WALES&WEST UTILITIES

‘Life Extension’ of Ageing Pipelines
(Management of Ageing Assets)

Grant Rogers - Asset Integrity Manager, WWU

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Ageing LTS Pipelines

LTS Life Extension Challenge

- During the past two years all Gas Distribution Networks have been negotiating their Regulatory Settlement for the next 8 years (2013-2021)
- One of WWU's significant challenges has been to demonstrate 'Effective' and 'Efficient' management of ageing Transmission Pipelines in it's RIIO-GD1 Business Plan
- Innovation through the application of Condition Based Risk Management models to generate Health & Risk Indices
- Use of UKOPA data to demonstrate in context the issues faced in Wales
- Intervention Options and WWU Pipelines Asset Strategy
- Securing an appropriate level of funding in Ofgem's Final Proposals to satisfy the needs of stakeholders including consumers and the HSE

Ageing LTS Pipelines

Effective & Efficient Challenge

- The population of old LTS pipelines (1965 and earlier) operated by WWU is proportionately higher than that of any other UK pipeline operator by a factor of 2.5
- This population of pipelines presents specific issues due to their construction quality including the large number of low strength sub-standard welds
- The issues identified mean that WWU is at risk of major non-compliance as Duty Holder under:
  - the Pipelines Safety Regulations in ensuring that the risks to the public are as low as reasonably practicable (ALARP), and
  - the Gas Safety (Management) Regulations in ensuring security of supply and the avoidance of interruption, especially to domestic gas users

Ageing LTS Pipelines

Effective & Efficient Challenge

- The majority of the old, pre TD/1 standard pipelines in other areas of the UK have been either:
  - down-rated to distribution pressures;
  - upgraded to meet TD/1 Edition 2 requirements; or,
  - have been replaced by reinforcement schemes required to meet growing demand.
- Due to the minimal load growth in the small, remotely located population groups in Wales, the old transmission pipelines in Wales were not comprehensively captured in this process.
- Wholesale replacement of this population is not economically viable
  - Replacement cost estimated at = £2bn (30:30 iron programme = £1bn)

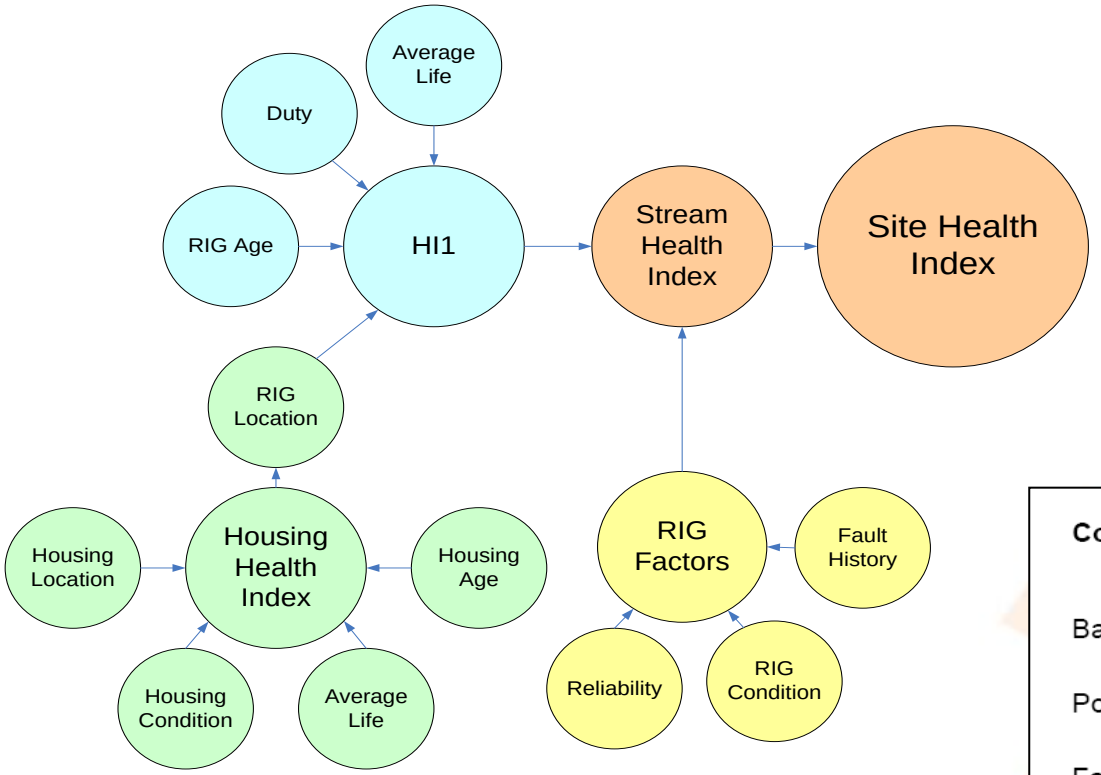
Innovation

Application of CBRM

- Innovation, developing leading asset management techniques with industry experts and academics
- Condition Based Risk Management methodology, used in the Electricity industry, developed to apply to Gas Assets
- Current condition defined from construction data and maintenance data from which future condition is forecast using CBRM model
- Define significant condition criteria, code information numerically, apply weightings and develop a simple algorithm to generate a HI for each asset.
- A Health Index is means of combining varied and relatively complex condition information as a single number
- Rank and apply calibration
- Estimate probability of failure

Health Index

CBRM for Above Ground Assets



Static asset data combined with external condition and fault rates to set each Pressure Reduction Station on a scale of 1-10

