Hydrocarbon Transportation by Pipeline

Industry Background

Transportation Research Board
May 12 -13, 2016
Summary
Pipelines: The Last Five Years

- The shale revolution was brought about by the favorable conditions of increased supply and demand, high crude prices and improved technology.
- These conditions provided an economic environment that encouraged many new producers to enter the industry.
- The Federal and State regulators supported the development of new pipelines, and where not feasible, other modes of transportation were utilized.
- The primary causes of environmental and safety incidents remain the same:
  - Corrosion
  - Equipment failure
  - Excavation
  - Incorrect operations
  - Material pipe/weld failure
  - Natural force
  - Outside force
  - Other
- The increase in the number of miles of pipe and the increased volume of crude, natural gas and NGLs has had little impact on incidents and the historical trend of decline has continued.
Near term crude oil prices are difficult to predict in today’s market but...

For oil prices, the market-implied confidence band is very wide

Source: EIA, Short-Term Energy Outlook, July 2015
Pipeline Safety with Context Measures (1988-2014)

Data Sources: Energy Information Administration, Census Bureau, PHMSA Annual Report Data, PHMSA Incident Data -- as of March 25, 2015.
PPTS vs. PHMSA Data

- Unique Information in Each System:
  - Some incidents reported to one system but not the other
  - Some incident data / questions different between the systems

Use of both systems simultaneously enables robust data analysis.
PPTS & PHMSA Report Criteria Changes

- **PPTS**
  - All releases to water
  - Costs > $50,000
  - ≥5 Gallons
  - Fire/Explosion
  - Death/Injury

- **PHMSA**
  - Costs > $1,000
  - Costs > $5,000
  - Costs > $50,000
  - ≥50 Bbls or >5 Bbls/day HVL
  - Fire/Explosion
  - Death/Injury

Costs > $50,000
≥5 Gallons
Fire/Explosion
Death/Injury
PHMSA Releases by Year

**NUMBER OF RELEASES**

- Tank: [Chart showing number of releases for each year]
- Onshore Pipeline: [Chart showing number of releases for each year]
- Offshore: [Chart showing number of releases for each year]
- Facility: [Chart showing number of releases for each year]

**BARRELS RELEASED**

- Tank: [Chart showing barrels released for each year]
- Onshore Pipeline: [Chart showing barrels released for each year]
- Offshore: [Chart showing barrels released for each year]
- Facility: [Chart showing barrels released for each year]
PHMSA Releases by Location

**RELEASES BY LOCATION (2010-2015)**
- 56% OFFSHORE
- 33% ONSHORE
- 10% PIPELINE
- 7% TANK

**BARRELS RELEASED BY LOCATION (2010-2015)**
- 78% OFFSHORE
- 9% ONSHORE
- 13% PIPELINE
- 0% TANK
PHMSA Releases by Cause

**RELEASES BY CAUSE (2010-2015)**

- CORROSION: 21%
- EQUIPMENT FAILURE: 4%
- EXCAVATION: 7%
- INCORRECT OPERATION: 4%
- MWF: 9%
- NATURAL FORCE: 14%
- OTHER: 4%
- OUTSIDE FORCE: 4%

**BARRELS RELEASED BY CAUSE (2010-2015)**

- CORROSION: 13%
- EQUIPMENT FAILURE: 18%
- EXCAVATION: 8%
- INCORRECT OPERATION: 10%
- MWF: 6%
- NATURAL FORCE: 12%
- OTHER: 18%
- OUTSIDE FORCE: 6%

MWF – Material Pipe/Weld Failures
PHMSA Pipeline ROW

MWF – Material Pipe/Weld Failures

**RELEASES BY CAUSE (2010-2015)**
- CORROSION: 28%
- EQUIPMENT FAILURE: 17%
- EXCAVATION: 10%
- INCORRECT OPERATION: 7%
- MWF: 5%
- NATURAL FORCE: 5%
- OTHER: 3%
- OUTSIDE FORCE: 25%

**BARRELS RELEASED BY CAUSE (2010-2015)**
- CORROSION: 40%
- EQUIPMENT FAILURE: 11%
- EXCAVATION: 11%
- INCORRECT OPERATION: 11%
- MWF: 16%
- NATURAL FORCE: 4%
- OTHER: 7%
- OUTSIDE FORCE: 0%
PHMSA Facility Releases

