Wilton to Grangemouth Ethylene Pipeline - Block Valve Integrity

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INEOS

WGEP Background

Commissioned:	1979
Design:	99.3 barg, -10 to 38 degC
Length/Size/Spec:	250 km/10”/Class 600
Valves:	18 valves stations. Remote monitoring and operation from Wilton Ethylene Control Room by Sabic.
Care and Maintenance:	INEOS Grangemouth for Scottish section Sabic Wilton for English section

Ethylene Leak in 2004

- Routine visit to Block Valve 15 near Peebles, Feb 2004.
- Ethylene present in cubicle
- Traced through new cable ducting installed to route buried cables from valve/PT's to control equipment in cubicle.
- Valve site excavated and ethylene leak found at weld on ¼" lubrication injection pipework associated with 10" block valve.

Leaking Pipework

Leaking Pipework

Inspection and Repair

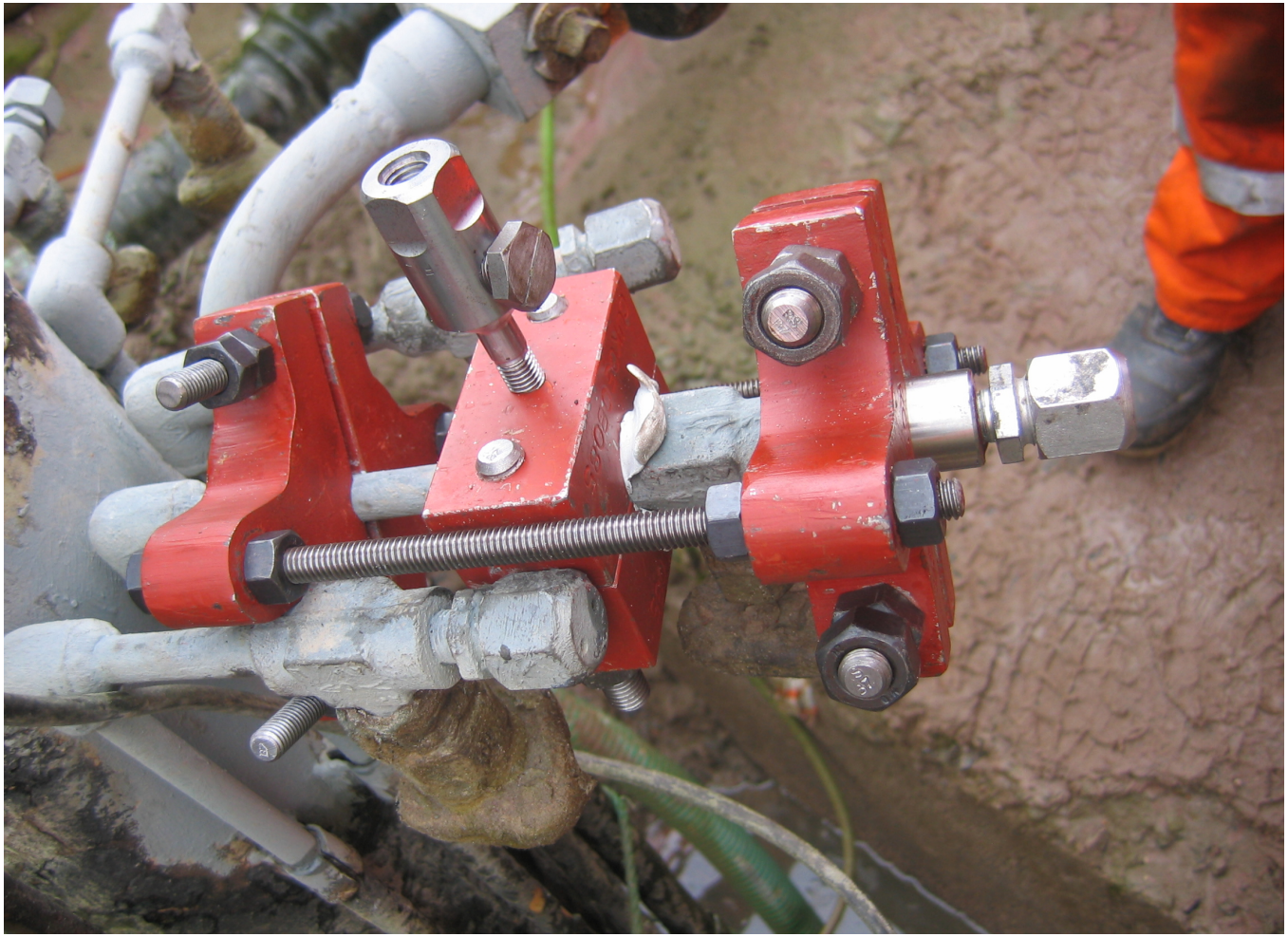
- Urgent repair arranged. No option for hot work so Mechanical Clamp fitted.

