

Utility Pipeline Risk Management

Presented by:
Mark Semrau, PE, PMP
September 10, 2018

Murphy's First Corollary

*Left to themselves,
things tend to go from bad
to worse*

Devastating Potential



1. Horizontal and Linear
2. Product under Pressure
3. Minimal Installed Equipment
4. Extensive Environmental Impacts
5. Multiple Jurisdictional Interface
6. Extensive Public Interface

Several Technical Issues

- Metallurgy
- Fracture Mechanics
- Stress-Strain Reactions
- Coatings
- Soil Chemistry
- Hydrology Influences
- Geotechnical Events
- Electro-Chemical Reactions



Make Pipelines Safer

Through:

- Understanding Issues
- Measurement and Tracking
- Continuous Improvement

Hazard – a characteristic or group of characteristics that provides the potential for a loss.

Hazard ≠ Risk

Risk – the probability of an event that causes a loss and the potential magnitude of that loss.

Risk = Likelihood × Consequences

Three Questions:

1. What can go wrong?
2. How likely is it?
3. What are the consequences?

Failure - What can go wrong?

1. Not able to perform its intended function.
2. Loss of integrity.
3. Unintentional release of pipeline contents.

Probability – How likely is it?

1. Likelihood
2. Degree of belief

Related Terms:

Frequency – Past observation counts

Statistics – Past observation analysis

Failure Rate – Counts over time

Consequences – What are they?

- Property damage
- Human health degradation
- Environmental damage
- Loss of product
- Repair costs
- Cleanup and remediation costs

Consequences – Indirect costs

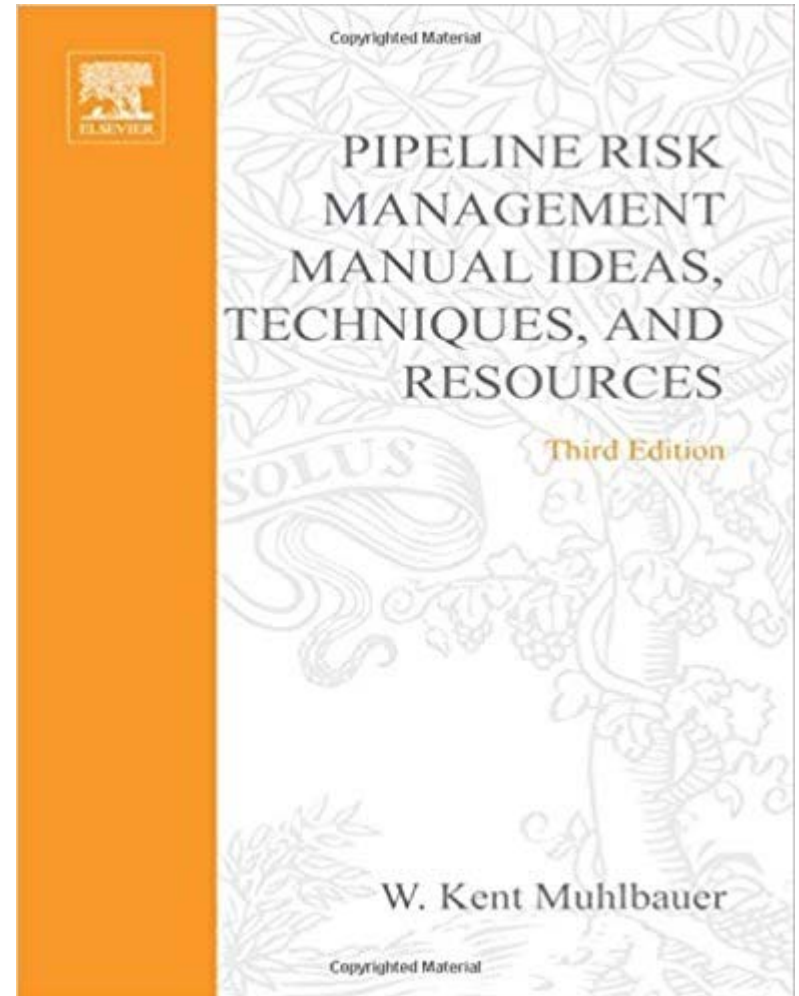
- Litigation
- Customer dissatisfaction
- Political reaction
- Regulatory agency fines and penalties
- Contract violations
- Loss of public trust

