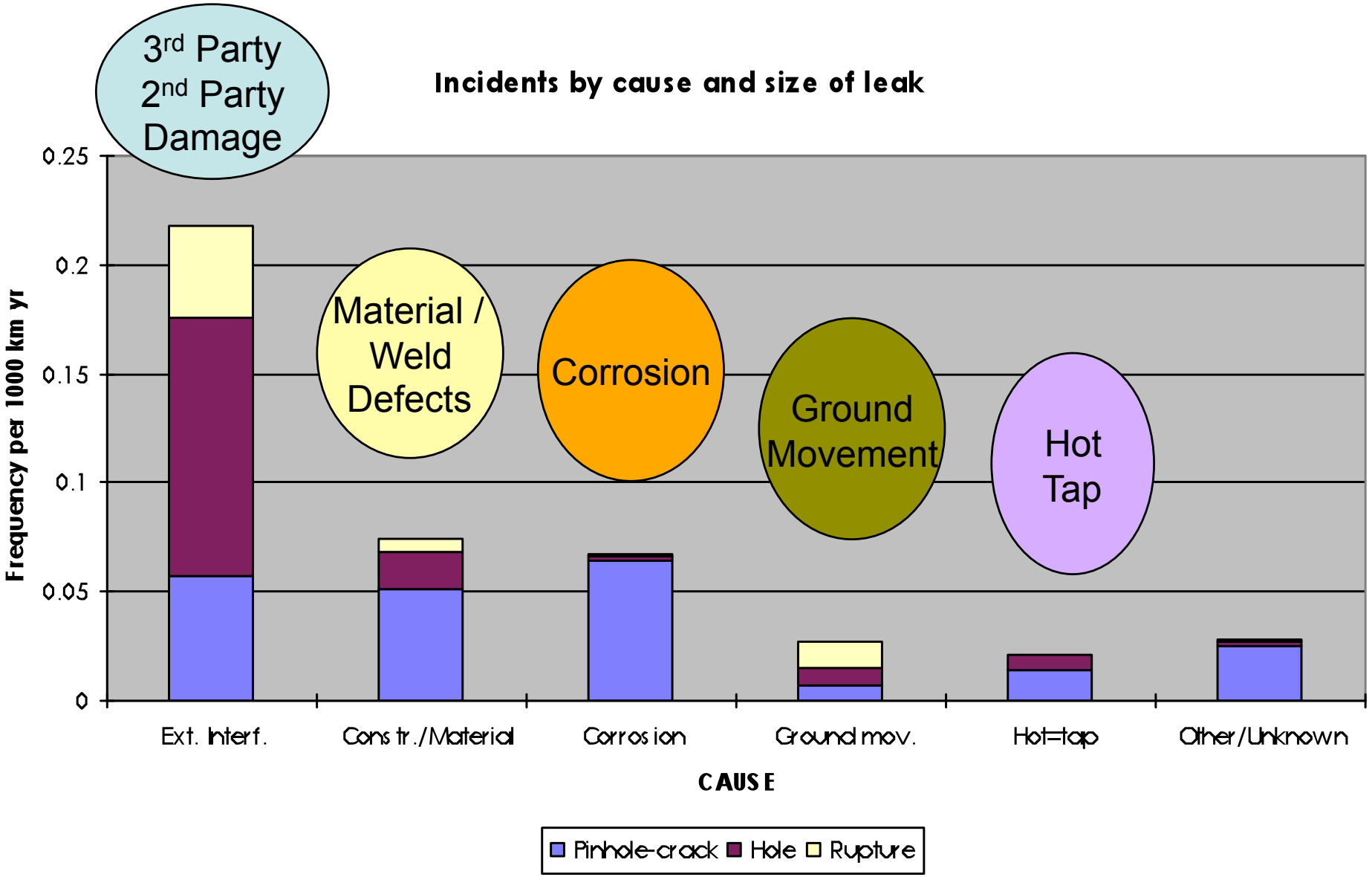
Example of Pipeline damage and failure causes and case histories

