RAISING YOUR
RETURN ON
INTEGRITY

Using GIS to Meet Distribution Integrity Management Program (DIMP) Requirements

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QUESTAR Gas

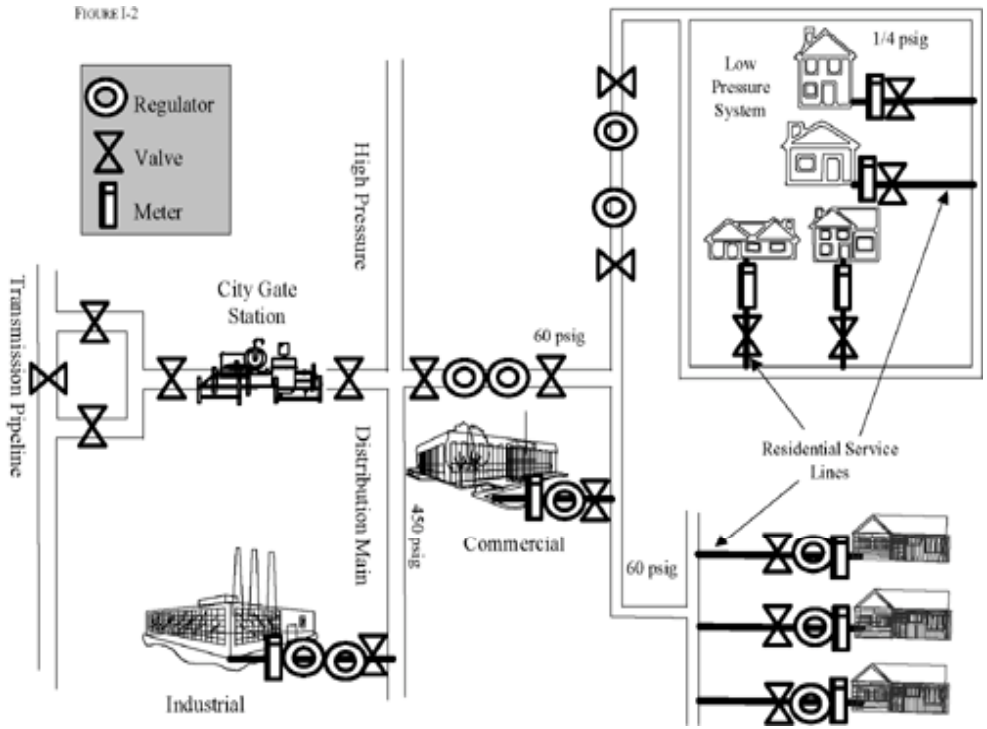
NEW CENTURY SOFTWARE

Presentation Outline

- Brief Overview of DIMP
- Role of GIS
- Data Model Requirements
- Other Data
- Spatial Risk Assessment Using GIS
- Using Risk Valuations in GIS
- Monitor Results and Continually Improve
- Integrating Data to Make Informed Decisions
- Five Things to Do Right Now

What is Distribution?

- 9,221 Operators
  - Large
  - Small
  - Master Meter
  - LPG
- 1,138,000 Miles of Main
- 750,578 Miles of Service (est.)
- 60,970,000 Services



http://ops.dot.gov/regs/small_ng/images/Chapter1_img_1.png

DIMP Requirements

Required by Proposed Federal Regulations

The Seven Elements:

1. Knowledge of infrastructure
2. Identification of threats
3. Evaluation and prioritization of risks
4. Mitigation of risks
5. Measuring and monitoring of performance
6. Periodic evaluation and improvement
7. Reporting of results

Element 1
Know Your System

- Assemble as complete an understanding of infrastructure as possible
  - Use the best information available
- IM program should identify gaps
  - Address through normal activities
  - Record data from any new installations, maintenance, and exposures
- GPTC: Current data maintenance practices may be good enough
  - …or they may need modification

Element 1
Know Your System

Where is your data now???

- Leak data
  - Is it attached to pipe/facilities?
- External force damage
  - 3rd party
  - Construction activity
  - Geo-hazzards
- Corrosion and CP data
- Pipe and facility data
  - Mechanical fittings
  - Reconditioned pipe
  - Cast Iron / problem pipe
- Compliance and Inspection data

