NTSB National Transportation Safety Board

Importance of Integrity Verification

Presentation to:

Pipeline Integrity Verification Process Workshop

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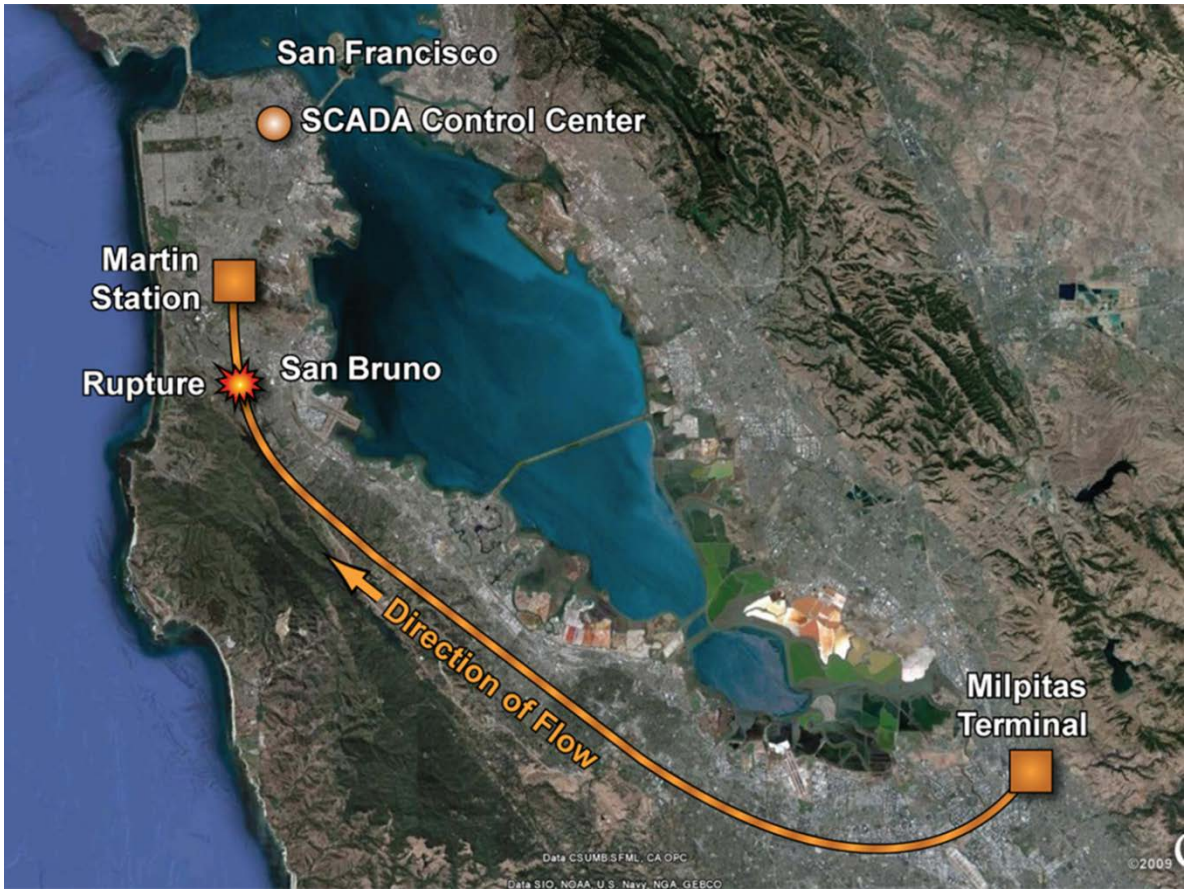
NTSB 101

- Independent federal agency, investigate transportation mishaps, all modes
- Determine probable cause(s) and make recommendations to prevent recurrences
- Primary product: Safety recommendations
  - Favorable response > 80%
- *SINGLE FOCUS IS SAFETY*
- Independence
  - Political: Findings and recommendations based upon evidence rather than politics
  - Functional: No “dog in the fight”

