NTSB National Transportation Safety Board

Pipeline Safety: A Perspective from the NTSB

Lessons Learned from PG&E Natural Gas Transmission Pipeline Rupture and Fire

Robert L. Sumwalt
NTSB Board Member

NTSB is an independent federal agency, charged by Congress to investigate transportation accidents, determine probable cause, and issue safety recommendations.

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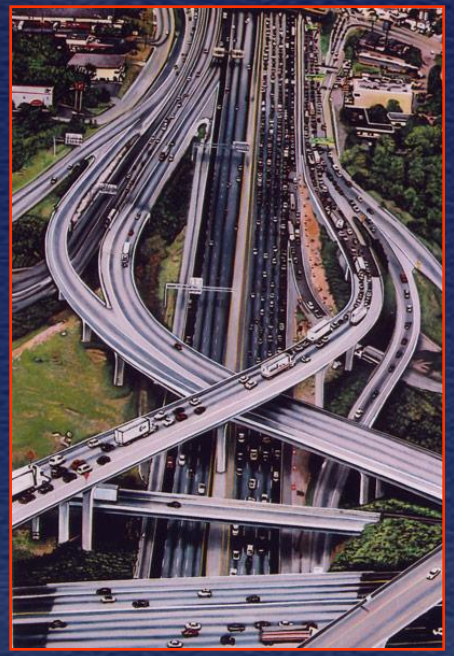

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The Board

- Five Presidentially appointed Board Members
  - Nominated by the President, confirmed by the Senate
  - Serve for five year terms

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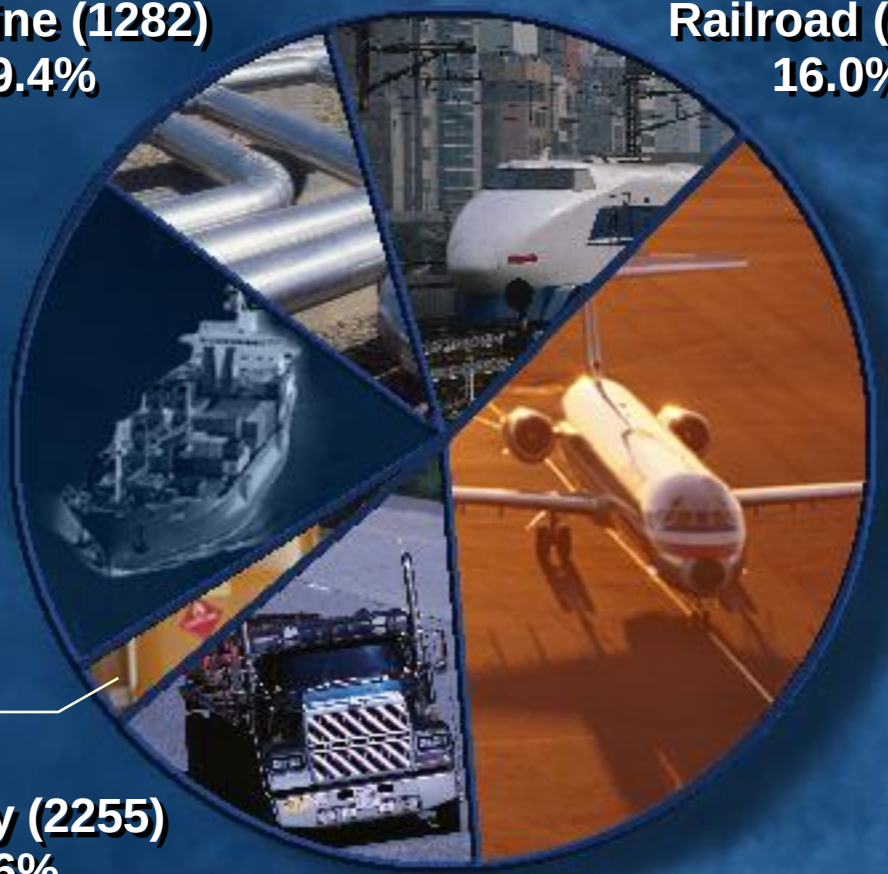
13,621 Safety Recommendations issued since 1967