FACILITY RELEASES BY CAUSE (2010-2015)
- Corrosion: 18%
- Equipment Failure: 16%
- Excavation: 12%
- Incorrect Operation: 10%
- Natural Force: 8%
- Other: 6%
- Outside Force: 1%

BARRELS RELEASED BY CAUSE (2010-2015)
- Corrosion: 32%
- Equipment Failure: 18%
- Excavation: 13%
- Incorrect Operation: 12%
- Natural Force: 10%
- Other: 6%
- Outside Force: 1%

MWF – Material Pipe/Weld Failures
Serious Onshore Accidents

Serious Onshore Gas Transmission Accidents by Year

Year of Accident
- 2010
- 2011
- 2012
- 2013
- 2014
- 2015

Number of Injuries plus Fatalities

- Corrosion
- Equipment
- Excavation
- Incorrect Operation
- Material Failure of pipe or weld
- Outside Force Damage
- Other

12
Public Property Damage Cost

Significant Onshore Gas Transmission Accidents by Year

Year of Accident

Public Property Cost in Dollars

- 2010
- 2011
- 2012
- 2013
- 2014
- 2015

CORROSION FAILURE
EQUIPMENT FAILURE
EXCAVATION DAMAGE
INCORRECT OPERATION
MATERIAL FAILURE OF PIPE OR WELD
NATURAL FORCE DAMAGE
OTHER INCIDENT CAUSE
OTHER OUTSIDE FORCE DAMAGE
Public Safety Regulatory Structure

**Interstate**

PHMSA

**Intrastate**

Minimum standards dictated by PHMSA

Process by determined by the individual states involved.

National Association of Pipeline Safety Representatives (NAPSR)
Regulatory Development Process
For Crude and Gas Transmission Pipelines

1. Need for Revised or New Regulation Identified?
   - Yes: Responsible Agency Drafts Regulations and Posts on Federal Registry
   - No: Agency Documents Basis for Decision

   - New or Revised Regulations Required?
     - Yes: Responsible Agency Reviews Input and Drafts Final Rule
     - No: Final Rule Published in Federal Registry

   - OMB Reviews for Cost/Benefit
     - No: OMB Review Positive?
       - Yes: Rule Becomes Final and Appropriate Notification Made to Affected Parties
       - No: Further Revision Required?
         - Yes: GO TO 1
         - No: Performance Data Collected to Test Rule Effectiveness and Need for Further Revisions

   - Performance Data Collected to Test Rule Effectiveness and Need for Further Revisions
     - No: End
     - Yes: End

* Needs can be identified by:
  - Executive Branch
  - Legislative Branch
  - Judicial Branch
  - Federal Agencies (including DOT-PHMSA and their Technical Advisory Committees)
  - State Agencies
  - First Responder Organizations
  - Industry Associations (API, AOPL, INGAA, etc.)
  - Companies
  - The Public
Industry has many methods to ensure and maintain pipeline operations

- **Prevention**
  - Evaluating, inspecting, and maintaining pipelines through operator integrity management programs to prevent releases
  - Billions are spent each year
    - “Smart pigs” – high-tech diagnostic devices that travel inside pipelines to identify pipe irregularities; 90% detection rate

- **Mitigation**
  - 24/7 control room operators reviewing information from instruments along pipeline
  - Shut-off valves to stop product flow within minutes and isolate pipelines where data indicates a possible leak

- **Response**
  - Response Plans are completed and shared with responders to ensure appropriate action
  - Drills are conducted to practice a response
Safety Improvement

- Liquids pipeline incidents are down 50% since 1999.
  - Specifically, releases caused by corrosion and third-party damage have decreased by 76% and 78%, respectively.
- Statistics show that incidents that do occur are very small in size and are contained in facilities, not along the right of way where public and the environment are impacted.
  - 35% of releases in 2013 were smaller than 1 barrel and two-thirds of releases were 5 barrels or smaller.
  - 66% of incidents are within operator facilities such as pump stations or tank facilities, and one-third are along a pipeline right of way.