San Bruno: Line 132

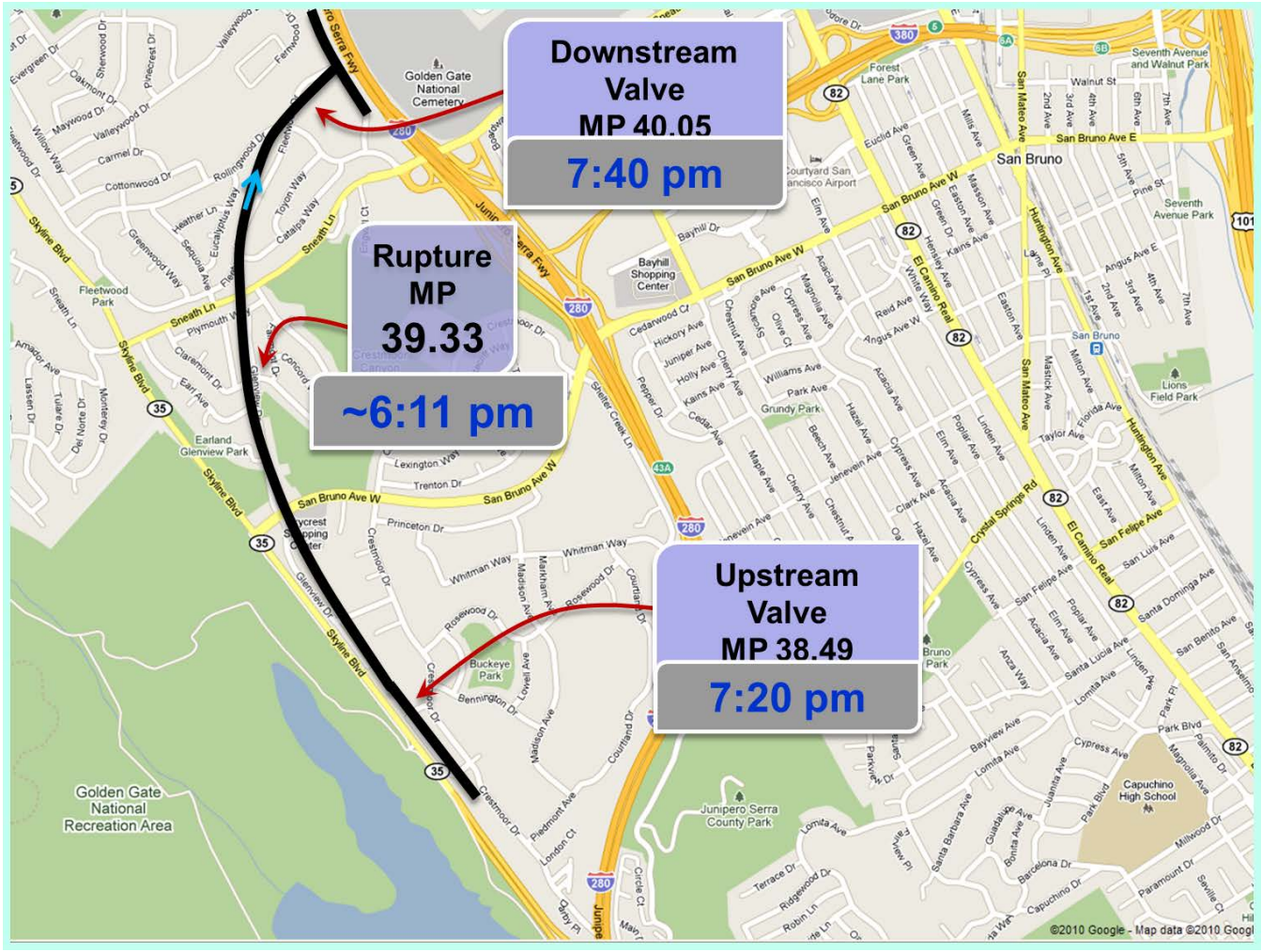


Ruptured Portion: Installed in 1956

Pre-Rupture Events, Sept 9, 2010

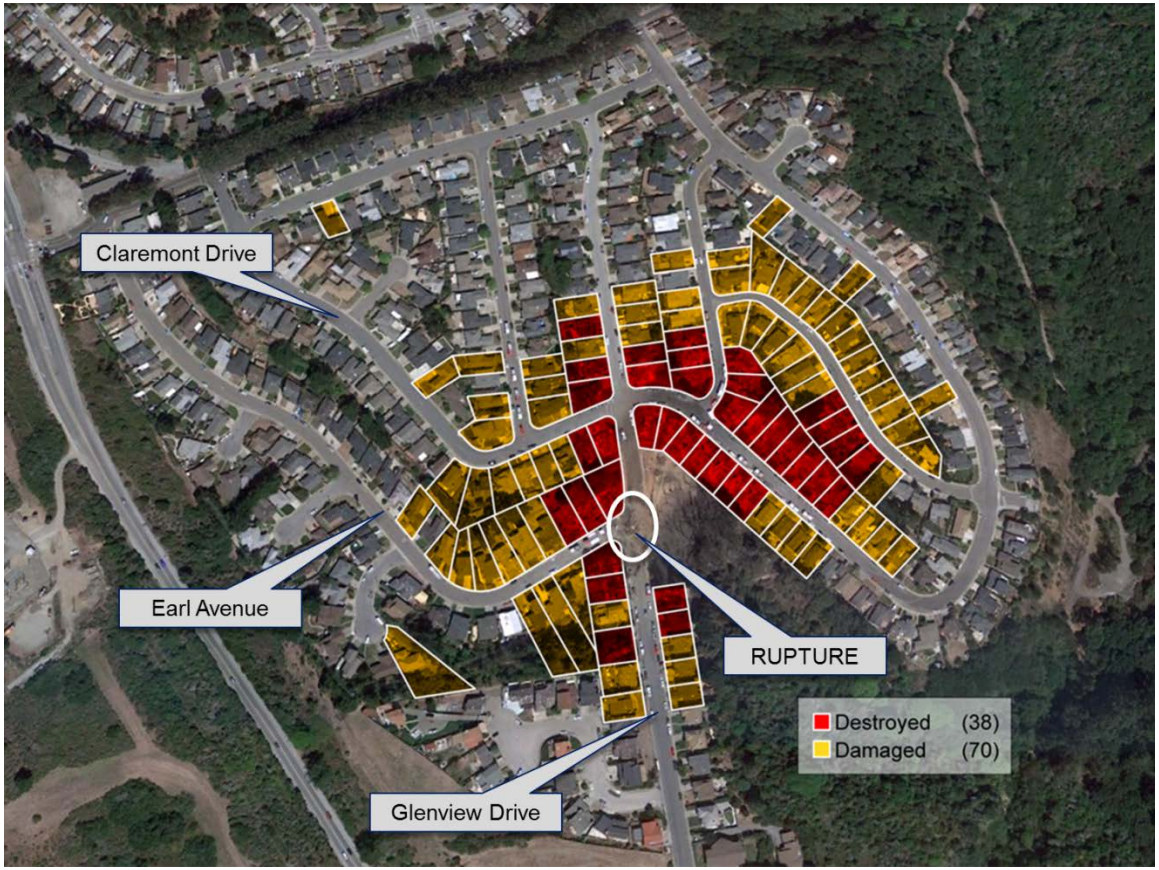
- During replacement of Uninterruptable Power Supply at Malpitas terminal, power supply modules malfunctioned
- Line 132 regulating valve moved to a fully open position
- Pneumatically actuated monitor valve activated
- Steady increase in pressure from 357 psi to 386 psi preceding line rupture at 6:11 pm (Incorrectly calculated MAOP: 400 psi)

