Integrity Management

Pete Chace
Public Utilities Commission of Ohio
Gas Pipeline Safety Program Manager

Before integrity management…

- Regulations were derived from long-standing consensus codes and standards
  - Based on experience and engineering judgment
  - Updated to address additional issues and problems found in the field
  - Highly prescriptive
  - Minimum standards

Before integrity management…

- Regulations triggered actions based on the discovery or detection of issues – patrolling, inspections, or tests
- Inspection is straightforward – either an operator did it (satisfactory) or did not (unsatisfactory)

What changed?

- Accidents began to occur at higher rates, sometimes with high consequences (Bellingham, San Bruno, etc)
- Investigations tended to reveal accident causes were often unique situations, often not addressed in any regulation
- Heightened public awareness

Why changed?

- Two basic approaches to reduce accident rates further:
  1. Keep adding prescriptive regulations to address accident causes or unique problems as they occur
  2. Encourage (or require) operators to find and address the issues that are unique to their own operating conditions

Why not just new regulations?

- Prescribing new regulations to address unique situations would require most operators to do things they may not really need to do, resulting in higher operational costs
- Safety benefit is not cost effective
- Operators have an economic incentive to prevent accidents, and are in the best position to know the unique threats to their system

What is integrity management?

- IM is a risk-based approach to improving pipeline safety
- Integrated and iterative process for assessing and reducing risks in order to reduce both the likelihood and consequences of accidents
- Goal is to “work smarter, not harder”

What is integrity management?

- Definition of "risk" =
  1. Possibility of loss or injury
  2. Someone or something that creates a hazard
- Integrity management describes a process used by the operator of a pipeline system to assess and mitigate risk in order to reduce both the likelihood and consequences of incidents

How do you evaluate risk?

- Risk = likelihood x consequences
- Likelihood is the chance something will occur, while consequences are the bad effects that happen if it occurs

Distribution integrity management (192.1001)

- “Integrity management program” means an overall approach by an operator to ensure the integrity of its gas distribution system
- “Integrity management plan” is a written explanation of the procedures the operator will use to implement its IM program

(a) System knowledge

- An operator must demonstrate an understanding of its gas distribution system developed from reasonably available information.

Reasonably available information

- Does not require excavation
- Identify characteristics important to identifying threats and analyzing risk
- Identify information gaps not addressed by reasonably available information
- Develop a process to fill gaps over time through normal activities
- Capture info on newly installed pipelines

Sources of reasonably available information

- Pipe specifications (what pipe and fittings are in the system)
- Construction specifications (type of welding/joining used)
- Tap cards, drawings
- Corrosion control systems (type and condition of coatings, etc.)

Sources

- Results of inspections and surveys (leak surveys, exposed pipe inspections, CP surveys, internal pipe inspections, etc.)
- Documentation of repairs
- Operating pressures

Other information

- Historical annual reports
- incident / outage reports
- Riser failure / mechanical fitting failure reports

Other information

- PHMSA advisory bulletins

http://www.phmsa.dot.gov/pipeline/advisory-bulletin

Substandard plastic materials, mechanical coupling issues, snow buildup, flooding, etc.

Other information

- Geological maps of:
  - River crossings or areas prone to washouts or flooding
  - Areas subject to slippage, subsidence/mining, etc.

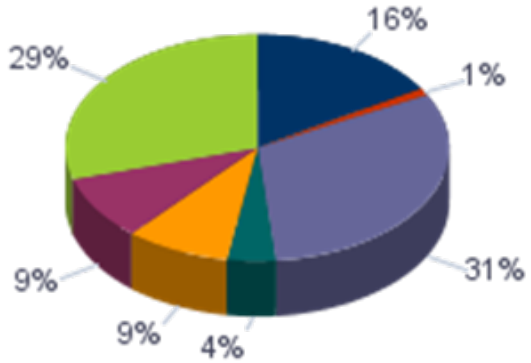
Other information

- Infrastructure changes
  - Future land development
  - Public improvements
  - Other utilities
- Research organizations and trade association reports

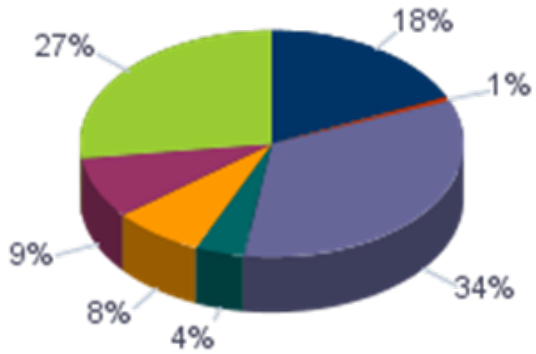
(b) Identify threats

1. Corrosion
2. Natural forces
3. Excavation damage
4. Other outside force damage
5. Material or weld failure
6. Equipment failure
7. Incorrect operation
8. Other