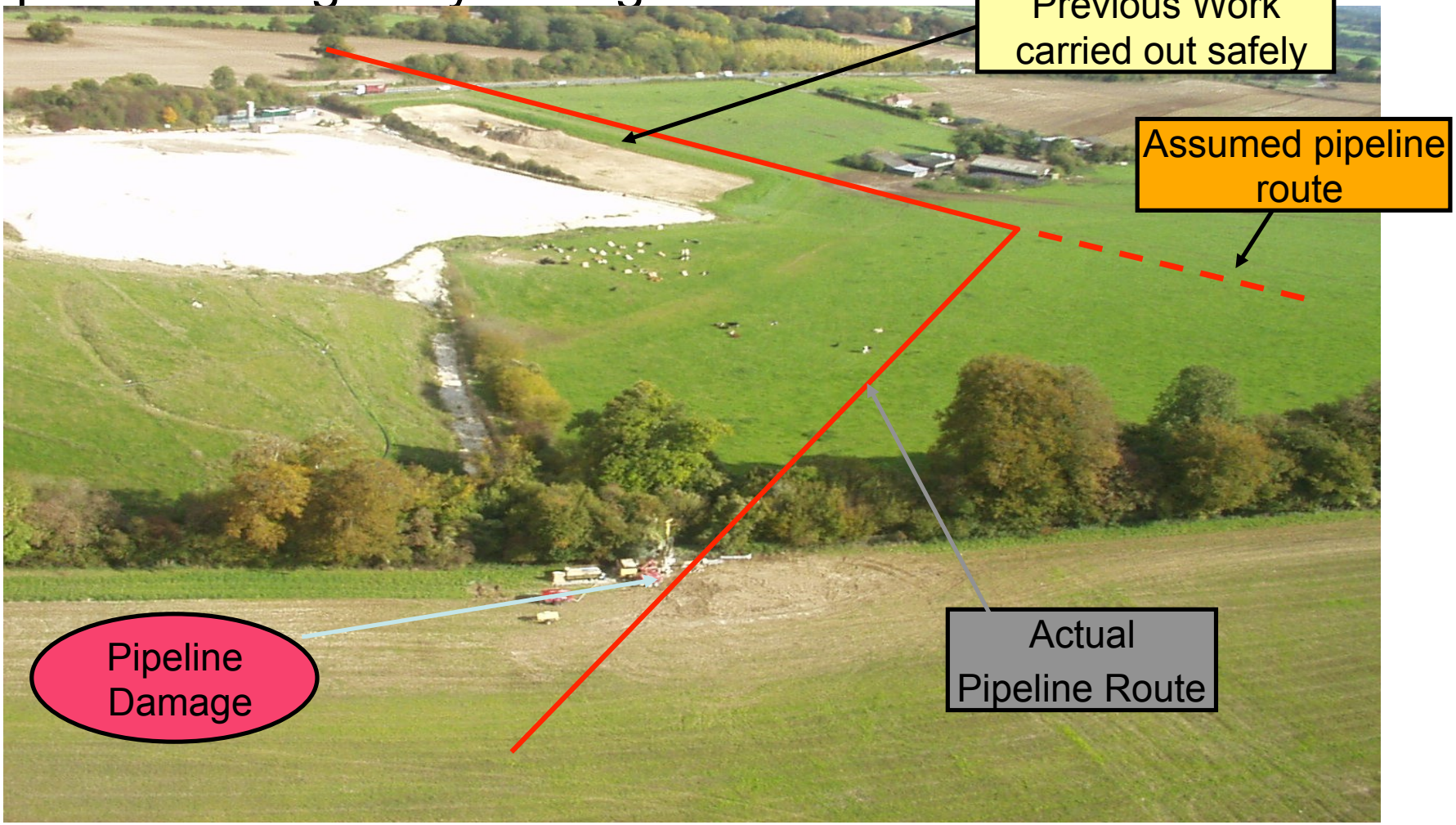
Tony Stonehewer

Loss of Gas Incidents by Cause & Size of Leak (data from Western Europe, EGIG)



3rd Party Damage Example

Pipeline damaged by drilling machine



3rd Party Damage Example

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3rd Party Damage Example

Causes – Human Errors

- Poor Communication
- Lack of Site Survey
- Lack of understanding of issues competence of Landfill site manager
- Lack of competence of Bore hole team
- Lack of pipeline identification

Actions Taken

- National Training Programme agreed with Landfill Operator
- Marker Post replacement scheme

