PD1740: Using Autodesk® AutoCAD® Plant 3D for Compliance Assurance

George Crowe
Colonial Pipeline Company,
CAD / Project Manager

Eric Klein
Global Information Systems, LLC,
Director of Atlanta Operations

Class summary

The ability to track and store asset data is paramount in calculating and verifying the maximum operating pressures (MOP) of a pipeline/facility infrastructure.

This class defines how AutoCAD Plant 3D software can be used to build a facility model to house specific asset data and then use that data to calculate MOP information for a given segment of the facility piping or for the facility as a whole.

This data set may then be used for regulatory audits: compliance assurance; and infrastructure management.

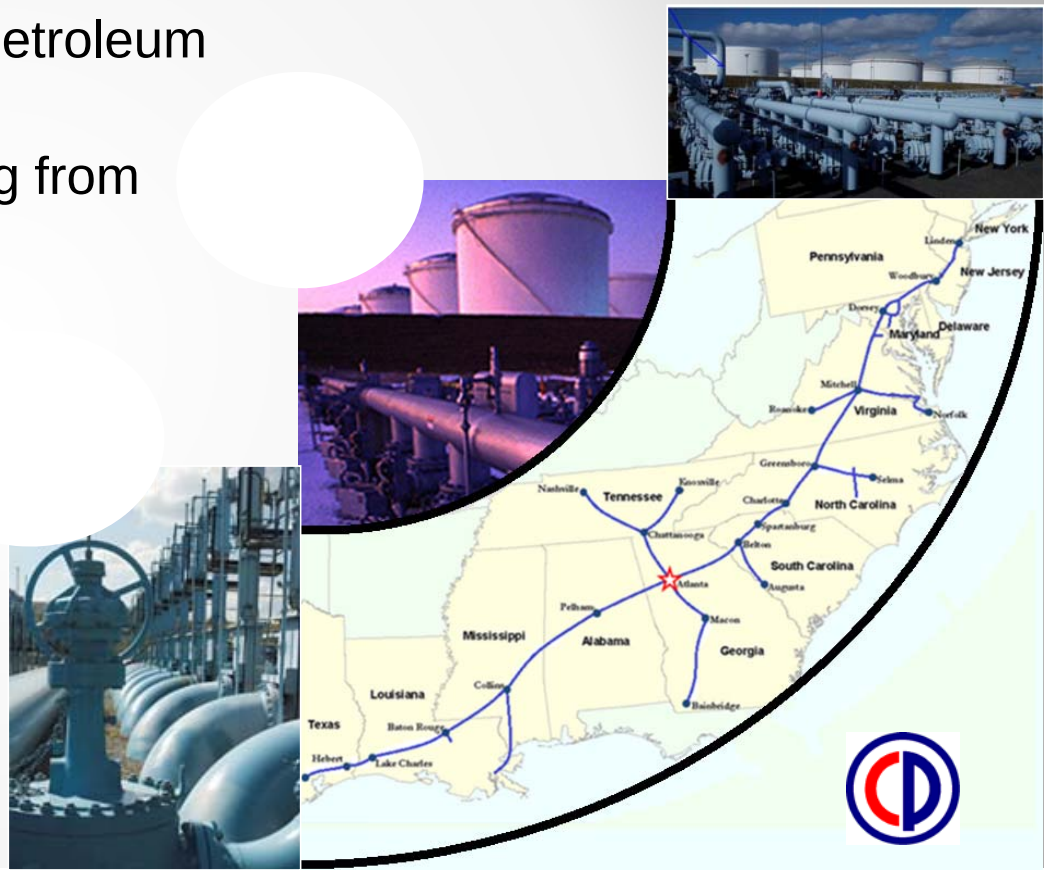
Key learning objectives

At the end of this class, you will be able to:

- Understand the importance of maintaining an infrastructure model in Plant 3D
- Use the CAD environment for regulatory compliance
- Go beyond the primary structure of Plant 3D to meet a greater need
- Explain why a visual component (3D model) speaks volumes more than other documents can

Colonial Pipeline Company – Business Overview & Safety Share

- Interstate common carrier of refined petroleum products
- Over 5,500 miles of pipeline stretching from Houston to New York harbor
- Headquartered in Alpharetta, GA
- ~700 employees
- Transports approximately 100 million gallons per day:
  - Gasoline
  - Home heating oil
  - Diesel fuel
  - Commercial jet fuel
  - Military fuels



Presentation Outline

- Introduction
- Project Drivers
- Technology Selection
- Process Overview
- Additional Value – Next Steps
- Wrap Up – Q&A