Inspection and Repair

- Program of inspection works planned for remaining valve stations.
- In Scottish sector BV11/13/14/15/16 & 17 excavated and inspected. Radiography + Dye Pen + Visual.
- Sabic carried out parallel inspections on Southern section of WGEP.
- Inspection revealed;
  - Porosity
  - Cracking
  - Insufficient throat thickness
  - Lack of fusion
  - Undercut
  - Inclusions
  - Poor socket weld fit up ie. no gap, excessive gap

    -on many of the small bore pipework welds on both the 10” main block valves and 4” by-pass valves.
- A further 6 mechanical clamps fitted in Scottish sector between 2004 and 2007 to both seal leaks and provide reinforcement where defects were assessed as presenting risk.

Inspection and Repair



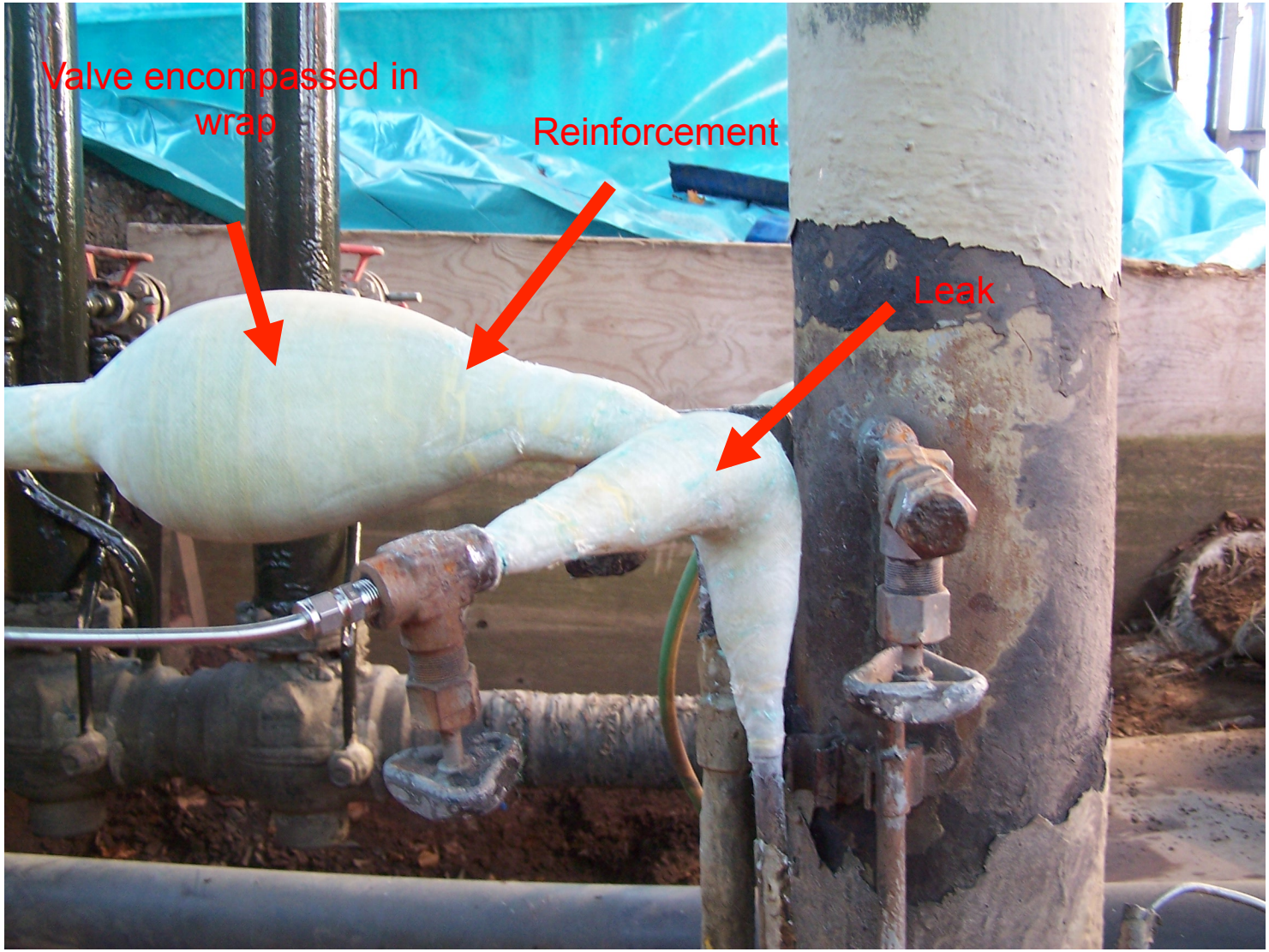
Mechanical Clamps - Problems

- Temporary – INEOS policy is yearly inspection and removal after 5 years in service. Limited number of reinjections allowed.
- Expensive – bespoke design and manufacturer for each clamp location. Costs circa £3k-£4k each.
- Cumbersome – awkward to fit and often clashes with other pipework
- Imposed stress – careful fitment required to prevent over stressing of already weak weld
- Design/approve/fabricate process can be lengthy.

Alternatives??

- In 2007 began discussions with Walker Technical Resources on use of new standard ASME PCC-2 ‘Repair of Pressure Equipment and Piping’ – Part 4 deals with non-metallic repair methods.
- Composite Wrap repair approved for use in late 2007 and used at three locations at BV-17, including one leaking weld.

Composite Wrap Repair at BV17



Composite Wrap Repair at BV17

PROS

- Permanent
- Simple