Condition	Health Index	Remnant Life	Probability of Failure
Bad	10	At EOL (<5 years)	High
Poor		5 - 10 years	Medium
Fair		10 - 20 years	Low
Good	0	>20 years	Very low

Health Index

CBRM for LTS Pipelines

- Model developed to define proximity to ‘End of Life’ for each pipeline section
- Estimates likelihood of failure represented as HI based on condition
  - Used to estimate the time to failure
- Failure based on average expected asset life +/- x years
  - Influencing factors include: wall thickness, effectiveness of the CP system, depth of cover, material grade, faults and defects, etc.
- Identified 234km worst condition pipelines (HI>7 before 2021)

Health Index

CBRM – Use of Results

- Integrity Studies to validate model and identify possible life extending intervention options
- Focussed on pipelines with high HI – included full route analysis and sample NDT of joints
- Results – most are still in original condition, albeit not to current standards.
- Issues
  - Pipelines not historically split into standard units
  - Faults not historically assigned to specific parts of the pipeline
  - Faults not historically ranked – 1 fault = corrosion hole or CP post knocked over.
  - Well maintained pipeline could have indefinite life
- Risk – consequence of failure varies significantly, but PSR is absolute
- Large and varied sample is statistically reliable in determining future workloads, further studies will be commissioned to affirm interventions

Ageing LTS Pipelines

UKOPA Data

- The pipeline network developed in Wales to serve remote communities located in difficult terrain, as a consequence this resulted in:
  - shallow trenches (i.e., shallow depth of cover over the pipelines);
  - a large number of above-ground sections
  - welding using the ‘spigot and socket’ joint arrangement (as applied in low pressure distribution systems)
  - welding quality below that established by the earliest subsequently published standards, and therefore as a result highly unlikely to be able to withstand any adverse loading event compared with a pipeline built to those standards
  - pipelines constructed in sections of variable diameter
  - as the communities requiring supply were remote and fairly small, the pipelines tended to be small diameter.

Ageing LTS Pipelines

UKOPA Data

- The old sections of gas transmission pipelines in Wales were constructed in 1965 or earlier and do not meet the quality established by the earliest subsequently published construction standards.
- Analysis of the pipeline data relating to old (1965 or earlier) UK pipelines recorded in the UKOPA pipeline database shows that 14% (941 km) of the length of pipeline commissioned in 1965 or earlier is in WWU
- 95% (891 km) of this population is in Wales
- Analysis of the leak data in the UKOPA database shows that 50% (131 of 263 leaks) of the leaks recorded on UK pipelines have occurred in the population of old pipelines in WWU, and 47% (124) of these leaks have occurred on old pipelines in Wales
- This leak rate is a factor of 5.5 times higher than that of other old pipelines in the UK. Of the leaks reported on old pipelines in Wales, 50% are due to failed girth welds, corrosion and internal Stress Corrosion Cracking (SCC)

Intervention Options

WWU Business Plan Principles

1	2	3	4	5	6	7
Active	Active	Active	Reactive	Active	Active	Reactive
Full Replacement	Refurbishment	Enhanced condition monitoring & risk management	Non Routine Maintenance – major fault repair	Non Routine Maintenance - planned	Routine Maintenance	Fault response & repair

- Cost Benefit Analysis utilised in decision making.
- Whole life cost approach utilised.
- Varies by asset group

Intervention Options - pipelines

WWU BP Principles – LTS Pipelines

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Range of options (1-6) utilised for pipelines

- Full replacement where cost effective (Complete 2008-13)
- Determine ranked order of LTS Pipelines by HI
- Refurbish locations where a major accident potential exists
- Additional inspection to identify deterioration early on pipelines HI > 7
- Routine maintenance for majority of pipelines continues

Ageing LTS Pipelines

Steps to Acceptance of Asset Strategy

Steps	Status
Demonstrate compliance with S. Case – Good as or better than now	Draft risk and impact assessment submitted to HSE November 2012
Codify management of assets	Detailed description drafted, July 2012
Outline approach to HSE	Draft submitted to HSE, August 2012
Discussions with Ofgem	Approach outlined to Ofgem, Sept 2012. Final proposals outlined December 2012
Seek HSE Guidance	KP4 recommended – WWU have adopted for onshore assets

Pipelines Asset Strategy – to comply with HSE KP4 technical policy

Key Components

1. CBRM – HI>7.0, non piggable pipelines
   - 234km out of 2500km (continue routine maintenance for others)
2. Integrity Studies – actual condition assessment
3. Identify ‘Hot Spots’ - Major Accident & high likelihood locations
4. Determine intervention options at each location (outline definition)
5. Determine intervention options for non ‘hot spots’ (routine and non-routine maintenance)
6. Commercially engineer solution and test against ALARP (Detailed definition)
7. Detailed design and approve
8. Complete intervention
9. Update records and report outputs

Procedure for the management of ageing assets and life extension

- WWU/PM/ALE/1 – KP4 derived risk based approach:
  - Recognition of ageing and where it may be occurring
  - Review of extent, frequency and robustness of inspection and maintenance
  - Re-rating or replacement of work equipment
  - Justification of the plant remaining in service
- Processes to determine deterioration of the pipeline assets:
  - CBRM Health Index calculated (Condition Based Risk Management)
  - HI > 7.0 receive further assessment, including integrity studies
- Asset Management Plans
  - Focus on high consequence areas
  - Wide range of intervention options considered – ALARP style approach

Thank you - Questions