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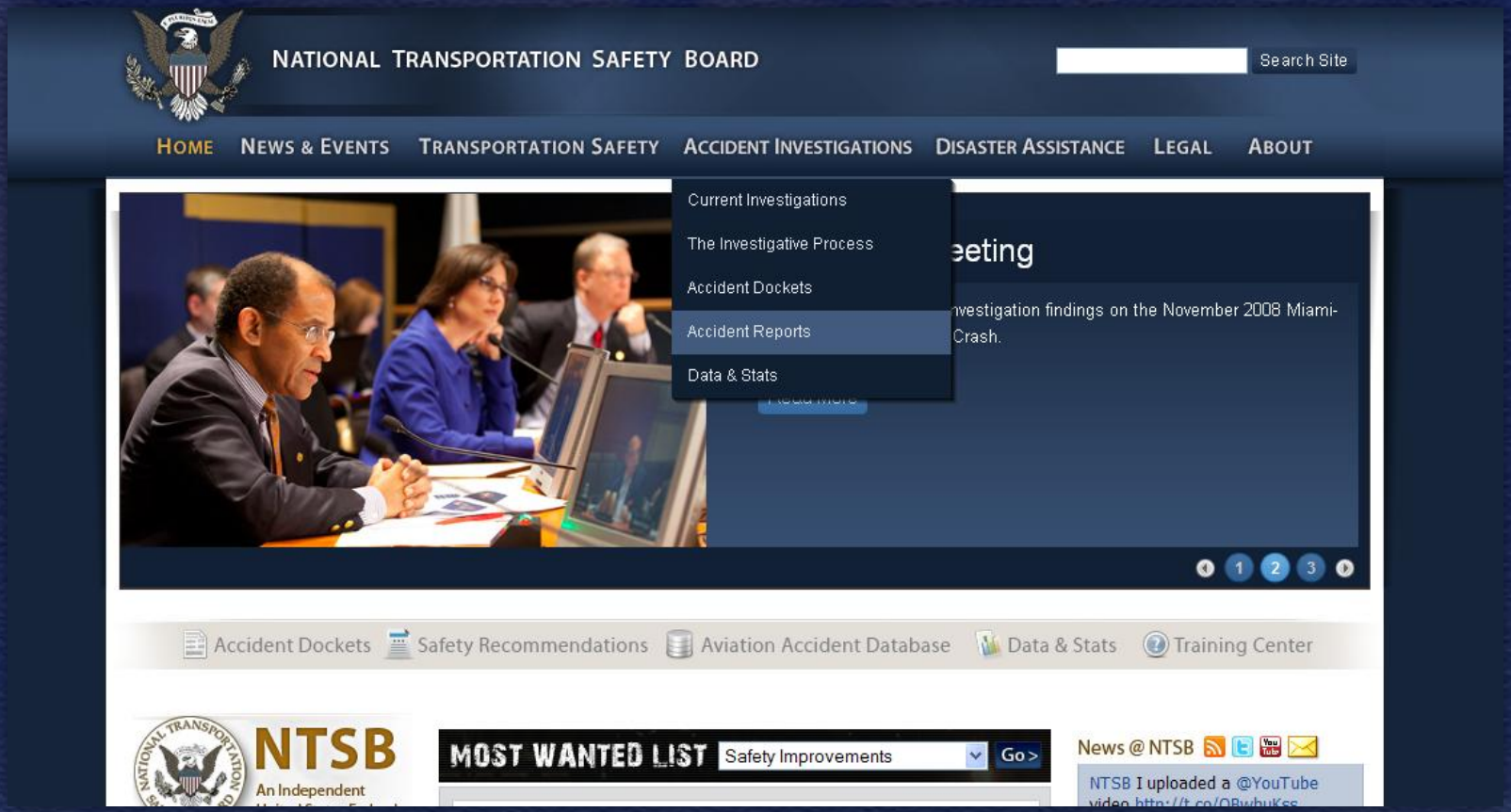

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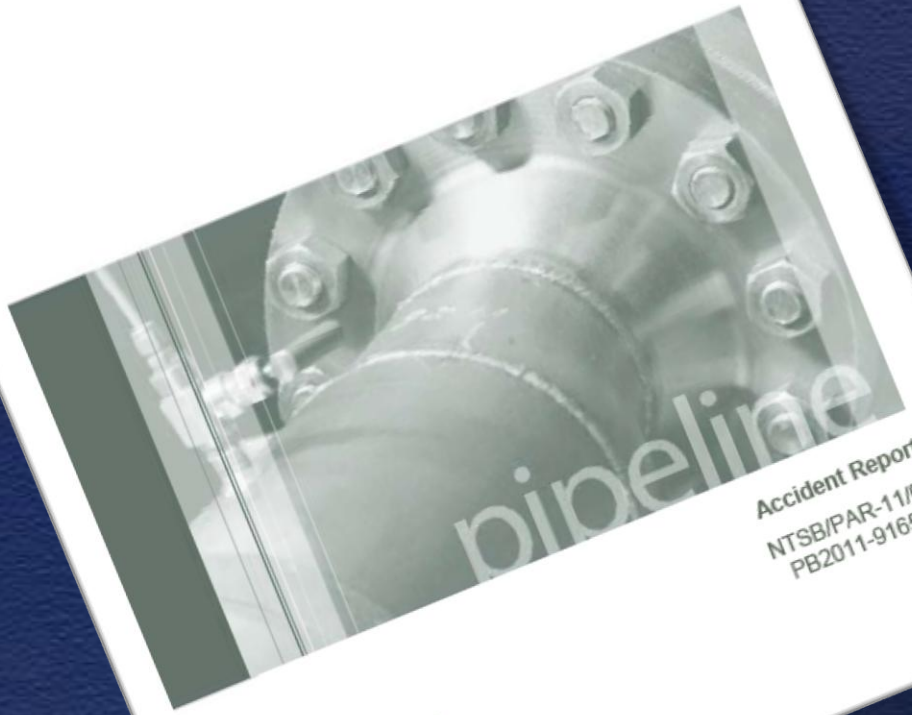
Pacific Gas and Electric Company
Natural Gas Transmission Pipeline Rupture and Fire
San Bruno, California
September 9, 2010