Project Drivers

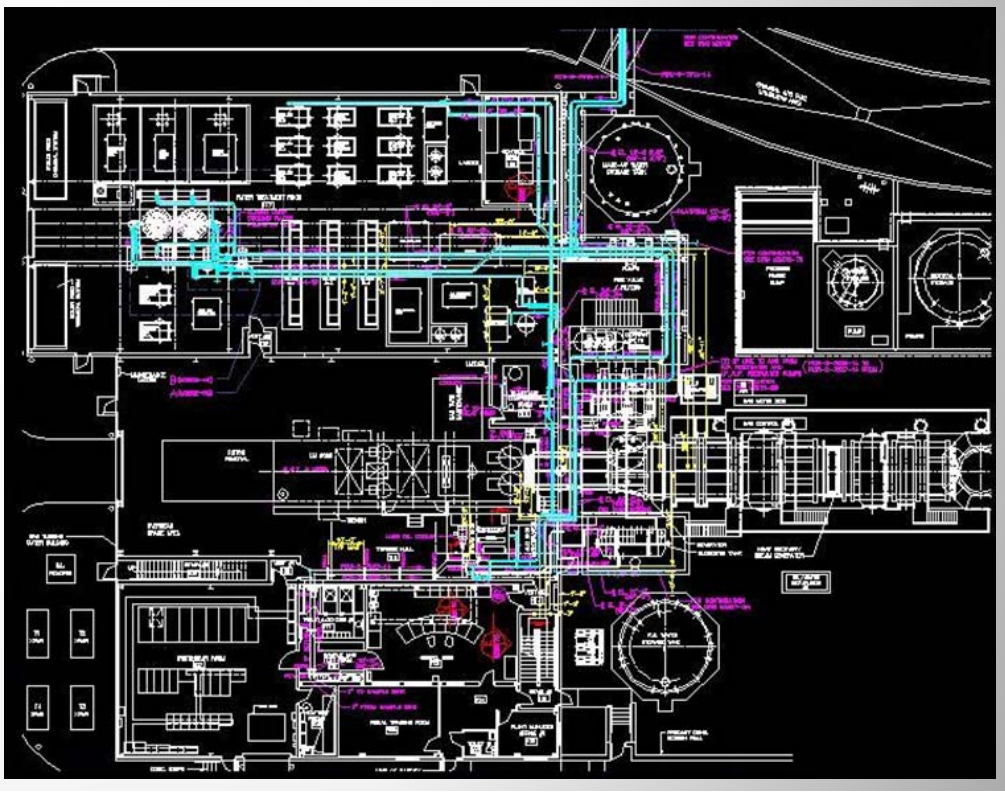
Project Drivers - Regulation

- Department of Transportation – (PHMSA) Pipeline and Hazard Material Safety Administration
- Maximum Allowable Operating Pressure (MAOP) and Maximum Operating Pressure (MOP)
  - Advisory Bulletin ADB-2012-06 – MAOP
  - News Bulletin Dated – May 7, 2012 – MOP held to MAOP Standards

"Traceable, verifiable and accurate recordkeeping in the pipeline world is crucial," said PHMSA Administrator Cynthia Quarterman. "It enables us to respond more quickly in the event of an emergency, as well as gives us a more accurate snapshot of the overall infrastructure."

Project Drivers – Beyond Line Pipe

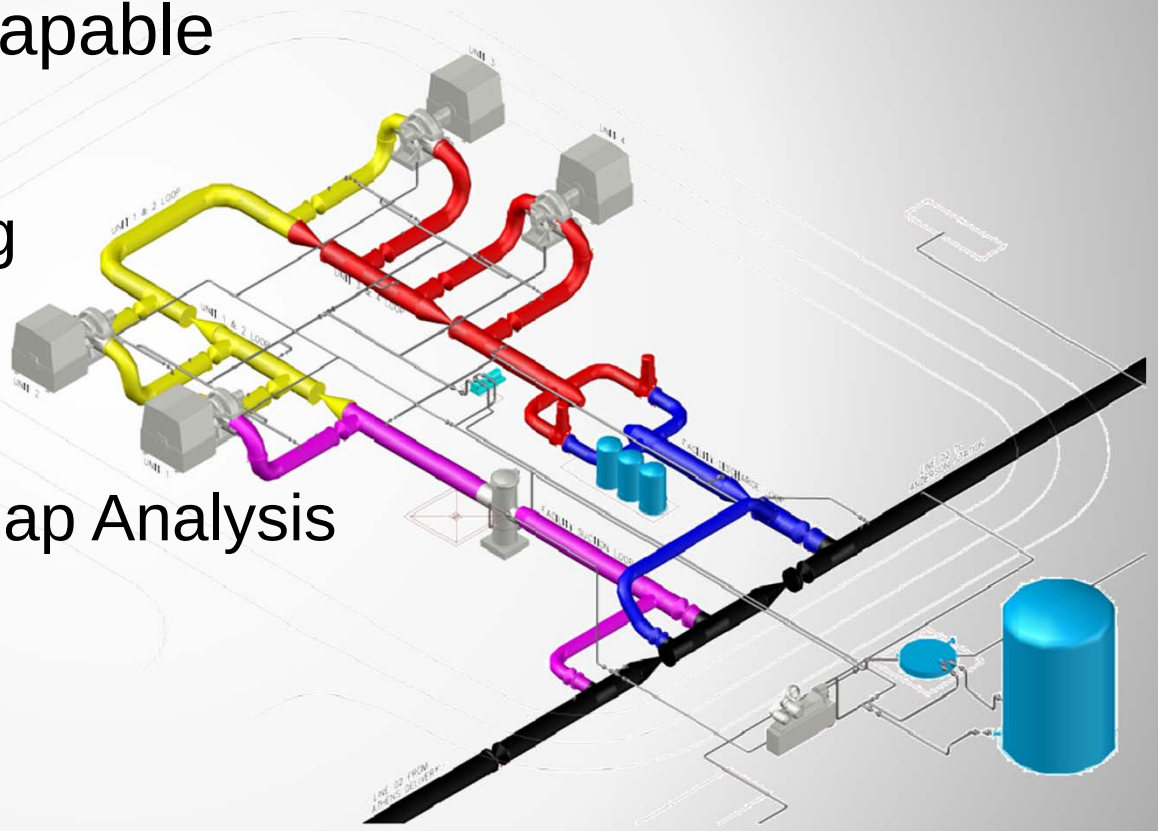
- PHMSA Expected to Extend Regulation to Facilities
- Facility Complexity



