The Cost of a Pipeline Failure

- Failure Statistics
- Cost of a Failure
- Failure Causes
- Integrity Management Plan
- Risk Assessment
We have had a reduction in pipeline failures of 46% from 2009
- Total of 93 pipeline failures in 2013 – 112 pipeline failures in 2012
- Three large spills – one resulted in an AER news release
- Largest failure has a $4.3 million cost incurred to date
- Second highest cost for clean-up was $1.2 million and a third spill at $600,000
- The average clean-up cost of failures this year with the three largest failures taken out $85,000
Environmental Costs 2013 – Clean-up

- The cumulative environmental clean-up cost for 2013 was $18.7 million
- 2012 clean-up costs were $23.7 million
- 21% reduction in environmental clean-up costs corresponding to a 20% reduction in pipeline failures from 2012 to 2013
Pipeline Failure Causes

**2013 Pipeline Failures by Cause**

- Corrosion Internal: 33%
- Corrosion External: 27%
- Miscellaneous: 5%
- Operator Error: 4%
- Damage by Others: 7%
- Mechanical Damage: 1%
- Girth Weld Failure: 2%
- Equipment Failure: 1%
- Overpressure Failure: 1%
- Pig Trap: 1%
- Valve Leak: 1%
- Earth Movement: 1%
- Pipe Failure: 1%
- Mechanical Joint Failure: 2%
- Valve or Fitting Failure: 2%
- Pipe Failure: 1%
- Pig Trap: 1%
- Earth Movement: 1%
- Pipe Failure: 1%
- Mechanical Joint Failure: 2%
- Operator Error: 4%
- Miscellaneous: 5%
- Unknown: 9%

*The Unknown cause of failures are failures still being investigated.*
Components:
Penn West’s Pipeline Integrity Management Plan (PL-IMP)

1. Pipeline Integrity Management Plan
   - Corporate commitment
   - Purpose of the PL-IMP
   - Why do we need a PL-IMP?
   - Manual distribution
   - Roles and responsibilities

2. Management Program and Processes
   - Implementation
   - Work processes and record keeping
   - Pipeline engineering assessments

3. Pipeline Operating and Maintenance
   - Overview of activities
   - Highlights

4. Pipeline Acts and Regulations
   - Pipeline acts
   - Regulations
   - Directives and notification
What is Risk?

- **Likelihood or Probability**
  - Probability or chance of something happening

- **Consequence**
  - The effect, result, or outcome of something occurring

- **Risk**
  - Likelihood x Consequence

- **Risk Assessment**
  - Process to assess risk (Likelihood and Consequence)

- **Risk Management**
  - Decisions on resource allocation
Pipeline Risk Management

- Prioritize pipeline segments
- Evaluate benefits of mitigation
- Determine most effective mitigation, monitoring and inspection activities
- Allocate resources effectively
- Improve production reliability
- Continual assessment process
Pipeline Risk Assessment Structure

**Total Risk**

**Failure Probability**

**Internal Corrosion**
- **Original Conditions**
  - \(\text{CO}_2, \text{T, O}_2, \text{H}_2\text{S, Cl, bacteria, Sulphur, age, failure history}\)
- **Mitigated**
  - Pigging, batching, inhibitor injection, coupon, internal coating, ILI.

**External Corrosion**
- **Original Conditions**
  - Coating type, coating condition, ILI, failure history, age, soil type, interference
- **Mitigated**
  - Effective CP, CP survey, rectifier check, coating effectiveness, coating survey, coating quality control, ILI, dig verification

**Consequence**
- **Leak/Spill Volume**
- **Health & Safety**
- **Financial**
- **Cleanup**
- **Repair**
- **Social**
Pipeline Risk Management

- Risk Mitigation Strategy
  - Data collection on all operated pipelines
  - Calculation of risk
  - Identify high risk pipelines
  - Develop a mitigation plan
  - Implement
  - Monitor and inspect
Pipeline failures have a huge impact to a company's bottom-line due to financial impact (environmental clean-up and lost production) and corporate reputation

Implementation of an effective Pipeline Integrity Management Plan can significantly reduce pipeline failures

High risk pipelines are identified through a risk assessment process and then further action is determined through the Pipeline Integrity Management Plan