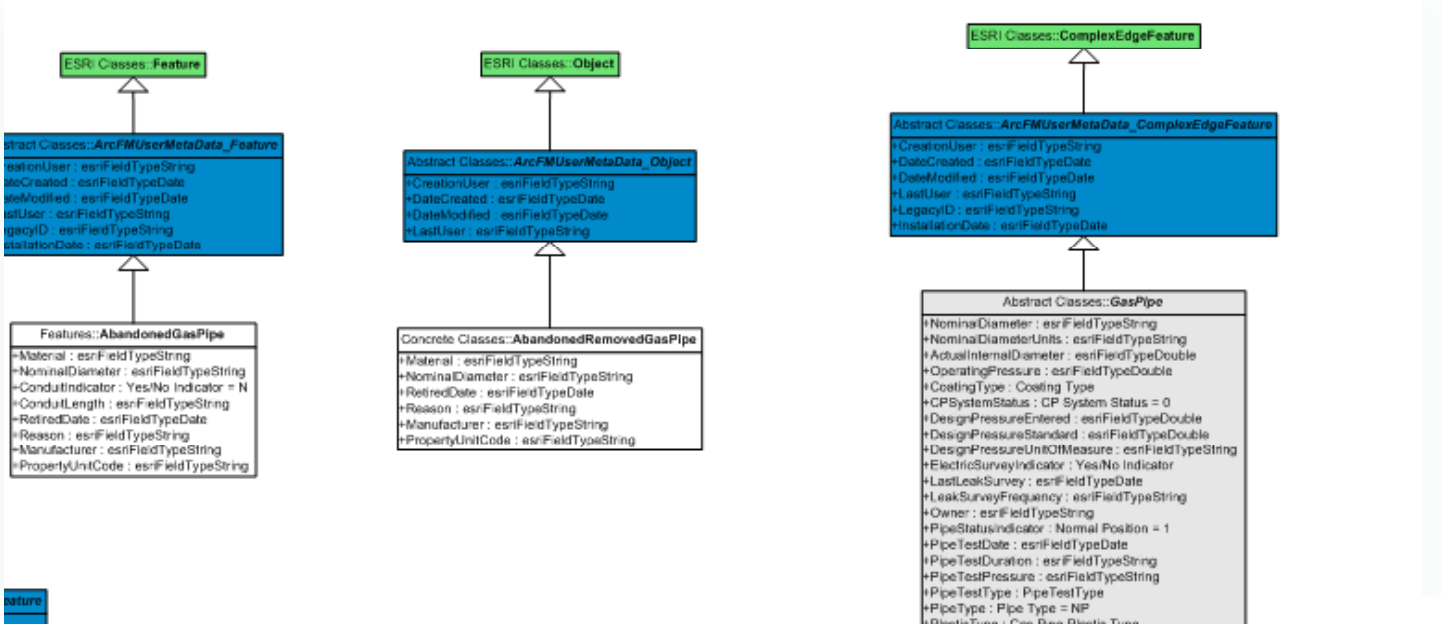
- Is this data available in GIS?
- Is it geo-located?
- Can it be accessed from GIS?
- Is it all in separate systems and databases?

Role of GIS

- GIS provides spatial and tabular means to collect, merge, store, display, analyze, report, and validate data
  - Facility geometry + attributes + relationships
  - Landbase geometry + attributes + relationships
- May need to gather, convert, or migrate data to meet full requirements
- If you don’t have a GIS, you’ll be at a disadvantage

Data Model Requirements

- DIMP does not imply a fixed data model
- Standard Data Models mostly sufficient
  - Example: ArcGIS Gas Distribution Data Model
    - Provides **template** for building your model
      - Great deal of variation in GIS implementations
    - Assumes non-stationed data in a geometric network



Data Model Attributes

- Do you have a Transmission / HP model with HP Distribution Pipe?
  - APDM
  - PODS
- Must be considered for DIMP

Data Model Attributes

- Recommended attributes in facility data
  - Distribution Main and Service Pipe

Subtype(s)	Attributes
All Pipe	Diameter, Depth of Cover, Above Ground Indicator, Installation Date, Connection Type, Pipe Grade, SMYS, Design Pressure, SOP, SOP Range
Steel Pipe	Material, Coating, Cathodic Protection, Wall Thickness
Plastic Pipe	Material, SDR, Pipe Manufacturer, Product Name, Resin Manufacturer, Resin Name, Pipe Color, (Print Line data)

Data Model Attributes

- Recommended attributes in facility data

Feature Class	Attributes
Exposed Pipe Inspection	Coating Condition, Corrosion Indicators (Pitting Depth), Date (Questar Gas uses FAR Report)
Pipe Test Data	Pressure Test Date, Pressure Test PSIG (link to pipe directly or through work order)
Pipeline Markers	Location
Leak Reports or Leak Repairs	Leak Class, Leak Cause, Date

Element 2
Identify Threats

- GIS: aggregates multiple data sources
  - Facility data covers system components and operations
  - Other data sources are input to analysis (e.g., threats and consequences)
- Risk analysis involves simultaneously considering many factors
  - Use GIS to consolidate and quantify them
- Regulation provides example threats

Role of GIS

- Identifying **Threats**: Sample GIS Data Sources

Threat	Data Source
Corrosion	Facility Database: • Main and Fitting attributes • Leak attributes • CP readings Natural Resources Databases: • Soils Data
Outside Forces	Natural Resources Databases: • Soils Data • Seismic Zones / Geo-hazards • Flood plains, snow/ice slope
Excavation Damage	Census Bureau: • Areas of growth and trends Local Government: • Building permit applications • One Call ticket density

Role of GIS

Threat	Data Source
Other Outside Forces	Roads Database: • Streets, Road types Facility Database: • Above-ground pipe indicators
Material or Welds	Facilities Database: • Pipe Material, Plastic Resin/Manufacturer/Lot • Connection Type Used • Leak Frequency
Equipment Malfunctions	Facilities Database: • Leak Repair records • Maintenance records
Operations	Maintenance Records: • Failures due to not following procedures, safety practices, workmanship?