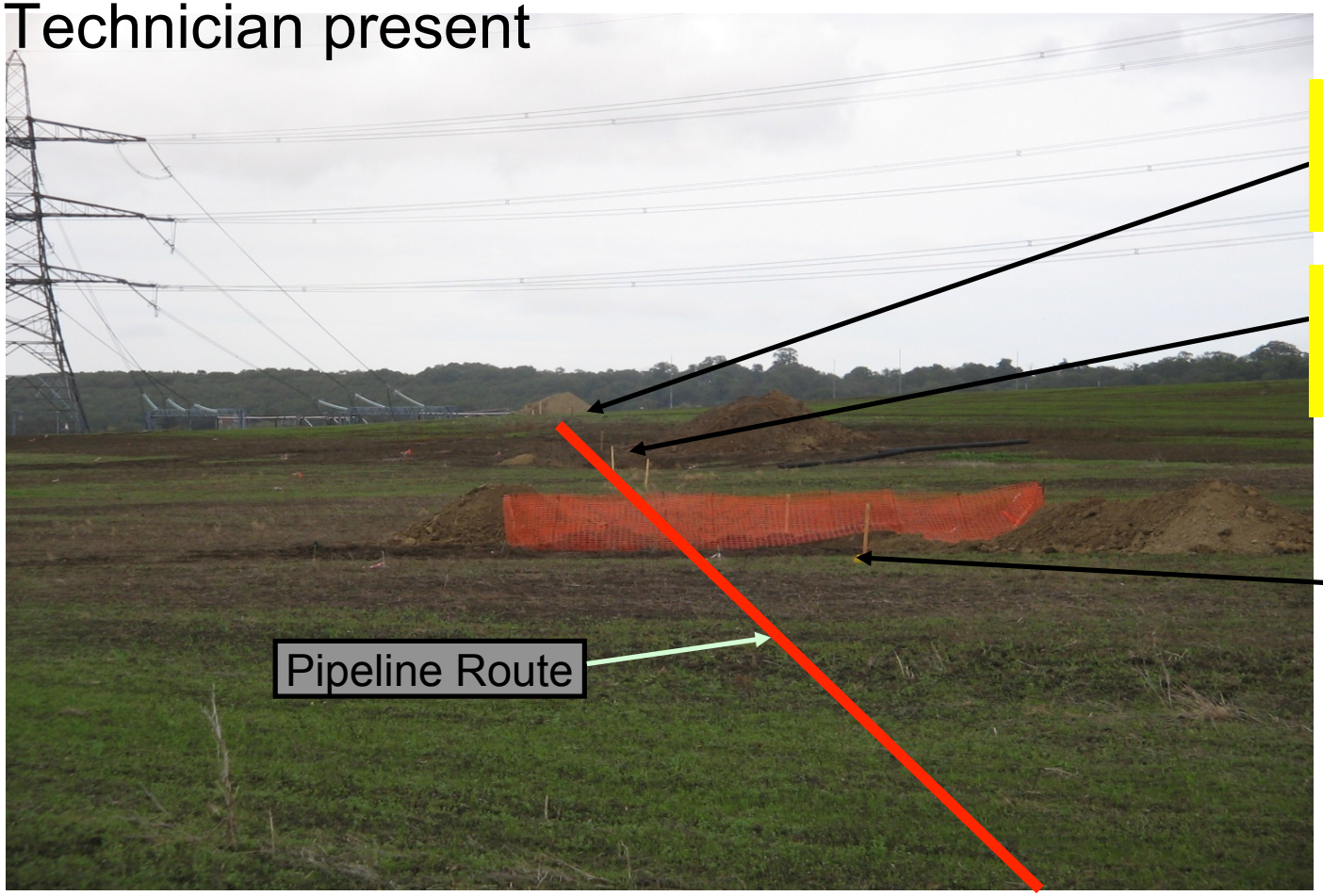
2nd Party Damage Example

Trial holes to find position of pipeline monitored by Pipeline Inspector

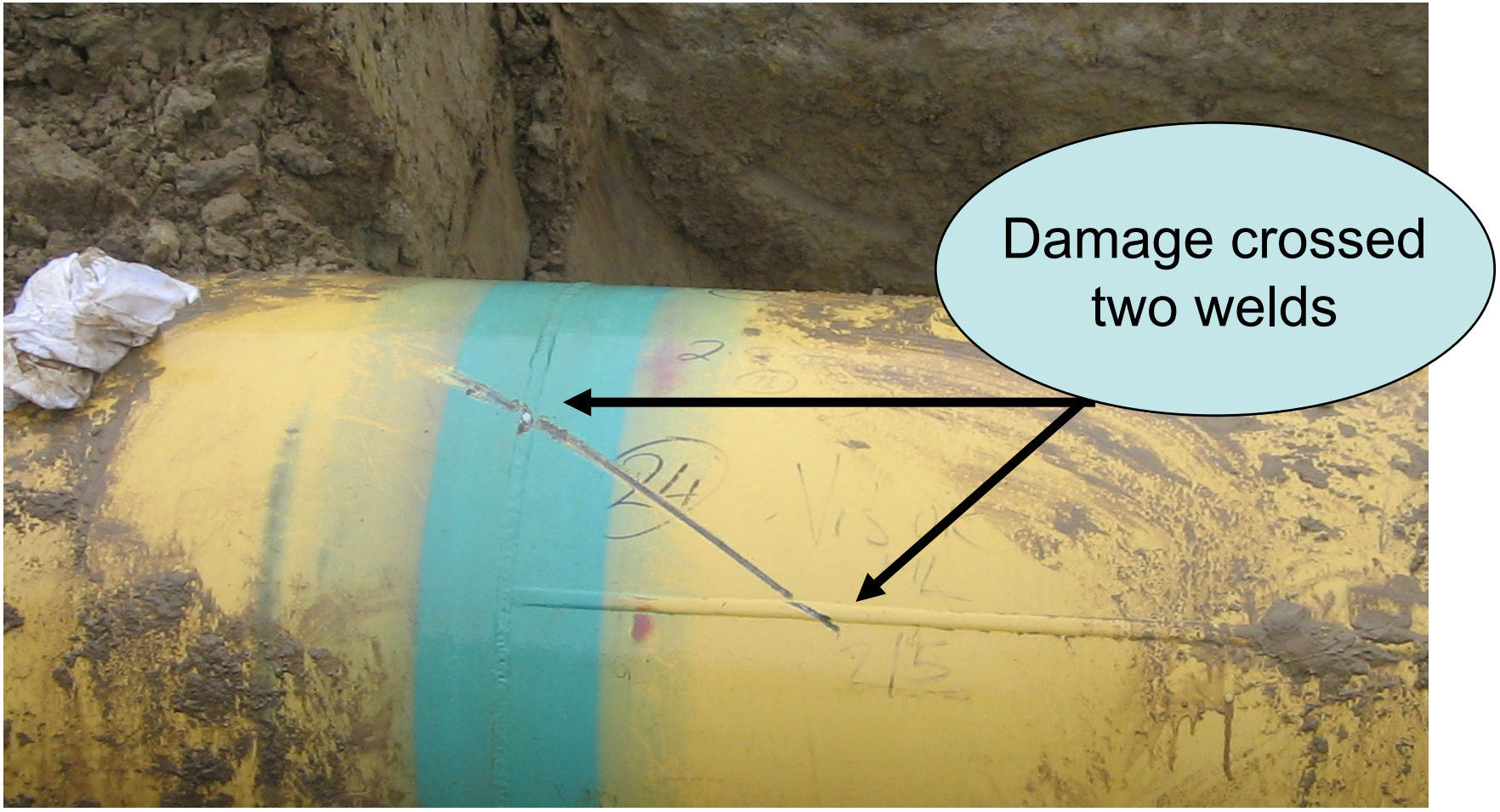
- Pipeline Details
- Diameter: 750mm
- MOP: 70 Bar
- NWT: 11.91mm
- Grade: X52