Shutoff Time: More Than an Hour

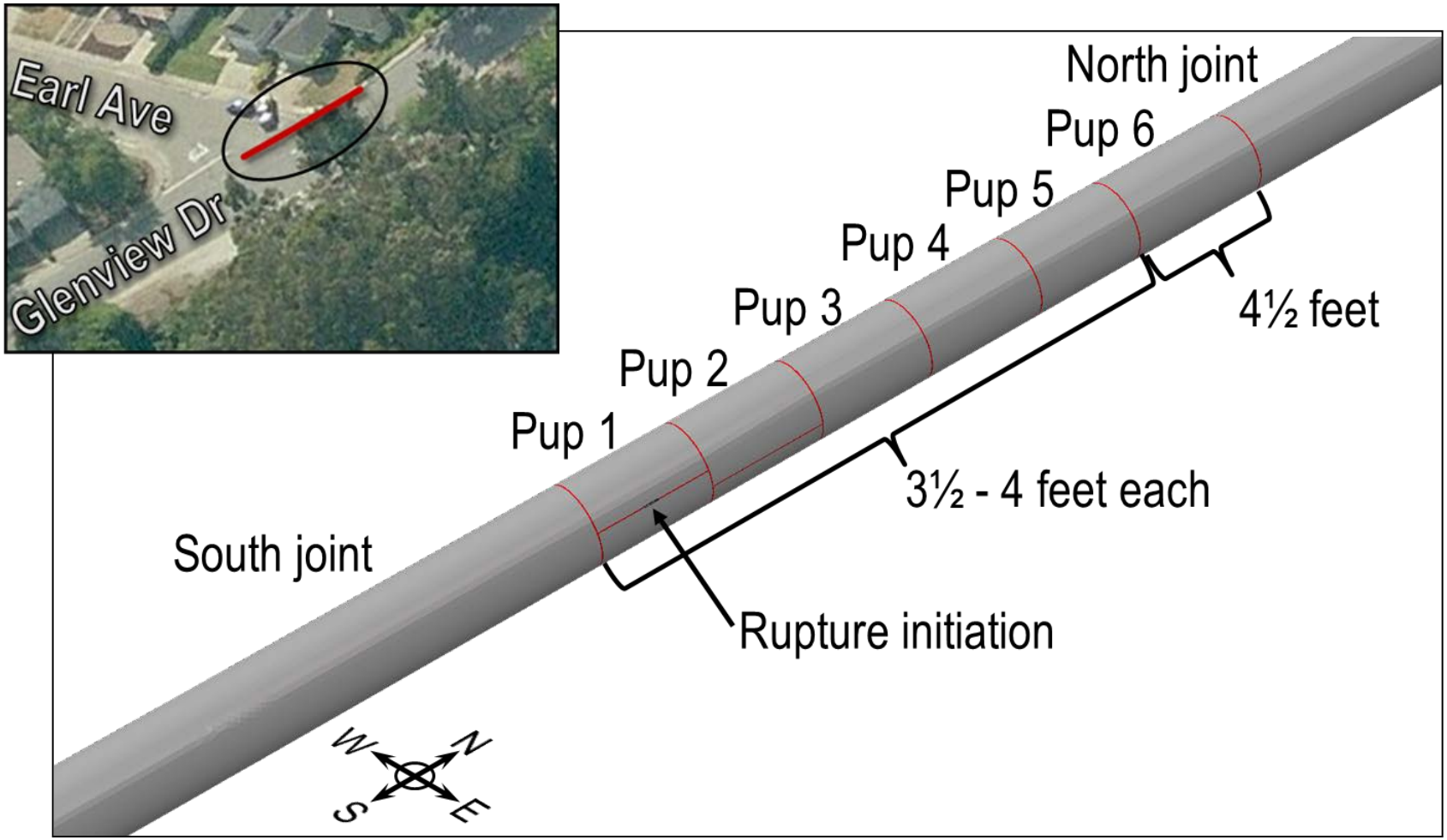


Results of Explosion and Fire

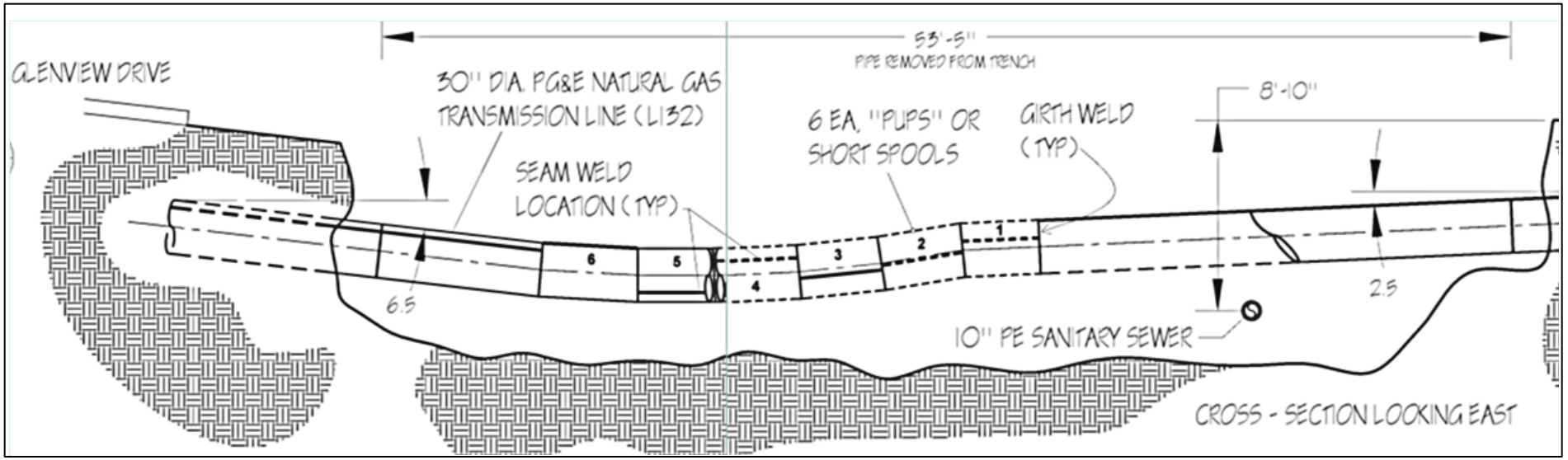
- 8 Fatalities
- 58 Injured
- 38 Homes destroyed
- 70 Homes damaged