Role of GIS

- Determining **Consequences**: Sample GIS Data Sources

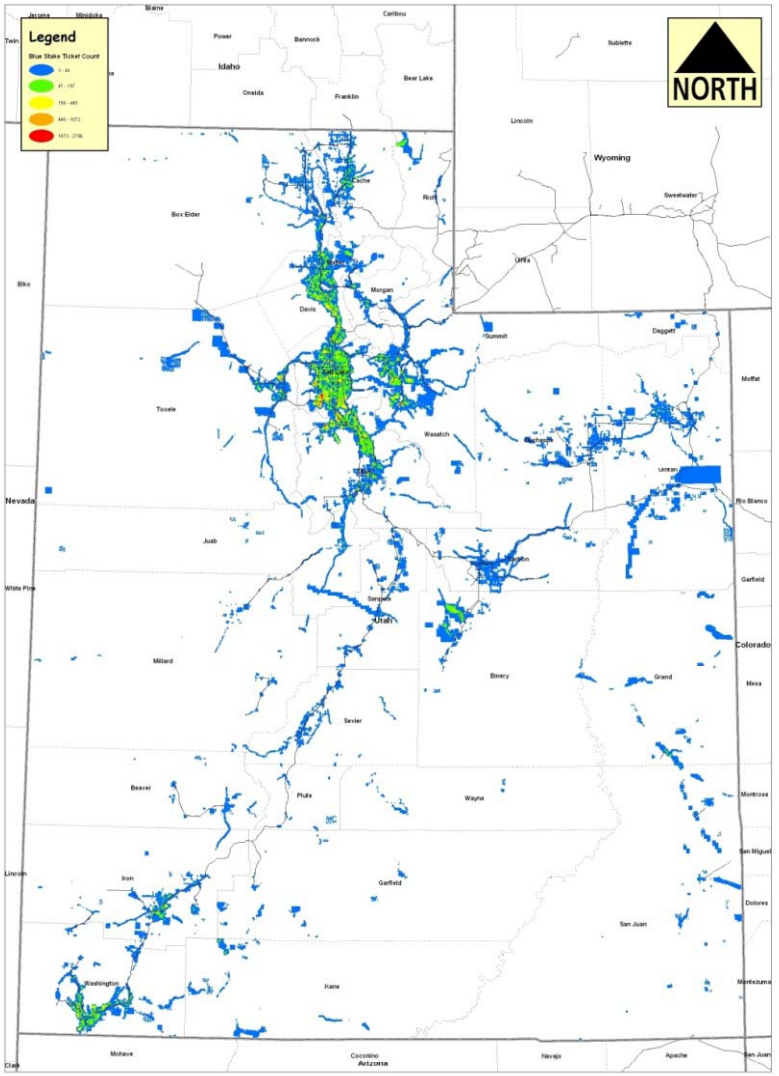
Consequence Factor	Data Source
Gas Pressure and Volume	Facility Database: • Distribution Main Operating Pressure • Distribution Main Diameter
Buildings, Business Districts	Local/State Government Databases: • Shapefiles • Engineering "planimetrics"
Surface Cover	2001 NLCD TerraServer, Google Earth Local/State Government Databases

Other Data Sources

- GIS offers ability to leverage government and 3rd-party data
- Examples:
  - USGS, FEMA, Census Bureau, USDA/NRCS, National Agriculture Image Program
  - County Assessor and Tax Offices
  - US DOT for County Roads
  - ESRI on-line services
  - National Pipeline Mapping System (NPMS)
  - Unusually Sensitive Areas (USAs – PHMSA)
  - One Call ticket densities

Role of GIS

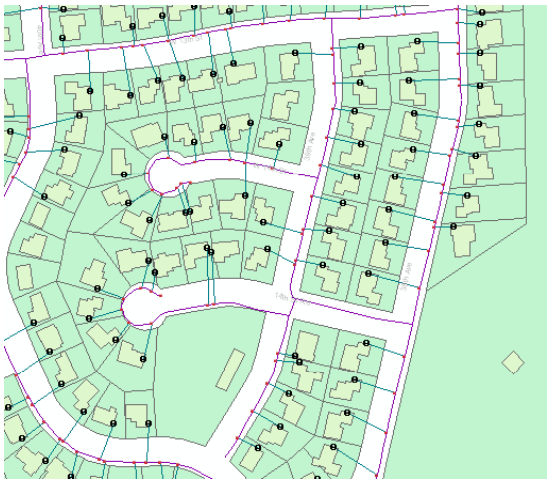
- One Call ticket densities
  - Questar Gas Example
- Excellent way to analyze construction activity around pipelines and facilities
- The biggest threat to pipelines



Utah Construction Activity Level Around Questar Pipelines

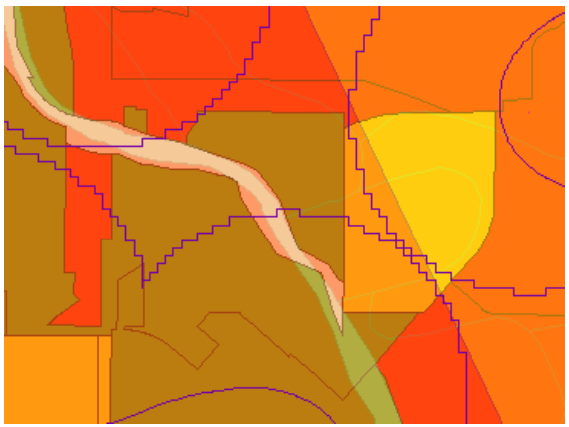
July 31, 2005 to July 19, 2006

Role of GIS



ArcGIS/ArcFM Data Model

- Pipe Geometry and Attributes
- Related Objects (Pressure System, CP System)
- Leak Reports/Repairs
- Exposed Pipe Inspection
- Pipeline Markers

