Safety Issues: HCA Identification, Threat Identification, and Risk Assessment

Nathan Doble
Transportation Research Analyst
HCA Identification

- Remediation
- Preventive & Mitigative Measures
- Data Integration
- Integrity Assessment
- Risk Assessment
- Threat Identification
Potential Impact Circle (PIC)
HCA Identification Safety Issues

• Reporting requirements
• Positional accuracy and buffering
• Authoritative sources for geospatial data
Reporting Requirements

• HCA identification frequently cited in inspections
  • Highest percent of collected civil penalties

• Operator incident reports do not verify HCA identification

• Operators not required to submit HCA data to NPMS
Positional Accuracy and Buffering

- Operators must account for mapping/measuring inaccuracies
  - Most interviewed operators add a distance buffer to PICs, but approaches vary
- No standards for geospatial data commonly used by pipeline industry
- Lack of standards limits operators’ ability to determine technically sound buffers
Authoritative Sources for Geospatial Data

• Errors in determining Identified Sites are a frequent compliance issue
  • Palm City, FL

• No national repository for geospatial data used in HCA identification

• Lack of authoritative data source may contribute to inaccurate HCA identification
Threat Categories

• Time-Dependent
  • External Corrosion
  • Internal Corrosion
  • Stress Corrosion Cracking

• Stable
  • Manufacturing
  • Construction
  • Equipment

• Time-Independent
  • Third-Party / Mechanical
  • Incorrect Operations
  • Weather-Related / Outside Forces

Source: PHMSA, NTSB
Threat Identification Safety Issues

• Elimination of Threats
• Interactive Threats
Elimination of Threats

• “Elimination” does not remove threat
  • Operator assumes threat not not present
• Approaches vary among operators
  • Flowcharts
  • Decision trees
  • Statistical tests on risk model outputs
State Inspection Difficulties: Threat Identification

Number of Responses

IM Inspection Area

HCA Identification
Threat Identification
Risk Assessment
Integrity Assessment
Continual Assessment

1: Most Difficult
2
3
4
5: Least Difficult

Source: NAPSR
Elimination of Threats

- Factor in Palm City, FL accident
- Lack of data precludes thorough analysis
- Threat elimination compliance issues cited in 30% of PHMSA IM inspections
- Little guidance available to operators or inspectors
Interactive Threats

- Interactive threat compliance issues cited in 51% of PHMSA IM inspections
  - Most frequent issue cited
- Approaches vary among operators
- Insufficient guidance available
  - How to evaluate interactive threats
  - What threat interactions to consider
- Lack of data precludes thorough analysis
Risk Assessment

- HCA Identification
- Threat Identification
- Data Integration
- Remediation
- Preventive & Mitigative Measures
- Integrity Assessment
- Risk Assessment
Risk Assessment Safety Issues

- Safety performance of risk models
- Risk modeling guidance
- Professional qualification standards
Risk Models

• Risk = Likelihood × Consequence

• Four types of models allowed
  • Subject matter expert (SME)
  • Relative risk
  • Scenario-based
  • Probabilistic (absolute risk)

• Most operators’ models most closely resemble relative risk model
Risk Model Performance

• Operators considering probabilistic models
  • Data-intensive
  • Have advantages over relative risk models
• Insufficient guidance regarding relative safety performance of each model type
• Lack of data precludes analysis of risk model effects on accident occurrences
State Inspection Difficulties: Risk Assessment

IM Inspection Area

Number of Responses

1: Most Difficult
2
3
4
5: Least Difficult

Source: NAPSR
Risk Modeling Guidance

• Weighting factors
  • Indicate relative importance of risk factors
  • System-wide weighting factors can obscure uncommon, but high-risk threats

• Risk metrics and risk aggregation
  • Operators often aggregate risk from segment to HCA level
  • Metrics may mask localized threats
Professional Qualification Standards

• Engineers and SMEs play large role in risk model design, implementation, and validation

• Professional qualification standards are often inadequate

• Example: risk validation role
  • No required training beyond IM familiarity
  • No required math or statistics knowledge