- Short timeframe from PO to installation
- Standardised design (11 wrap system) encompasses all foreseeable WGEP small bore repairs.

CONS

- Surface prep critical and sometimes difficult to achieve in field
- Specialist required to apply wrap
- 24-48 hour cure time (temp. dependent)
- Costs comparable to mechanical clamps
- Costs drive need for extensive inspection works

<u>Alternatives??</u>

Use of Lokring Fitting to Replace Pipework

- Lokring provides a means of connecting cut pipe sections together without the need for hotwork.
- Uses hydraulic compression to plastically deform Lokring fitting onto pipe OD forming an interference fit.
- Used previously for low pressure services.
- Assessed by INEOS Grangemouth for use on small bore BV pipework at pipeline design temp/pressures.
- Risks assessed for removal of old pipework and Lokring application as no positive isolation available
- Approved in April 2009 and used at BV17 on 10” small bore injection pipeworkl

Use of Lokring Fitting to Replace Pipework

- Fit up sequence

Lokring Repair at BV17

Allowed complete removal of previously wrapped leaking defect

Lokring Repair

PROS

- Permanent
- Simple
- From pipe cut to Lokring compression takes 10-15 minutes
- With simple training, can be installed by Pipelines Team
- Cheap – ¼” fitting is £65, equipment rental £130/day
- Removes most of the defective small bore welds
- Costs mean standard approach to all valve stations can be taken which is;

  – *Inspect only those welds that cannot be replaced with Lokring*
  – *Selectively use pre-approved composite wrap repair on these welds*
  – *Replace all other small bore pipework using Lokring – no need to inspect these.*

END