Accident Report
NTSB/PAR-11/01
PB2011-916501

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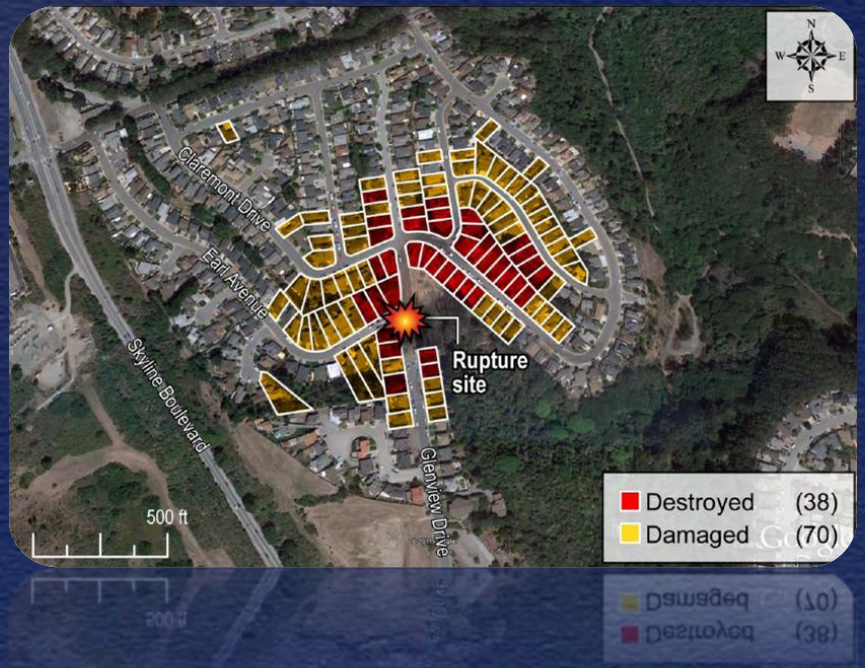
Fatalities, Injuries, Physical Damage

- 8 fatalities
- 10 serious injuries
- 48 minor injuries



- 108 houses affected
  - 38 homes destroyed
  - 17 homes severe-to-moderate damage
  - 53 minor damage

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Dispatch Center
San Francisco
SCADA Center
Martin Station
San Bruno
Rupture
Direction of flow
Milpitas Terminal
20 mi

Construction of the Pipe

North joint
Pup 6
Pup 5
Pup 4
Pup 3
Pup 2
Pup 1
South joint
4½ feet
3½ - 4 feet each
Rupture initiation
N
E
S
W

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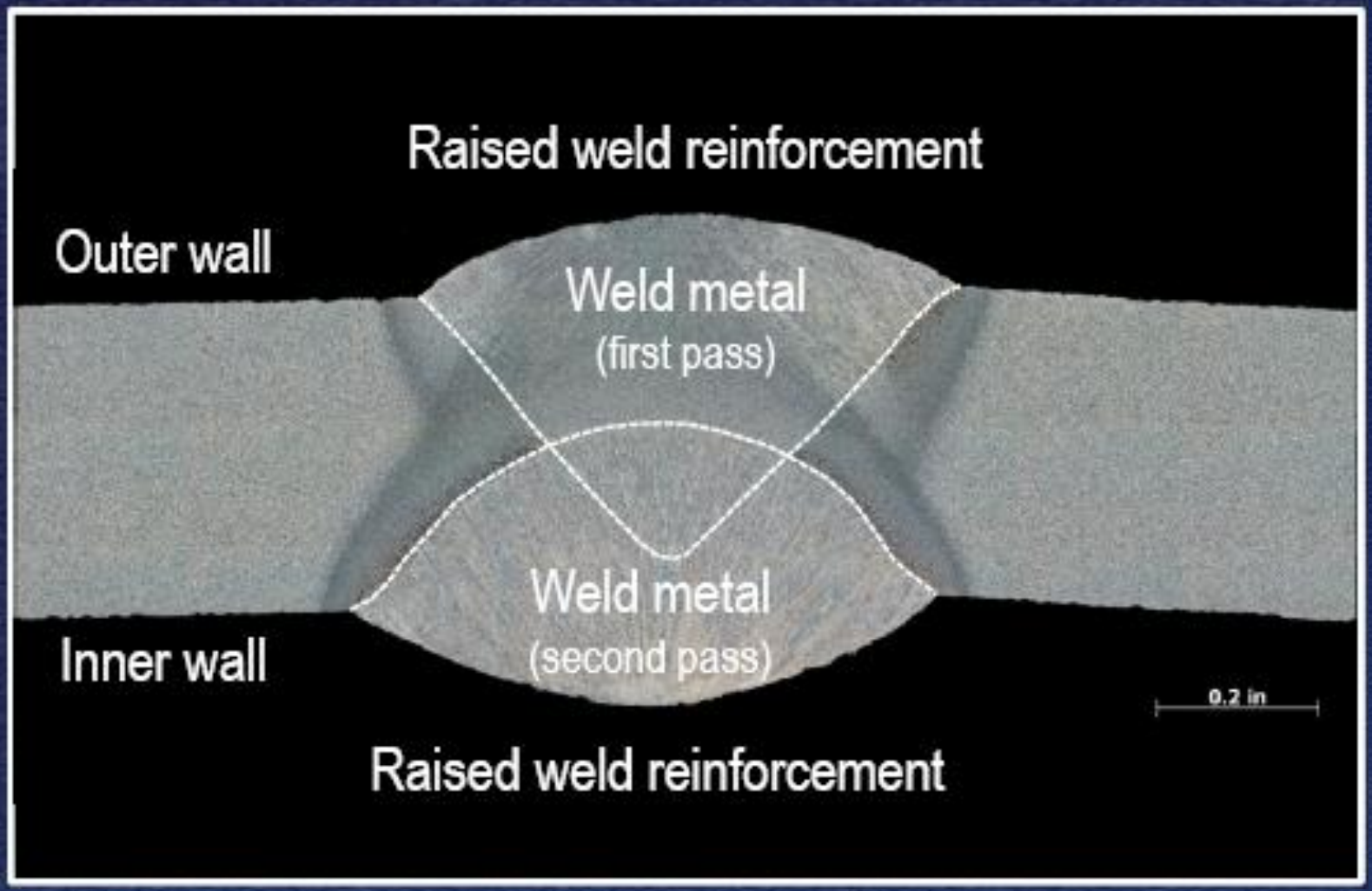
Typical DSAW Sean Weld



