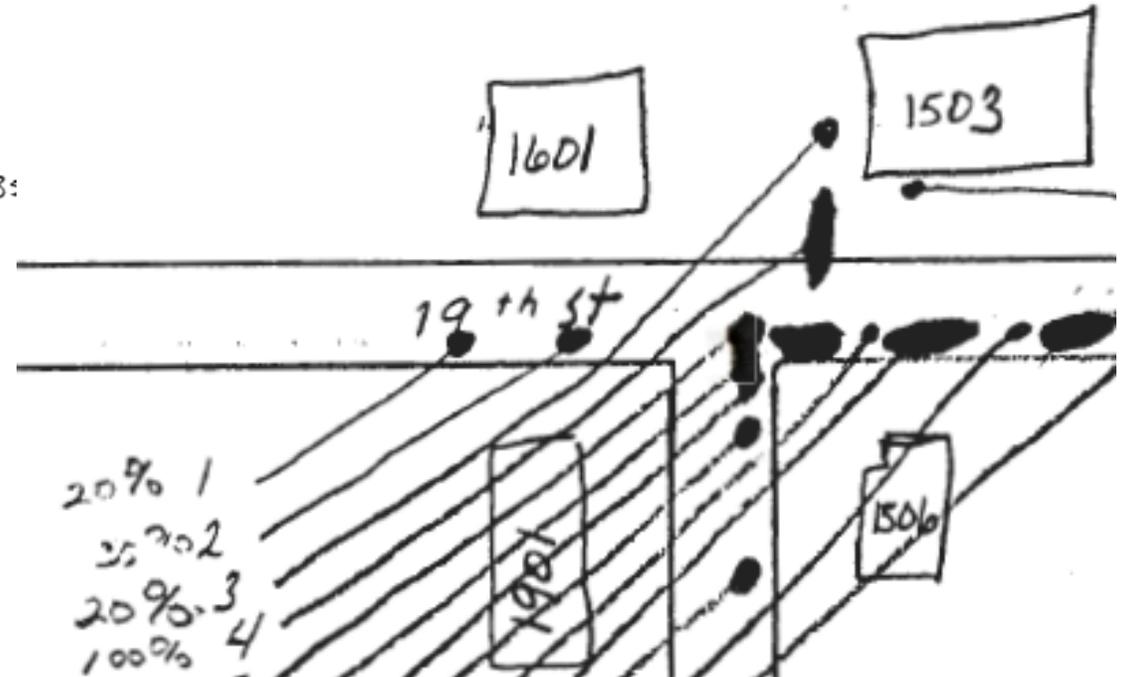
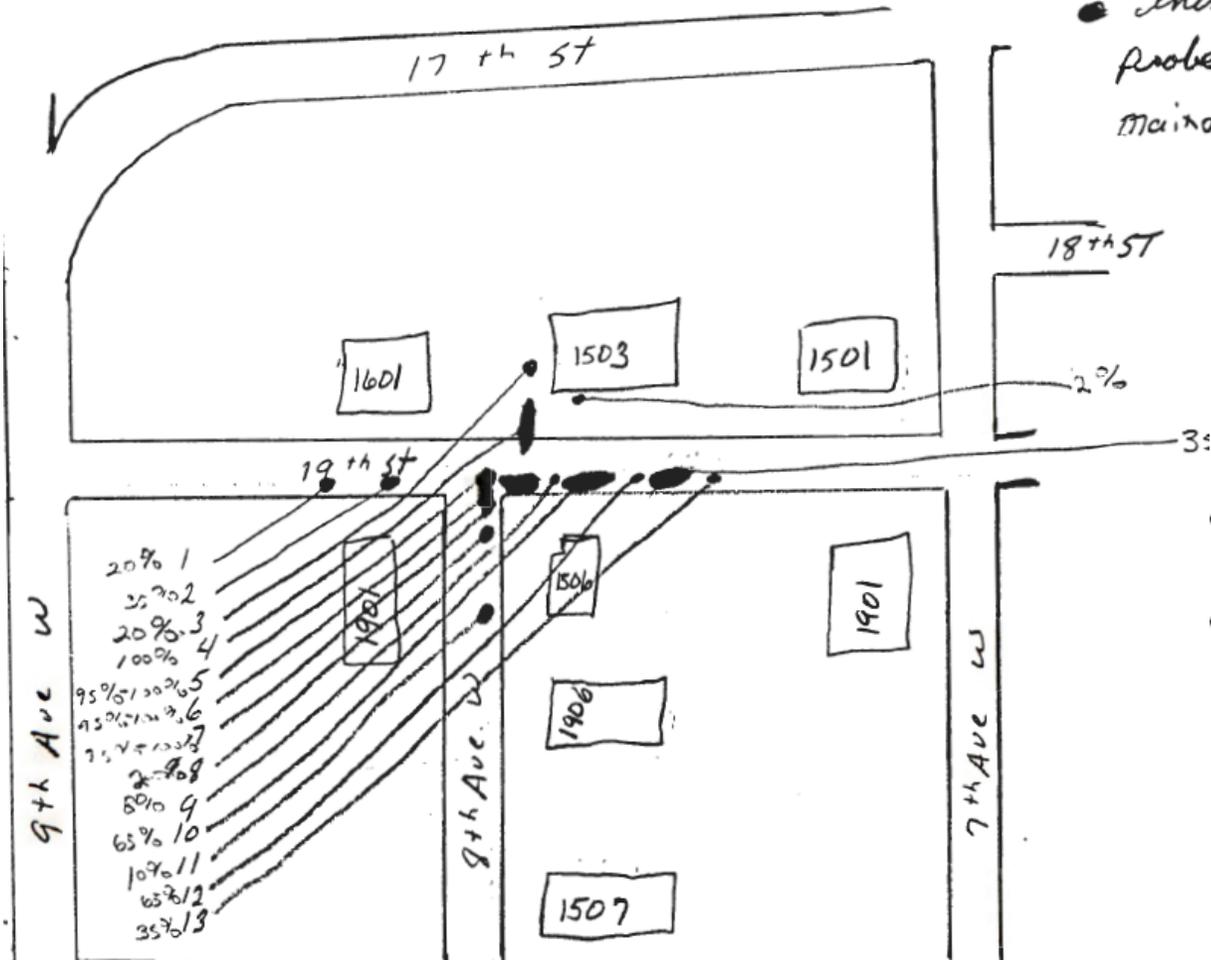
February 20 Barholing

4

— Gas Main.
 - - - Gas Service.
 Bar ditch.

• This shows where the probed holes along the main and service were made.
 JW 525 166