Location of Pups

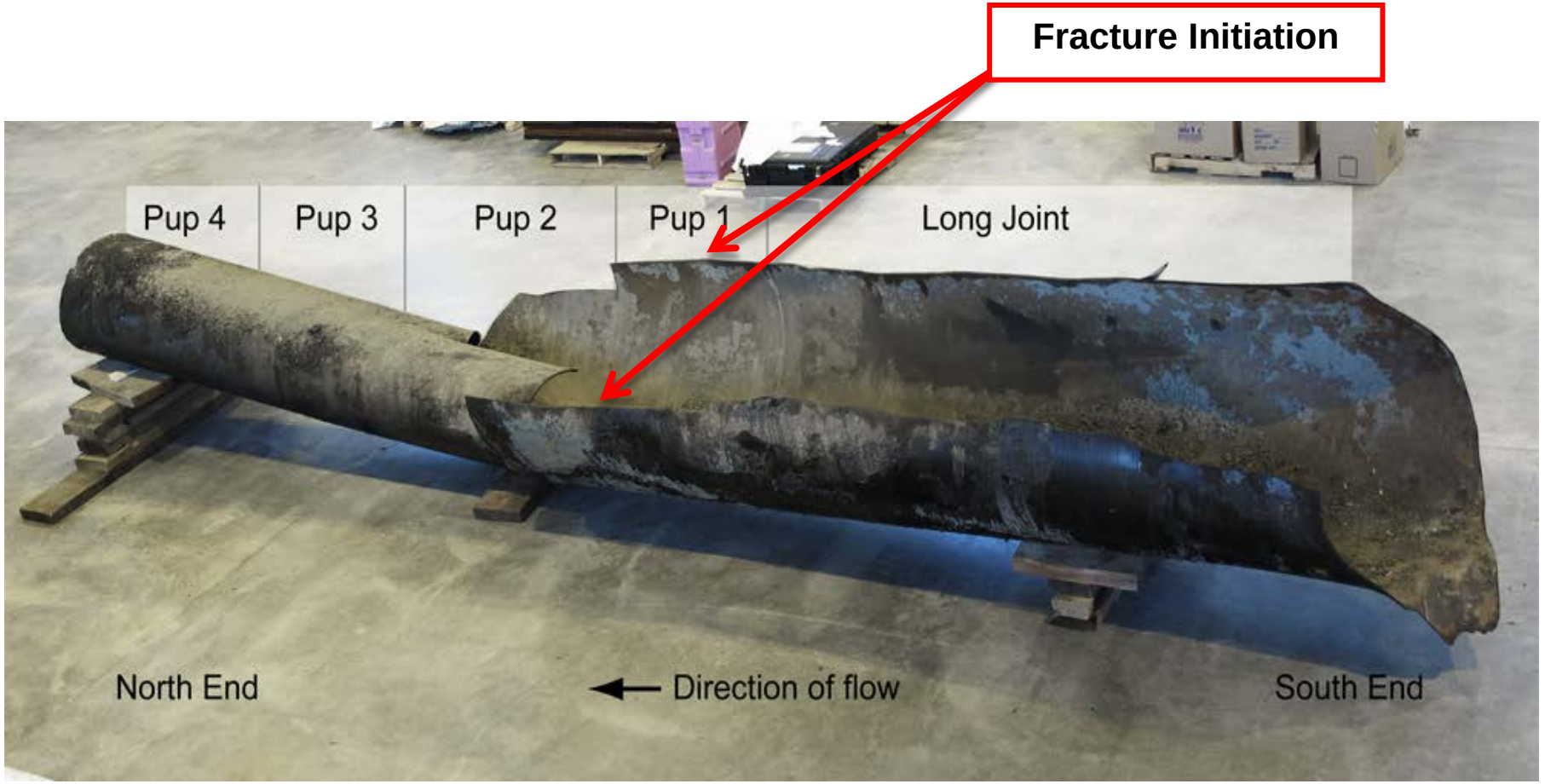


Pup Elevation Detail



Portion of Diagram from San Bruno Docket No. SA-534, Exhibit No. 2-D:
“Schematic Showing Relative Locations of Nearby Services and L132 in the Trench”

