Alaskan Arctic Pipeline Workshop

Appraisal and Development of Pipeline Defect Assessment Methodologies

Presented by:
Justin Bucknell, MSL Corporation
Primary Goal

To Review and Appraise Available Methods for Assessing Pipeline Defects.
Other Objectives

• Review Defect Assessment Methods

• Understand Current Industry Practice
  (design, inspection, defect assessment)

• Comprehensive Defect Database

• Appraisal of Defect Assessment Techniques
Scope/Status of Work

PHASE I (completed October ’99)

- Collation of Literature (400 references)
- Database of Pipeline Defect Forms
- Review of Inspection Methodologies
- Selective Interviews with Operators
- Review of Current Industry Practice

PHASE II (due for completion March ’00)

- Appraisal of defect assessment methods
Pipeline Failures

- Corrosion
- Third Party Interference
- Storms and slides
- Weld/material defects
- Equipment/component failure

Sources: Mandke, DOT, HSE/UKOOA
Defect Types

- Corrosion
- Mechanical damage
- Girth weld defects
- S-N (fatigue) and crack growth
- Stress corrosion cracking
Literature Survey

- Codes and Standards (14)
- Technical Papers (376)
- Technical Reports (10)
Codes and Standards

- International Standards Organization ISO 13623
- Canada CAS-Z662-99
- Germany GL 1995
- Norway DnV 1996
- Russia SniP2.05.06-85
- United Kingdom BS 8010 Pt.3, 7910 & 4515 & R/H/R6
- United States ASME B31.4, B31.8 & B31G
  API 1104 & 1107
**International Bodies**

- API: American Petroleum Institute
- ASME: American Society of Mechanical Engineers
- BSI: British Standards Institute
- CEGB: Central Electricity Generating Board
- CSA: Canadian Standards Association
- GL: Germanischer Lloyd
- ISO: International Standards Organization
Codified Defect Assessment Guidance

Weld Defects:
API 1104: Empirical Acceptance Standard: fitness-for-purpose criteria
BS 7910: Failure Assessment Diagram – fracture assessment criteria

Corrosion Defects
ASME B31G: Semi-empirical assessment of corroded pipes
Inspection Techniques

Flaw Types:

- Geometric Anomalies (dents, ovality or wrinkles)
- Metal Loss (corrosion, mechanical)
- Cracks (crack-like defects) (fatigue, SCC)
Industry Interviews

Regions

- US Gulf of Mexico
- UK and Norwegian North Sea

Objectives

- Current inspection practice
- Current defect assessment practice
- Perceived future trends
Technical Papers

Advances in Sub-Sea Pipeline Engineering: ASPECT, 1994
International Workshop on Offshore Pipeline Safety: MMS, 1991
Pipeline Crossing: ASCE, 1996
Deepwater Pipeline Technology Conference and Exhibition: Clarion, 1997 – 1999
+ numerous industry journals
Technical Reports

- US Minerals Management Service
- UK Health & Safety Executive
- American Petroleum Institute
- Operating Companies (incl. BPA & Exxon)
Database: Defect Types

- Corrosion (15)
- Mechanical damage (7)
- Girth weld defects (7)
- S-N (fatigue) and crack growth (9)
- Stress corrosion cracking (5)
## Database Statistics

<table>
<thead>
<tr>
<th>Defect Type</th>
<th>Test data</th>
<th>FE data</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mechanical</td>
<td>217</td>
<td>9</td>
<td>226</td>
</tr>
<tr>
<td>Corrosion</td>
<td>181</td>
<td>343</td>
<td>524</td>
</tr>
<tr>
<td>Crack</td>
<td>32</td>
<td>88</td>
<td>120</td>
</tr>
<tr>
<td><strong>Total data points</strong></td>
<td><strong>880</strong></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Phase II

- Commenced October 99’
- Appraisal of defect assessment methodologies
- Final report due March 2000
Concluding Comments

- Data capture and literature review
- Codified guidance and industry practice
- Available defect methodologies identified
- Defect database has been compiled
- Phase II – Appraisal commenced