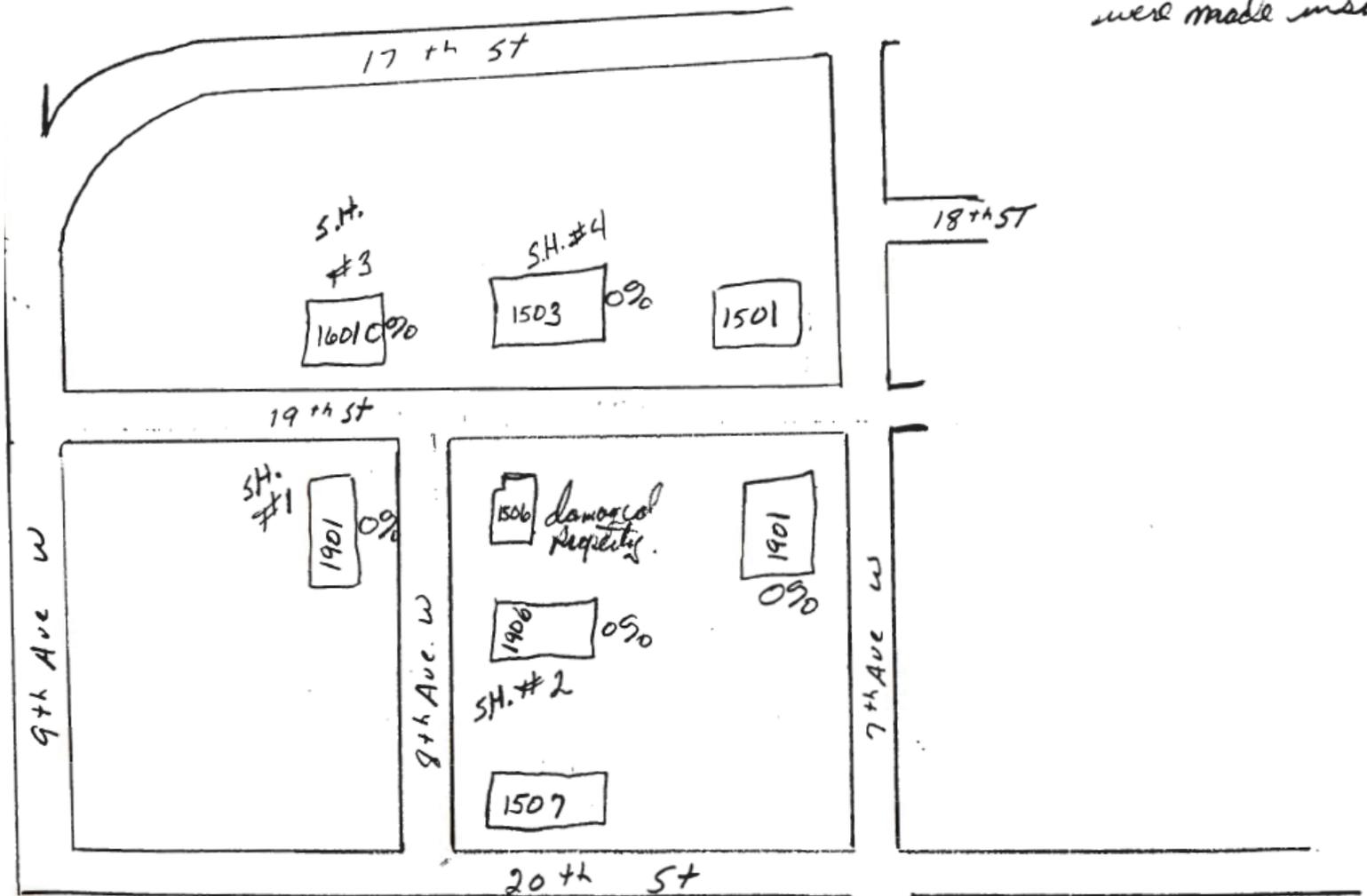
- Barholing over the pipeline found a range of values of gas in air, up to 100%



February 20 House Survey

Interior of house
surveys were negative
for gas

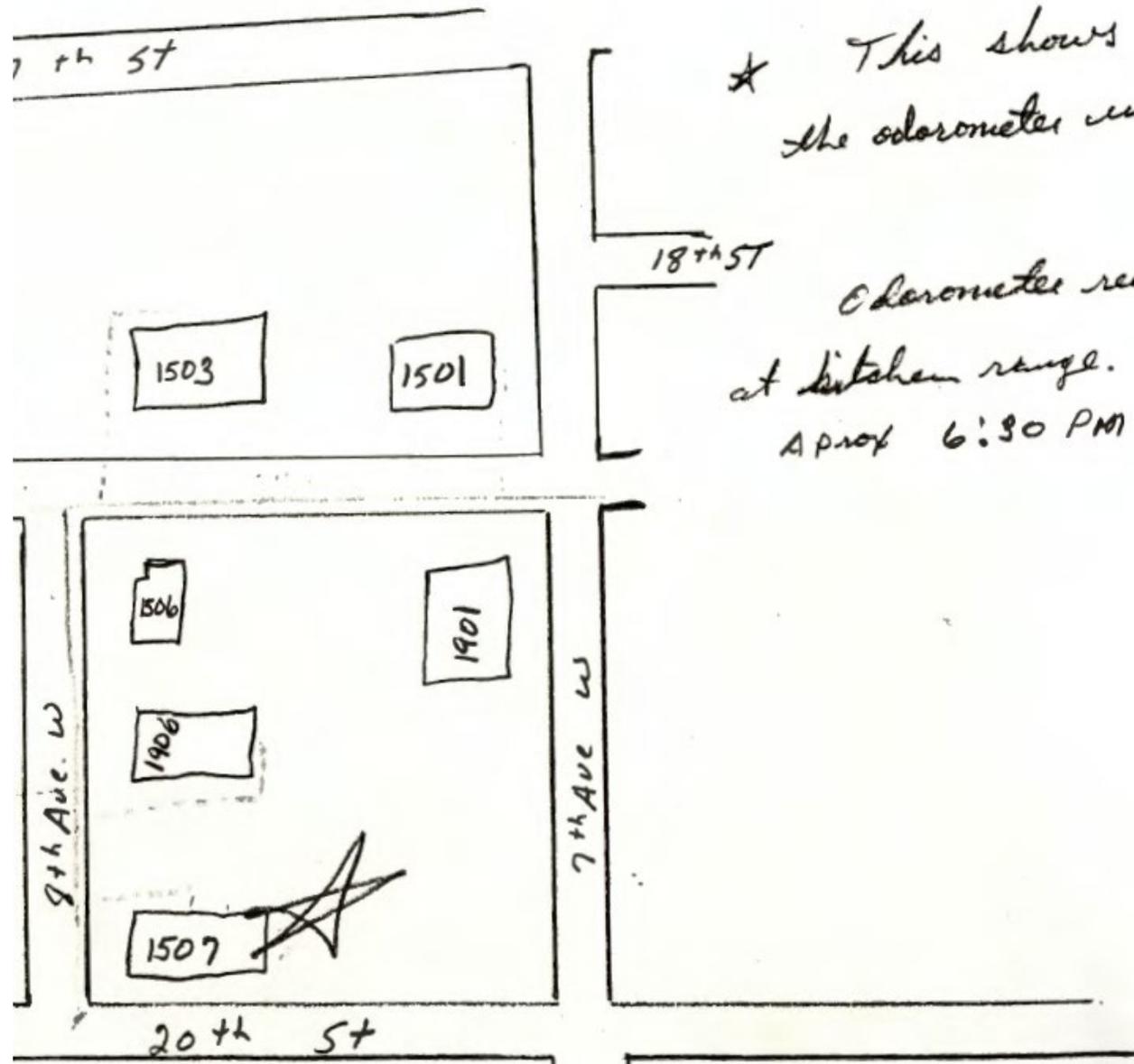
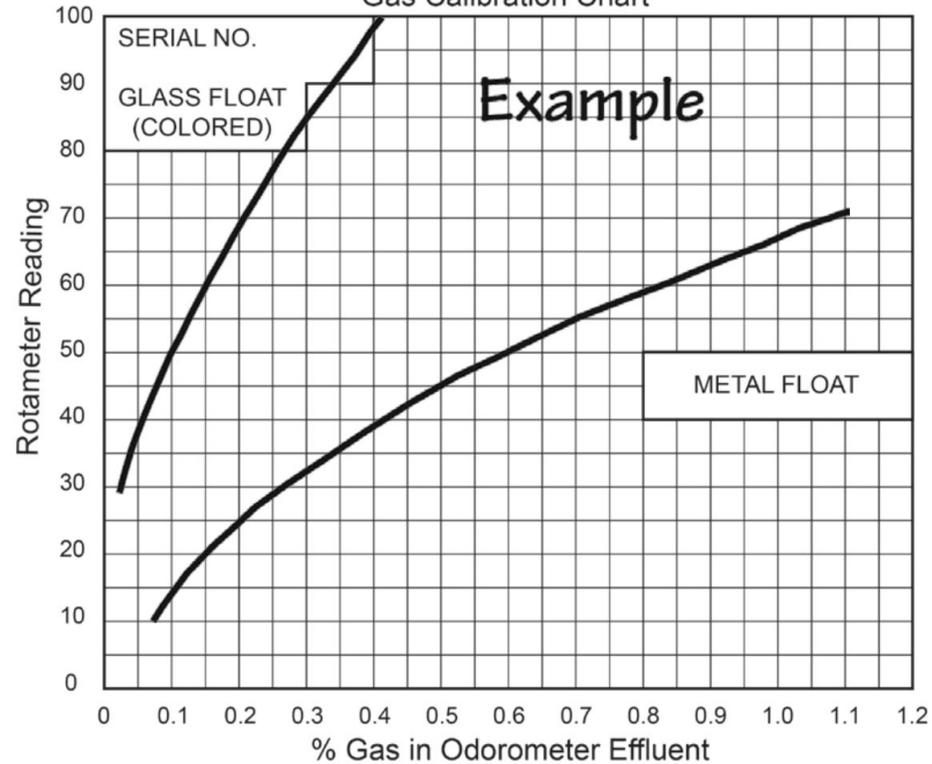
#1. Shows ^{where} inspections
of surrounding homes
were made inside.