Gas Distribution Incidents



ALL REPORTED-GD



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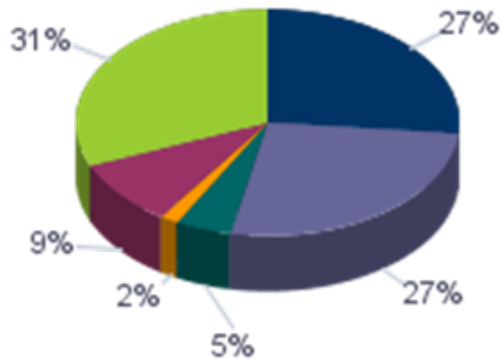


SERIOUS-GD

ALL OTHER CAUSES
CORROSION
EXCAVATION DAMAGE
INCORRECT OPERATION
MATERIAL/WELD/EQUIP FAILURE
NATURAL FORCE DAMAGE
OTHER OUTSIDE FORCE DAMAGE

Threats can have subcategories

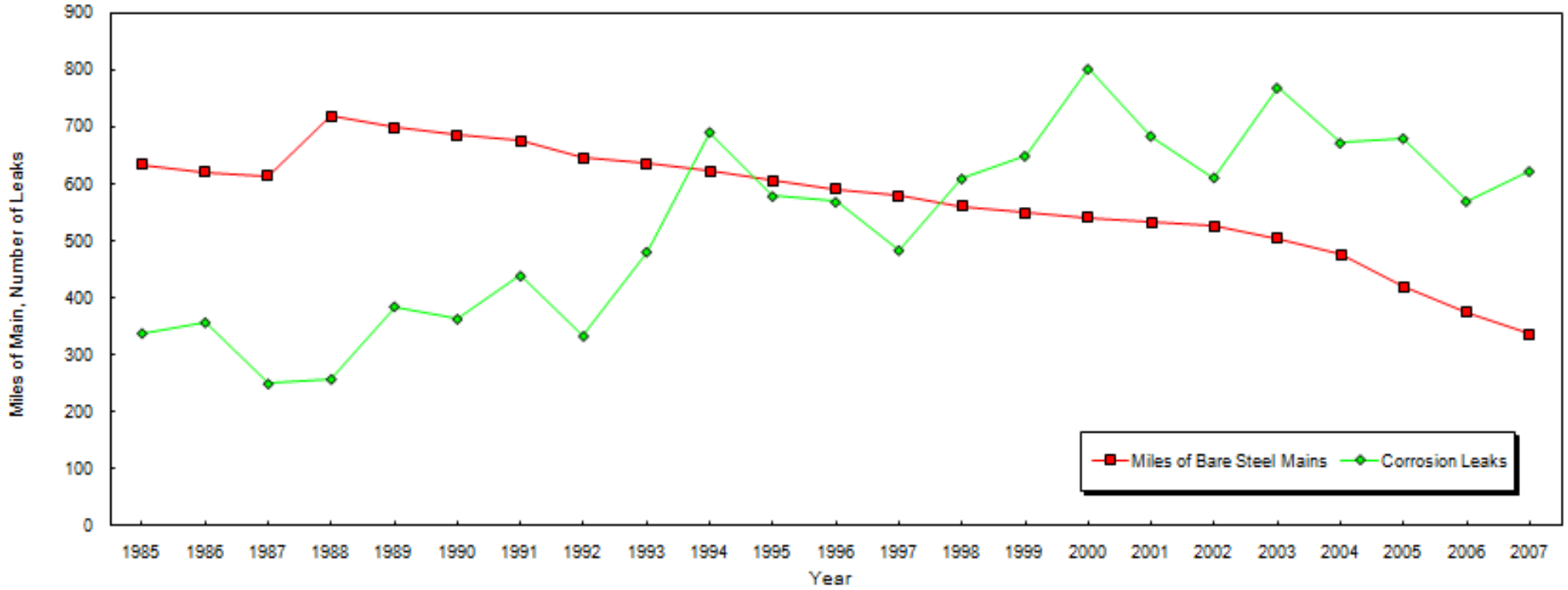
- Excavation damage can be broken down to:
  - Failure to call 811
  - Failure to receive and respond to locate request
  - Poor marking practices
  - High risk excavators
  - Hazards associated with trenchless technology

Primary Threat	Threat Subcategories	Questions to Check Subcategory Applicability to System	Extent of Threat		
			General	Local	NA
OTHER OUTSIDE FORCE DAMAGE	Vehicular	• Are aboveground facilities being hit by vehicles? • Are aboveground facilities located near a roadway, driveway, or other location where they may be susceptible to vehicular damage? • Are susceptible aboveground facilities protected from vehicular damage?			
	Vandalism	• Has damage or leakage been caused by malicious actions of unauthorized individuals? • Has gas theft occurred?			
MATERIAL, WELD, OR JOINT FAILURE	Manufacturing defects	• Have manufacturing defects in pipe or non-pipe components been experienced?			
	Mechanical damage	• Have failures due to mechanical damage been experienced, such as underground structures in contact with facilities?			
	Materials/ Plastic	• Do any of the following materials exist in the system? > Century Utility Products?			

