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Offshore Pipeline Construction and Operation

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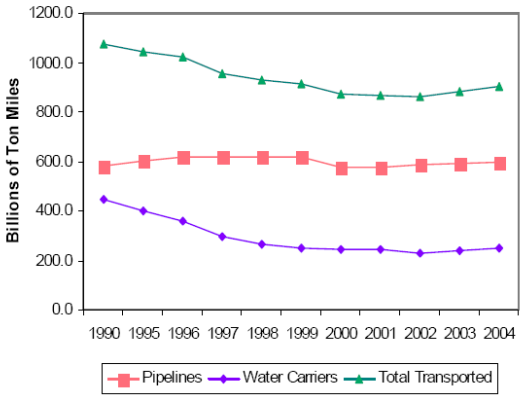
My Qualifications

- Professional Engineer in 4 states
- Summa Cum Laude graduate of the Georgia Institute of Technology
- Masters Degree in Mechanical Engineering
- 28 years of experience in oil and gas production and transportation; Area Manager of a large pipeline company
- Professional Member of the National Association of Corrosion Engineers
- Actively involved in the Pipelines and Informed Planning Alliance (PIPA) / Protecting Communities task force
- Active in various pipeline industry associations and initiatives

Domestically, Liquids move Primarily by Pipeline, not Barge or Tanker

Figure 8. Domestic Transportation of Crude Oil and Petroleum Products, 1990-2004



Source: Prepared by CRS with data from Association of Oil Pipelines, *Shifts in Petroleum Transportation*, June 2006, available at [http://www.aopl.org].

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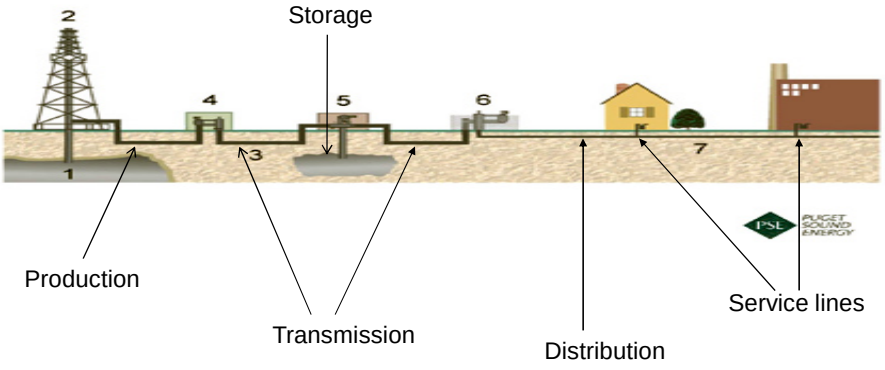
Types of Pipelines



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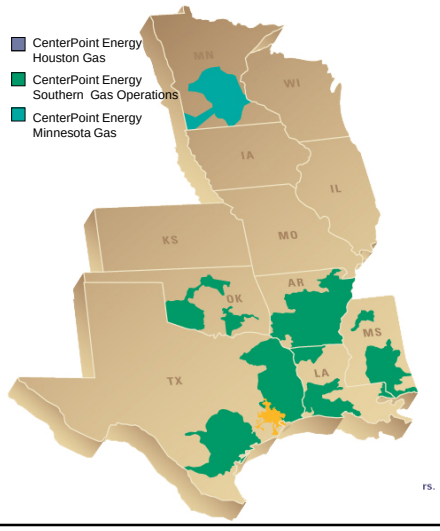
Example relationship: Transmission, Distribution, Service Pipelines



- 740 miles of Transmission Pipeline
- Over 65,000 miles of Distribution Mains
- 3+ million Service Lines

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Offshore Pipeline Industry

- "Production" and "Transmission" pipelines, not Distribution
  - "Production" mostly inside the leased area, regulated by the Minerals Management Service (MMS, within the DOI)
  - "Transmission" from the lease to shore, regulated by the Pipelines and Hazardous Materials Safety Administration (PHMSA, within the DOT)
- Both "Gas" and "Liquid" pipelines
  - Most pipelines are dedicated to only one or the other. They are built for one or the other, don't carry both at the same time, and very rarely are changed from one to the other.
  - Gas and Liquid are regulated independently

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Transmission of Oil and Gas from Offshore Leases

