High Temperature Guided Wave Pipe Inspection

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Guided Wave Testing (GWT)

- Long Lengths of Pipe Examined
- Upstream and Downstream Inspection
- Extensive Insulation Removal Not Required
GWT

- 100% of Pipe is Inspected Over Test Range
- Performed in Pulse-Echo Mode
- Performed with Pipe in Service
Wave Modes

- Torsional Mode - Shear Mode
- Longitudinal Mode - Compression Mode
Data Display

- A-Scan – Signal Amplitude vs. Distance
- C-Scan – Signal Amplitude as Colour Plotted vs. Distance and Circumferential Position
- Frequency Sweeping
Data Display (cont)

- Normalized amplitude range (weld DAC is 0 dB)
- Pipe schematic
- Dead zone
- Near field
- Weld DAC
- Call DAC
- End of test range
Symmetric Wave

- Symmetrical features create symmetrical reflections proportional to the change in cross-sectional area (circ welds, flanges, etc)

Black Data Trace are Symmetric Signals
Asymmetric Wave

• Asymmetrical features create symmetrical reflections and mode-converted flexural waves (corrosion, T’s, branch connections, supports, etc.)
Reflectors Aspect Ratio

- Equivalent Cross Sectional Wall Loss
- Different Severities and Corrosion Depths

![Graph showing amplitude vs. distance with more serious and less serious corrosion levels]
Calibration

• Machined Reference Reflectors Not Feasible
• Circ Welds Reflect 20 – 25% of Sound
• Set DAC on Circ Welds
• Screening Inspection

Distance-Amplitude Correction (DAC) based on regular features such as welds.
Range

- Range Depends on Many Factors
  - Pipe Coating
  - Presence of Corrosion
  - Buried
  - Pipe Contents
- Typical Range is 70 m
Example – Pipe Corrosion
High Temperature Methodology

- Previously Only Available for $T \leq 150$ °C
- High Demand for Inspection of Hot Piping
- GUL Designed High Temperature Rings
- Field Testing at CNRL in Alberta
- 8 Inch Steam Assisted Drainage (SAGD) Line
Ambient Temperature Test

- Temperature Raised from Ambient to 340 °C
- Raised in 50 °C Increments
- Test Duration Limited to 5 min at High Temp
Comparison to 340 °C
Conclusions

• New Capability of GWT on Piping to 400 °C
• Allows On-line Inspection of Hot Piping
• Significant Guided Wave Testing Advance