2nd Party Damage Example

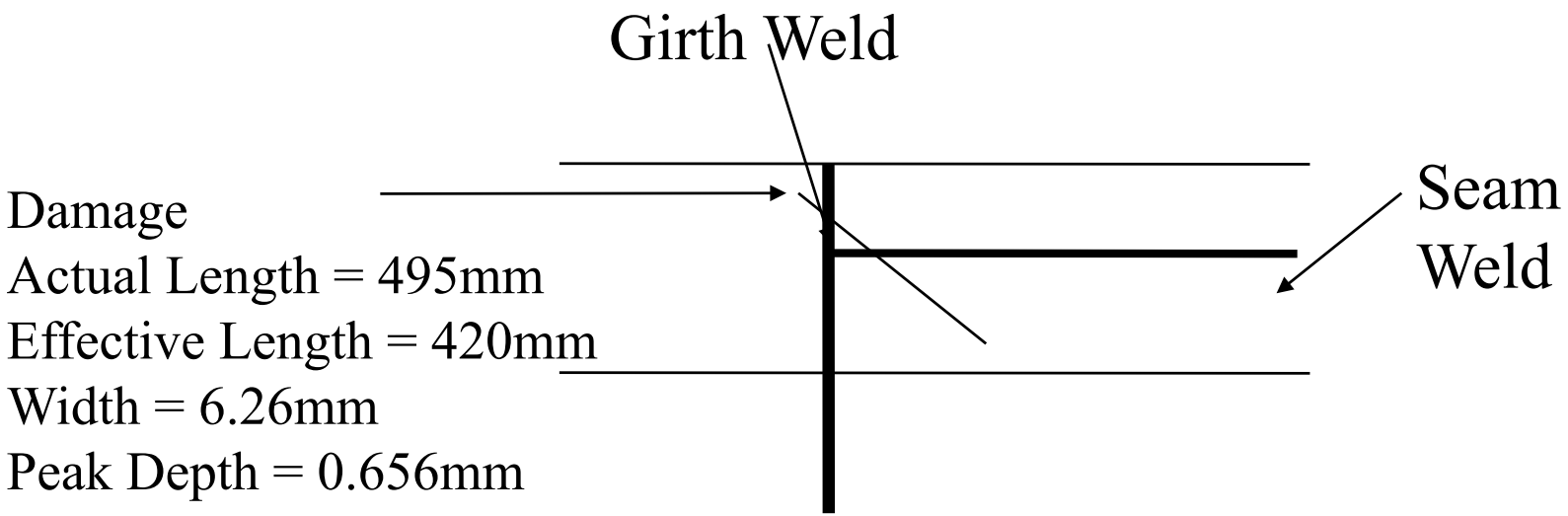
Pipeline damaged by mechanical excavator whilst Pipeline Technician present



2nd Party Damage Example



2nd Party Damage Example



2nd Party Damage Example

T/PM/P/11

TABLE 8 - Damage categories for damage to seam welds, girth welds and their heat affected zones, for pipelines constructed from steels up to grade X65 (L450)

Type of Damage	Damage Categories			
	Superficial Damage	Moderate Damage	Severe Damage	Extreme Damage
Welding Arc Strikes (9.2.2)	All Types	N/A	N/A	N/A
General Corrosion	Refer to Tables 1 to 4 inclusive, as appropriate (see Note)			
Pitting Corrosion	Refer to Tables 1 to 4 inclusive, as appropriate (see Note)			
Cracks or Spalling (App. H)	N/A	N/A	*f* equal to or less than 0.2 irrespective of length *f* equal to or less than 0.3 and *L* equal to or less than 0.6R (see Note) *f* equal to or less than 0.5 and *L* equal to or less than 0.35R (see Note) *f* equal to or less than 0.72 and *L* equal to or less than 0.2R (see Note)	N/A *f* equal to or less than 0.3 and *L* greater than 0.6R *f* equal to or less than 0.5 and *L* greater than 0.35R *f* equal to or less than 0.72 and *L* greater than 0.2R
Smooth Dent (7.4)	N/A	N/A	*f* equal to or less than 0.2	*f* greater than 0.2
Smooth dent plus cracks or smooth dent plus spalling (App. H & 7.4)	N/A	N/A	*f* equal to or less than 0.2	*f* greater than 0.2
Smooth dent plus gouge (App. H & 7.4)	N/A	N/A	*f* equal to or less than 0.2	*f* greater than 0.2
Kinked dent (7.4)	N/A	N/A	*f* equal to or less than 0.2	*f* greater than 0.2
Gouge (App. H)	N/A	N/A	*f* equal to or less than 0.2 irrespective of length *f* equal to or less than 0.3 and *L* equal to or less than 0.6R (see Note) *f* equal to or less than 0.5 and *L* equal to or less than 0.35R (see Note) *f* equal to or less than 0.72 and *L* equal to or less than 0.2R (see Note)	N/A *f* equal to or less than 0.3 and *L* greater than 0.6R *f* equal to or less than 0.5 and *L* greater than 0.35R *f* equal to or less than 0.72 and *L* greater than 0.2R
Stress corrosion cracking	N/A	N/A	*f* equal to or less than 0.2	*f* greater than 0.2

N/A = Not applicable
f = Design factor
L = Effective length of defect (See Appendix H)
R = Radius of damaged pipe.