- Gas can't really move from offshore to sales without a pipeline
  - we don't have offshore gas liquification plants
  - Gas might be re-injected into the reservoir, instead of being sold
- Oil almost always travels by pipeline, unless in a very remote area with no pipeline infrastructure
  - FPSO – Floating Production, Storage, and Offloading system: a moored ship-based facility capable of producing oil from subsea wells and storing and offloading the oil into shuttle tankers

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The Pipeline Safety Record

- Significant pipeline accidents are very rare, as are injuries and fatalities to the public due to pipeline accidents.
  - Easily outnumbered by the number of annual drownings in bathtubs, deaths due to bee stings, etc.
  - Within the Department of Transportation, pipeline-related fatalities can't even be seen on the graph
- This is so, even though the median decade of construction for US pipelines is the 1960s!
  - Modern pipelines will be even safer than average

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Pipeline Safety Statistics

- Fatalities / year from material transportation activities:
  (Source: GAO/RCED-00-128)
  - Pipelines - 22
  - Barge - 66
  - Railroad – 590
  - Trucking - 5,100
- Offshore pipeline systems have a slightly better reportable incident record than onshore pipeline systems, on an incidents / mile basis – even when hurricanes Katrina, Rita, and Ivan are included

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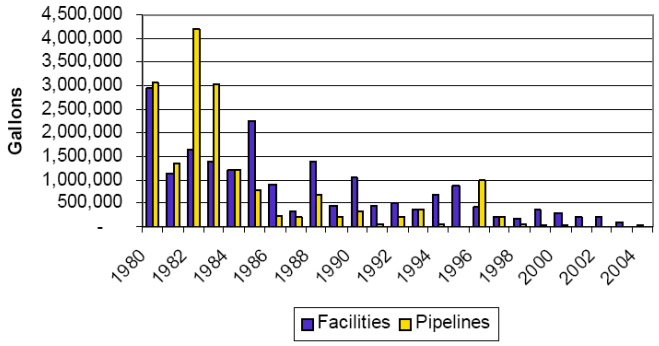
Industry Performance: Vastly Improved Since the 1980's

Figure A2. Volume of Oil Spills into U.S. Coastal Waters from Facilities and Pipelines, 1980-2004



Source: Prepared by CRS with data from USCG Oil Spill Compendium.

Note: The above USCG data includes incidents from land-based facilities and pipelines, as well as oil industry facilities and pipelines in state (nearshore) and federal (offshore) waters.

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Offshore Pipeline Characteristics

- Welded steel construction (not plastic)
- Comprehensive design and construction specifications
  - additional design factors required for pipeline risers
  - shallow hazards survey; archaeological resource report
- Comprehensive inspection during construction
- Protected from internal and external corrosion
- Qualification programs for operations and maintenance personnel
- Automated monitoring and shut down / safety systems
- Inspected routinely by the operator

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Regulatory Environment

- Both gas and liquid pipelines are subject to extensive regulation related to design, construction, operation, maintenance, and abandonment
- OCS: Regulated by the Federal Government through the Department of Interior (DOI), the Department of Transportation (DOT), and the US Coast Guard (DHS)
- State Waters: Regulated by the relevant state agencies
- Operators are inspected routinely by the applicable regulatory agencies, and enforcement actions are taken when appropriate
- The requirements are not ignored

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Pipeline Regulation in Florida

- Like most states, Transmission pipeline mileage in Florida is much smaller than Distribution pipeline mileage
  - 4,638 miles of transmission versus 25,017 miles of distribution mains, and 847,960 service lines (2008 data)
- The Florida Public Service Commission has been certified by the federal DOT to regulate intra-state gas pipelines
  - The PSC has adopted the federal gas pipeline safety regulations (25-12.005), with additional requirements in a number of areas
- The federal DOT regulates hazardous liquid transportation pipelines in Florida
  - note that crude oil and oil products pipelines are by

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PHMSA Regulatory Scope

- Design of new / repaired pipelines
- Construction of new / repaired pipelines
- Testing of new / repaired pipelines
- Operations of existing pipelines
- Maintenance / Inspection / Integrity Assessment / Repair
- Emergency Response
- Corrosion Control
- Qualification / Training of OMER personnel
- Drug & Alcohol Testing of OMER personnel
- Reporting of incidents / safety-related conditions
- Does not include:
  - Commercial tariffs (FERC), ROW agreements and siting

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Underwater Inspection in GOM

- Applicable to lines w/in 15' waters of the Gulf of Mexico & its Inlets
  - Identify lines <12" below underwater natural bottom or exposed above underwater natural bottom
  - Survey frequency determined per regulation, by risk
- Remedial actions after discovery
  - Notify National Response Center < 24 hours
  - Mark location of line w/in 7 days per USCG
  - Bury pipeline to 36" (or engineering alternative means of protection) w/in 6 months