Technology Selection

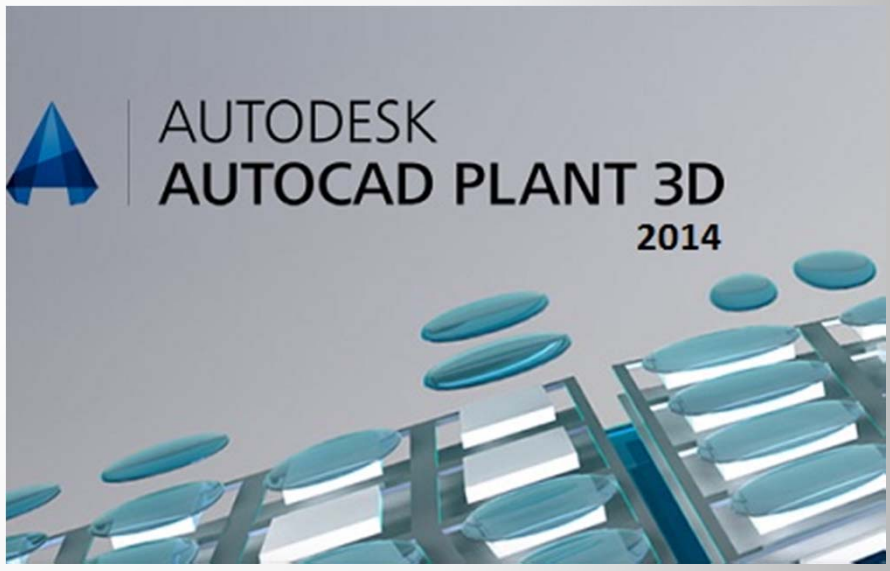
Technology Selection – 3D CAD

- GIS Not Appropriate/Capable
- 2D CAD Inadequate
  - Component Accounting
  - Visualization
  - Verification
  - Data Management – Gap Analysis



Technology Selection – Why AutoCAD Plant 3D

- Relatively Low Cost to Implement
  - Efficient Workflow
  - Familiarity of AutoCAD
- Ease of Maintenance
- Intelligent Data Management
  - Component Data Integration
  - Database Driven