NOTES If the damage is coincidental with welding defects, or with the seam welds of ERW pipe, or if the pipeline has a history of poor quality welds with low toughness, the damage should be re-categorised as Extreme Damage. The damage should either be repaired or expert assistance sought.

Damage is assessed using T/PM/P/11 table 8

- Referring to table 8 (gouge) the pipeline design factor is greater than 0.5 and less than 0.72
- The effective length of defect x 0.2R = 420mm x 0.2R = 76mm.
- Defect is categorised as ‘Extreme Damage’

2nd Party Damage Example

Repair

Epoxy Shell

2nd Party Damage Example

Immediate Causes – Human Factors

- Failure to follow Work Procedure Maint/5028
- Failure to follow Safe Operating Procedure SSW/22

Root Causes

- Inadequate training
- Shortfall in Competency Assessment
- No workplace monitoring carried out

2nd Party Damage Example

Actions Taken

1 Raise awareness of Work Procedures

2 Training package to be introduced to cover supervision of mechanical excavation within 3 metres of HP pipelines (above 7 Bar)

5 Issue searcher bars

6 Pipeline Technician's to attend a people management course to help teach them how to be assertive

5 Pipeline technicians to be trained in the duties of banks person

6 Safety Technical Competency specific entry to cover supervision of mechanical excavation within 3 metres of HP pipelines (above 7 Bar). Training to have been attended.

Corrosion

Corrosion defect identified by routine In Line Inspection

Pipeline Details

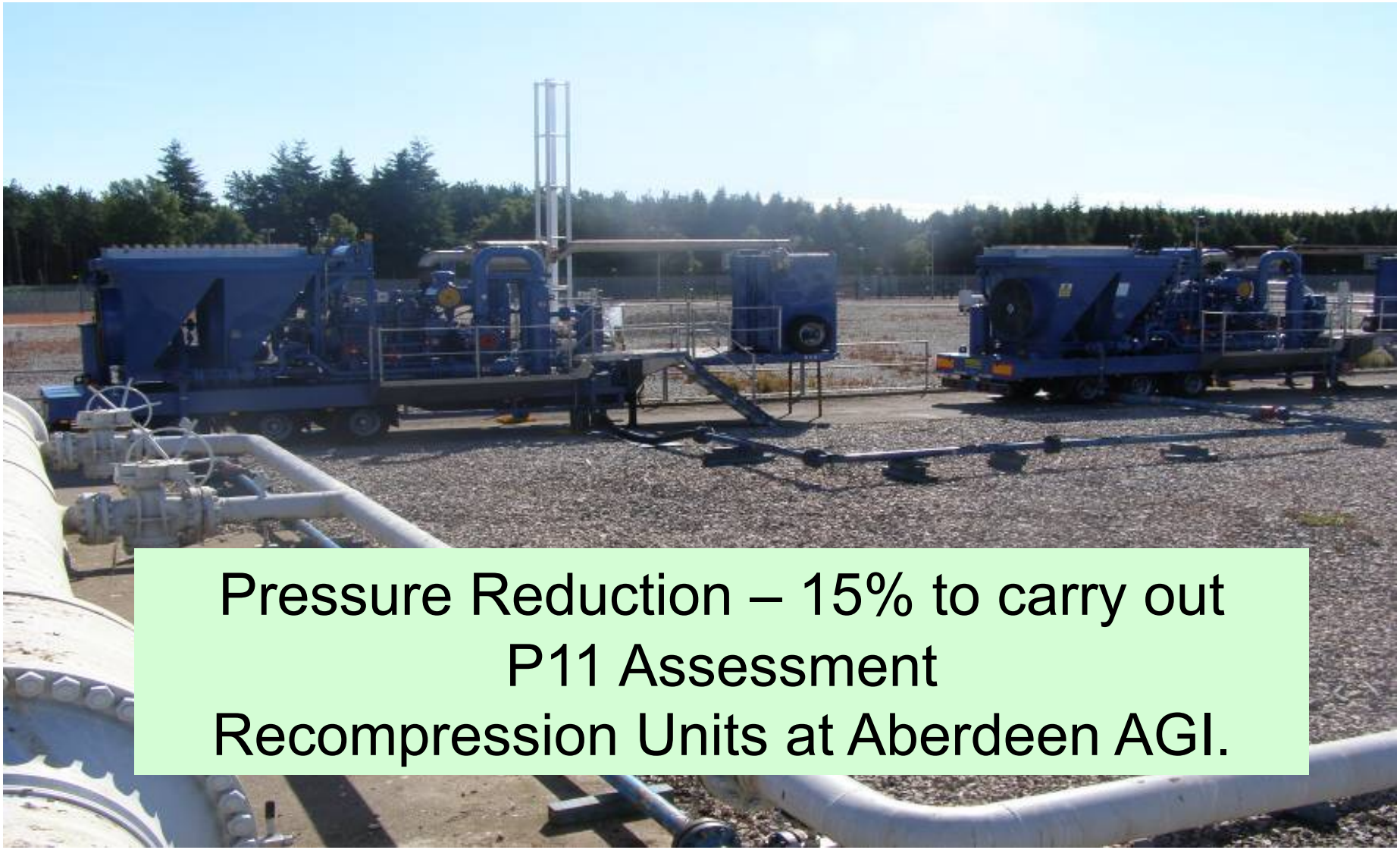
- Diameter: 900mm
- MOP: 70 Bar
- NWT: 12.70mm
- Grade X60