Risk Assessment – A measuring process

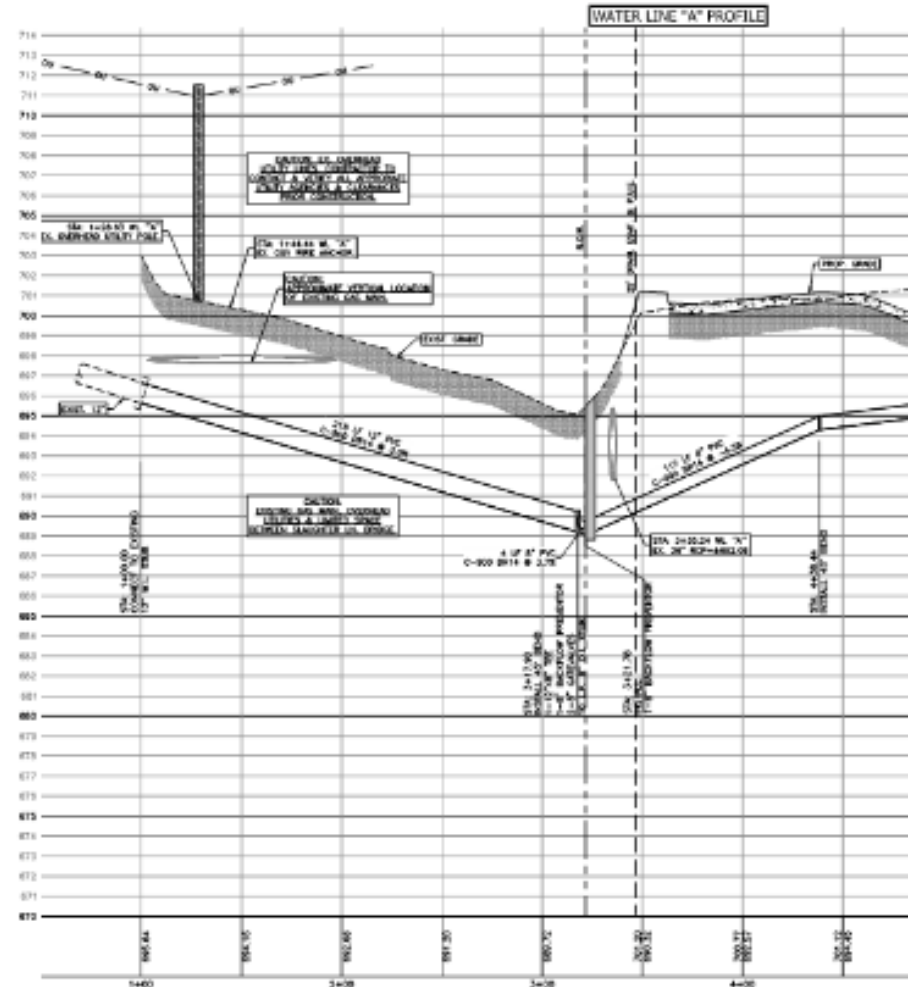
- Application of risk modeling tools

Risk Management – A reaction to perceived risk

1. “Pipeline Risk Management Manual Ideas, Techniques, and Resources”, Third Edition, W. Kurt Muhlbauer (2004)
2. “Identifying and Managing Project Risk”, Tom Kendrick, 2003



- Material Selection
- Safety Factor
- Fatigue
- Surge Potential
- Integrity Verification
- Land Movement



- Inspection
- Materials Handling
- Backfill
- Survey / Maps /
Records



- Atmospheric
- Internal
- Subsurface Environment
- Cathodic Protection
- Coatings



- Training
- Procedures
- SCADA
- Documentation



Murphy's Second Corollary

*It is impossible to make
anything foolproof because
fools are so ingenious*

- Depth of Cover
- Activity Level
- Above Ground Facilities
- Line Locating
- Right-of-way Conditions
- Patrolling



Risk Score Tabulation

Project: JR-MV Transmission Line - Phase 2

Pipe Section

Station 0+00 to 8+00

Date: February 28, 2018

I. DESIGN INDEX

Section	Index Description	Range	Score	Comments
A.	Material Selection	0-20 pts	18	Wrapped Welded Steel Pipe
B.	Safety Factor	0-25 pts	10	MOP = 180 psi
C.	Fatigue	0-15 pts	10	Normal fluctuations of 10%
D.	Surge Potential	0-10 pts	5	Downstream valves nearby
E.	Integrity Verification	0-15 pts	12	Ability for routine pressure testing.
F.	Land Movement	0-15 pts	12	Flat ground, but recorded earthquake in vicinity.
Total Score		0-100 pts	67	

Safety Factor

$$\text{Ratio} = \frac{\text{Design Pressure}}{\text{MOP}}$$

$$\text{Risk Score} = 25 \times \text{Ratio} - 25$$

(Maximum of 25 points)

Table I-C: Fatigue Risk Score

Percent Above MOP	Lifetime Cycles				
	$<10^3$	10^3-10^4	10^4-10^5	10^5-10^6	$>10^6$
100	7	5	3	1	0
90	9	6	4	2	1
75	10	7	5	3	2
50	11	8	6	4	3
25	12	9	7	5	4
10	13	10	8	6	5
5	14	11	9	7	6

Data Criterion Categories

Table V-B: Activity Level Risk Score	
Score	Characteristics
0 - 7	<ul style="list-style-type: none"> • Urban population densities (Class 3¹) • Frequent construction activity • Many buried utilities nearby • Dredging or ditch cleaning
8 - 14	<ul style="list-style-type: none"> • Suburban population densities (Class 2¹) • Moderate construction activity • Few buried utilities nearby • No dredging
15 - 20	<ul style="list-style-type: none"> • Rural population densities (Class 1¹) • Low or no construction activity • No buried utilities nearby • No agricultural activities