Pipeline Design, Construction & Operations
Technical Committee

Damage Prevention

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DC&O Mission Statement

Develop safe, environmentally responsible, cost-effective and reliable solutions for the design, construction, and operation of energy pipelines
Key Emphasis Areas

- Offshore
- Onshore & Arctic
- Damage Prevention & Detection
- Reliability-Based Design & Assessment
- Integrity Practice Standardization

1. **Prevention of Third Party Damage** $1,305k
2. **Implementing Integrity Standards** $3,060k
3. **Reliability-Based Design Alternatives** $918k
4. **Determination of Max. Safe Surface Loads** $994k
5. **Leak Detection and Notification** $350k
6. **Prevention of Critical Pipeline Strains** $1,363k
7. **Solutions for Adverse Crossings** $245k

Total: **$8,235k**
Damage Prevention

- Addressed by all seven technical programs
- Categorized into four areas:
  - Integrity Assessment for Operating and External Loads
  - Mechanical Damage
  - Industry Standards Development
  - Human Factors (new)
Integrity Assessment for Operating Loads

Current Projects

Surface Loading

– effects of non-typical loading conditions on buried pipelines
– centrifuge modeling of pipe stress from extreme loads
– effects of static and cyclic surface loadings on the performance of welds in pre-1970 pipelines
Integrity Assessment for Operating Loads

What’s Needed

Surface Loading

- Calibrate improved FEM techniques to full-scale test data
- Expand database for varied load conditions, pipe parameters, soil types and cover depths using FEM
- Develop tools to assess extreme surface loads on pipelines at various cover depths
Integrity Assessment for Operating Loads

Current Projects

Structural Integrity
- local buckling and collapse of corroded pipelines
- wrinkle bend integrity study
- decompression response of high-pressure natural gas pipelines under rupture/blowdown conditions
Integrity Assessment for Operating Loads

- Past and Current Projects

  Environmental Forces
  - integrity assessment of exposed and unburied pipelines in river channels
  - pipeline on-bottom stability
  - seismic design and assessment guidelines
  - satellite-based ground movement monitoring
Ground Subsidence Along SoCalGas ROW due to Belridge Oil Production

Integrity Assessment for Operating Loads

- Satellite-Based Ground Movement Monitoring
  - Mature service with several providers
  - Reliable measurements
  - Applicable to most right-of-ways (arid to semi-arid regions ideal)
  - Radar reflectors required in regions with moderate to dense vegetation
  - Successful pilots conducted
  - Large data archive covering most regions back to 1992
  - Cost effective when multiple rights-of-way are covered in a single satellite image
  - Very cost effective in remote regions
  - New satellites are bringing costs down (~30% less than 2002)
Integrity Assessment for Operating Loads

What’s Needed

– more satellites: closer intervals, more images, reduced cost
– enhanced radar imagery resolution
– enhanced imagery processing for larger areas
– enhanced software for automatic detection and notification
– company-specific pilots to demonstrate benefits
– tests to determine if reflectors are required
Mechanical Damage

- **Past and Current Projects**
  - pipeline design for mechanical damage
  - reliability-based pipeline design for mechanical damage
  - reliability-based prevention of mechanical damage to pipelines
  - reliability-based planning of inspection and maintenance
  - effectiveness of new prevention technologies for mechanical damage
  - real-time acoustic monitoring
  - detection of third-party encroachment using satellite-based remote sensing technologies
  - automated detection of encroachment events using satellites
Mechanical Damage

- Satellite-Based Third Party Encroachment Monitoring
  - Capabilities and performance continue to improve
  - Automated detection rates approaching human performance
  - New satellites bring new levels of performance
  - Optical satellites close to ‘people’ detection
  - Radar satellites similar to optical resolution to be launched in 2005
  - Radar satellites essential for operations in cloud areas
  - High imagery cost - vendors must become part of overall service provision to make service viable in the long term
Mechanical Damage

What’s Needed

- More satellites / lower imagery cost
- Enhanced imagery resolution & processing
- Higher accuracy rate (less false calls)
- Alternatives to satellite monitoring (new platforms)
- High speed processing chain required for full operation
- Framework for integration with one-call and 1st/2nd party coordination

Pilot Projects:

Short duration (1 month) pilots have been successful
Long duration (6 month) pilots required to demonstrate full benefits
Mechanical Damage

What’s Needed

- Best practices compendium with current and emerging technologies to prevent mechanical damage
- Effective methods for monitoring offshore pipelines
Industry Standards

Implementing Integrity Standards

- Provide draft language for the periodic integrity assessment and management of threats to pipelines
- Develop supporting standards for the Integrity Management Program
- Provide foundation technical reports to ASME, ASNT, NACE, and other Standards Development Organizations (SDOs)
Industry Standards

Projects

Complete
- ASME B31.8S – Managing System Integrity of Gas Pipelines
- API 1162 – Communications for Integrity Management Program
- Acceptance criteria for mild ripples in pipeline field bends

In ballot
- API RP1163 – ILI Qualification Standard
Industry Standards

Projects

Continuing
- Conducting analysis of industry incidents
- Conducting analysis of one-call performance
- Developing industry-performance metrics

Initiated
- ASME B31.8Q Operator Qualification Standard
- Study on fatigue as a root cause for pipeline failure
Industry Standards

What’s Needed

- Standards organizations to adopt and incorporate acceptance criteria for mild ripples in pipeline field bends into existing codes and standards

- Develop standards for RBDA for gas, liquid, Arctic pipelines
Human Factors

Human Factors Analysis of Pipeline Control Room Operations and Procedures

– Identify recurring human factors that have the potential to compromise the ability of controllers to effectively recognize and respond to leaks

– Identify strategies that would cost-effectively reduce the likelihood of leaks, accidents, shut-downs or other incidents associated with the identified human factors
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