Corrosion Feature Reported

Peak Depth – 28%

Average Depth – 14%

Corrosion



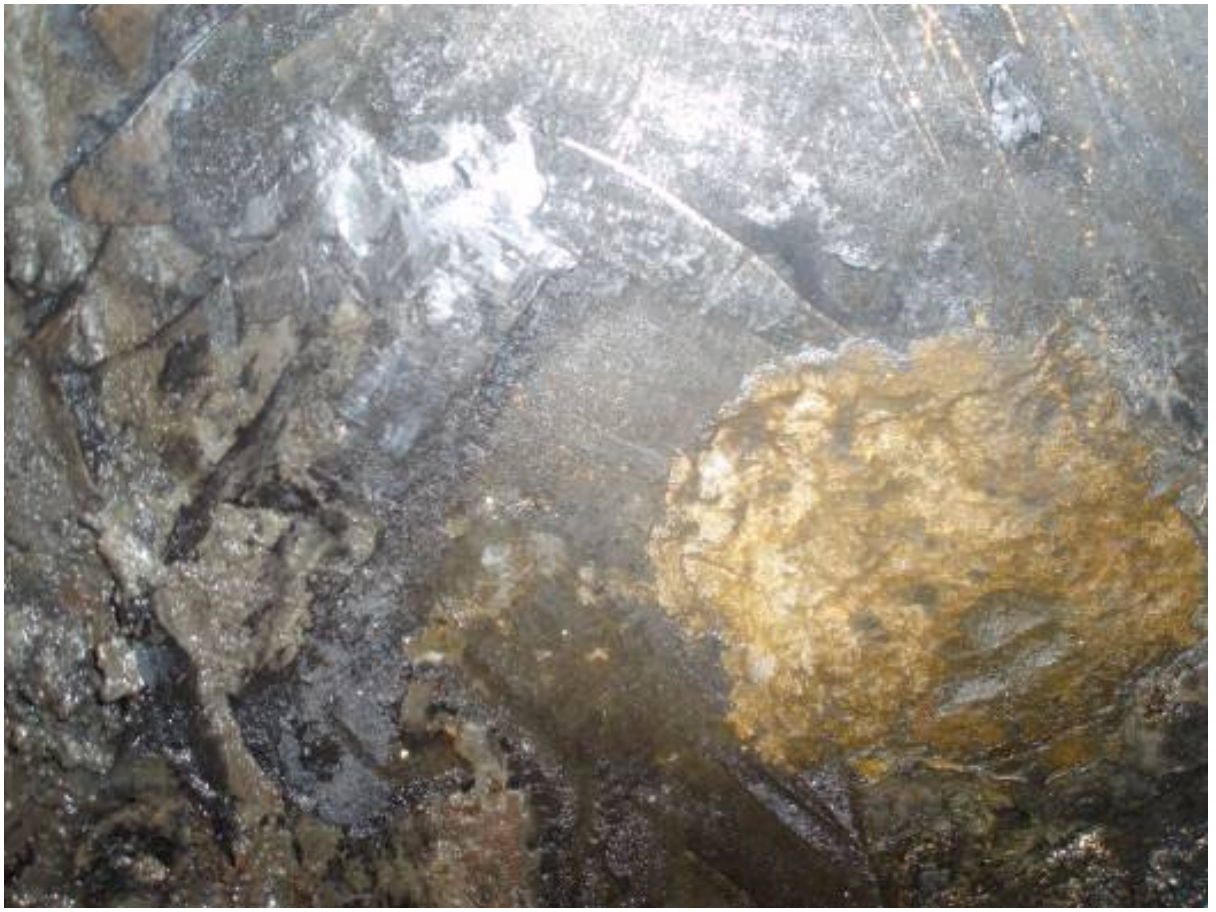
Pressure Reduction – 15% to carry out
P11 Assessment
Recompression Units at Aberdeen AGI.

Corrosion

General corrosion

Extreme Damage

Actual Length = 110mm
Effective Length = 110mm
Width = 110mm max
Peak Depth = 5.2mm (39%)



Corrosion

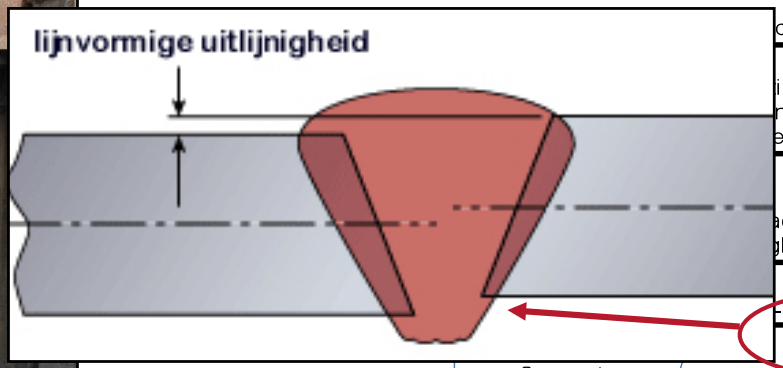
Repair- Epoxy Shell

Material / Weld Defects

Incident in the Netherlands

Whilst carrying out routine inspection on the pipeline easement an employee found gas leaking from funnel like holes and bubbling