February 20 Odor Test

- Odorometer test had had found odorant to be acceptable.

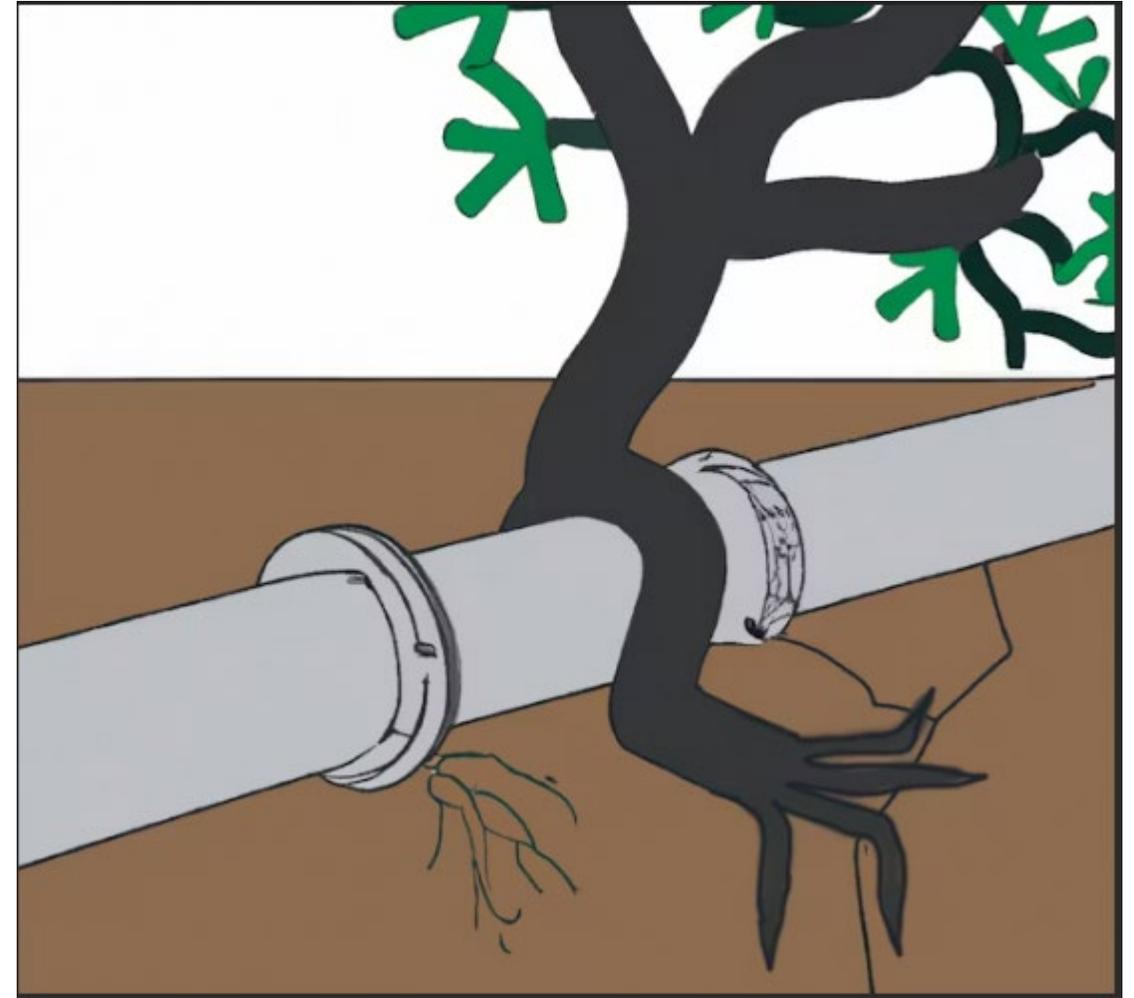
ODOROMETER
Gas Calibration Chart



* This shows where the odorometer was taken at kitchen range. Approx 6:30 PM.

Operator Remediation

- The service line to house across the street was replaced. In the area of the leak, a tree root had followed along the service under the street. The service line was partly embedded in the tree root. Service depth was 25" below grade.
- The leak was 85 feet from the destroyed house. The ground had 6"-12" of frost, making the crawlspace the path of least resistance.
- The operator believed the service leaked at a rate of 150 SCF/Hr.



Cedarburg Excavation Damage

No one was
home.

No one was
injured.

The house was
destroyed.



October 12, 1990

Cedarburg Backstory

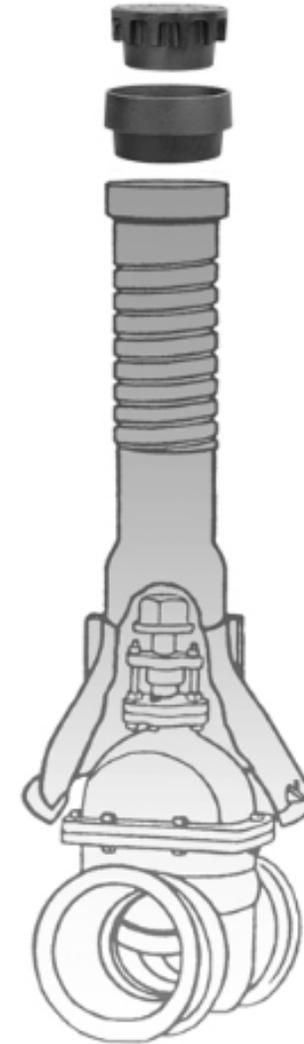
- A sewer contractor was performing work in the area approximately a month prior. The sewer was deep, and the contractor needed a shield. Approximately 20 feet of gas service lateral was removed to accommodate shield, then reconnected with a compression fitting.



September 1990

Cedarburg @1:40 PM

- Operator received a gas odor complaint.
- Gas foreman found stop box and could feel gas pressure through finger holes.
- Gas employees went back to vehicles to request equipment when explosion occurred. The house fire started within minutes.



October 12, 1990

Operator Actions During Incident

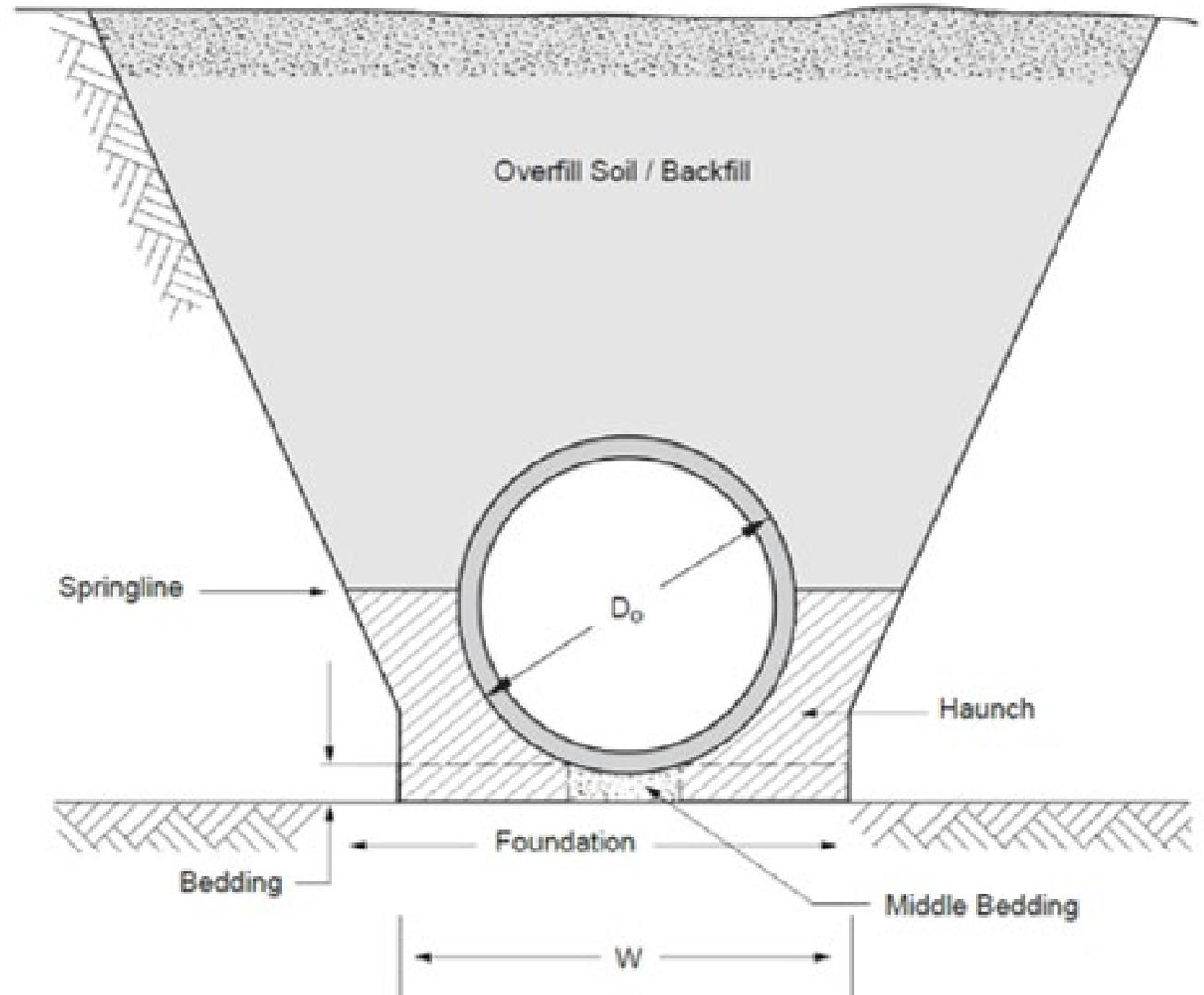
- Operator shut off gas at box, but house continued to burn.
- Operator followed procedure and checked surrounding homes.
- Gas appeared to migrate, so services were turned off at stop boxes.



