Pipeline Integrity Management

presented by Na’el Barghouti
PII Pipeline Solutions
a GE Oil & Gas and Al Shaheen joint venture

Engineering Consultancy Services for Pipeline Integrity Review and recommendations for Selected Offshore Pipelines
What is pipeline integrity management?

- PIM is a subset of the Operations & Maintenance (O&M) function of Pipeline Operations
- It comprises those actions focused on preventing pipeline failures and ensuring:
  - Public and employee safety
  - Protection of the environment
  - Reliable service
- These actions generally include the following:
  - Inspection of the pipeline
  - Integrity assessment
  - Repair and remediation
  - Risk prevention and mitigation programs
  - Continual integrity assessment planning
In summary, we want to prevent these things....

- Corrosion (Internal/External)
- Mechanical Damage
- Incorrect Operations
- Loss of Ground Support
- Stress Corrosion Cracking
... from causing these things
Pipeline Integrity Management Process

**Core Process**

- Selection of Pipeline Segment
- Threat Identification and Risk Assessment
- Baseline Assessment
- Plan and Integrity Plans
- Integrity Assessment
- Discovery Management
- Repair & Remediation
- Reporting & Performance Measurement
- Continual Evaluation & Assessments
- Prevention and Mitigation
- Enablers
  - Document
  - Management of Change Process
  - Comm. Plan
  - Environment & Safety Process

**Notice**

NOTICE THE CENTRAL/KEY ROLE PLAYED BY DATA IN THIS PROCESS
Case Study - QP Selected Offshore Pipeline Integrity Assessment

- Engineering Consultancy study follows the methodology laid out by QP. The overall objective of the study is to:
  - Evaluate the condition of the 51 selected offshore pipelines
  - Establish their fitness-for-purpose and need for any remedial work
  - Determine the level of risk associated with continuing operating life
  - Identify the remedial measures and costs required to bring operation risks in line with standard industry practice levels
- The production of individual pipeline study reports
- Overall Pipeline Integrity Study Report (PIR)

Other deliverables:
- PIM document philosophy (Corporate Philosophy and Codes of Practices)
- GIS based Pipeline Management Integrity System (PIMS)
Study approach & methodology

The work is being carried out in five phases:

- Phase 1: Data gathering, review & integration
- Phase 2: Engineering evaluation of FFP
- Phase 3: Risk assessment
- Phase 4: Define SOW for FEED
- Phase 5: Development GIS based PIMS software
Study approach & methodology

Phase 1
Data gathering, review & integration

Phase 2
Engineering evaluation of FFP

Phase 3
Pipeline risk assessment

Phase 4
Define SOW for FEED

Phase 5
GIS based PIMS software & procedures

IMP’s
Volume of data...

- More than 5 GB of data gathered, checked & loaded including:

  - Alignment sheets for 51 pipelines (total of 965 km)
  - Centerlines set up
  - Survey results imported:
    - 107 ROV reports
    - 85 external UT reports
    - 9 ILI reports
  - Data elements for more than 90 attributes entered for multiple line segments (~40,000 individual entries)
Engineering evaluation

- Evaluation of the severity of over:
  - 600,000 ILI anomalies
  - 4,600 pipeline spans
  - 500 crossings
  - 100 stabilizations
  - 600 anodes (CP)

- Written deliverables...more than
  - 350 reports prepared
  - 250 risk profiles (before & after remediation)
  - 51 IMP’s developed

- Identified & provided cost estimate for:
  - Over 800 remediation activities
Supply of GIS Based PIMS System

- GIS Facility Data Management system (based on ESRI’s ArcGIS)
- Web Access Software
- Pipeline Integrity Management Software
  - Risk Assessment module
  - Data Alignment module
  - Feature Assessment Module
  - Integrity Planning Module
Integrity Management Software

- **Data Alignment Module**
  - Load and align various data sets to enhance analysis and visualization of pipeline data

- **ILI Feature Assessment**
  - Perform in-depth feature analysis for an understanding of current and future condition

- **Risk Assessment**
  - Accurately rank and forecast risk for cost-effective, long-term pipeline management

- **Integrity Planning**
  - Automatically and / or manually generate scenarios consisting of proposed mitigation actions. Compare between various scenarios based on risk reductions, costs and KPI performance
Data Alignment

- Tools to load & align data various data types and formats – in-line & above-ground inspections – for subsequent analysis & visualization
- Align new data to centerline or other inspection data
- Automatically or interactively establish matches or common features
- Immediate feedback of alignment based on user-established tolerances
- Graphic and tabular interface to target & align data
Feature Assessment

- Analyze and prioritize data for more effective prioritization and management of repairs
- Engineering critical analysis of feature data
  - Probability of Exceedance
  - Deterministic: (B31G, modified B31G, DNV)
  - Corrosion growth
- Configurable repair criteria including
  - API 1160
  - B31.8S
- Repair management
Risk Assessment

- Generate a risk profile including histogram of risk algorithm results and condition assessment results
- Perform threat screening
- Perform a data gap analysis with ability to directly edit pipeline data
- View and compare multiple risk results
- Generate output in charts and customizable reports
Integrity Planning

- PipeView Integrity provides the ability to generate integrity plans
- Create an auditable documented process for integrity management that is compliant with regulations
- Ensure company standards are achieved by incorporating the client’s guidelines on best-practices for mitigation and remediation
- Calculate the most cost-effective mitigation strategies for the client’s pipelines
51 Integrity Management Plans (Example)

1. FFP Evaluation

2. Threat identification & risk profile

3. Recommended remediation activities
Pipeline Life Extension

- Notional design life is 25 years
- 38 pipelines have exceeded 25 years design life
- Main concerns (of this study) to remaining useful life are time dependent threats:
  - Internal corrosion Mitigated/Monitored by ...
  - External corrosion rehab
  - Stability
  - Sour cracking
  - ILI/auto UT/inhibition/sampling
  - CP surveys/anode retrofits/coating
  - Repair anomalous spans, crossings
  - Control internal corrosion risk
- As long as pipelines are regularly monitored for all relevant threats, maintained & remediated as required they can continue to be operated beyond design life indefinitely until economically unviable
- Life extension relies more and more heavily on effective use of increasing volumes of data as the life extension process matures.