Modeling High Pressure Distribution For Integrity Management

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What’s This About

- Key Concepts in the New Rules
- Why Distribution?
- Transmission vs. Distribution Data Models
- Practical Implementation at CenterPoint Energy
- Summary
Why New Rules?

• Carlsbad, New Mexico, August 19, 2000
• 12 people killed
• 1 Million Dollars direct damage
• 18 Million Dollar per day economy hit
• Since 1986
  – 300 Deaths, 1400 Injuries
  – $300,000,000 in Property Damage
  – 2400 Natural Gas Incidents
NTSB Findings

• The Major Safety Issues:
  – The Design and Construction of the Pipeline
  – The Adequacy of the Operator’s Internal Corrosion Control Program
  – The Adequacy of Federal Safety Regulations for Natural Gas Pipelines
  – The Adequacy of Federal Oversight of the Pipeline Operator
Pipeline Safety Improvement Act of 2002

• DOT is charged with Enacting the Regulations:
  – Research and Special Programs Administration (RSPA)
  – Office of Pipeline Safety
  – Title 49 of CFR
  – Part 192 – Transportation of Natural and Other Gas By Pipeline: Minimum Safety Standards
Key Concepts

- May apply to some Distribution Mains
- Integrity Management Program
- Identify and Characterize Threats
- Conduct a Baseline Assessment
- Mitigation
- Continuously Monitor
New Term - HCA

• Applies to the Engineering/Regulatory Definition of Transmission
• Depends on DOT Class Definition
• The Nature of the Line Itself
• Depends on the Structures Surrounding the Line
• Requires a Complex Spatial Analysis
Applicability of the New Rule

• Apples to Transmission

• Key Factors
  – Specified Minimum Yield Strength (SMYS)
  – Hoop Stress

• If High Pressure Distribution
  – Hoop stress greater than 20% SMYS
    Treated as transmission
  – $S_h = PD/2t$
What is Transmission?

- Transports gas from a gathering station
- Operates at Hoop Stress of 20% or more of SMYS
- Transports gas within a storage field
May Apply to High Pressure Distribution Mains
So What?

• Different Operating Characteristics
  – Pressure (usually less than 500psi)
  – Configuration
  – Concerns
  – Business Processes

• Tough to Meet Inspection
  – In-line Inspection
  – Hydrostatic Testing
  – Direct Assessment
Data Models

- Old data models just tables
- Evolved into Data Base Schema’s
- Data Model is a metaphor for the real system
Intelligent GIS Supports

Industry Data Models —
Electric, Gas, Water, Telco, . . .

Generic Data Sets

Data Models

User Features

Topology
Vectors
Networks

Schema
Rules
Relationships
Definitions
Behavior

Defining Real World Features
Transmission and Distribution Pipeline Data Models

- Options:
  - Single Data Model (Transmission and Distribution)
  - High Pressure Distribution Data Model (3rd Model)
  - Separate Transmission and Distribution Data Model
Facilitating Pipeline Integrity Regulations at CenterPoint Energy
Who is CenterPoint Energy?

- One of the largest energy delivery companies in U.S.
- Electric transmission and distribution
- Natural gas distribution sales
- Interstate pipelines and gathering operations
- 14K MW electric generating capacity

- Wholesale and retail energy services
- Unregulated power generation
- Retail electricity service
CenterPoint Energy

LDCs
Arkla/Entex
Minnegasco
Houston Gas
Houston Electric

Pipeline

- Interstate Pipelines:
  - CNP Gas Transmission
  - CNP Miss. River Transmission Corp
- Field Services
  - Gas gathering company
- Pipeline Services
  - Comprehensive operation & maintenance and project management services
GIS at CenterPoint Energy

LDC’s
- LA
- OK
- MS
- AR
- Stx
- Etx
- MGC
- Houston Gas & Electric

- Centrally located
- Centralized Administration & Support

Pipeline

ArcGIS
Challenge to GIS for LDC’s

Facilitate a repository, within the enterprise GIS, for data to support pipeline integrity regulations

– Within the required timeframe

– Building the best solution for the long term
Q: Can’t you just add this new data to the existing GIS database?
A: No, it’s not that easy

**Existing Data Model**
- For gas distribution
- Comprised of points, lines, polygons – things with static characteristics
- Two dimensional x,y coordinate system

**New Data Model Needed**
- To handle linear data with characteristics that are dynamic in nature
- Commonly referred to as linear referencing or dynamic segmentation
- To allow multiple sets of attributes to be associated with ‘any’ portion of a linear feature
Q: OK, so how do we do that?
A: Develop a new data model to store the event-related data.

Pipeline data models and standards are evolving.
The Contenders

PODS
Currently used by Pipeline Group

APDM
ESRI data model designed for geodatabases
Comparison –
Either Model ‘could’ work

- Both data models can be used to store pipeline data for use in a GIS.
- Both have origins with the ISAT data model.
- Both have many pipeline components and attributes. Neither has every possible pipeline feature or component.
- Some of the PODS member companies also participate on the APDM committees.
- Both can be implemented with ESRI GIS technology.
- ESRI is supportive of both.
- User applications will be needed to use both data models.
Comparison –

*Either Model ‘could’ work*

So what differentiates these two?

**PODS**

- Relational data model
- Platform neutral
- More work to integrate with ESRI GIS
- Could affect distribution GIS system performance since the database has to be linked to ESRI rather than the data being stored within an ESRI standard data format
- Model must be implemented in its entirety to be PODS compliant

**APDM**

- Built on the ESRI geodatabase
- Vertical integration with SDE and the geodatabase with full-featured geoprocessing —— better able to take advantage of ESRI geodatabase technology
- Only required to implement “core” tables —— more flexibility
PODS and APDM are two completely different types of database models, designed for two different purposes.

**PODS**
- Pipeline industry standard model, driven by membership of the PODS Association
- Owned by the PODS Association
- Annual membership fees for participation in association

**APDM**
- ESRI ‘template’ or example geodatabase designed to implement pipeline system in a geodatabase
- Owned by ESRI
- No fees to participate on committees
Best leverage our enterprise GIS in both the short and long term

- Integrated enterprise solution
- More efficient processing of data via geodatabase
- Easier to support in-house with existing ESRI tools (data and database maintenance)
- Major new releases of ArcGIS will consider data model requirements
- Better spatial analysis, mapping and reporting
- Likelihood that most ESRI business partners will include new product development for APDM
Integrated “LDC” Solution

Integrated “Enterprise” Solution

One common data model

Known, stable migration path to move data from PODS into APDM

APDM

Common Tools, Applications, Reporting

GIS Houston Gas
GIS MGC
GIS Arkla/Entex

GIS Houston Gas
GIS MGC
GIS Arkla/Entex
Data Modelling
Timeline & Milestones

- Data Model Review and Development Workshop (including gap analysis)
- Draft Pilot Logical Model Development
- Draft Pilot Physical Model Development
- Pilot Data Development
- Data Migration Requirements/Plan
- Pilot Data Model Review Workshop
- Finalize Logical Model
- Finalize Physical Model

Jul 04 to Dec 04

Currently
What do we need beyond just the data model? What will it take? How much will it cost?

Full needs assessment
Being conducted concurrently with data model effort

Migration of HPT data from distribution model to new APDM dataset
Will be handled by internal resources

Generation of control points and acquisition of additional data
Will probably be handled by internal resources

Purchase or development of various tools/applications
Questions

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