October 12, 1990

Cause of Leak Improper Backfill

- With lateral improperly supported, it pulled out of service tee when trench was filled.
- Service line was found 1-1/8" lower than connection point
- Another mechanical fitting had 5/8" separation.



October 12, 1990

Cedarburg Remedial Actions

- Oct 13, a trench was dug in front yards to allow for venting.
- Oct 15, other services on block exposed. Six services reported as bowed, and two of those had pulled out of mechanical couple ~1/4"



October 12, 1990

- 49 CFR 192 Subpart G 319.b

- ⊙ **§ 192.319 Installation of pipe in a ditch.**

- (a) When installed in a ditch, each transmission line that is to be operated at a pressure producing a hoop stress of 20 percent or more of SMYS must be installed so that the pipe fits the ditch so as to minimize stresses and protect the pipe coating from damage.
- (b) When a ditch for a transmission line or main is backfilled, it must be backfilled in a manner that:
 - (1) Provides firm support under the pipe; and
 - (2) Prevents damage to the pipe and pipe coating from equipment or from the backfill material.

Taychedah Excavation Damage

Sewer construction project

132 customers lost service

2" MDPE gas main

Two people received 3rd
degree burns and were
hospitalized.



May 27, 2003

Taychedah Diggers Hotline

Sewer foreman and 1 injured crew member attended DH Excavator meeting 2 years prior.
Pipeline was properly located.
Markings were visible at time of incident.



**Dial 811 or
(800) 242-8511
DiggersHotline.com**

May 27, 2003

May 27 @ 1:00 PM

Sewer crew was installing sewer.

Backhoe was used to just scrape off a little dirt.

Sewer foreman thought the gas was deeper.

Pipe struck was 31" – 39" below grade.

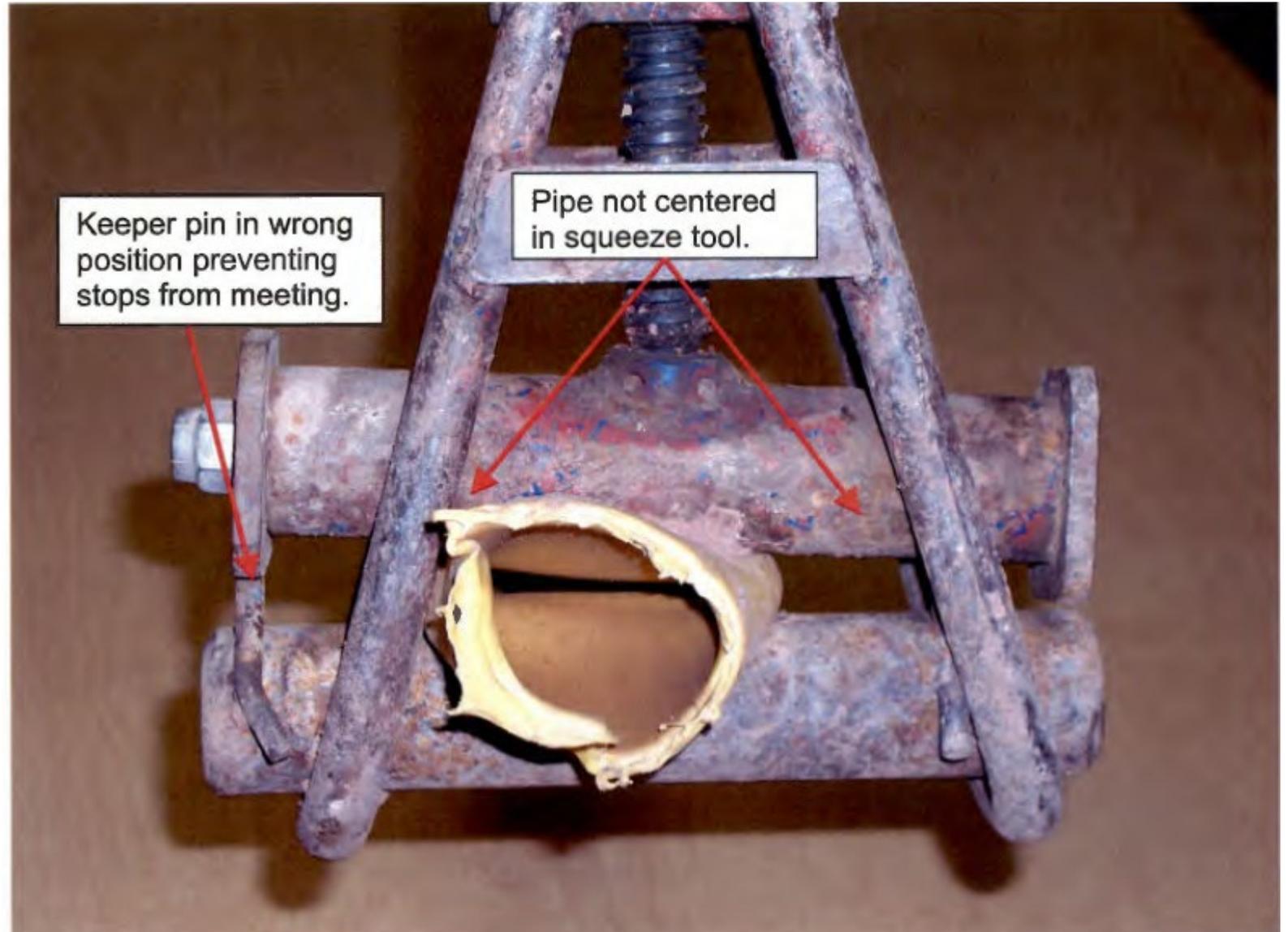


May 27, 2003

Taychedah Improper Actions

Sewer construction crew jumped into hole and tried to squeeze gas main with sewer pipe squeezer.

Squeezer was not grounded for static electricity.

