

Alaskan Arctic Pipeline Workshop



Appraisal and Development of Pipeline Defect Assessment Methodologies

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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

CSA Z662: Work Quality Standard – engineering critical assessment

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



Offshore Technology Conference: SPE, 1985 - 1999

Int. Pipeline Conference: ASME, 1996 and 1998

Int. Conference on Offshore Mechanics and Arctic Engineering: ASME, 1990 – 1998

Int. Pressure Vessel Technology Conference: ASME, 1990 – 1998

Pressure and Piping Conference, AMSE 1990 – 1998

Int. Offshore and Polar Engineering Conference: ISOPE, 1997 and 1998

Pipeline Conference: API, 1990 – 1998

Pipeline Engineering Symposium: ASME, 1985 – 1990

Pipeline Engineering: ASME, 1991 – 1995

International Conference on Pipeline Protection: MEP, 1991 – 1997

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



Defect Type	Test data	FE data	Total
Mechanical	217	9	226
Corrosion	181	343	524
Crack	32	88	120
Total data points			880



Phase II

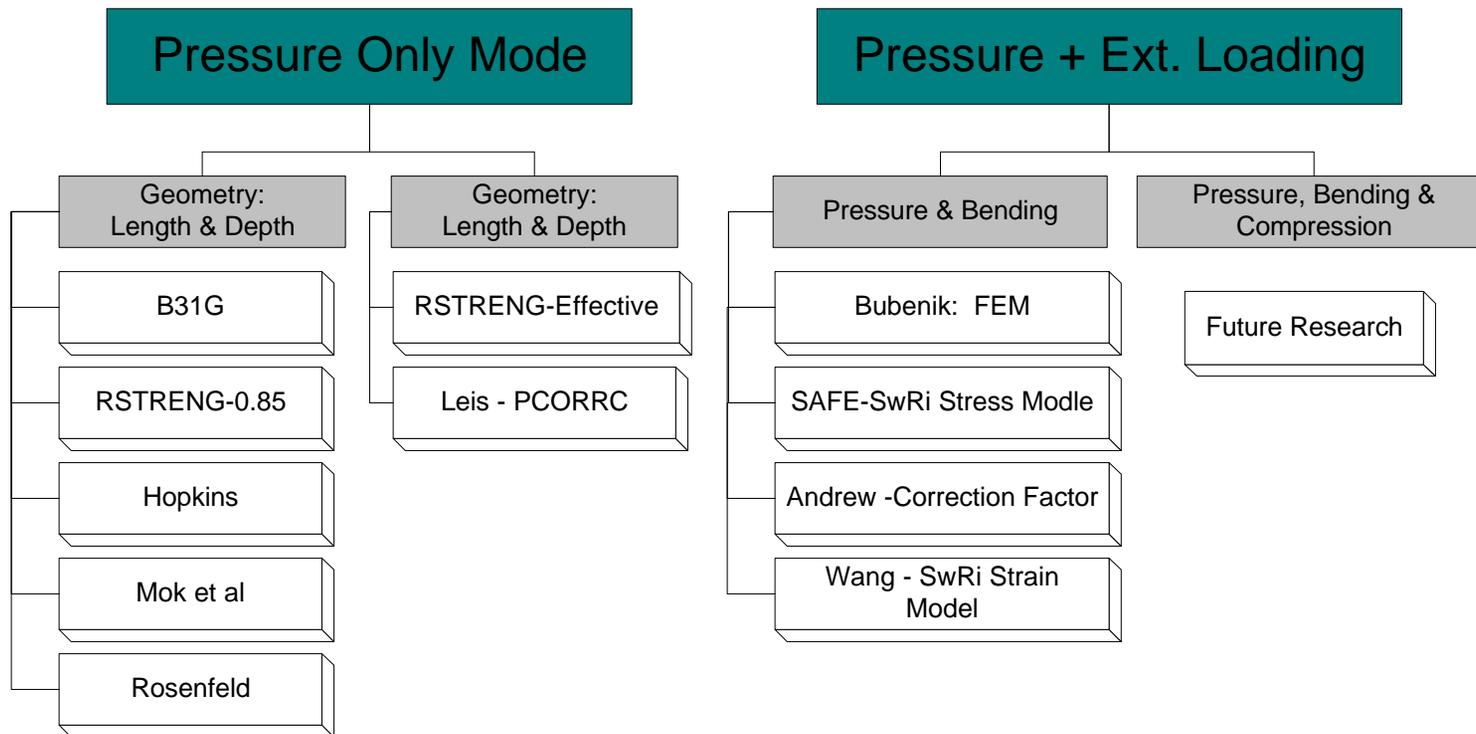


- Commenced October 99'
- Appraisal of defect assessment methodologies
- Final report due March 2000





Corrosion Defects





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