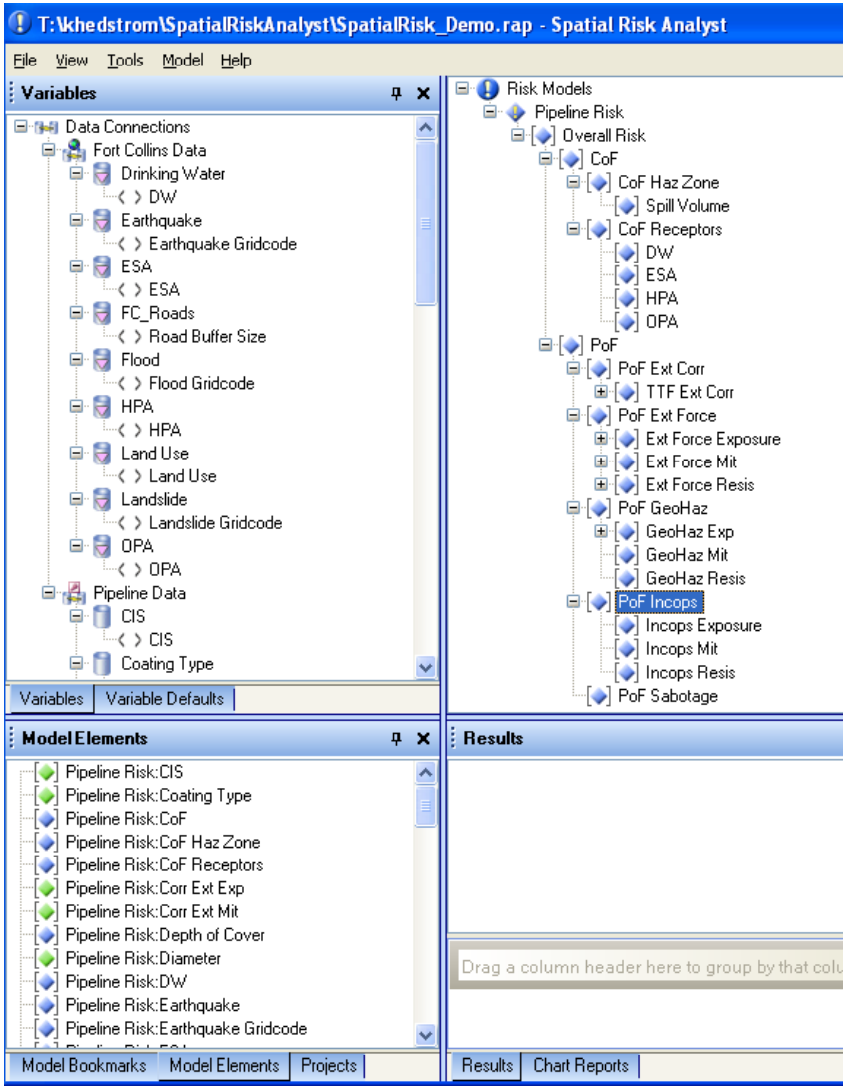


Other/Landbase and digital data

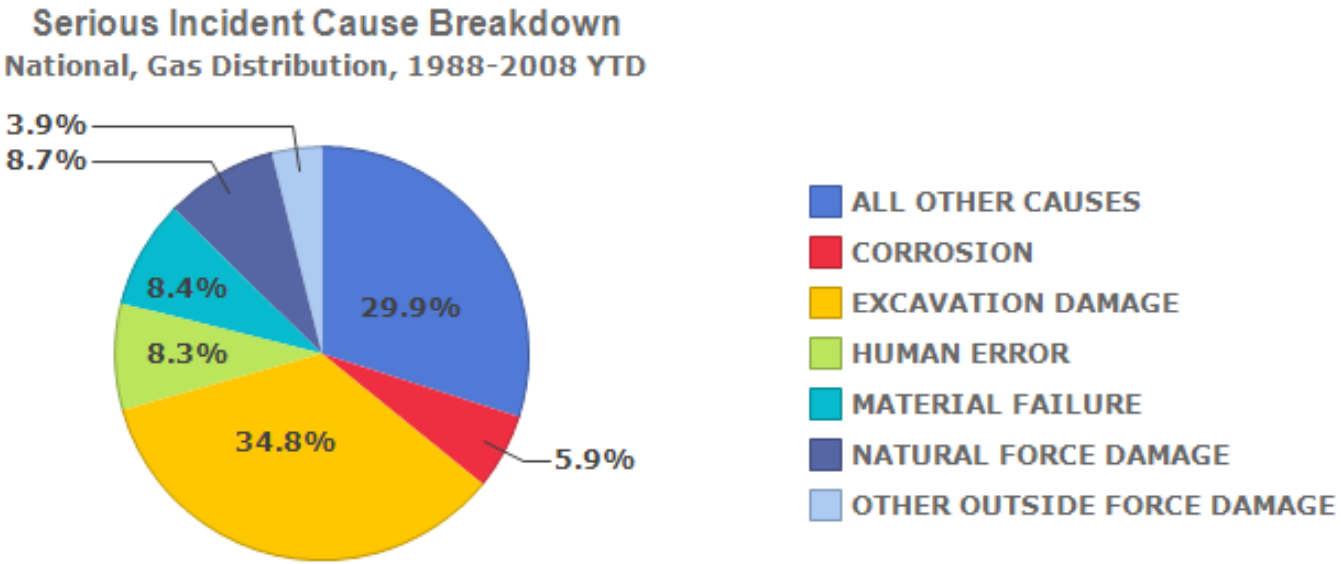
- Soil Types
- Roadways
- One-Call Tickets
- Building Footprints
- Other Threats
- SME Input