![Corrosion Chart]

![Third Party Damage Chart]
## Natural Gas Pipeline Financial Regulatory Structure

<table>
<thead>
<tr>
<th>Interstate Gas Transportation</th>
<th>Intrastate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Once an interstate natural gas pipeline is built, the Federal Energy Regulatory Commission (FERC) has the authority to ensure that pipeline rates are “just and reasonable.”</td>
<td>Public Utility Commissions Process by determined by the individual states involved.</td>
</tr>
</tbody>
</table>

These rates include operating and maintenance expenses and an allowed return on investment set as a percentage of the capital invested in facilities used to serve customers.
Regulating Oil Pipelines

The Commission’s responsibilities include:

- Regulation of rates and practices of oil pipeline companies engaged in interstate transportation;
- Establishment of equal service conditions to provide shippers with equal access to pipeline transportation; and
- Establishment of reasonable rates for transporting petroleum and petroleum products by pipeline.

<table>
<thead>
<tr>
<th>OIL SECTION</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Annual Charges</strong></td>
</tr>
<tr>
<td>The Commission receives an annual appropriation from Congress to defray its operating costs. <a href="#">Read More</a></td>
</tr>
<tr>
<td><strong>Safety &amp; Inspections</strong></td>
</tr>
<tr>
<td>Once oil projects become operational, safety is regulated, monitored and enforced by the Department of Transportation. <a href="#">Read More</a></td>
</tr>
<tr>
<td><strong>Environment</strong></td>
</tr>
<tr>
<td>FERC has no jurisdiction over construction or maintenance of production wells, oil pipelines, refineries, or storage facilities. <a href="#">Read More</a></td>
</tr>
<tr>
<td><strong>General Information</strong></td>
</tr>
<tr>
<td>- <a href="#">Required Filers</a></td>
</tr>
<tr>
<td>- <a href="#">Oil Pipeline Index</a></td>
</tr>
<tr>
<td><strong>Industry Activities</strong></td>
</tr>
<tr>
<td>- <a href="#">Staff Oil Pipeline Handbooks</a></td>
</tr>
</tbody>
</table>
Natural Gas

* Commission's Responsibilities

**Gas Pipelines and Storage**
- Approved Major Pipeline Projects
- Major Pending Pipeline Projects

**Gas Storage**
- Active Jurisdictional Storage Fields
- Pending Storage Fields
- Pre-Filing Storage Fields
- Certified Storage Projects Since 2000

**LNG**
- Existing North American LNG Import Terminals
- Approved North American LNG Import Terminals
- Proposed North American LNG Import Terminals
- Proposed North American LNG Export Terminals

**Environment**

**Initiatives**
- Order No. 687

**Seminars**
- March 8-10, 2016 - FERC Environmental Reviews and Compliance for Natural Gas Facilities Seminar (San Diego, California)

**Environmental Documents**
- April 21, 2016 - FERC Staff Issues Draft Environmental Impact Statement for the Leach XPress and Kayne XPress Expansion Projects (CP15-614-000, CP15-539-000)

**NATURAL GAS SECTION**

**Annual Charges**
The Commission receives an annual appropriation from Congress to defray its operating costs. Read More

**Safety & Inspections**
Once Natural Gas pipeline projects become operational, safety is regulated, monitored and enforced by the Department of Transportation. Read More

**Industry Activities**
- LNG
- Blanket Certificates
- Alaska Natural Gas Transportation Projects
- Natural Gas Storage
- Pre-Filing
- Gas Pipelines

**General Information**
- Intrastate Transportation
- Required Filing
- Memorandum of Understanding (MOU) with Canada
- Cost-of-Service Rate Filing
- Three Digit Pipeline Code List for Index of Customers (Form 546B)
- Related Websites
- Form 546B - Index of Customers
- FERC NOGA Tariffs - Historical
# Major Pipeline Projects Pending (Onshore)