Material / Weld Defects



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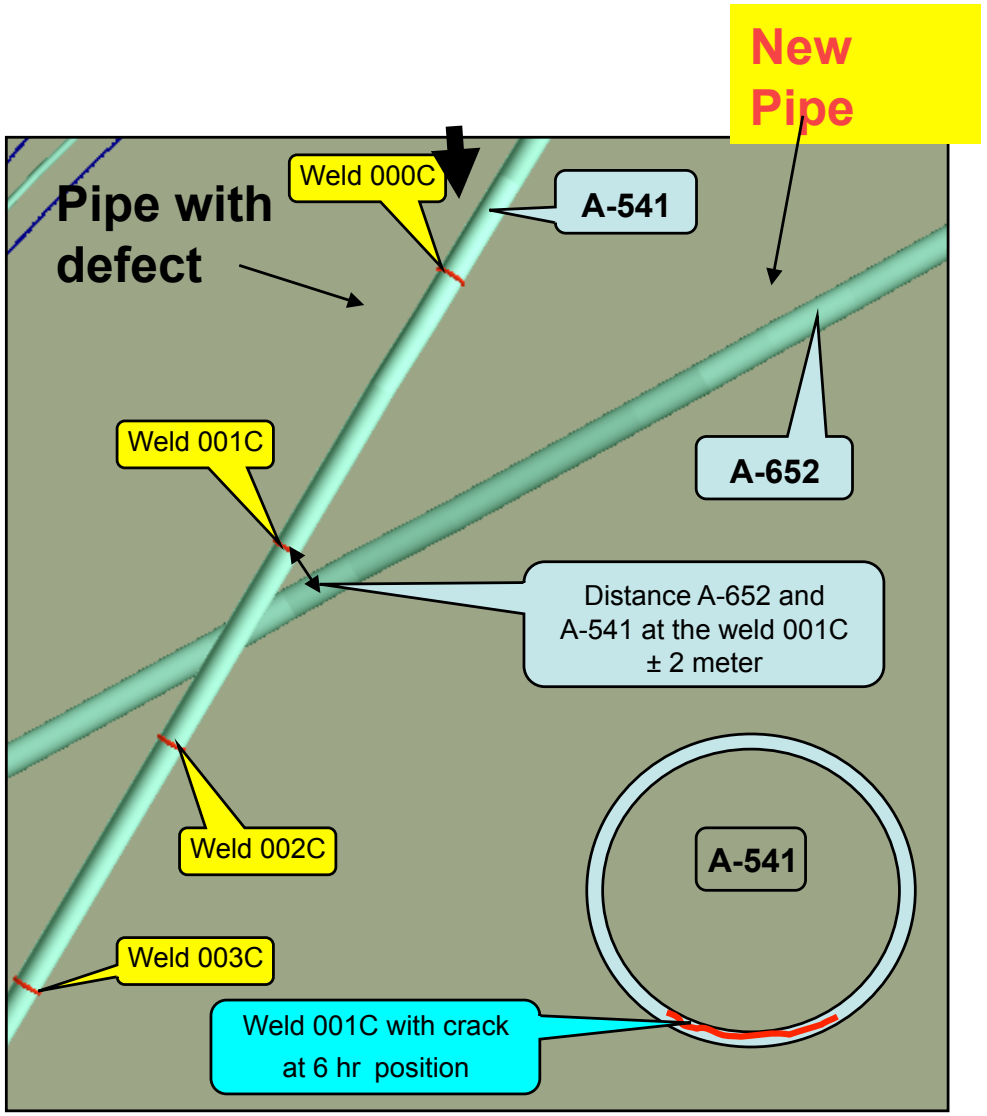
Temperature
Construction GWWL
Settlement
Construction GWWLL
Other
Gas inclusion
Cold crack
Other inclusions
Corrosion
Fatigue
Stress corrosion cracking

Material / Weld Defects

- New Pipeline laid 1m underneath existing 42”constructed in 1971
- Girth Weld failed 18 months after construction work
- No precaution taken to support pipe during construction of new pipe and the welds on old pipeline were not inspected



1st Party Damage Example

- Water jetting was used to remove asphalt coating on a 30” gas pipeline. *Norway* on *6 October 2008*

- Water jet operating at *approx. 1000 bar and 180 l /min* failed resulting in the jet moving repeatedly along the same line for a duration of approximately 10-15 minutes.

Distance from nozzle to pipeline 460mm

With:26mm
Dept: 0,2-1,2mm

Length; 460mm

Ground Movement

Gas Transmission Pipeline failure Lanhtal Germany

Pipe failed as a result of ground movement

Cause - new pipeline being constructed parallel to exist pipeline on side of hill

The trench for new pipe was below existing, excavated material placed on top of existing pipe, heavy rain, excavation for new pipe collapsed land slip caused pipeline to fail