Process Overview

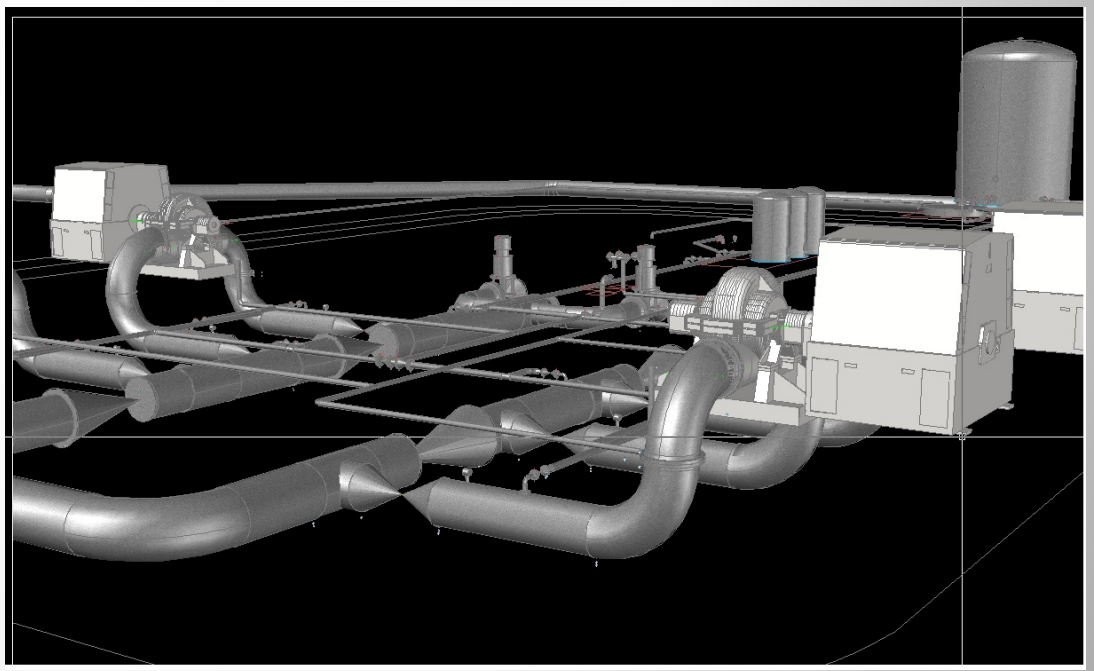
Process – Data Storage and Management

- Underlying Database Development

Microsoft®
SQL Server® 2008

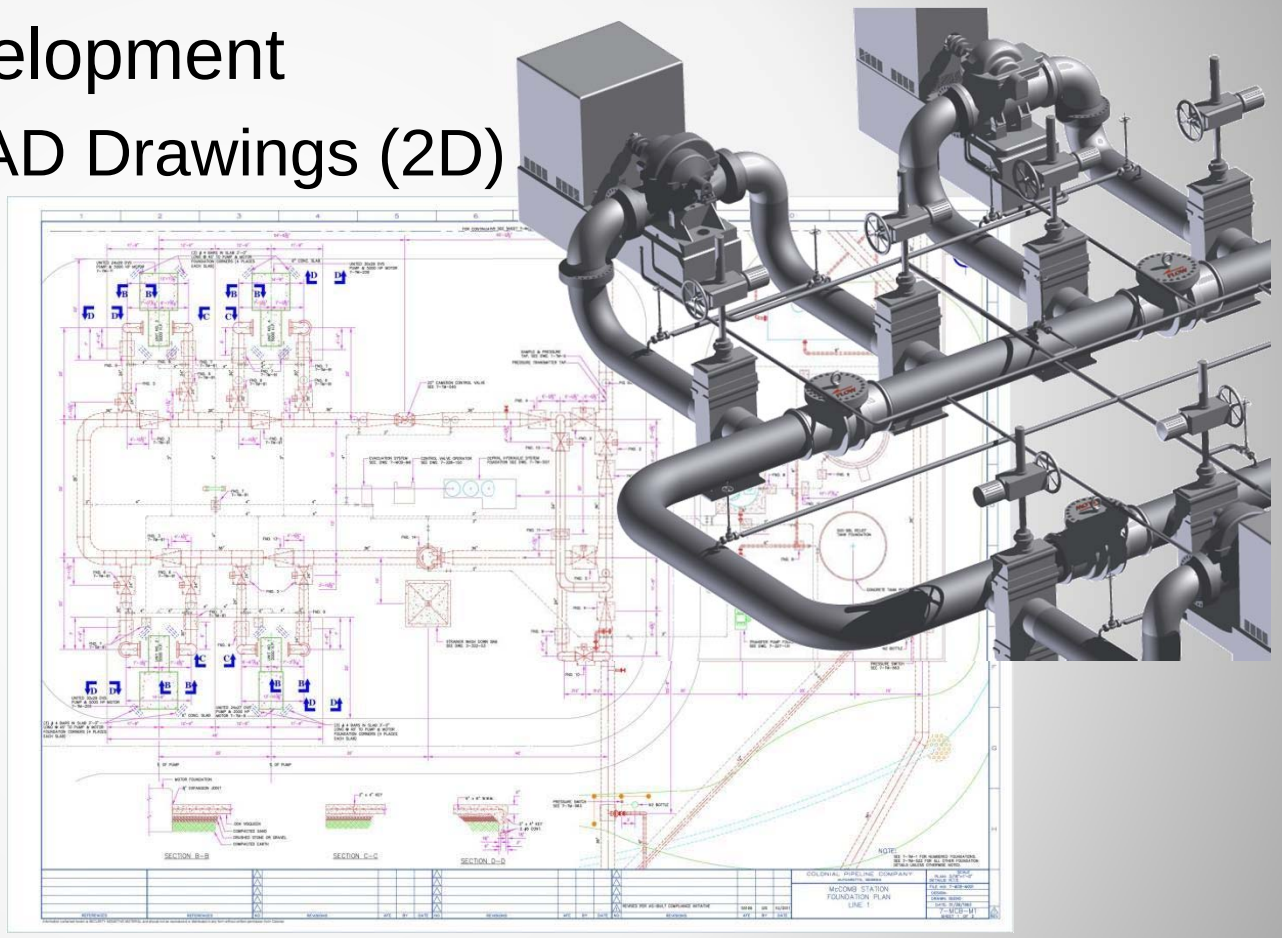
Process – Data Storage and Management

- Facility Model Development
  - Facility As-Built CAD Drawings (2D)
  - Bill of Materials



Process – Data Storage and Management

- Facility Model Development
  - Facility As-Built CAD Drawings (2D)
  - Bill of Materials