Data as of March 14, 2016

<table>
<thead>
<tr>
<th>Year</th>
<th>Docket No.</th>
<th>Company/Project</th>
<th>Capacity (MMcfd)</th>
<th>Miles of Pipe</th>
<th>Compression (HPS)</th>
<th>States</th>
<th>Filing Date</th>
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</thead>
<tbody>
<tr>
<td>2015</td>
<td>CP15-36</td>
<td>Columbia Gas Transmission, LLC (PP15-21)</td>
<td>1,300.00</td>
<td>29.20</td>
<td>183,383.00</td>
<td>VA, WV</td>
<td>12/30/15</td>
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<tr>
<td></td>
<td>CP15-46</td>
<td>First Midstream, LLC</td>
<td>152.00</td>
<td>16.60</td>
<td>0.00</td>
<td>PA</td>
<td>12/18/15</td>
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<tr>
<td></td>
<td>CP15-21</td>
<td>Tennessee Gas Pipeline Company, LLC, (PP15-22) Northeast Energy Direct Project</td>
<td>1,300.00</td>
<td>419.70</td>
<td>361,100.00</td>
<td>CT, MA, NH, NY, PA</td>
<td>11/20/15</td>
</tr>
<tr>
<td></td>
<td>CP15-22</td>
<td>NEXUS Gas Transmission, LLC, (PP15-10) NEXUS Gas Transmission Project (NGT)</td>
<td>1,500.00</td>
<td>255.90</td>
<td>130,000.00</td>
<td>MI, OH</td>
<td>11/20/15</td>
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<tr>
<td></td>
<td>CP15-23</td>
<td>Texas Eastern Transmission, LP (PP15-11) Appalachian Lease Project (TEAL)</td>
<td>950.20</td>
<td>4.70</td>
<td>28,200.00</td>
<td>OH</td>
<td>11/20/15</td>
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<tr>
<td></td>
<td>CP15-17</td>
<td>Millennium Pipeline Company, LLC, (PF15-23) Valley Lateral Project</td>
<td>130.00</td>
<td>7.80</td>
<td>0.00</td>
<td>NY</td>
<td>11/12/15</td>
</tr>
<tr>
<td></td>
<td>CP15-13</td>
<td>Equitrans, L.P., (PP15-22) Equitrans Expansion Project (see Mtn Valley/CP15-12)</td>
<td>600.00</td>
<td>7.90</td>
<td>31,300.00</td>
<td>PA, WV</td>
<td>10/27/15</td>
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<tr>
<td></td>
<td>CP15-12</td>
<td>Tennessee Gas Pipeline Company, LLC Southwest Louisiana Supply Project</td>
<td>205.00</td>
<td>3.80</td>
<td>18,400.00</td>
<td>LA</td>
<td>10/26/15</td>
</tr>
</tbody>
</table>

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**Notes:**
- The capacity values are in millions of cubic feet per day (MMcfd).
- The miles of pipe values are in thousands of linear feet.
- The compression values are in hundred pounds per square inch (HPS).
- The states listed indicate the locations of the projects.
- The filing dates are as of March 14, 2016.
# Approved Major Pipeline Projects (2009-Present)

Data as of March 14, 2016

<table>
<thead>
<tr>
<th>Docket No.</th>
<th>Company/Project</th>
<th>Capacity (MMcfd)</th>
<th>Miles of Pipe</th>
<th>Compression (HP)</th>
<th>States</th>
<th>Filing Date</th>
<th>Issued Date</th>
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</thead>
<tbody>
<tr>
<td>CP14-529</td>
<td>Tennessee Gas Pipeline Company, LLC, Connecticut Expansion Project</td>
<td>72.10</td>
<td>13.30</td>
<td>0.00</td>
<td>CT, MA, NY</td>
<td>07/31/14</td>
<td>03/11/16</td>
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<tr>
<td>CP15-137</td>
<td>Rockies Express Pipeline LLC REX Zone 3 Capacity Enhancement Project</td>
<td>800.00</td>
<td>0.00</td>
<td>156,657.00</td>
<td>IN, OH</td>
<td>03/21/15</td>
<td>02/25/16</td>
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<tr>
<td>CP14-554</td>
<td>Florida Southeast Connection, LLC (FF14-2) FL SE Conn Proj (See Sabal Tr, Trans/Hillabee)</td>
<td>640.00</td>
<td>120.00</td>
<td>0.00</td>
<td>FL</td>
<td>06/20/14</td>
<td>02/02/16</td>
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<tr>
<td>CP15-18</td>
<td>Transcontinental Gas Pipe Line Co., LLC (PF14-8) Hillabee Expansion Proj (See Sabal Trail, FL SE Con)</td>
<td>1,131.70</td>
<td>43.50</td>
<td>86,500.00</td>
<td>AL</td>
<td>1/1/04/14</td>
<td>02/02/16</td>
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<tr>
<td>CP10-17</td>
<td>Sabal Trail Transmission LLC (PF14-1) SE Util Pl Proj (See FL SE Conn, Trans/Hillabee)</td>
<td>1,075.00</td>
<td>510.20</td>
<td>209,900.00</td>
<td>AL, FL, GA</td>
<td>1/21/14</td>
<td>02/02/16</td>
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<tr>
<td>CP15-60</td>
<td>Columbia Gas Transmission, LLC Tri-County Bare Steel Replacement Project</td>
<td>34.00</td>
<td>0.00</td>
<td>0.00</td>
<td>PA</td>
<td>02/20/13</td>
<td>02/01/10</td>
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<tr>
<td>CP15-105</td>
<td>Texas Gas Transmission, LLC Western Kentucky Lateral Project</td>
<td>230.00</td>
<td>22.50</td>
<td>0.00</td>
<td>KY</td>
<td>03/04/15</td>
<td>01/21/10</td>
</tr>
</tbody>
</table>
Eminent Domain Definition

