5th Colombia OIL & GAS Conference & Exhibition

CWC TECHNICAL SEMINARS

Pipeline and Oilfield Security Technologies

Global Benchmarks and State of the Art

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Contents

Why Pipeline Security Programs?

- **Accidental spills**
  - Montana
- **Accidental fire and explosion**
  - Nigeria
  - China / Sinopec
  - China / PetroChina
  - Mayflower, Arkansas
  - Ghislenghien, Belgium
  - Mexico
- **Malicious attacks**
  - Bicentenario pipeline
  - Caño Limon Coveñas pipeline
  - 259 attacks in 2013, 67 in 2014 H1
- **Oil and gas siphoning activities**

Policies, Principles Standards, and Frameworks

Laws, Principles, and Standards

Laws (US)

- Pipeline and Hazardous Materials Safety Administration
- Office of Transportation Sector Network Management, Pipeline Security Division (2002) Pipeline Security Guidelines

Principles (AOPL)

- Zero Incidents
- Organization-Wide Commitment
- Employ Technology
- A Culture of Safety
- Continuous Improvement
- Communicate with Stakeholders
- Learn from Experience
- Safety Systems for Success Stakeholders
- Reporting

Standards (API, etc.)

- API 1130 (computational pipeline monitoring)
- API RP 1149, Pipeline Variable Uncertainties and Their Effects on Leak Detectability
- RP 1155, Evaluation Methodology for Software Based Leak Detection Systems
- RP Il6l, Guidance Document for Qualification of Liquid Pipeline Personnel, August 2000
- RP Ill3 Developing a Pipeline Supervisory Control Center
- Canadian Standards Association (CSA) Z662-M99 Oil and Gas Pipeline Systems, Appendix E, " Recommended Practice for Leak Detection"
- ISO pipeline standards

Safeguarding Infrastructure: Physical Barriers and Access Controls

- **Barriers**
- **Gates**
- **Locks and keys**
- **Lighting**
- **Intrusion detection**
- **Personnel identification and tracking**
- **Background checks**
- **Equipment maintenance and construction standards**
- **Materials, Joining, Construction specifications to minimize corrosion**
- **Depth of cover**
- **Pressure Testing**

However, Low-Tech Detection Solutions are Often Uneconomical to Scale

- **Surveillance challenges:**
  - Round-the-clock vigil - Monitoring leakages
  - Electronic surveillance - less useful if not incorporated into a complete security system
  - Physical ground and/or air patrolling - infrastructure costs are not economically viable
  - Long-range radar water and surface-based solution - need for power and network connectivity.
- **Armed security guards cannot be everywhere at the same time.**
- **"Point sensing" detection technologies require many nodes to provide sufficient information.**
- **Positioning detectors and transmitters correctly can be prone to error.**
- **Can be disrupted by a single large and often harmless event blinding the system to specific activities that can affect the process.**
- **May be retrospective, only notify that a damaging event has occurred**

Overview of Detection Technologies (From the Outside In)

- UAVs
- Radar/LIDAR
- Intrusion Detection via Image Pattern Recognition
- Infrared Imaging
- Smart Pigging
- Magnetic Flux Leakage
- Ultrasonic Tools
- Geometry Tools
- Distributed Fiber Optic Sensing
- Acoustic Sensors
- Temperature and Strain Sensing
- Electric Field Mapping
- Pipe Coating, Lining and Cathodic Protection

- Cyber-Secure Networks

Selecting Vendors, Assessing Costs and Benefits

Pipeline Security Technology Selection and Economic Cost-Benefit Evaluation Process