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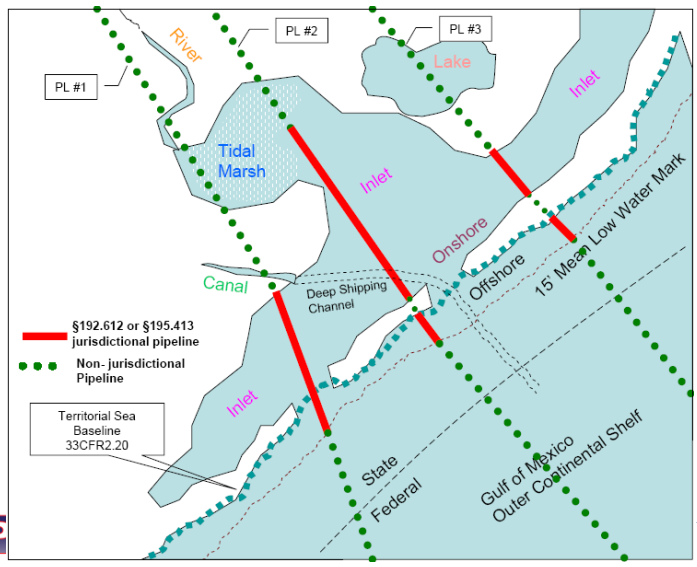
Gulf of Mexico & Inlets



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Industry Standards Incorporated Into Regulations

- American Gas Association
- American Petroleum Institute
- ASME International
- Manufacturers Standardization Society
- American Society for Testing & Materials
- National Fire Protection Association
- NACE International
- Plastic Pipe Institute
- Gas Technology Institute

Pipeline Industry Initiatives

- INGAA, API, AGA, OOC Committees and Activities
  - INGAA and API Pipeline Integrity Committees
  - API / AOPL Pipeline Performance Excellence Team, and the Pipeline Performance Tracking System (PPTS)
  - API Operations Technical Committee (for pipelines)
  - Offshore Operators Committee – pipeline subcommittee
- Standards development and updates
  - .... dozens
- Joint Industry Research programs: PRCI, GTI, NYSEARCH, INGAA Foundation

Shoreline Impacts from Pipelines

- Shore approach is typically directionally drilled
  - Florida already has lots of shoreline directional drills, for telecommunications projects
- Pipe is normally buried on and offshore (until a certain distance / depth)
  - virtually no surface evidence of the pipeline's existence
- Could have storage tanks for liquids and / or processing facilities for gas, within a few miles of the coastline
  - similar to the size of a warehouse facility
  - generally smaller footprint than a shopping mall, or a water treatment plant

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Pipeline Routing

- This isn't rocket science, or a conspiracy
  - Start at the well, and get to the market…
- Routing Factors
  - Impact minimization
    - environmentally sensitive areas, highly populated areas
  - Installation cost
    - Distance
    - Difficulty (initial survey work may be required)
  - Delivery point characteristics
    - Gas sales opportunities / options
    - Processing options

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Pipelines and Protecting Communities

- Pipelines are by nature “dispersed” assets that may be in or near populated areas
- Transportation Research Board called for a “Risk Informed” planning approach for pipeline and community development
- The Pipelines and Informed Planning Alliance (PIPA) is currently working to develop guidelines that are risk informed, to protect both pipelines and the communities in which they operate

Pipeline Installation - Onshore

Most of the time: it’s a ditch, then you’re done

- note extra width may be required during construction

Typical Pipeline Signs

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A Typical PL ROW

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Pipeline ROW after restoration

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Living with a Pipeline Right of Way

- There are a few common-sense restrictions on land use around pipeline Right of Ways:
  - Some inspections and tests require physical access to the easement – don't block it, or build over it
  - Stability of the easement is important – don't undermine it
  - The signs are there for a reason – don't move them
  - Vegetation in or hanging over the easement may be cut, including trees, on a routine basis
  - Repairs to the pipeline, if ever needed, will require digging

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Gulfstream Pipeline – In operation today

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Conclusion

- Pipeline transportation is generally recognized as the safest mode of material transportation
- Pipelines are subject to comprehensive state and federal safety regulations, and these requirements are actively enforced
- Development of these types of pipelines can be compatible with coastal communities and the environment

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