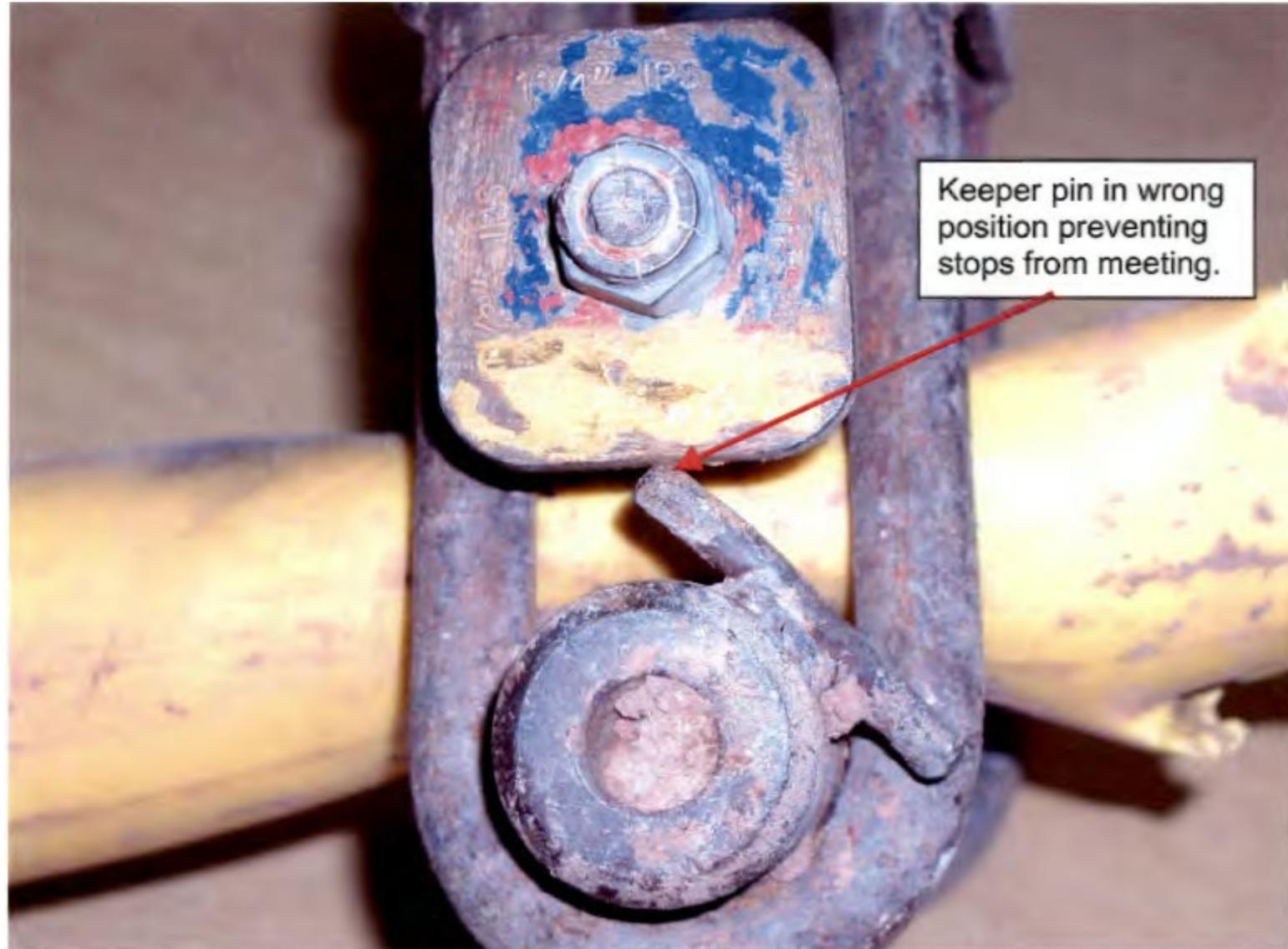


May 27, 2003

Taychedah Improper Actions

A full squeeze was never going to happen.

After ignition, back hoe operator attempted to fill trench to smother fire.



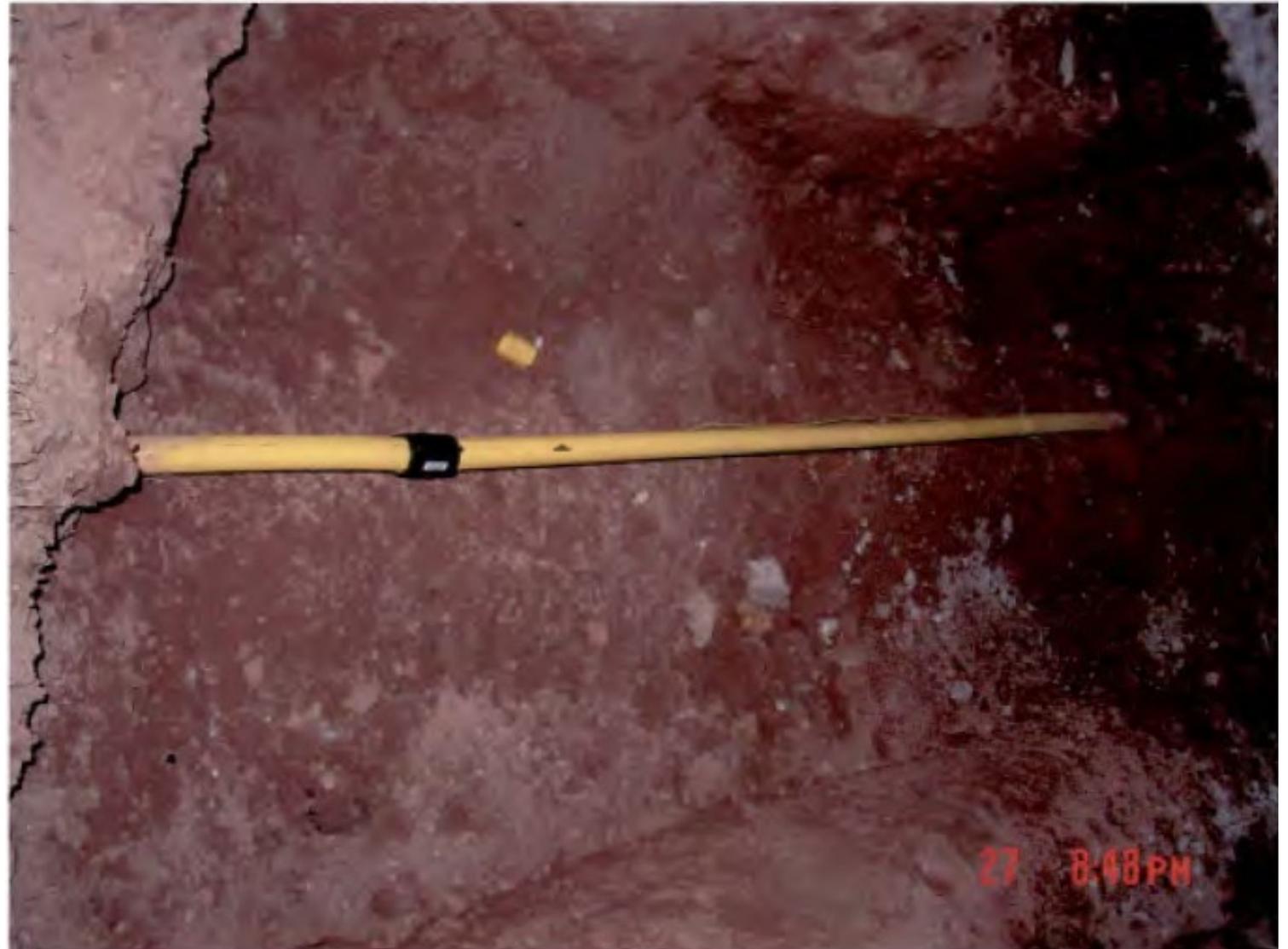
May 27, 2003

Operator Actions

After arriving on site,
2 valves were shut
within 23 minutes.

Fire burnt out within
23 minutes.

Repaired in 2.5 hours.



May 27, 2003

49 CFR 192 Subpart N 605 b

§ 192.805 Qualification program.

Each operator shall have and follow a written qualification program. The program shall include provisions to:

- (a) Identify covered tasks;
- (b) Ensure through evaluation that individuals performing covered tasks are qualified;

49 CFR 192 Subpart N 603

Sewer contractors are not qualified to work on gas pipelines

Qualified means that an individual has been evaluated and can:

- (a) Perform assigned covered tasks; and
- (b) Recognize and react to abnormal operating conditions.

Abnormal operating condition means a condition identified by the operator that may indicate a malfunction of a component or deviation from normal operations that may:

- (a) Indicate a condition exceeding design limits; or
- (b) Result in a hazard(s) to persons, property, or the environment.

Wayne, MI Pipeline Failure



December 29th, 2010

- Overview
- Pre-Incident
- Emergency Response
- Investigation and Cause
- Applicable Code
- Takeaways

- Threaded coupling failure
- Furniture store explosion and subsequent fire
- 600,000 cubic feet of natural gas released
- 2 fatalities, 2 injuries
- \$2,573,000 in damages
- Affected
 - Furniture store
 - Adjacent structures
 - Passing vehicles
 - Utility customers

Keep In Mind

- Leak survey procedures
- Leak Investigation procedures
- Emergency response procedures

How would you handle the situation?