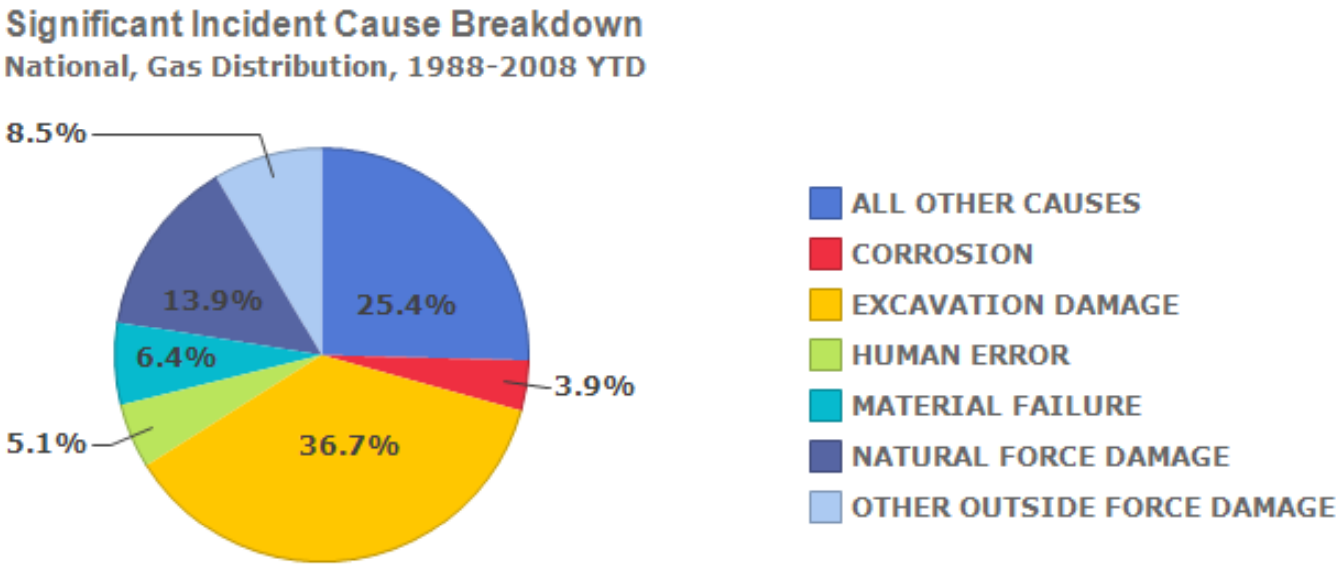
Element 3
Evaluate and Prioritize Risk

- Both existing and potential threats
- Distribution Systems vary widely
  - Different information available
  - Different threats
  - May assign different values during risk ranking
- Use or obtain all available data or develop means to capture data over time