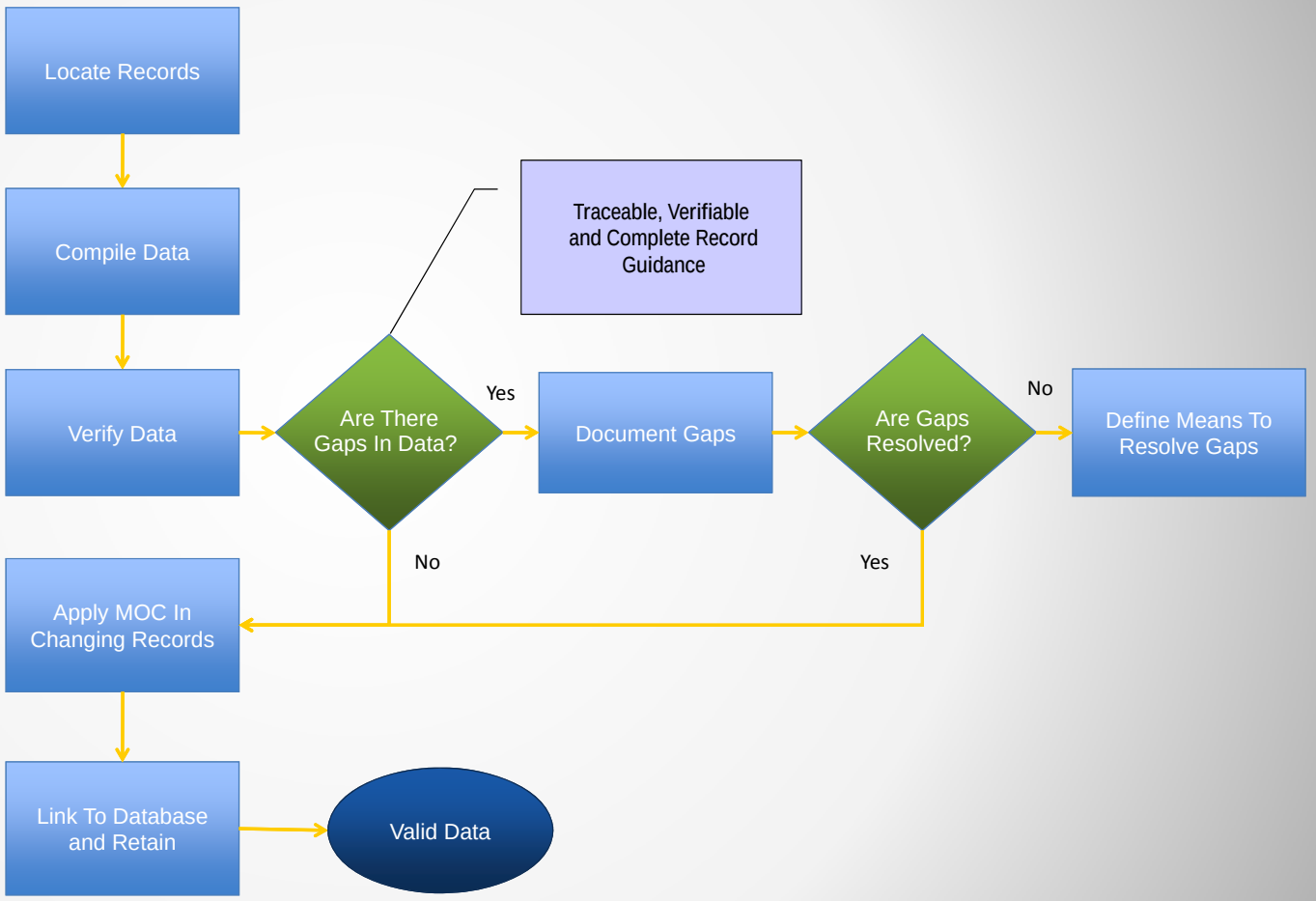


Process – Records Approach

- **TVC** Defined in ADB-2012-06
- **T**raceable: Can be clearly linked to original information
- **V**erifiable: Confirmed by complimentary, but separate documentation
- **C**omplete: Finalized by signature, date or other appropriate marking