Separated Pipe Segment



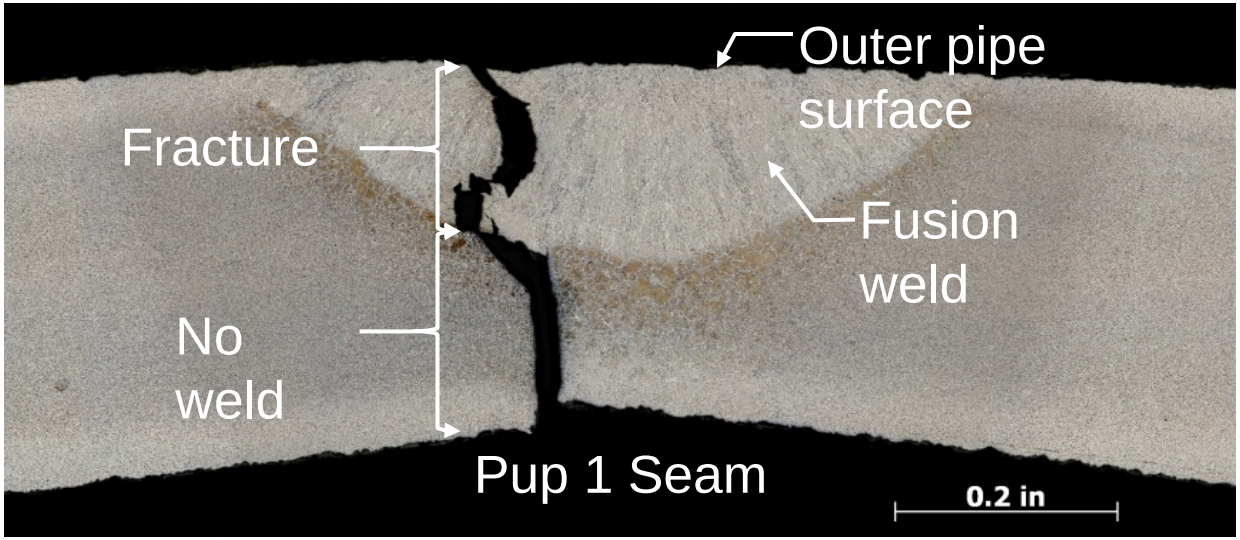
Pup Integrity Issues

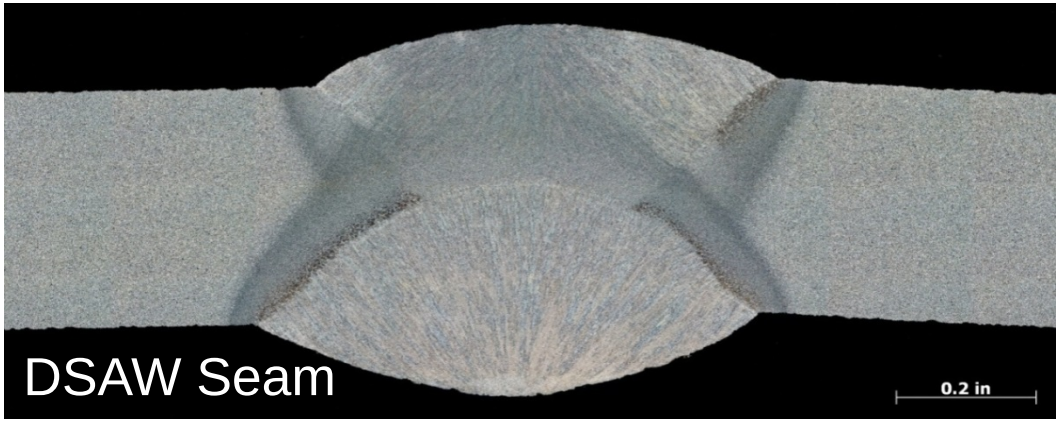
- Ruptured portion installed in 1956
- Manufacturing technique and material properties deviated from PG&E specifications
  - Lower yield strength
  - Chemical makeup was sub-specification
  - Plate rolling direction was circumferential, rather than longitudinal
- Unknown manufacturer