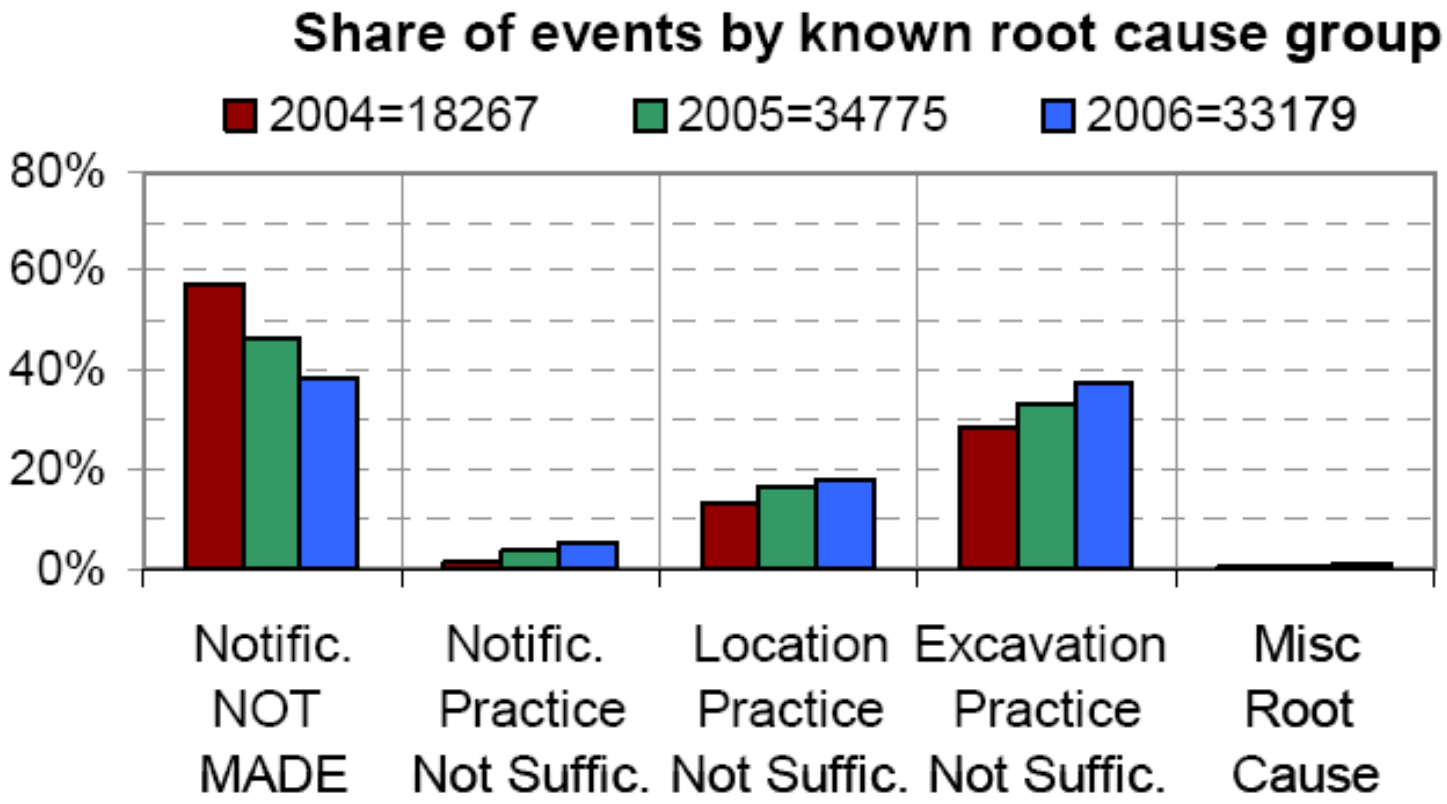
Distribution System Risks





Source: PHMSA Significant Incidents Files October 14, 2008

3rd-Party Damage Risk



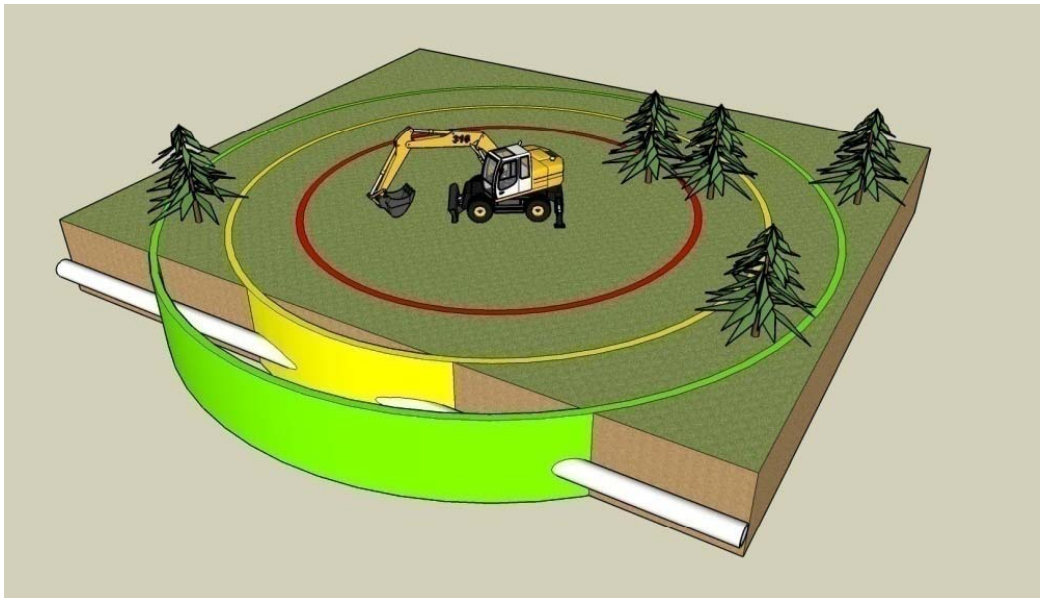
Source: Common Ground Alliance analysis of 2004 - 2006 data submitted to DIRT

Risk Assessment

- Overall Risk = Probability of Failure (PoF) X Consequences of Failure (CoF)
- Consider
  - Probability of Failure (frequency)
  - Consequences of Failure (extent of potential damage)
- Use SME or mathematical method
- Scores determine relative risk