- Gas main located in abandoned alley/right-of-way
 - 2” bare steel
 - Cathodically Unprotected
 - Installed in 1940
- Residential Fence built above gas main in ROW
- Concrete wall built directly around gas main
- Sanitary sewer directly next to gas main
 - Travel parallel for 233 ft to back of furniture store
 - Manhole 18 in from failure

Incident Area



Incident Area



- Mobil leak survey months prior – no leaks found
- Difficult to complete walking survey due to fences
 - No records
- 2 separate leak calls
- No significant pressure changes recorded
- 21 °F day of

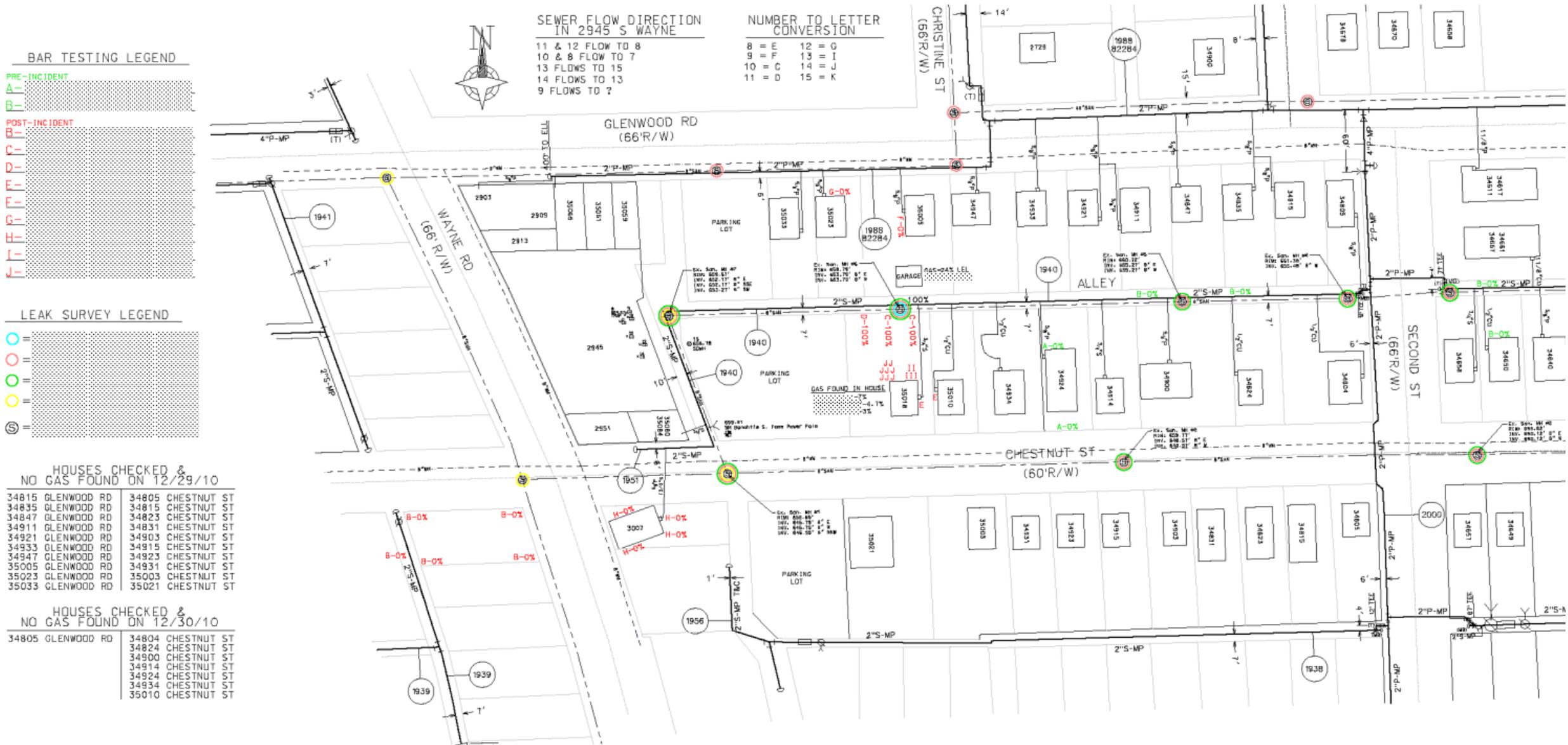
1st Leak Call

- 6:13am, employee arrived at 6:40
- Inside air readings
- Bar hole testing at service riser
- Fittings inspected with gas detector
- Shadow testing on meter
- Investigated manhole and neighboring houses
- No positive reads, or unusual gas flows detected
- Notified occupant of results
- Drove around neighborhood with windows down
- Completed work order and left at 7:00am
 - No leaks detected but occasionally smelt gas in air

2nd Leak Call

- 7:04am, employee arrived 8:02am
- Fire department on site
- Took air reads around the house
 - No positive reads, no smell
- Bar hole test from riser to main connection
 - No positive reads, no smell
- Bar hole test along main to the West (down wind)
 - No positive reads
 - Sporadically smelt gas
- Air reads driving west down the street
 - No positive reads, continues smelling gas
- Contacted supervisor for support with mobile leak detection unit
 - Explosion occurred before unit was dispatched