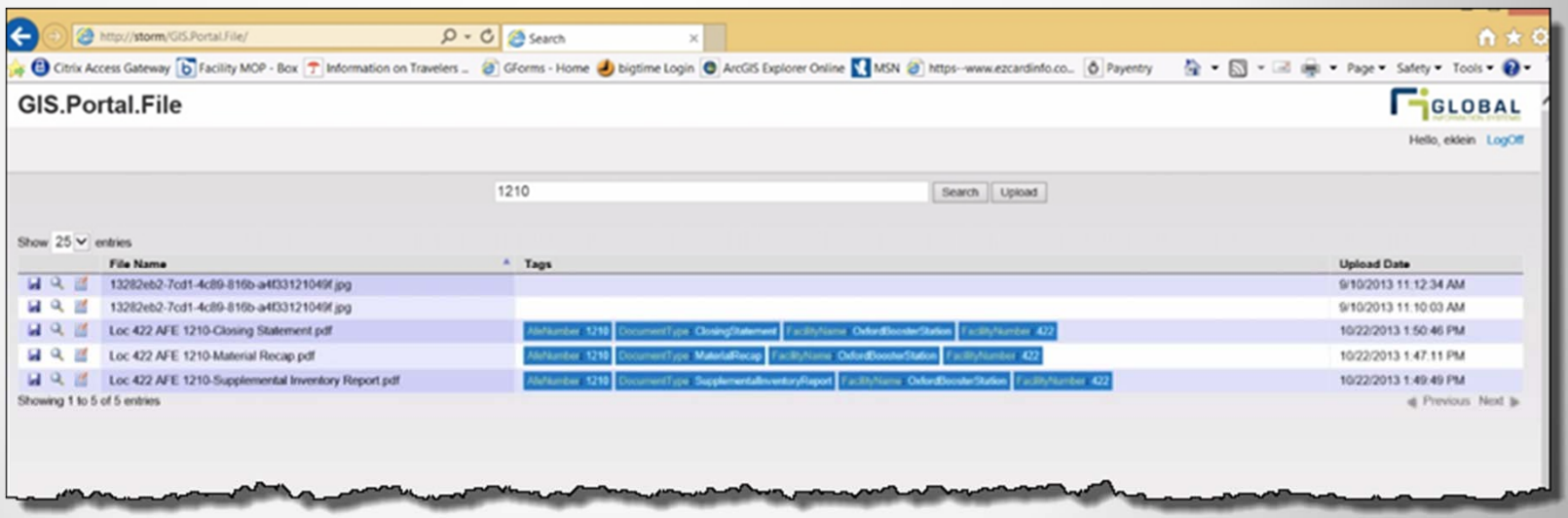
Process – Records

- Discovery
- Data Mining
  - Scanning
  - Scraping
- Document Management



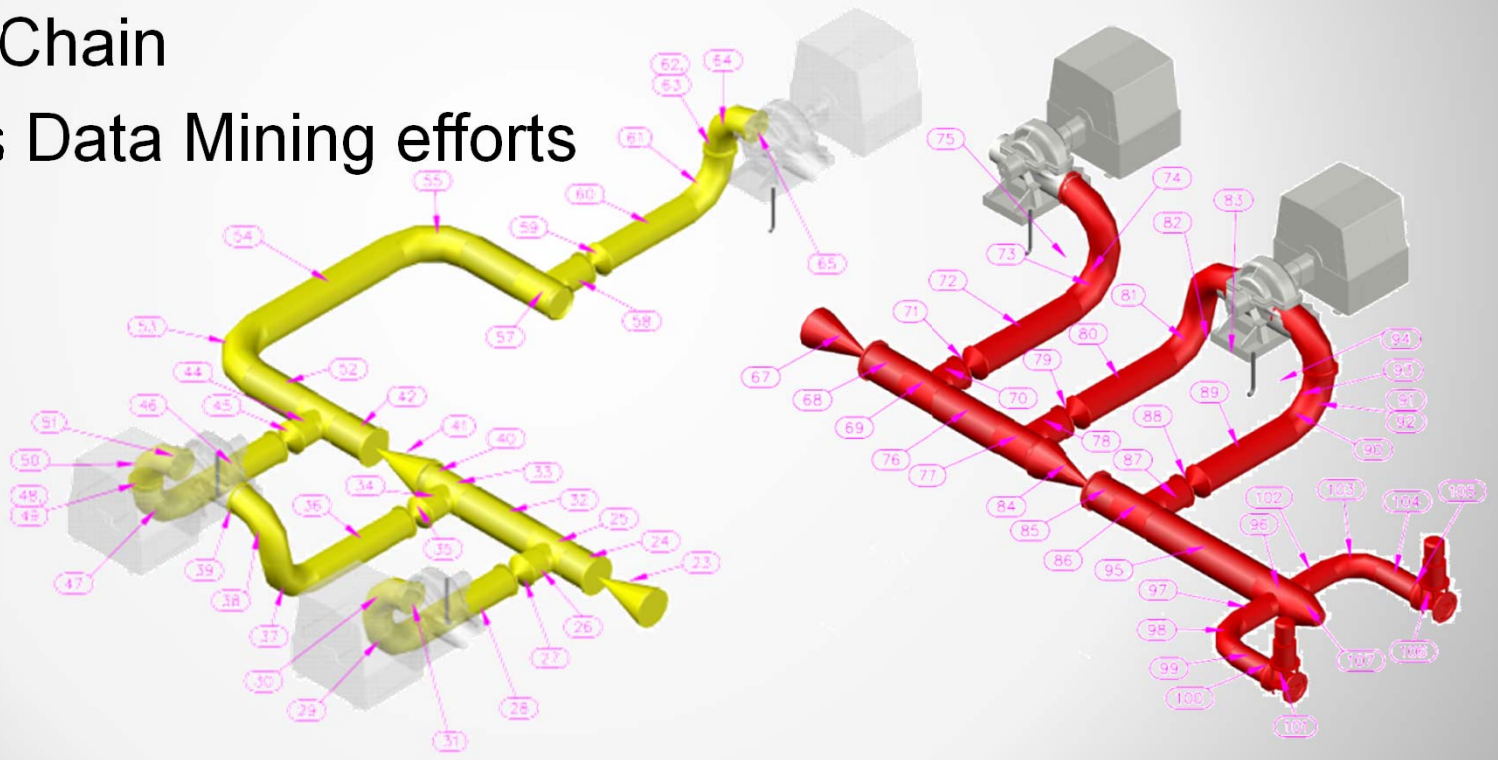
Process – Data Storage and Management

- Connecting Components to Records
  - Database Index
  - DMS Query



Process – Data Storage and Management

- Gap Analysis
  - Record Chain
  - Refocus Data Mining efforts



Process – Calculate MOP

§ 195.106 Internal design pressure.

(a) Internal design pressure for the pipe in a pipeline is determined in accordance with the following formula:

$P=(2St/D)\times E\times F$

P=Internal design pressure in p.s.i. (kPa) gage.

S=Yield strength in pounds per square inch (kPa) determined in accordance with paragraph (b) of this section.

t=Nominal wall thickness of the pipe in inches (millimeters). If this is unknown, it is determined in accordance with paragraph (c) of this section.

D=Nominal outside diameter of the pipe in inches (millimeters).

E=Seam joint factor determined in accordance with paragraph (e) of this section.

F=A design factor of 0.72, except that a design factor of 0.60 is used for pipe, including risers, on a platform located offshore or on a platform in inland navigable waters, and 0.54 is used for pipe that has been subjected to cold expansion to meet the specified minimum yield strength and is subsequently heated, other than by welding or stress relieving as a part of welding, to a temperature higher than 900 °F (482 °C) for any period of time or over 600 °F (316 °C) for more than 1 hour.