Role of GIS

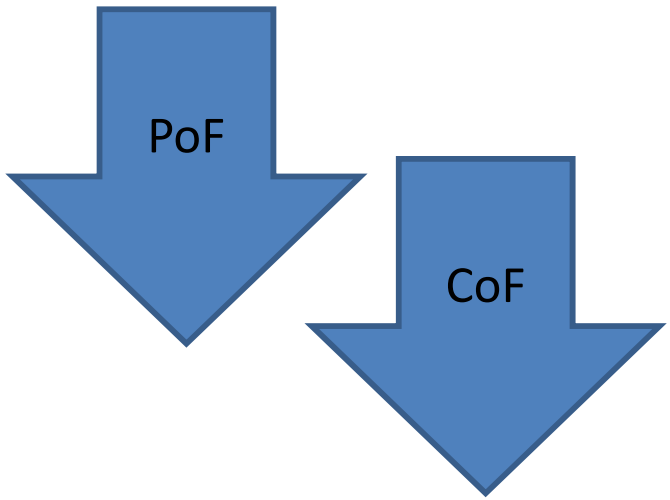
- Risk on pipe is a spatial question
  - Must consider many factors simultaneously to arrive at risk value
  - Risk applications must perform numerous techniques to determine risk rating values
  - GIS plays key role



Element 4
Mitigation of Risks

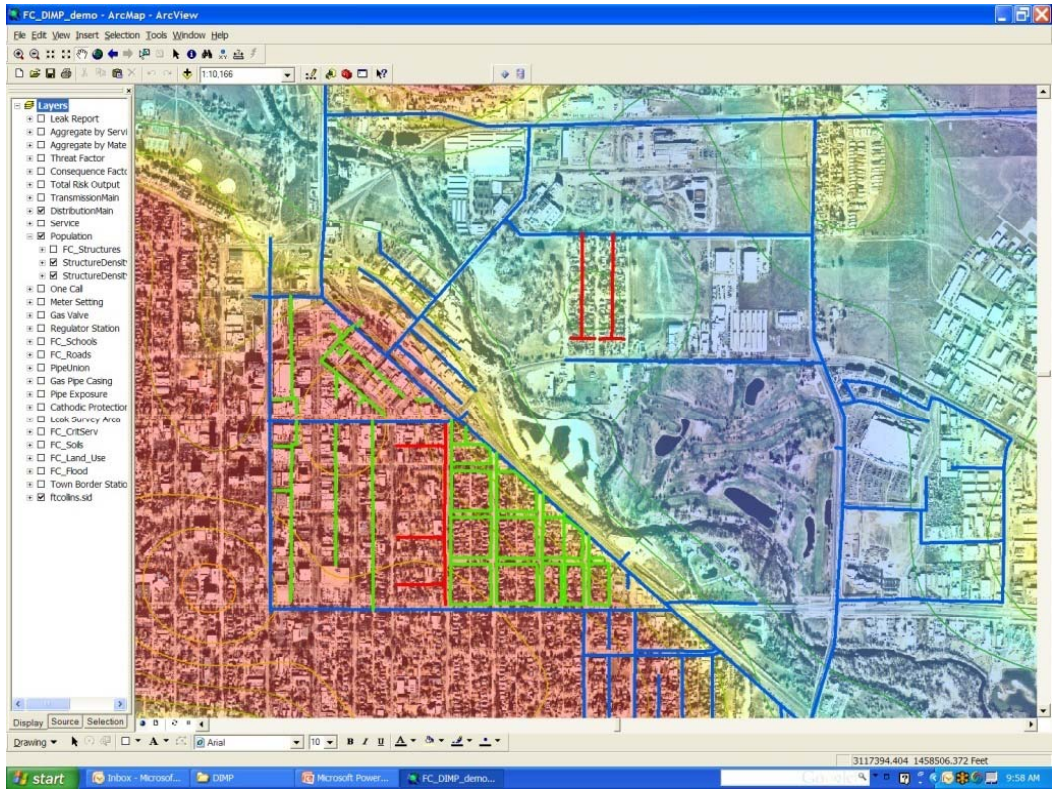
Once you've established risk for pipe segments…

- Sort by risk and attack highest first
- Manage Risk by
  - Reducing the probability of a problem occurring
  - Lessening the consequences of a potential problem.
- Pursue prevention, remediation, mitigation, and A/A Actions