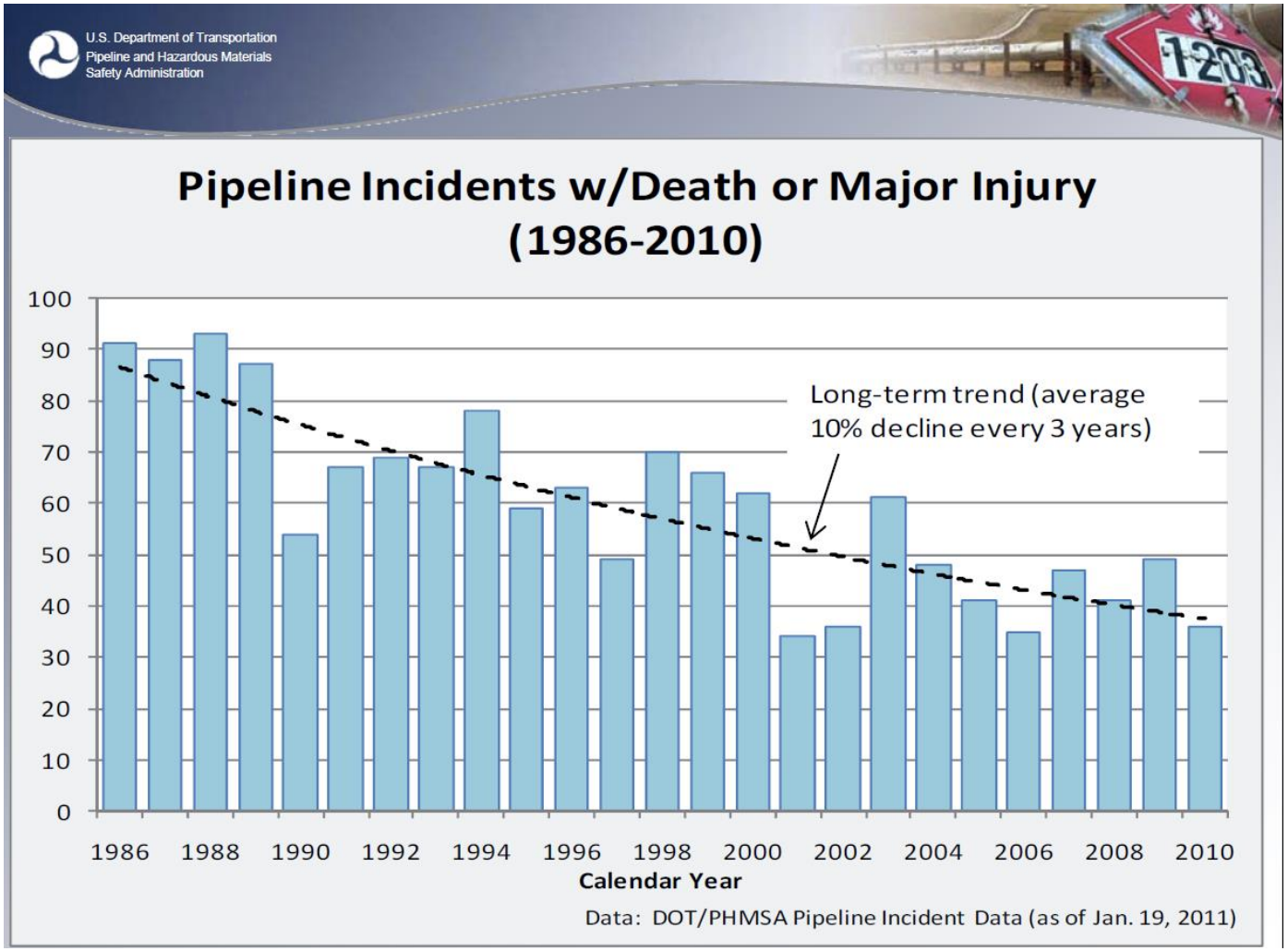
Benefits Assessment

Cost Management

Strategic, Fact-Driven Vendor Selection and Negotiating Process

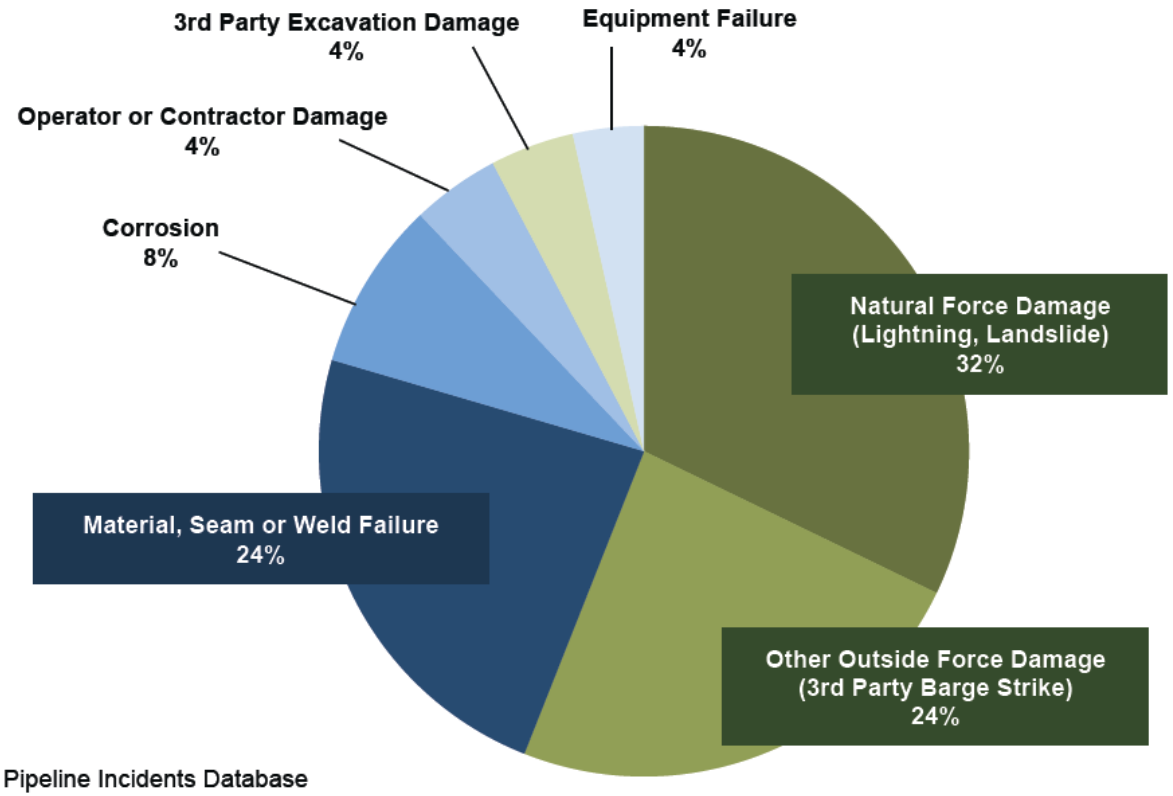
Independent Cost Estimating	Value Chain Engineering	Tender Design & Management	Supply Contract Negotiation	Contract Administration
✓ Benchmark Project Economics	✓ Determine Ways to Achieve Target Economics	✓ Ensure Capacity Availability, Price Stability	✓ Make price-risk tradeoffs ✓ Ensure Total Cost basis	✓ Control in project execution
✓ Capital Project Cost Estimates ✓ Equipment / Component Cost Estimates	✓ Supply Chain Strategy (for Buyers) ✓ Value Chain Strategy (for Suppliers)	✓ Supplier Prequalification ✓ Technology Selection ✓ Preparation of Invitations to Bid	✓ Negotiation preparation ✓ Finalization of Terms and conditions	✓ Objective claim drafting & rebuttal ✓ Claims Drafting ✓ Rebuttals and Defenses

KPIs: Number of Incidents
Reduction in incidents 50% from 1999-2013 (AOPL, 2013)



