

Root Cause Analysis Methodology Columbiana County, Ohio

Nancy Barton

Manager, Damage Prevention and Public Awareness

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Our Purpose



Provide natural gas and related energy products in a safe, efficient, and dependable manner



Vision & Values

the **place** to work

Employees
Safety

the **neighbor** to have

Compliance
Facility integrity

the **company** to own

Reliability
Profitability
Customer Service



Agenda

- TGP Incident on Line 200-4 ~MP 214+11.5
- Why conduct a Root Cause Investigation?
- How to conduct a Root Cause Investigation
 - Steps
 - Methodology
- Conclusion



TGP 214-4 Incident and Root Cause Analysis



TGP Line 200-4 ~MP 214+11.5

Incident Facts

- Incident Date – February 10, 2011
- 36 -Inch Line #200-4 (Line #4)
- Location – Columbiana County, near Hanoverton, Ohio
- Pipeline constructed in 1963
- 36” O.D. x 0.344” w.t., Grade X60, DSAW, National Tube
- Operating at ~733 psi at time of failure
- Line MAOP is 790 psi

TGP Line 200-4

- In-Line Inspections on TGP
 - Specific line involved inspected in 2005
 - No actionable anomalies at or near the failure site
 - TGP has 11,724 miles of pipeline that can be inspected by in-line inspection (ILI) tools
 - Completed first ILI inspections on 98% of those miles
 - Re-inspected approximately 62% of those miles
- Strong integrity management program
 - Aerial Inspections – Monthly
 - Completed review of MAOP and pressure test records on TGP 200 Line System
- Had very effective emergency response at this incident
 - Meetings with First Responders
 - Mock drills and Incident Command Structure

Root cause analysis and external actions

- Root Causes Analysis is complete
 - Pre-existing crack failed by tensile overload from combination of interacting stressors
- Cooperating fully with PHMSA Central Region and Ohio PUC on a IVRP (Integrity Verification and Remediation Plan)
 - Conducting more digs for additional data
- Continuing to support industry research efforts to improve ILI tools to better detect Girth weld anomalies
 - Independent and in conjunction with PRCI

Additional internal improvements

- Improve thoroughness of project management construction field notes
 - Changes to Computer Based Training
 - Training for Inspectors
- Process for creating an index of past editions of company standards and manuals
- Initiative begun to scan and electronically file historical construction files

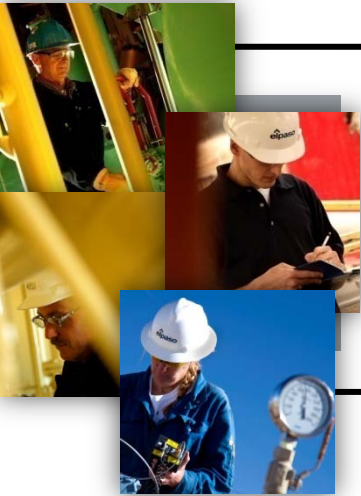


Why Conduct a Root Cause Analysis ?



Root Cause Investigation

- Root Cause Definition
 - Fundamental reason for the incident/condition
 - If removed will prevent recurrence
- Why conduct a root cause investigation?
 - Learn as much as possible about the event
 - Prevent or reduce the probability of recurrence
 - Manage or improve the consequences should there be a recurrence



Root Cause Analysis Methodology



Root Cause Investigation Steps

- First step: Determine significance of event
 - Dictates level of resources allocated
 - Aids in determining the correct number
 - Too many = increased costs
 - Too few = missed lessons learned
 - Many factors to consider
 - Injuries, property damage, likelihood of litigation
 - Opportunities to learn

Root Cause Investigation

- Standards used to judge a root cause analysis
 - Thoroughness
 - Historical Content
 - Fairness
 - Data gathered before conclusions reached
 - Absence of punitive considerations
 - Efficiency
 - Resources are scaled to situation
 - Continuous improvement of organizational learning

Root Cause Investigation Steps

- Preserve Evidence
 - Photos, surveys, chain of custody
 - Need for security?
- Establish the team of Analysts and Investigators
 - Single or team
 - Subject matter expertise
 - Independence / No Conflict of interest
 - Training in RCA development
- Determine Methods – Analytical tools
 - Help formulate questions to be researched/answered
 - Organize information to develop patterns and draw conclusions

Root Cause Analysis Methods

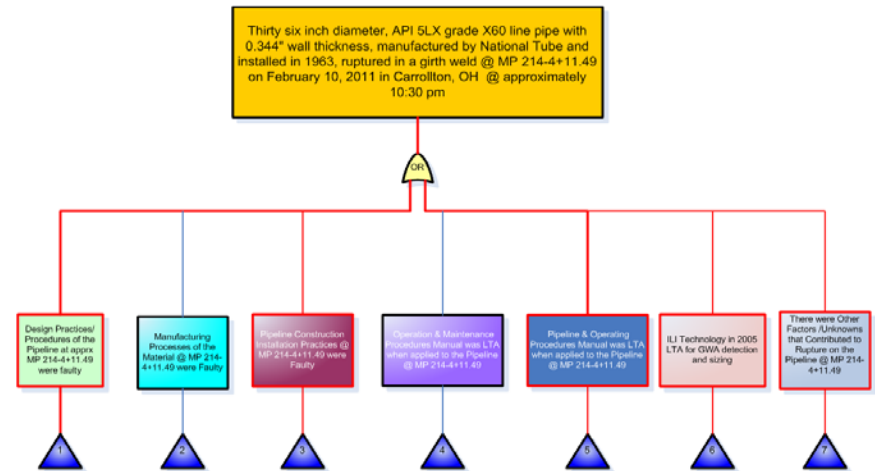
● Conger & Elsea, Inc.

- Events & Causal Factors Analysis
 - Timeline, focus on facts, conditions
- Fault Tree Analysis
 - Hardware, shows multiple possible failures
- MORT (Management Oversight and Risk Tree Analysis)
 - Programmatic, personnel and procedural issues
- Change Analysis
 - Comparison
- Hazard-Barrier-Target Analysis



Root Cause Analysis Methodology

- Fault Tree Analysis
 - Focus on a particular fault
 - Scope range of possible failure scenarios
 - Investigate possibilities
 - Determine critical path(s)
 - Analysis could take you back to more fact gathering



Conclusion

- Why conduct a Root Cause Analysis?
 - Use the opportunity to learn from incident
 - Prevent reoccurrence
 - Share lessons learned
 - Internally
 - Across the industry
 - Part of TGP's commitment to continuous improvement of pipeline safety and integrity