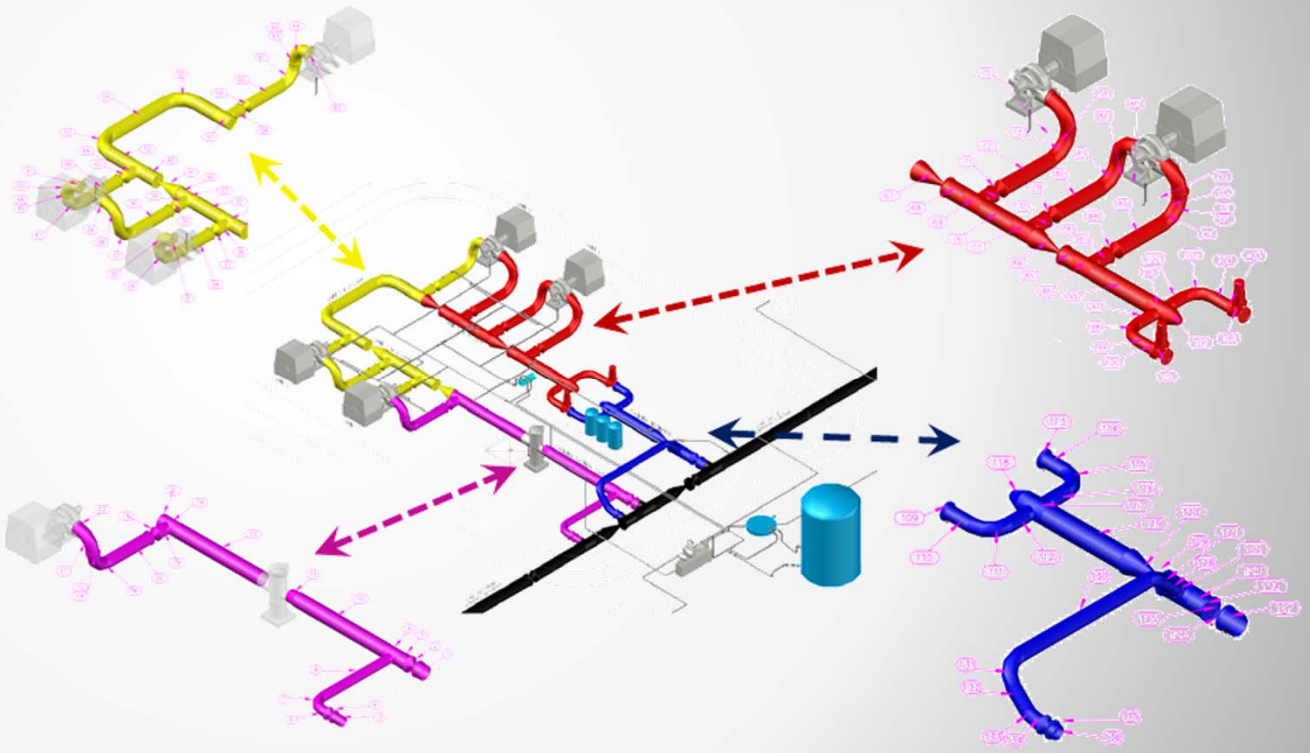
- Calculated in Accordance with PHMSA CFR 49 Part 195.406 (MOP) and CFR 49 Part 195.106 (IDP)

$$P=(2St/D)xExF$$

- Based on TVC Component Characteristics
- Hydrostatic Test Pressure in Accordance with CFR 49 Part 195.406

Process – Calculate MOP

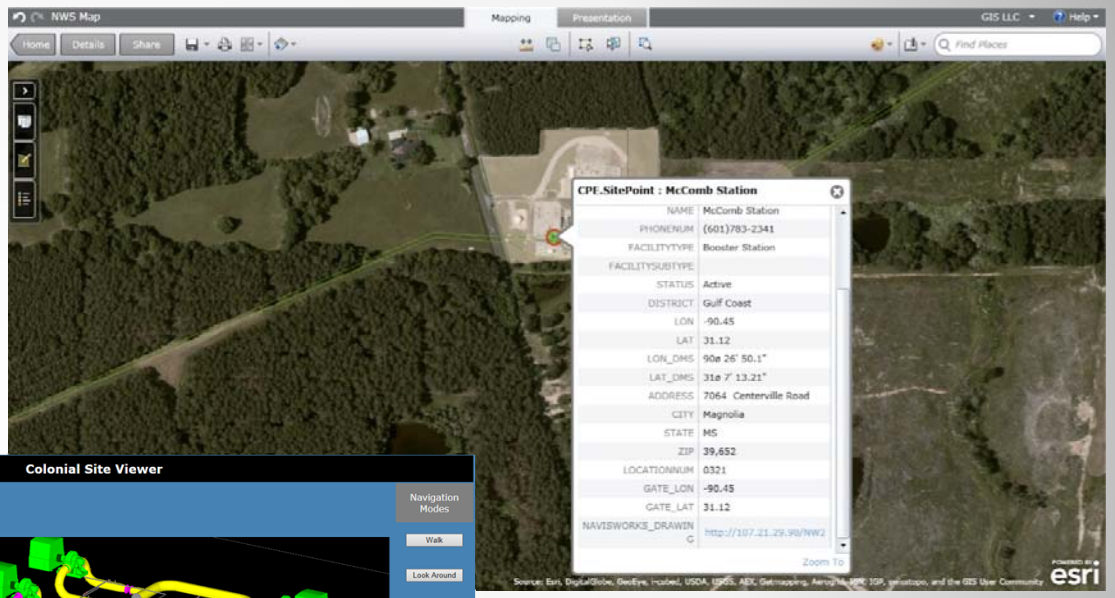
- IDP and MOP Calculated hierarchically
  - Component
  - Pressure Zone
  - Facility