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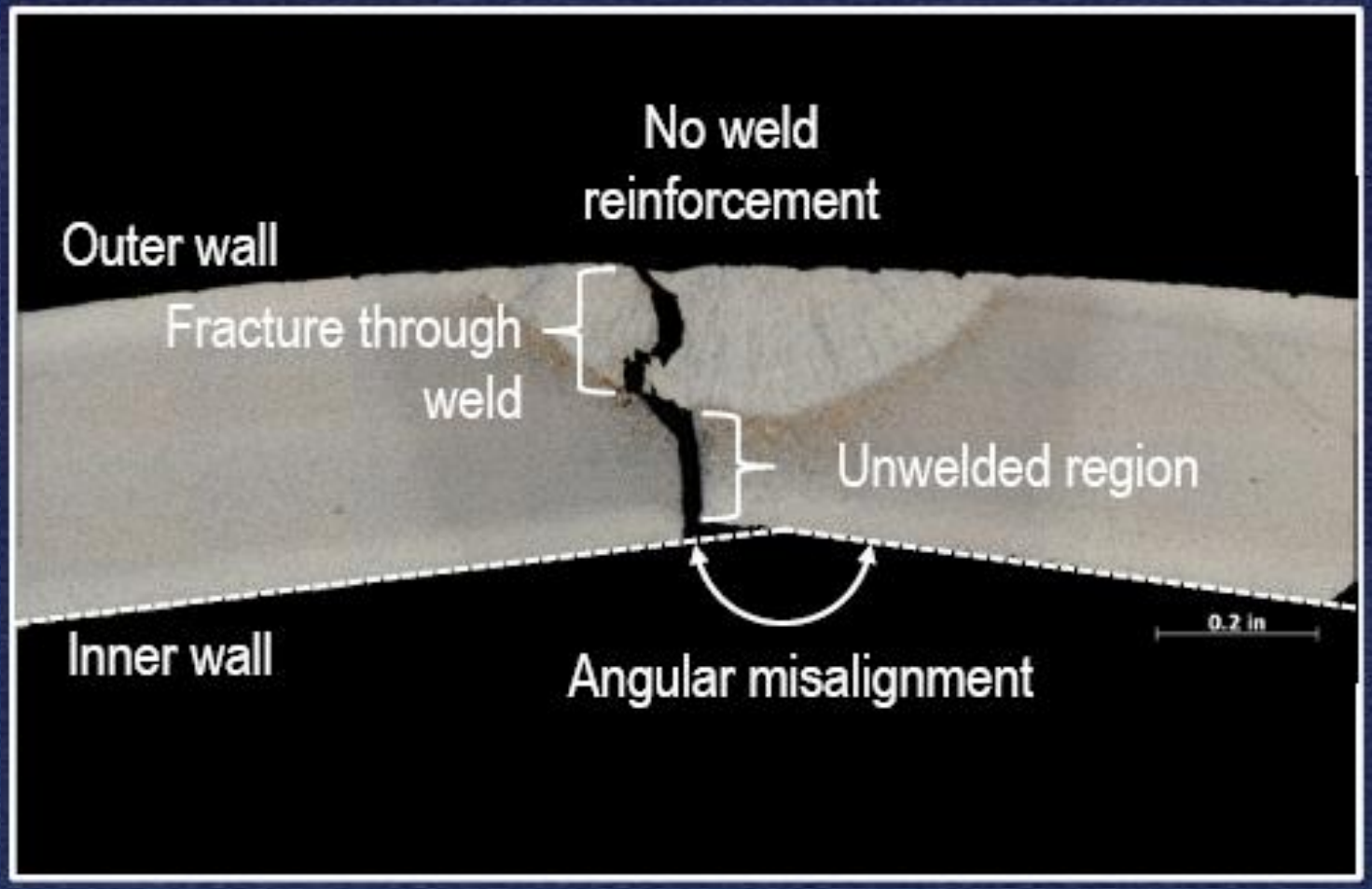
Incomplete Pup 1 Seam Weld