Integrity Issues, con't

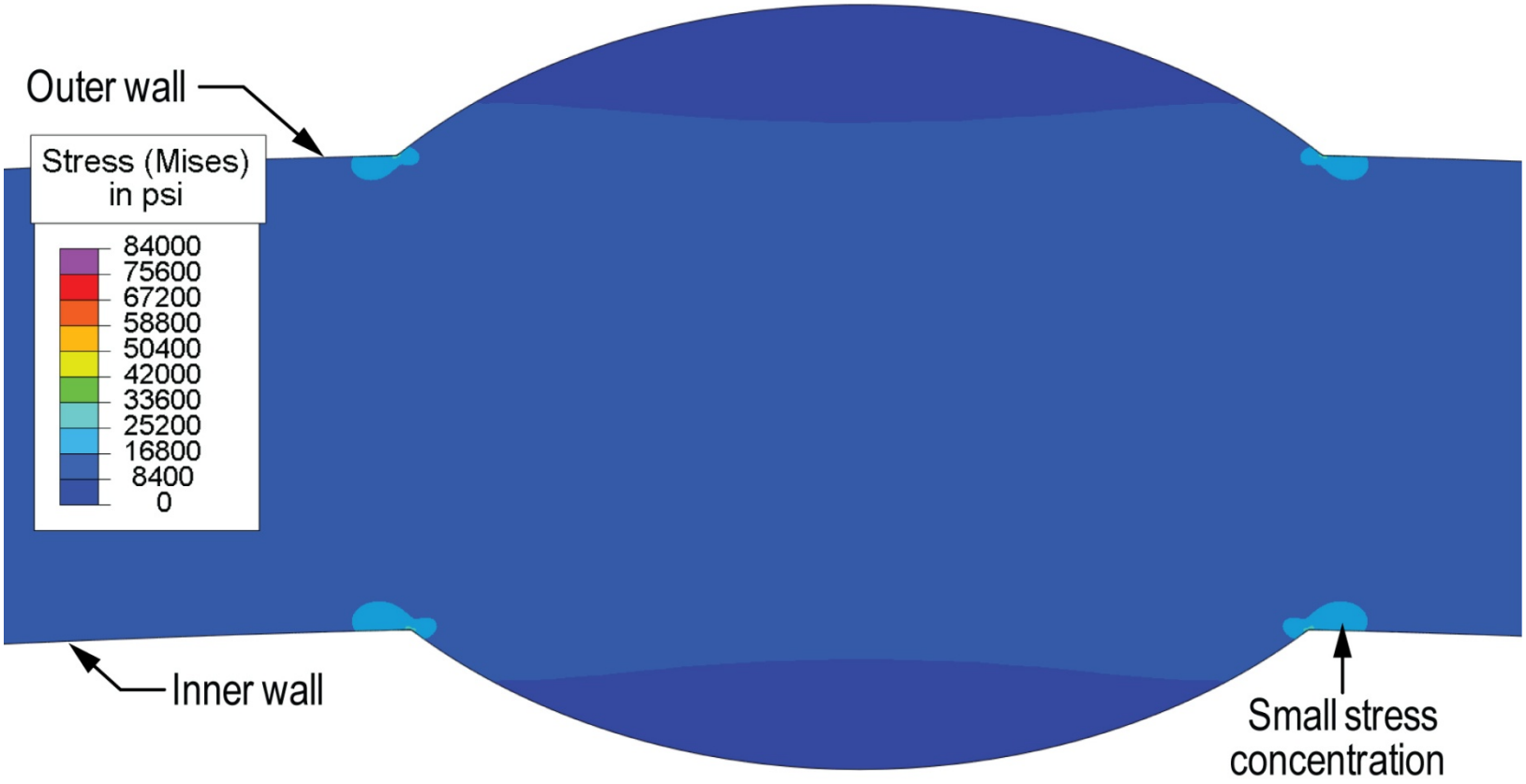
- PG&E records indicated "seamless pipe" but pipe segments had longitudinal weld seam
- Deficient weld quality
  - Single rather than double
  - Weld size
  - Workmanship