Eminent Domain

The power to take private property for public use by a state, municipality, or private person or corporation authorized to exercise functions of public character, following the payment of just compensation to the owner of that property.

Federal, state, and local governments may take private property through their power of eminent domain or may regulate it by exercising their Police Power. The Fifth Amendment to the U.S. Constitution requires the government to provide just compensation to the owner of the private property to be taken. A variety of property rights are subject to eminent domain, such as air, water, and land rights. The government takes private property through condemnation proceedings. Throughout these proceedings, the property owner has the right of DUE PROCESS.

Eminent domain is a challenging area for the courts, which have struggled with the question of whether the regulation of property, rather than its acquisition, is a taking requiring just compensation. In addition, private property owners have begun to initiate actions against the government in a kind of proceeding called inverse condemnation.
Pipeline Conversion
PHMSA’s Role

In order to assist regulated parties, PHMSA provides written explanations of the federal pipeline safety regulations (49 CFR Parts 190-199) in the form of guidance, interpretations, FAQs, and other materials. These guidelines for flow reversals, product changes, and conversion-to-service reflect PHMSA’s current application of the regulations to certain implementation scenarios that may impact a pipeline’s integrity. This guidance material does not create legally enforceable rights or obligations. This guidance is explanatory in nature and is provided to help operators making these operational changes understand how to comply with the regulations and to provide recommendations on integrity management practices.

For purpose of this guidance, the term “should” is used to recommend good practices, which operators may need to consider depending on the change being implemented and the risk profile of individual pipelines, but are not mandatory for purposes of conforming with this guidance. The term “must” is used within the guidance to signify actions that would need to be taken by an operator to remain in compliance with code requirements. However, the use of this term does not mean that the guidelines constitute regulations. PHMSA only enforces the language of the code itself. It should also be noted that if operators choose to address a scenario differently than recommended in the guidelines, it is generally important for them to develop and document a technical justification for their chosen course of action.
The energy giant Kinder Morgan Inc. has pulled the plug on its controversial natural gas pipeline proposed through parts of Massachusetts and Southern New Hampshire, after failing to sign up enough utility customers and facing stiff consumer and political opposition.

Kinder Morgan said on Wednesday that its Northeast Energy Direct project didn’t receive the commitments from big customers that it needed to proceed with the $3.3 billion plan, which would involve building a 188-mile pipeline from a point west of Albany, N.Y., to Dracut.

And the decision could provide a big boost to the other large pipeline construction project proposed for New England, Spectra Energy Partners’ Access Northeast, which has the financial backing of utilities Eversource Energy and National Grid.
North America Midstream Infrastructure through 2035: Leaning Into the Headwinds

Prepared by ICF International for The INGAA Foundation, Inc.

Press Conference Version

INGAA Foundation Final Report No. 2016.02

ICF International
9300 Lee Highway
Fairfax Virginia 22031

April 12, 2016
Shale resource development continues in earnest.
A Future Projection

U.S. and Canada Liquids Production (Average Annual Million BPD)

- Liquids production growth not nearly as robust as it recently has been.
A Future Projection

Miles of New Natural Gas Pipeline Added (Excluding Gathering Line)

- 18,000 and 29,000 miles of new gas pipelines from 2015 through 2035 – midpoint of 23,000 miles.
- Averaging 850 and 1,400 miles per year – midpoint of 1,100 miles per year.
- Activity maintained by buildout from areas like the Marcellus and Utica.