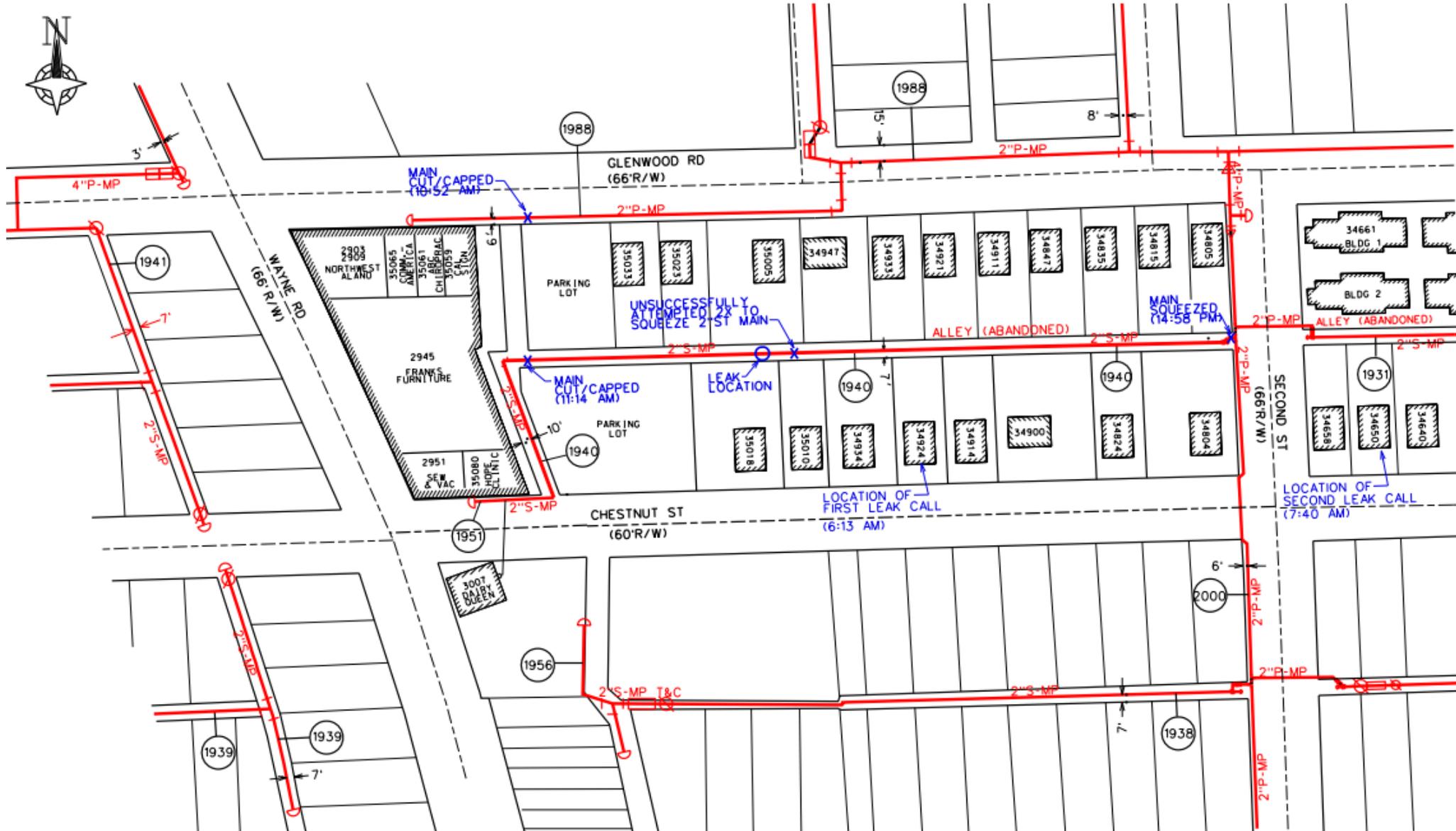
Leak Calls



Emergency Response

- 2nd leak call employee heard explosion and notified field leader
 - First responders mobilized
- Fire dept. arrived at 9:08 am, followed by police, medical, search and rescue, investigation, etc
- First responders smelt gas from the meter – damaged from explosion
- Operator employees arrived at 9:20 am
- RMLD and CGI used for mobile surveys with a block radius
- Notified MPSC at 9:59 am and NRC at 10:29 am
- 10:52 am a 2-inch plastic main to the north was cut and capped
- 11:14 am the 2-inch steel main serving furniture store was cut and capped
- Smell of gas in air still reported by 5 personnel
- MPSC and PHMSA responded on site between 12:00 pm and 2:00 pm

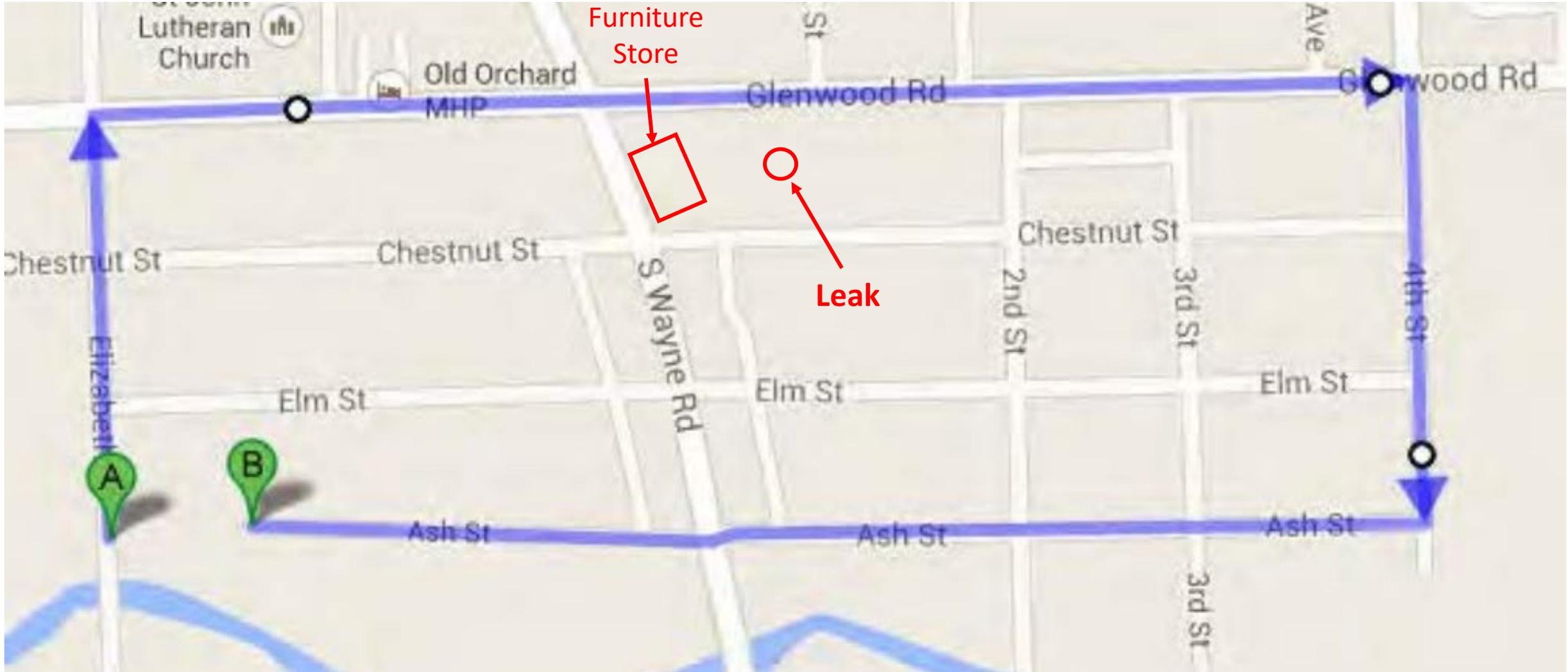
Emergency Response



Emergency Response

- Between 12:30 pm and 1:30 pm the leak source was found
 - 100% gas read in sanitary sewer manhole east of furniture store
- Bar-hole tested above 2-inch steel main near sewer
 - 100% gas read and gas noted to be blowing out of the hole
- Hand dug over leak location
- Removed sewer cover to vent
- Adjacent blocks evacuated
- Removed manhole covers in 6 block radius
- Bar-hole and gas in air testing done in vicinity of leak
 - Gas discovered in house on parallel street at 7% LEL
 - Gas discovered in garage on same street at 24% LEL
 - Gas migrated underground from main failure to houses

Evacuation Zone

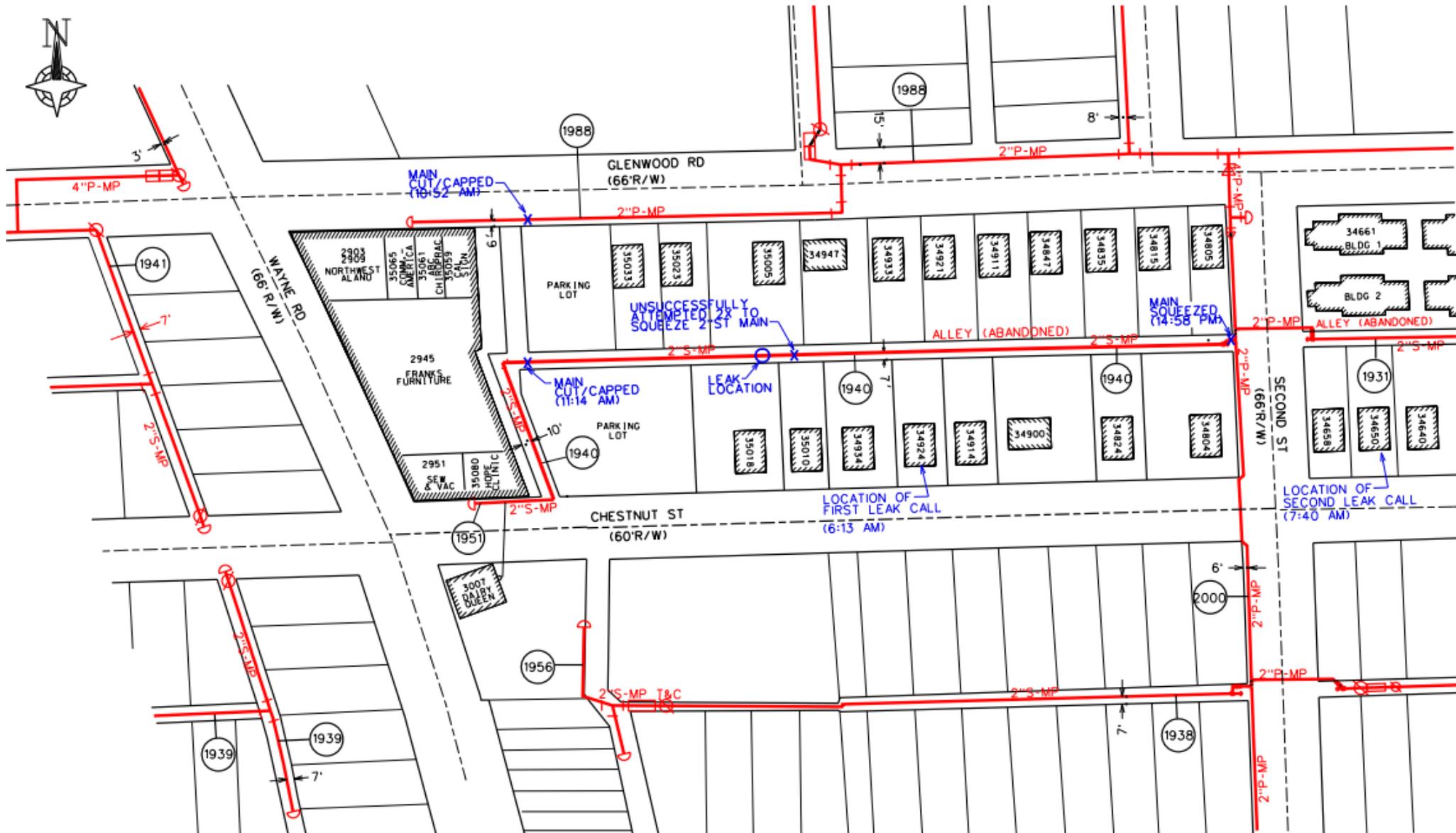


Emergency Response

- 1:50 pm attempt to squeeze steel main upstream
 - Each attempt resulted in seam failures
- 2:58 pm squeezed plastic main further upstream
- 3:05 pm found no gas freely flowing at leak location
- 4:30 pm excavated leak location and found failed threaded coupling
- Continued leak surveys to the next day
- Bar-hole tested leak location daily for 8 days
 - Repeated detection of gas
 - Soil was excavated, replaced, and no more gas was detected