Cross Section of Pup 1 Weld

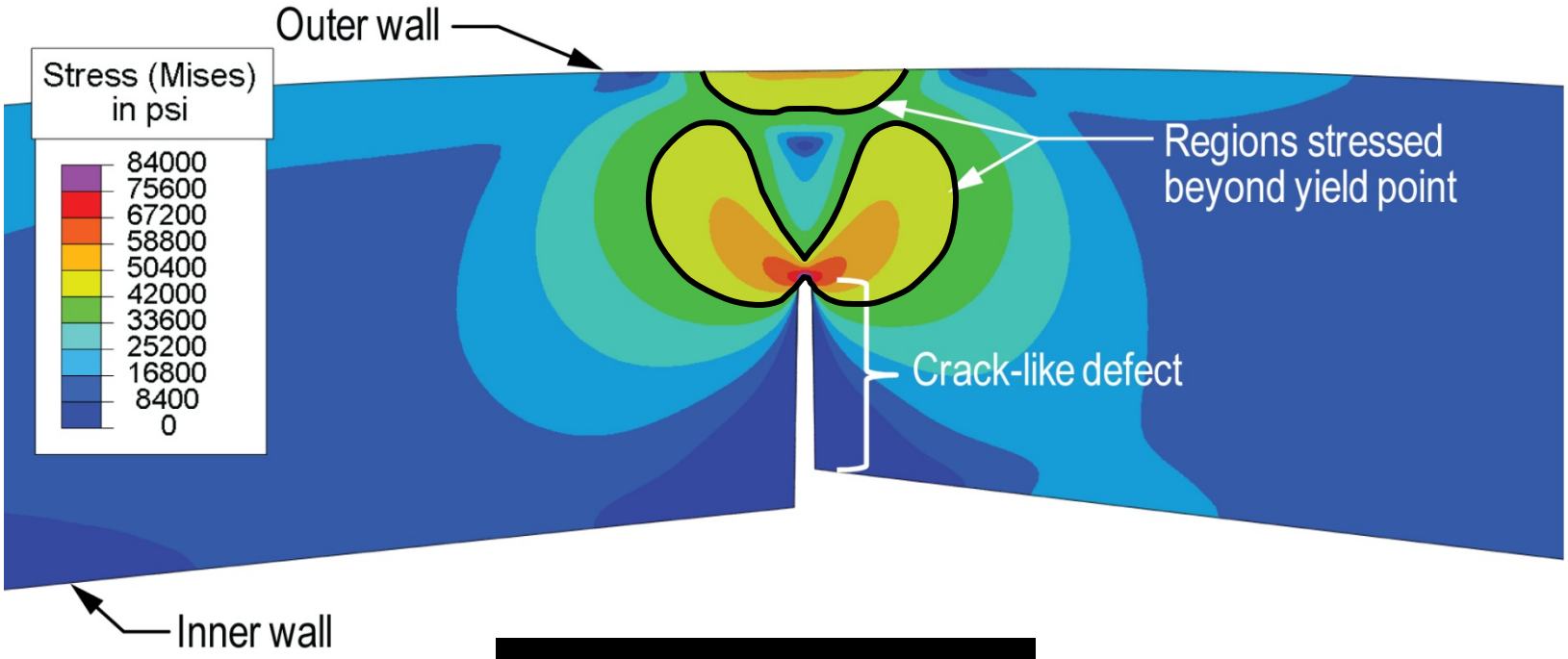


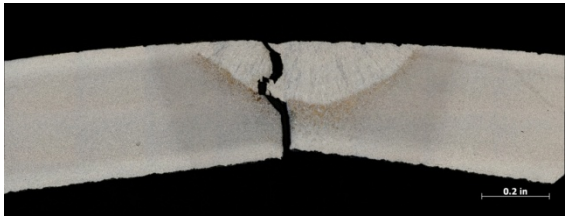


Stresses at DSAW Weld



Stresses at Incomplete Weld





Probable Cause

- Inadequate QA/QC during construction
- Inadequate integrity management
- Contributing to the accident:
  - Exemption from pressure testing due to grandfathering
  - Inadequate regulatory oversight
- Contributing to the severity of the accident:
  - Lack of automatic shutoff or remote control valves
  - Inadequate emergency response

Two Major Recommendation Areas:

- Rescind the grandfather clause and require hydrostatic testing at 1.25 MAOP for older pipelines
- Revise integrity management inspection protocols to minimize threat of pipeline ruptures

Facts to Consider

- The pipe segment that ruptured probably would have failed a hydrostatic test when it was installed
- The safety margin was so slim that a minor pressure increase (in this event, due to a maintenance process error) was enough to cause it to rupture
- When PG&E conducted hydrostatic testing, per our urgent interim recommendation, some pipeline segments failed
  - Verified stability of existing pipeline defects
  - Confirmed the integrity of the pipeline

Concluding Questions

- Do you have any grandfathered pipelines?
- How robust are your records for those pipelines?
- Do you have an adequate integrity assessment program for those pipelines?
- Could your integrity assessment program, if inadequate, result in a pipeline failure?

In Other Words . . .

- Are you willing to risk a major pipeline rupture such as the San Bruno explosion?

OR

- Would you rather find out *now* that you may have an integrity problem, and fix it *before* you experience a catastrophic failure?

Thank You!!!

Questions?