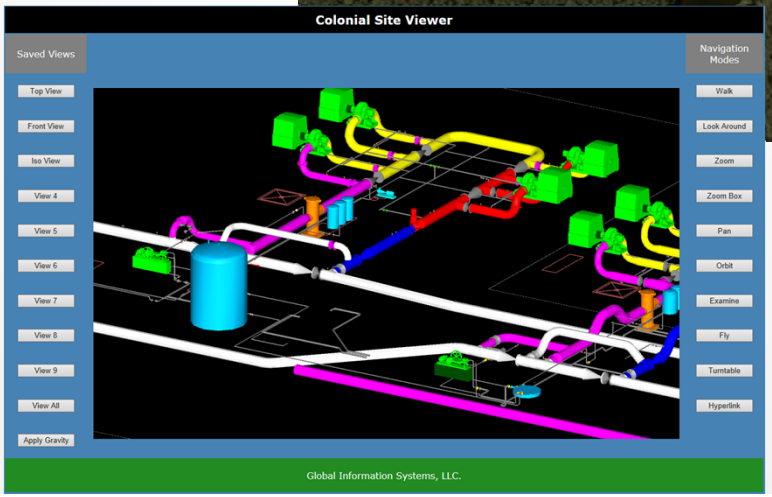


Extended Value

Extended Value – Data Accessibility

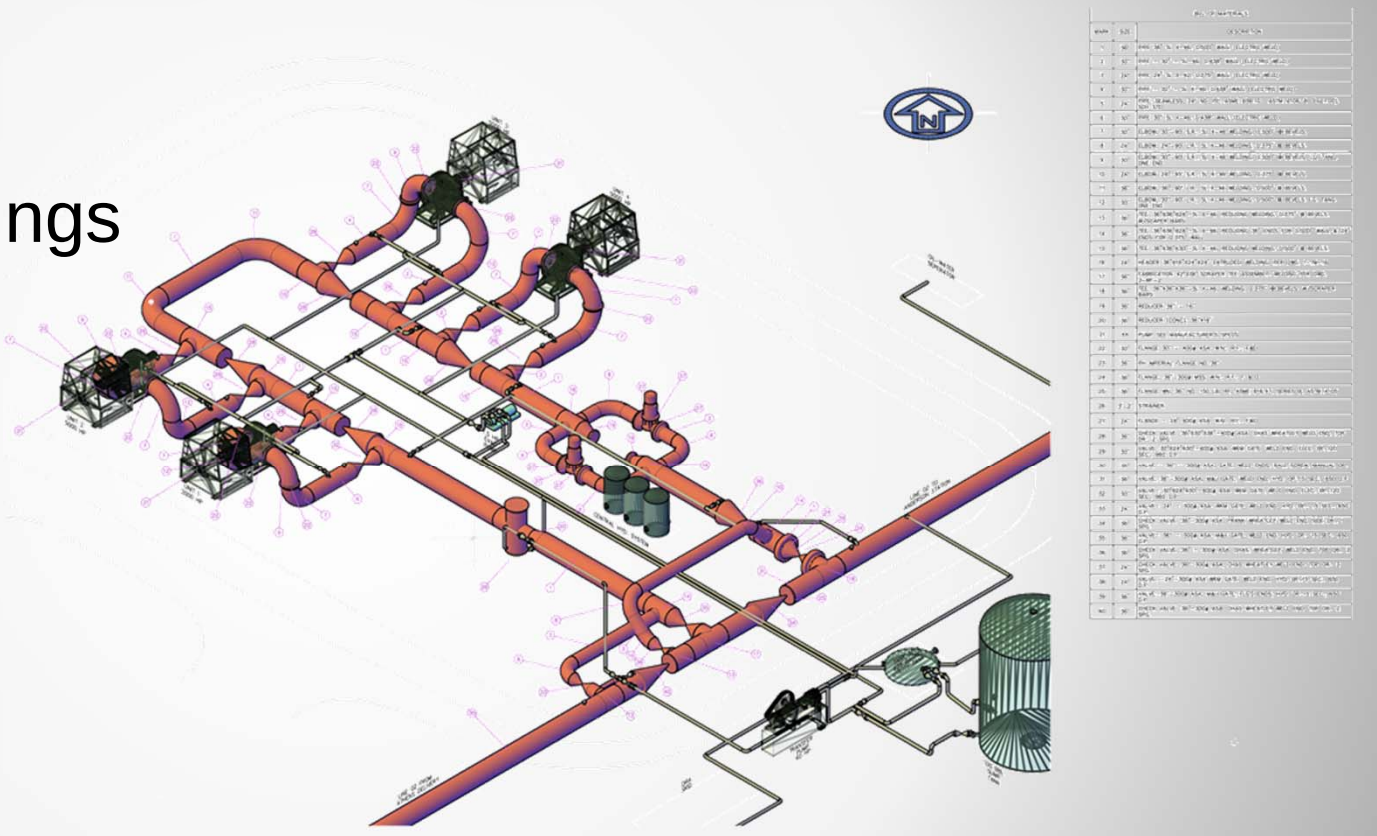
- 3D Applications
  - Web-Based
  - Map-Driven
- Database Functionality





Extended Value – Drawing Integration

- P&IDs
- Isometric Drawings
- Bill of Materials



Extended Value – Integration/Standardization

- Use and Extend Industry Standards
- Integration With Other Enterprise Systems
  - EAM
  - EPPM
  - Procurement
  - CMMS
  - GIS