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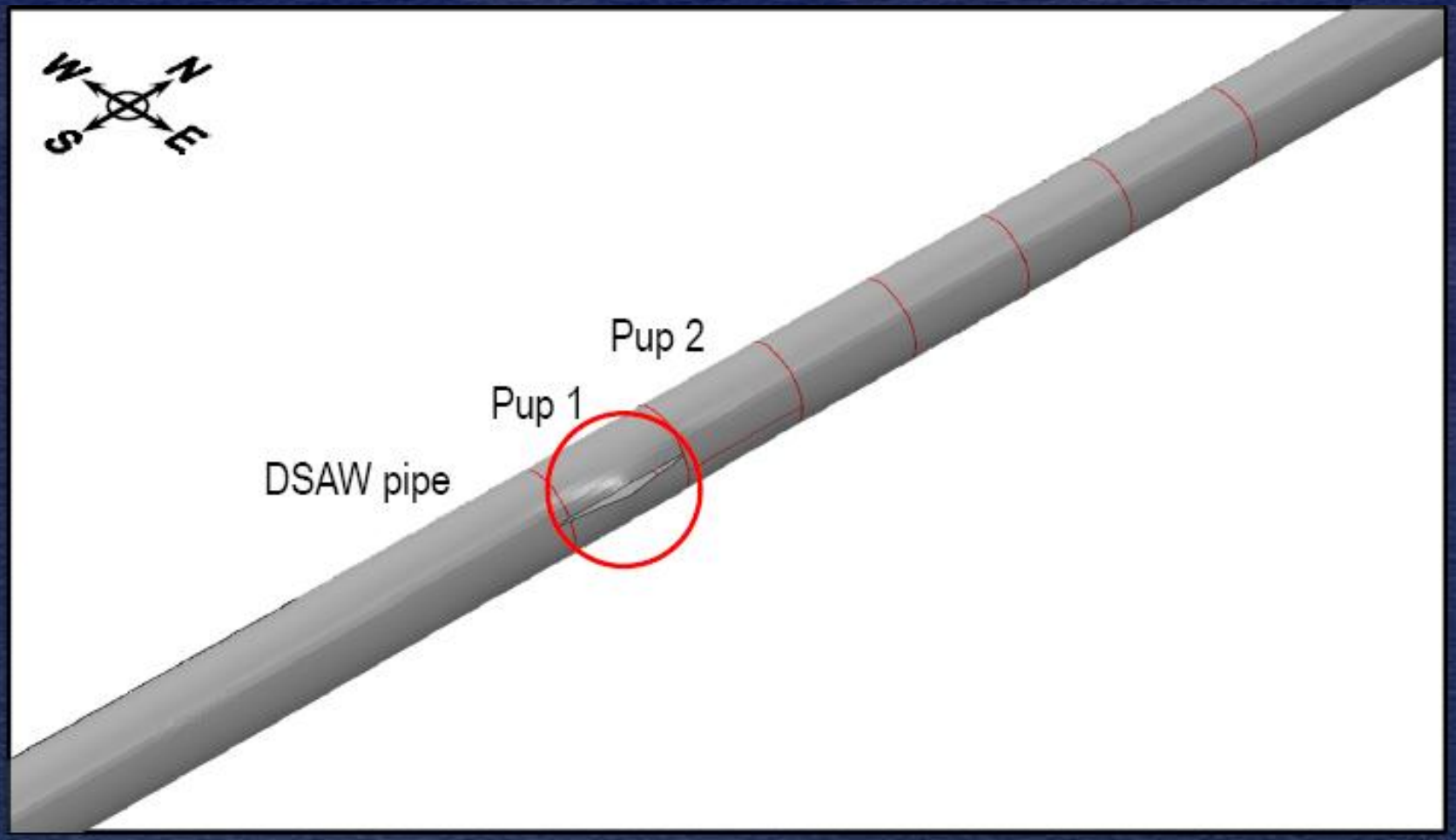
Rupture Sequence