Emergency Response



Return to Service

- Service interrupted to 20 customers
 - 9 residential
 - 11 business
- Temporary service installed to houses
 - Free air reading given before returning to homes
- Permanent main installed 1 week later
- Additional businesses returned to service almost 4 months later



Operator Investigation

- No standards or procedures need modification
- Produced advisory bulletin to restate/reinforce current procedures
 - Employees must follow leak survey standards
 - Must record encroachments to the pipeline
 - Continuing investigation until leak is located and classified
 - Discuss findings with field leader when no leak is found
- All gas employees completed review of gas procedures, proficiency, and competency

- Observation during...
 - Emergency response
 - Return to service
 - Post-incident testing and analysis
- Interviews of employees and witnesses
- Review of records and procedures
- Review of related third-party and Company reports
- Analysis of accident site layout
- Took 3 feet of pipe from each side of failure point for testing

- Arrived on site about 2 hours after explosion
- Made contact with Operator field leader and requested briefing
- Identified that employees were following relevant standards
- Requested info
 - Internal Incident Investigation Report
 - Leak survey history
 - Operating pressure charts
 - Dispatch logs
 - Service installation records
 - Main or service repair records
 - Cathodic protection records
 - Maps
 - List of employees that responded and respective duties
- Remained onsite unit about 8 pm

Field Leader

- Ground frost only encountered in one spot, and was about 4 inches deep

1st Leak Call Employee

- Source of gas was probably an inefficient furnace emitting unburned gas
- Equipment used was bump tested the morning prior, and calibrated every 3 months

Nearby Resident

- Sinkhole near manhole discovered 2 years prior
 - City filled with dirt
- Second sinkhole filled a couple months prior

Fire Department Responder

- Gas could still be smelled inside furniture store after shutting off flow to the meter

Adjacent Business Owner

- Did smell odor when entering his building, but did not recall if it was gas or from work
- Turned on light and adjusted furnace
- Explosion happened when he turned on another light
- Did not smell gas in air ever before the explosion
- Concrete wall had been there for 20-25 years

Leak Survey Employee

- Walking survey was completed on the main in the alleyway using RMLD
- No documentation to prove

- Concluded that damage to the meter manifold was due to explosion
 - Regulator and meter show no sign of fire exposure
- Multiple concrete footings for fenceposts rested on the gas main
- Used cameras and smoke to inspect sections of sewer system
 - Smoke permeated through foundation walls
 - Potential vacuum pulling gas toward building
- All lines connected to the failure point passed pressure tests
 - Rule out cause from any other leaks
- Main was excavated both sides of the concrete wall
 - East Side: Deflection of 4-³/₄ inches upward and 6-¹/₂ inches south
 - East Side: Prominent bend observed
 - West Side: Minimal bend slope downward 1 inch to failure point

MPSC Investigation



MPSC Investigation



- Four leak detection units exceeded calibration dates
- Leak survey for cathodically unprotected steel services
 - Completed on 5-year interval (3-year interval required)
- Standards require odorant sniff test after an explosion and determination of extent of leakage
 - Employees indicated that the gas odor was noticeable
 - No documented odorant sniff test

- Conducted:
 - Visual examination
 - Photographing of samples
 - Tensile testing
 - Hardness testing
 - Metallurgical examination
 - Radiographic examination
 - Scanning electronic microscopic examination
 - Physical measurements
 - Collection of soil samples from the pipe
- Engineering and stress load analysis
 - Estimated 1,200 lbs necessary to yield the pipe at the threaded coupling by 2 inches
 - Misalignment of the pipe would estimate an actual load significantly higher
 - Separation occurred due to rapid crack propagation (no cyclic fatigue detected)
- Metallurgical examination determined separation was due to material overload condition
 - Crack initiated in threaded portion of coupling are spread around entire circumference

Contributing Causes

- Overstress of the threaded and coupled joint on 2-inch bare steel main
 - Main was directly encased into concrete wall footing (no sleeve)
 - Chain-link fence with concrete footings installed directly above the gas main
 - Joint separated and misaligned by 2.5 inches
- Installation of sanitary sewer system directly next to the gas main
 - Migration of gas through sewer system into the furniture store
 - Contributed to external forces on the gas main
- Failure of Operator to identify and document the encroachment on the main
 - Form of 3rd party damage
- Reported Sinkhole in the vicinity of the main failure
 - Settlement of soil may have contributed to external forces on main
- Inadequate leak response by the Operator

§192.13 What general requirements apply to pipelines regulated under this part?

(c) Each operator shall maintain, modify as appropriate, and follow the plans, procedures, and programs that it is required to establish under this part.

- No documented sniff test conducted by the first Operator employee to arrive on scene post-explosion
- 4 leak detection units exceeded the 3 calendar months calibration requirement
 - 3 months and 4 days overdue
 - 2 months and 15 days overdue
 - 28 days overdue
 - 5 days overdue

§192.723 Distribution systems: Leakage surveys.

(b) The type and scope of the leakage control program must be determined by the nature of the operations and the local conditions, but it must meet the following minimum requirements:

(2) A leakage survey with leak detector equipment must be conducted outside business districts as frequently as necessary, but at least once every 5 calendar years at intervals not exceeding 63 months. However, for cathodically unprotected distribution lines subject to § 192.465(e) on which electrical surveys for corrosion are impractical, a leakage survey must be conducted at least once every 3 calendar years at intervals not exceeding 39 months.

- 2 service lines that are cathodically unprotected are leak surveyed on a 5-year interval instead of the required 3-year interval for unprotected lines

§192.605 Procedural manual for operations, maintenance, and emergencies.

(a) General. Each operator shall prepare and follow for each pipeline, a manual of written procedures for conducting operations and maintenance activities and for emergency response. For transmission lines, the manual must also include procedures for handling abnormal operations. This manual must be reviewed and updated by the operator at intervals not exceeding 15 months, but at least once each calendar year. This manual must be prepared before operations of a pipeline system commence. Appropriate parts of the manual must be kept at locations where operations and maintenance activities are conducted.

- First leak call did not follow procedures
 - Employee did not conduct any bar test over the main
 - Employee did not contact the field leader when gas odor was present, but no leak found

- 2012: Operator published advisory bulletin to employees
 - Employees performing leak surveys must follow relevant standards, including recording encroachments to the pipelines
 - Must be continuous investigation until leak is located or otherwise identified as foreign gas or no leak found
 - Surveyors must discuss findings with a field leader when no leak is found but encroachment is present
- MPSC proposed civil penalty of \$90,000 on the Operator for several violations of leak surveying
 - Frequency of surveys
 - Following procedures
 - Calibration dates
 - Documenting sniff tests

PSC 135.723 Distribution systems: leakage surveys additions [49 CFR 192.723].

(cw) Every operator shall maintain a gas leak-detection program and shall maintain records of operation under the program. The program shall consist of not less than the following:

(7) When a leak complaint is received and the odor of gas indicates that there is a leak in or near the premises, a search shall be conducted until the leak is found.

- First leak call not conducted correctly
 - Employee smelt gas, did not find the leak, and did not conduct any follow up

- Leak Surveys
 - Fully completed
 - Notice unusual activity
- Leak Investigations
 - Find the leak
 - Double check
- Gas Migration

Questions?