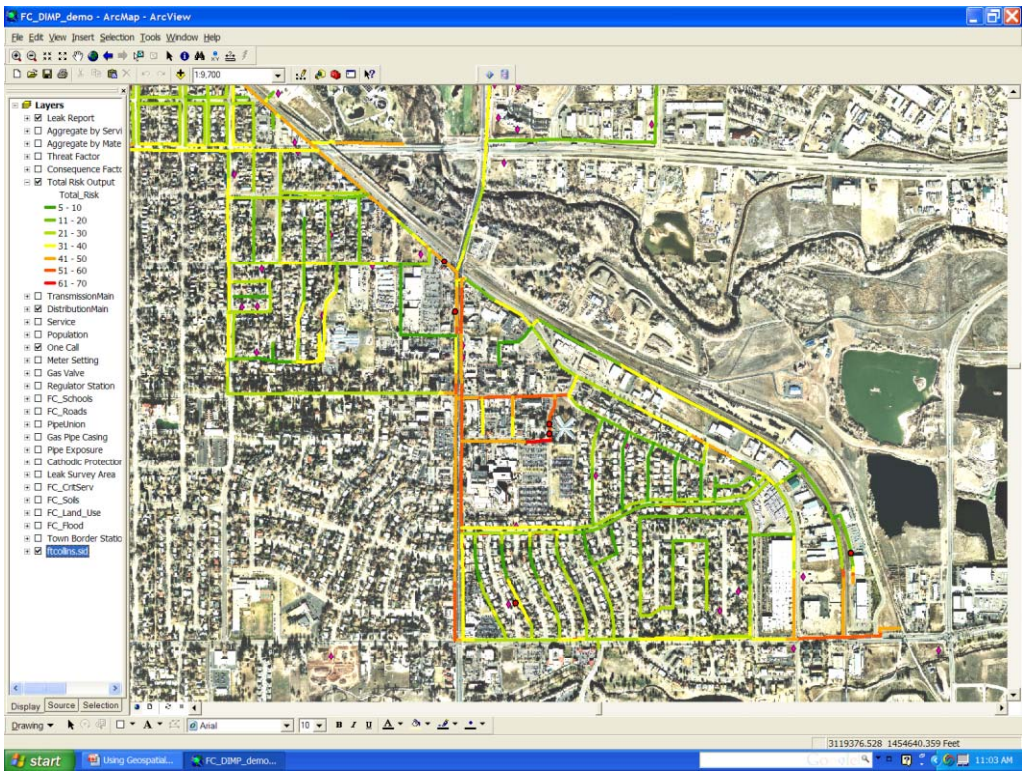
Role of GIS

- GIS can support grouping of pipe into projects
- Some considerations:
  - Do clusters of high-risk pipe exist?
  - Where do risk scores support upgrade of an entire low-pressure system to medium pressure?
  - Where are other utilities planning road excavations?
  - Where are exclusion zones or “moratorium” areas?
  - What technology is to be used?
    - Trench and replace?
    - Trenchless (slipline, poly woven hose)



Element 5
Monitor Results

- Measures should reflect your specific risk management practices
  - Examples:
    - Number of leaks, grouped by cause and by material
    - Number of excavation damages
    - Number of excavation tickets
    - Number of EFVs
  - Should track back to identified threats
  - Evaluate data being collected
    - Format (digital data, linked to facilities, location?)
    - Consistent measurement techniques (e.g., leak type)



Element 6
Periodic Review

- Written plan
- Review the effectiveness of the program
  - A complete re-evaluation required every five years
  - Which practices are producing results?
    - Tie technique or practice to specific risk
    - Is it producing results?
    - Can you tell yet?

Element 6
Continual Improvement

- Improve data
  - Better data → less uncertainty → lower risk
- Are performance measures still valid?
  - Have risks changed?
- Adjust Risk Model
  - Threats in one location relevant to other areas?
  - Evaluate predictive value of each parameter

Element 7
Report Results

- Measure
  - Performance factors
- Report
  - Report four of the required performance factors each March
  - Retain records for 10 years

How Distribution Operators Can Integrate Data to Make Informed Decisions

What geospatial solutions provide:

- Compliance with DIMP
- Improved knowledge of system
- Integrated data
- Relative risk assessment for risk-based decision-making
- Reduced costs associated with incidents
- Risk based adjustment of frequency for prescription inspections

What else could data be used for:

- Operational efficiency
- Resource allocation
- Outage management
- Knowledge portal
- Accurate asset inventory
- Market analysis
- Supply modeling and planning
- Improved system planning
- Integration with utility and paving work
- Mergers & acquisitions
- Geographic expansions
- Integrate replacement with growth plans
- Organic growth projects
- Shorter project schedule
- Reliability and dependability
- Customer retention
- Probabilistic risk analysis

Five Things To Do Now

1. Assess the state of your GIS data
   - Facility data complete, consistent, accurate, and well attributed?
   - Leak data in GIS, repairs tied to facility?
   - Exposed pipe inspections in GIS, tied to pipe?
   - Pressure Tests linked to pipe directly or through work order?
   - CP test points in GIS? Reads linkable to pipe?
   - Data well aligned with landbase? Conflate?
   - External data sources being used? Research what is available (from local gov't, other agencies)

Five Things To Do Now

2. Develop workflows to capture and maintain data
   - Examples: Include leak reports and exposed pipe in GIS
   - Determine if CP test read data is linked or linkable to facility database
3. Leverage existing processes to address formal, structured requirements of DIMP
   - You're doing many things already—need to formalize
   - Develop written plan to document that

Five Things To Do Now

4. Identify effectiveness measures
   - Start collecting data if not doing so
   - Migrate data to digital format to support reporting
5. Prepare your organization to embrace the process
   - Change management may be hardest part
   - Train and educate participants
   - Focus on benefits to organization

For More Information

- Guidance on Carrying Out Requirements in the Gas Distribution Integrity Management Rule [Docket No. PHMSA-RSPA-2004-19854], June 20, 2008
- GPTC Guide for Gas Transmission and Distribution Piping Systems [BSR GPTC Z380.1-2009 TR05-01-200x], Draft, July 17, 2008
- DIMP Frequently Asked Questions, 7/28/08
- PHMSA Joint work/study group Report of Phase 1 Investigations, Published 12/2005
- Pipeline Risk Management Manual, W. Kent Muhlbauer, Third Edition, 2004
- PHMSA DIMP Web Site:

  http://primis.phmsa.dot.gov/dimp/index.htm

Thank you for your participation.

Questions?