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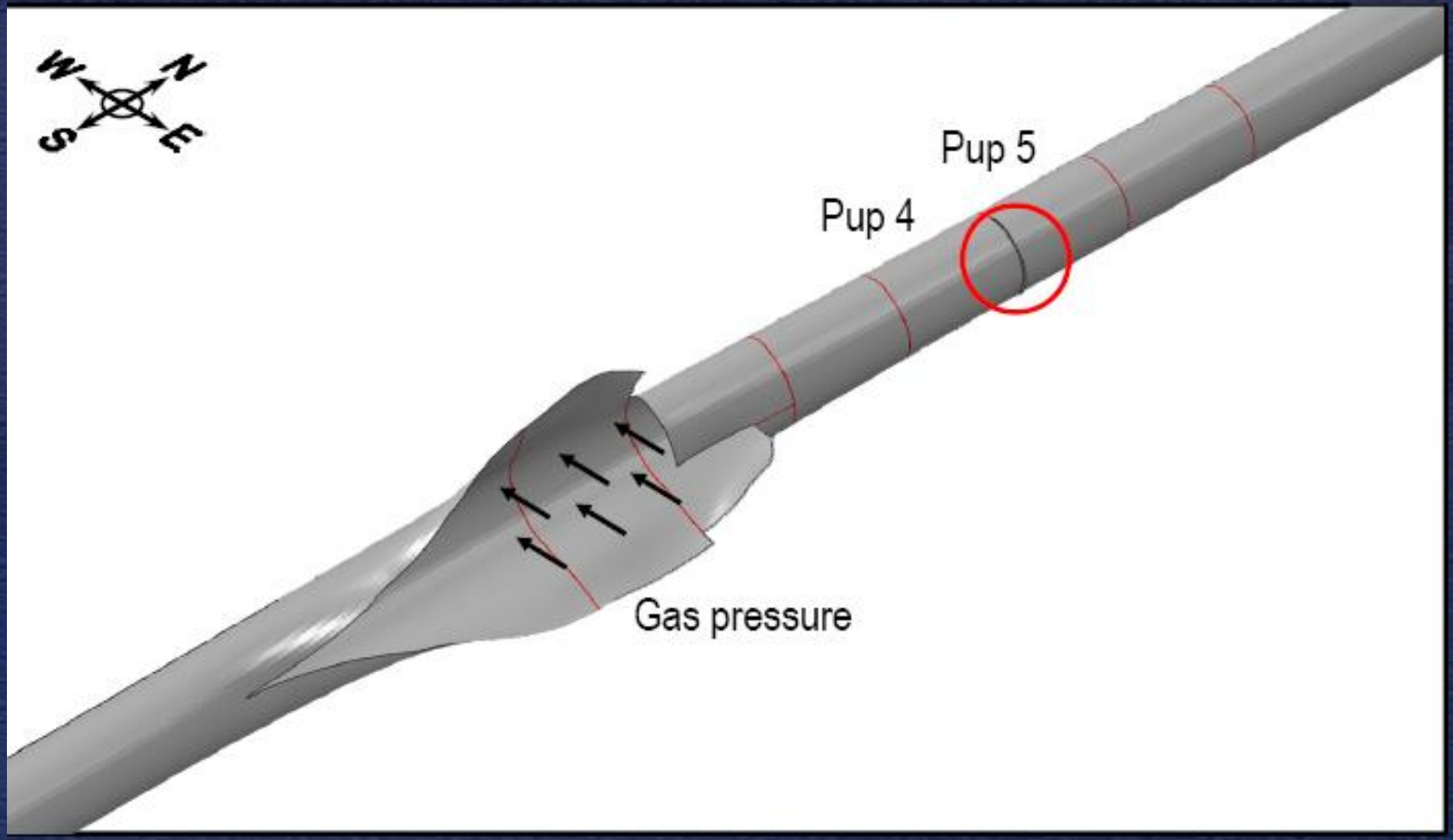

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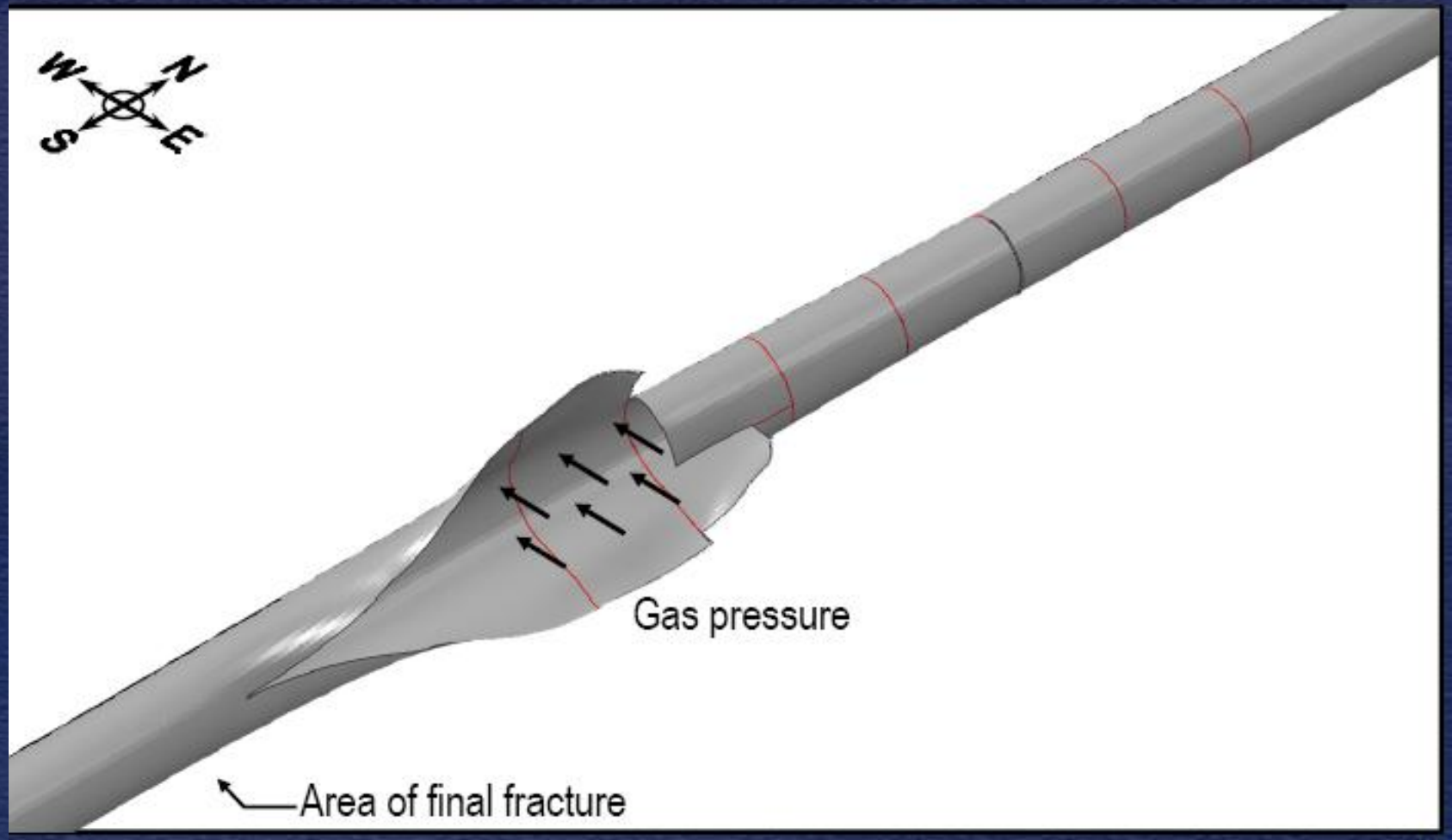