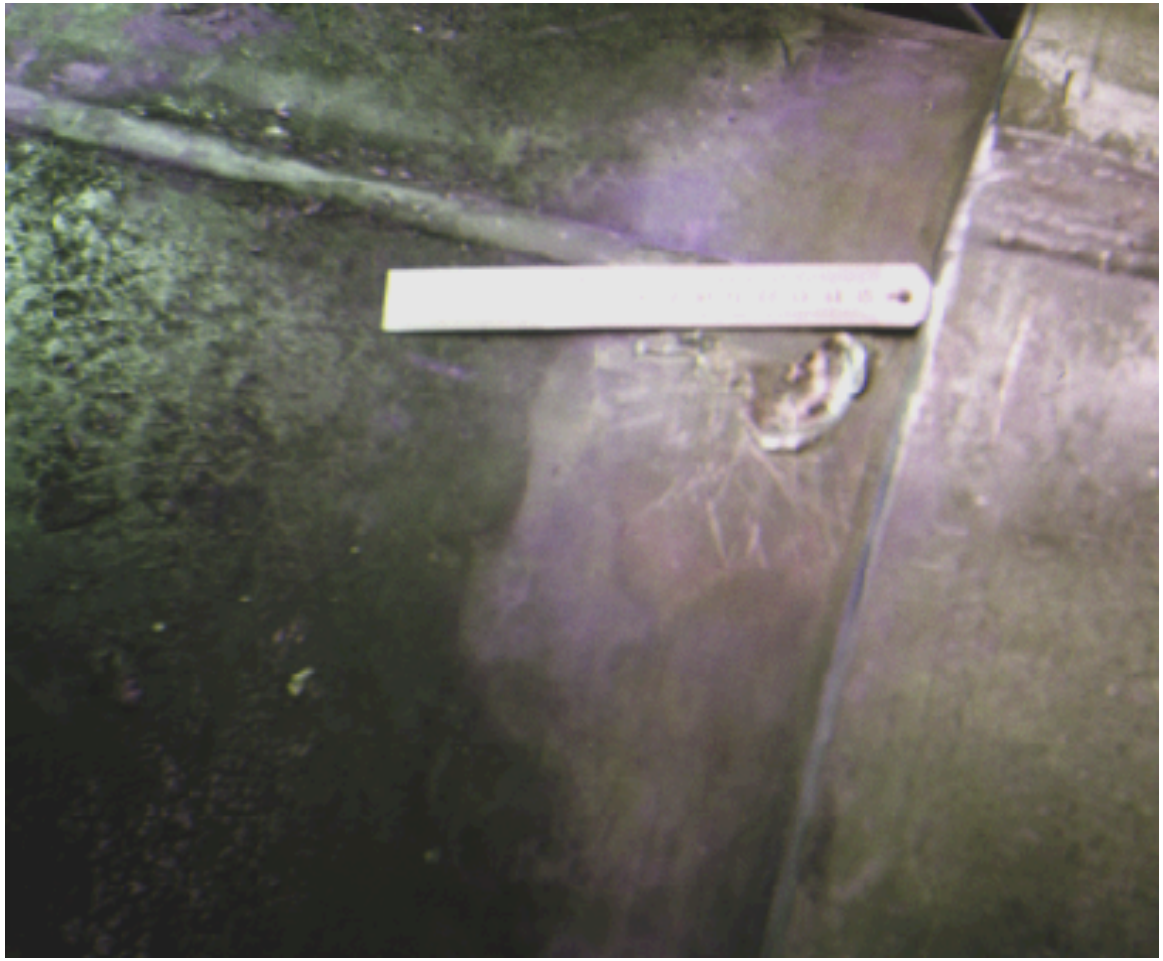
Hot Tap Incident

Hot tap connection

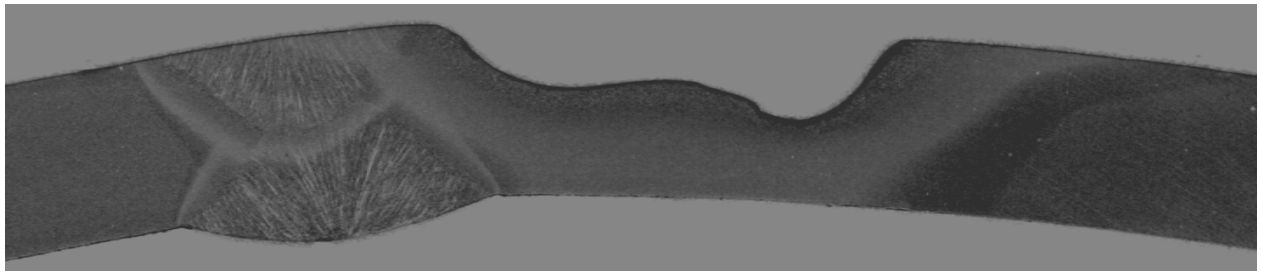
Damage caused to pipeline

Pre heat torch left against pipe unattended

Hot Tap Incident



Hot Tap Incident



- **Metal loss equivalent to 46% of pipewall for an area 42mm x 37mm**

Defect cut out and replaced by tee and new section of pipe

Hot Tap Incident

Causes – Human Errors

- Lack of Competency Management
- Lack of Understanding of risk
- Poor Site Management

Actions Taken

- New Heating torch introduced which reduced the risk of similar incident
- Prior to all hot tap operations the team carrying out the work undergo special briefing and training on risks carried out by specialist
- Improved competency management of welders mate

Summary – Why do we have these Incidents ?

Majority of pipeline incidents caused by
Human Factor failures

Competency
Attitude
Behaviour

Who is responsible ? Owners / Senior Managers

What can we do ? We need to develop processes which recognises human failings

The Bottom line on Safety

"It is the sum of our contributions to safety management that determines whether the people we work with live or die . . . . . ."

Brian Appleton - Piper Alpha report