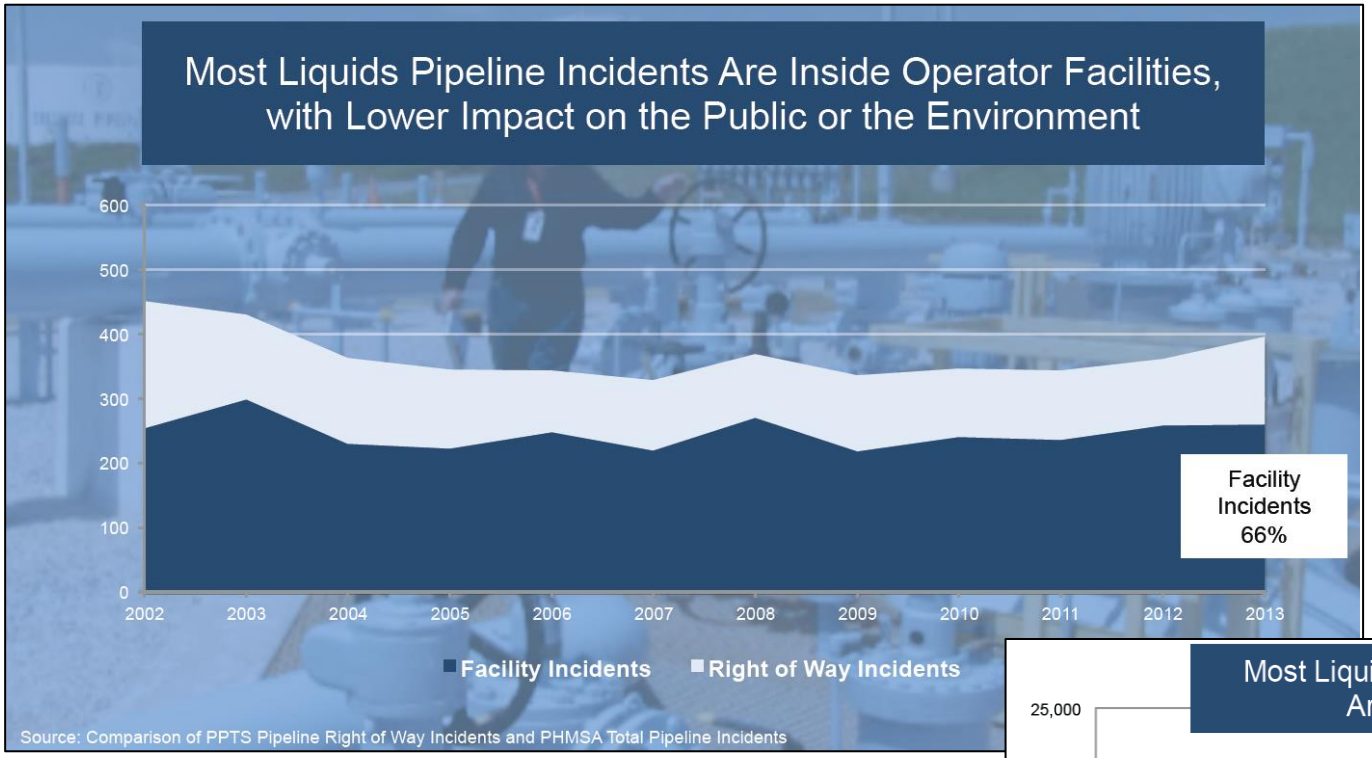
KPIs: Root Causes
78% Reduction in Incidents Caused by Third Party Construction

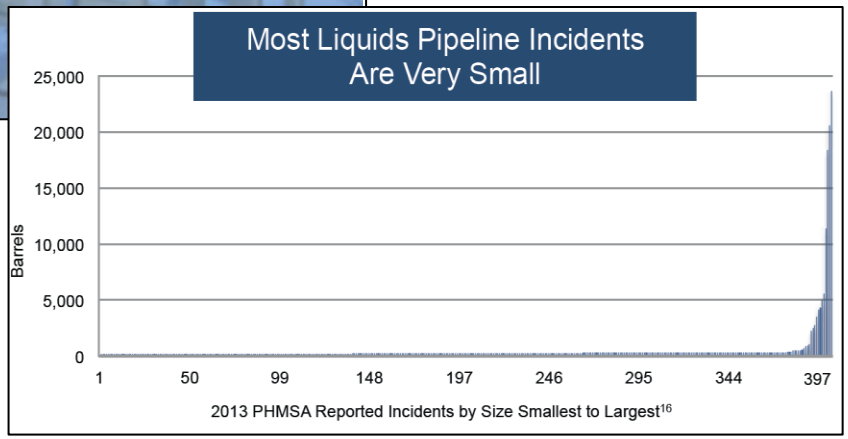
Causes of Top 10 Liquids Pipeline Releases in 2013



Source: PHMSA Pipeline Incidents Database

KPIs: Magnitude of Incidents
More Self-Contained, and Smaller, Incidents Over Time





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