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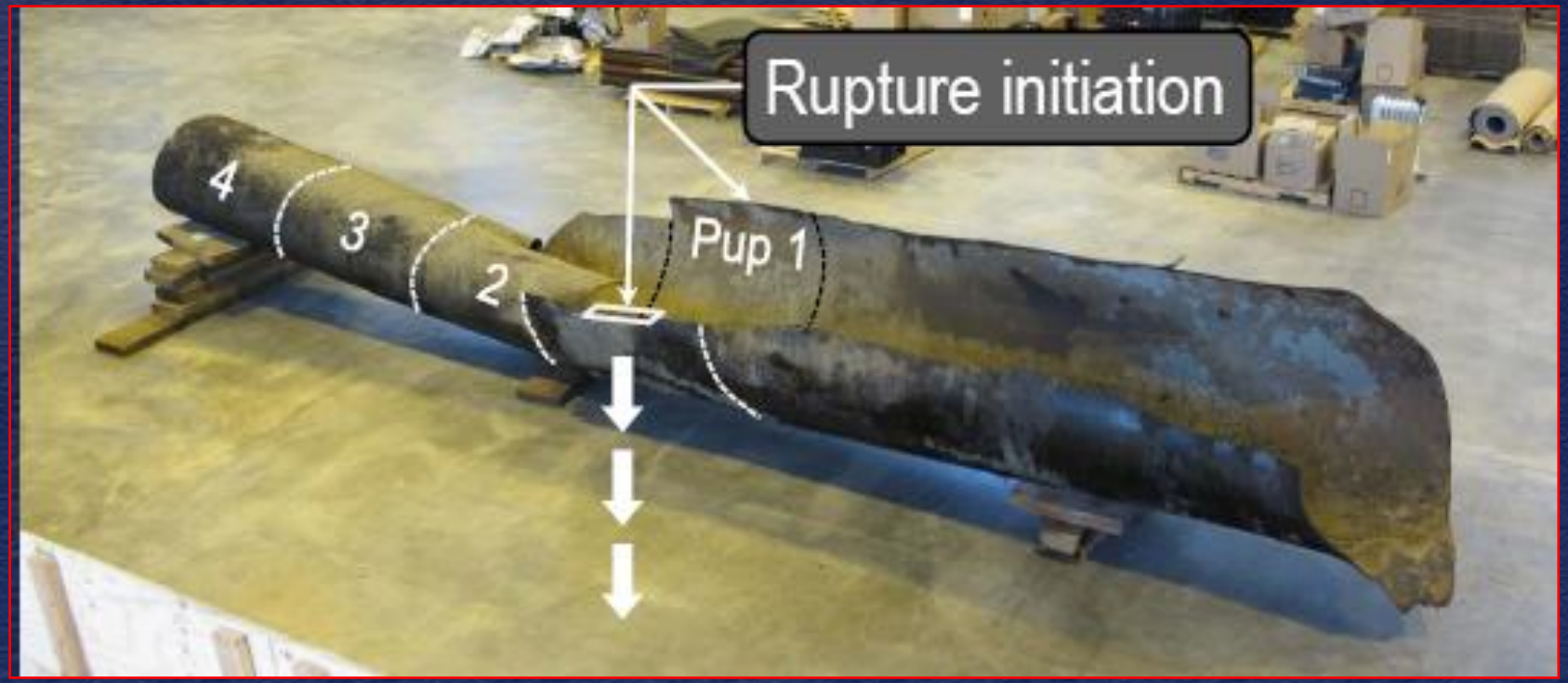

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10 in
Sanitary sewer line
4 in
Natural gas distribution line
72 ft
26 ft
28 ft
26 ft
72 ft
Gas flow
N


North
Earl Ave.


Ruptured
section of pipe
Earl Avenue
Crater with
exposed gas pipe
Glenview Drive
looking south

Summary of PG&E Practices

- “The accident pipe segment did not meet any known pipeline specifications.”
- “Construction and quality control measures for the 1956 relocation project were inadequate in that they did not identify visible defects.”
- “The integrity management program, including self-assessment of that program, was ineffective.”
- “Emergency response to the pipeline rupture was slow, and isolation and shutdown of gas flow were unacceptably delayed.”