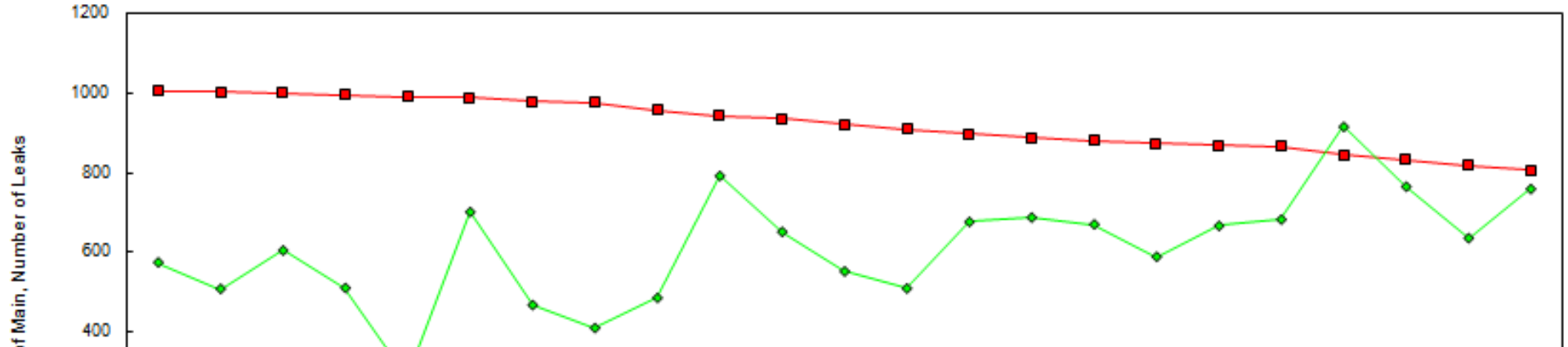
Threat assessment method

- Is the threat applicable and a problem?
- Look at trends of historic performance:
  - Leaks per mile of main/service
  - Damages per 1,000 locate requests
  - Corrosion leaks per mile of bare steel main
  - Cast iron main breaks per mile
  - Etc.

Bare Steel Mains and Corrosion Leaks - System A



Cast Iron & Wrought Iron Mains - System A



(c) Evaluate and rank risk

- Risk = likelihood * consequence
- For each threat, predict:
  - How frequently does it happen?
  - If it happens, how bad would it be?

Evaluating risk

- Risks may be different for different parts of your system
- You may subdivide your system into regions with similar characteristics

Risk models

- Can use a “subject matter expert” approach or a mathematical model
- Either one meets requirements
- Mathematical models are recommended for larger systems
- Commercially available programs such as SHRIMP are available

(note – SHRIMP is just a risk model!)

(d) Address risks

- Implement measures to reduce risk based on the results of your risk ranking
- Measures may reduce the likelihood and/or consequences of an occurrence

Quiz – likelihood or consequence?

a) Accelerated pipeline replacement programs
b) Increased patrolling
c) Plans to shut in systems during flooding
d) Riser replacement program
e) Relocating a line running through high population areas
f) Increased leak surveys in business districts
g) Installing excess flow valves
h) Buying better quality paint for line marking

(e) Measure performance, monitor results

- “Develop and monitor performance measures from an established baseline”

(e) Measure performance, monitor results

- "Develop and monitor performance measures from an established baseline"
  - "Performance measure" = something you can measure and compare from year to year
  - "Established baseline" = what the numbers were when you started

Performance measures – annual report form

- Reportable performance measures:
  - Number of hazardous leaks eliminated/repaired by cause
  - Number of excavation damages
  - Number of excavation tickets
  - Total number of leaks eliminated/repaired by cause
  - Number of EFV's installed

Performance measures – other requirements

- Number of hazardous leaks eliminated or repaired categorized by material
- Any additional measures the operator determines are needed to evaluate effectiveness of the IM program in controlling each identified threat

Examples

- Ensure your hazardous and other 7100 annual leak reporting numbers match your internal leak data
- Compare leaks by cause from year to year. Are leaks trending up or down, when looked at by cause?

(f) Periodic evaluation and improvement

- Determine interval for program review and evaluation
  - At least every five years
  - Based on complexity of system and changes in risk factors
  - Could be similar frequency as review of operational plans and procedures
  - Could be after a plan milestone such as a major pipe replacement program

Periodic evaluation and improvement

- Procedures must describe the program evaluation actions and include:
  - Frequency of review
  - Incorporate new system information
  - Re-evaluation of threats and risk
  - Frequency of measures to reduce risk
  - Effectiveness of measures to reduce risk