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Summary of PG&E Practices

- “The post-accident drug and alcohol testing program had multiple deficiencies.”
- “SCADA staff roles and duties were poorly defined.”
- “SCADA work clearance procedures were inadequate.”
- “Critical components at the Milpitas Terminal were susceptible to single-point failures.”
- “The public awareness program, including self-assessment, was deficient and ineffective.”

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NTSB's Probable Cause

Pacific Gas and Electric Company's:

(1) inadequate quality assurance and quality control in 1956 during its Line 132 relocation project, which allowed the installation of a substandard and poorly welded pipe section with a visible seam weld flaw that, over time grew to a critical size, causing the pipeline to rupture during a pressure increase stemming from poorly planned electrical work at the Milpitas Terminal; and

(2) inadequate pipeline integrity management program, which failed to detect and repair or remove the defective pipe section.

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Contributing to the Accident

- California Public Utilities Commission's (CPUC) and the U.S. DOT's exemptions of existing pipelines from the regulatory requirement for pressure testing, which likely would have detected the installation defects.
- CPUC's failure to detect the inadequacies of PG&E's pipeline integrity management program.

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Contributing to the Severity of the Accident

- the lack of either automatic shutoff valves or remote control valves on the line
- PG&E's flawed emergency response procedures and delay in isolating the rupture to stop the flow of gas.

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Systemic problem, organizational accident

- “The multiple and recurring deficiencies in PG&E operational practices indicate a systemic problem.”

- “The deficiencies identified during this investigation are indicative of an organizational accident.”

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Organizational Accidents:

- Result largely from actions/inactions of companies/organizations.
- Have multiple contributing causes, involve people at numerous levels within the system, and are characterized by a pervasive lack of proactive measures to ensure adoption and compliance with a safety culture.
- Are catastrophic events with substantial loss of life, property, and environment; they also require complex organizational changes in order to avoid them in the future.

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Could this accident happen in your organization?

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Instill a culture that focuses on safety

"Safety culture is the core values and behaviors resulting from a collective commitment by leaders and individuals to emphasize safety over competing goals to ensure protection of people and the environment."

Source: US Nuclear Regulatory Commission

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Safety Culture

- "Safety culture a set of established attitudes, values, beliefs, norms, and practices where safety is revered, promoted and treated as an overriding priority.
  - It begins at the top of an organization and permeates throughout the organization."

Source: US Nuclear Regulatory Commission

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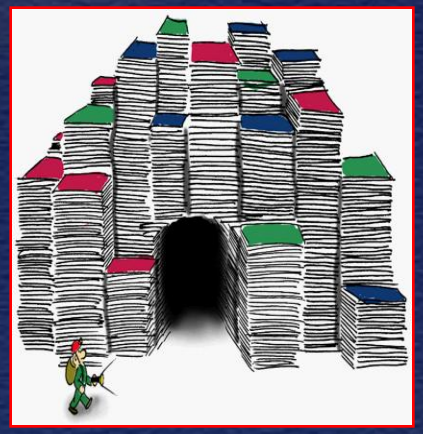
Be informed, stay informed

- Collect and analyze “the right kind of data” to stay informed of the safety health of the organization
  - Create a safety information system that collects, analyzes and disseminates information on incidents and near-misses, as well as proactive safety checks.



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How do you stay informed?

- Internal safety audits
- External safety audits
- Confidential incident reporting systems
- Employee feedback
- MBWA (Management By Walking Around)

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Open lines for reporting

- Employees are open and encouraged to report safety problems
  - Assurance that information will be acted upon
  - Confidentiality will be maintained or the data are de-identified
  - Assurance they will not be punished or ridiculed for reporting
    - Non-reprisal policy signed by CEO

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Non Reprisal Policy
December 2005

SCANA Aviation Department is committed to the safest flight operation possible. Therefore, it is imperative that we have uninhibited good faith reporting of any hazard, occurrence or other information that in any way could enhance the safety and efficiency of our operations. It is each employee's responsibility to communicate any information that may affect the integrity of flight safety.

We will not use this reporting system to initiate disciplinary proceedings against an employee who discloses in good faith a hazard or occurrence involving safety which is the result of conduct which is inadvertent, unintentional or not deliberate.

We urge all employees to use this program to help this Department be a leader in providing our passengers and our employees with the highest level of flight safety.

William B. Timmerman
Chief Executive Officer

Robert L. Sumwalt, III
Manager – Aviation

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Staying informed

1. How do you keep your finger on the pulse of your operations?

2. Are you taking proactive measures?

3. Do you have multiple data sources?

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Employees

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Create a "Just" Culture

- Basically, this means that employees realize they will be treated fairly
  - Not all errors and unsafe acts will be punished (if the error was unintentional)
  - Those who act recklessly or take deliberate and unjustifiable risks will be punished

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Just Culture

- "An atmosphere of trust in which people are encouraged (even rewarded) for providing safety-related information, but in which they are also clear about where the line must be drawn between acceptable and unacceptable behavior."

Source: James Reason

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What is Leadership?

"Leadership is about influence. Nothing more. Nothing less."

- John Maxwell

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