

Scotchkote 169 Pipeline Rehabilitation

Benefits of Pipe Lining

INCREASED THROUGHPUT:-

Increases of between 5% and 20% (in some cases even greater) have been experienced worldwide for many years with Scotchkote coated pipelines. It is generally accepted that even a 1% improvement in throughput justifies internal coating, from a cost point of view.

REDUCED MAINTENANCE

Experience has shown that the frequency of pigging is substantially reduced with a Scotchkote coated pipeline.

EXTENDED PIG LIFE

The use of Scotchkote Internal Linings produces a significantly smoother surface, thereby considerably extending the life of pipeline pigs. This extension is generally of the order of 4 times in comparison with uncoated lines.

Benefits of Pipe Lining

- **FASTER PIGGING**
 - Pipeline pigs run far easier through a Scotchkote pipeline and therefore pigging the line is much quicker.
- **REDUCED ENERGY COSTS**
 - Pumping / compression costs are significantly reduced during the lifetime of the pipeline. These reduced energy costs can provide a financial payback within 3-5 years of service.
- **MINIMAL WAX DEPOSITION**
 - A Scotchkote coated pipeline leads to a reduction in sidewall deposition in service. Paraffinic and wax Depositions in oil lines - which can dramatically reduce flow - are minimised. Tuberculation in water lines is also reduced

Benefits of Pipe Lining

- **ENHANCED PRODUCT PURITY**
 - A Scotchkote coated line prevents product contamination - thereby eliminating blocked filters and damaged equipment.
- **VALVE MAINTENANCE**
 - Pipelines with millscale and rust suffer from valve damage due to rust grit, which can give rise to costly annual maintenance. Practical experience has shown that valve maintenance costs are dramatically reduced by internally coating the pipeline with Scotchkote. Equally significant is the cost of disrupting a pipeline while maintenance is carried out.
- **IMPROVED FLOW PATTERN**
 - Turbulence of flow can be significantly reduced by internally lining, thereby reducing the stress within a pipeline to a more even flow pattern.

Pipeline Profile Improvement

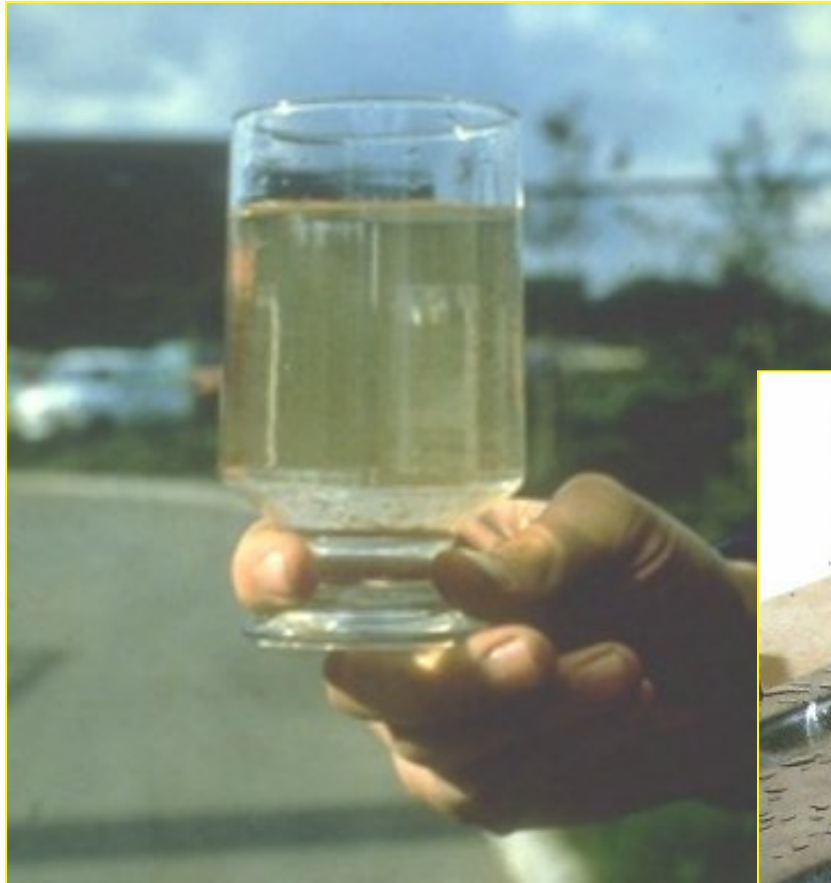


Scotchkote

Drinking Water Solutions



U.K Quality Problems



“an adequate and continuous supply of ‘**WHOLESOME**’ water”



U.K Approvals

- **BS 6920 Testing**

- Flavour
- Odour
- Metals
- Microbiological Growth, etc...

, , , , **WRAS Listing**

- Drinking water contact downstream of water supplier

- **DWI - Regulation 25(1)(a)**

- Formulation specific Leaching tests
- Drinking water contact Public water supplier

Potential Market for 169HB

MALAYSIAN WATER STATISTICS

*Malaysia Water Industry Report 2001/2002

National average NRW 39% (non revenue water)

Sabah NRW 62%

Kedah, Pahang, Selangor & Kelantan >40%

Causes of NRW in Malaysia

Leakages 16 to 30%

Meter faults 3 to 7%

Theft 1 to 8%

Others 1 to 3%

Perlis

Kedah

Pulau Pinang

Perak

Terengganu

N.Sembilan

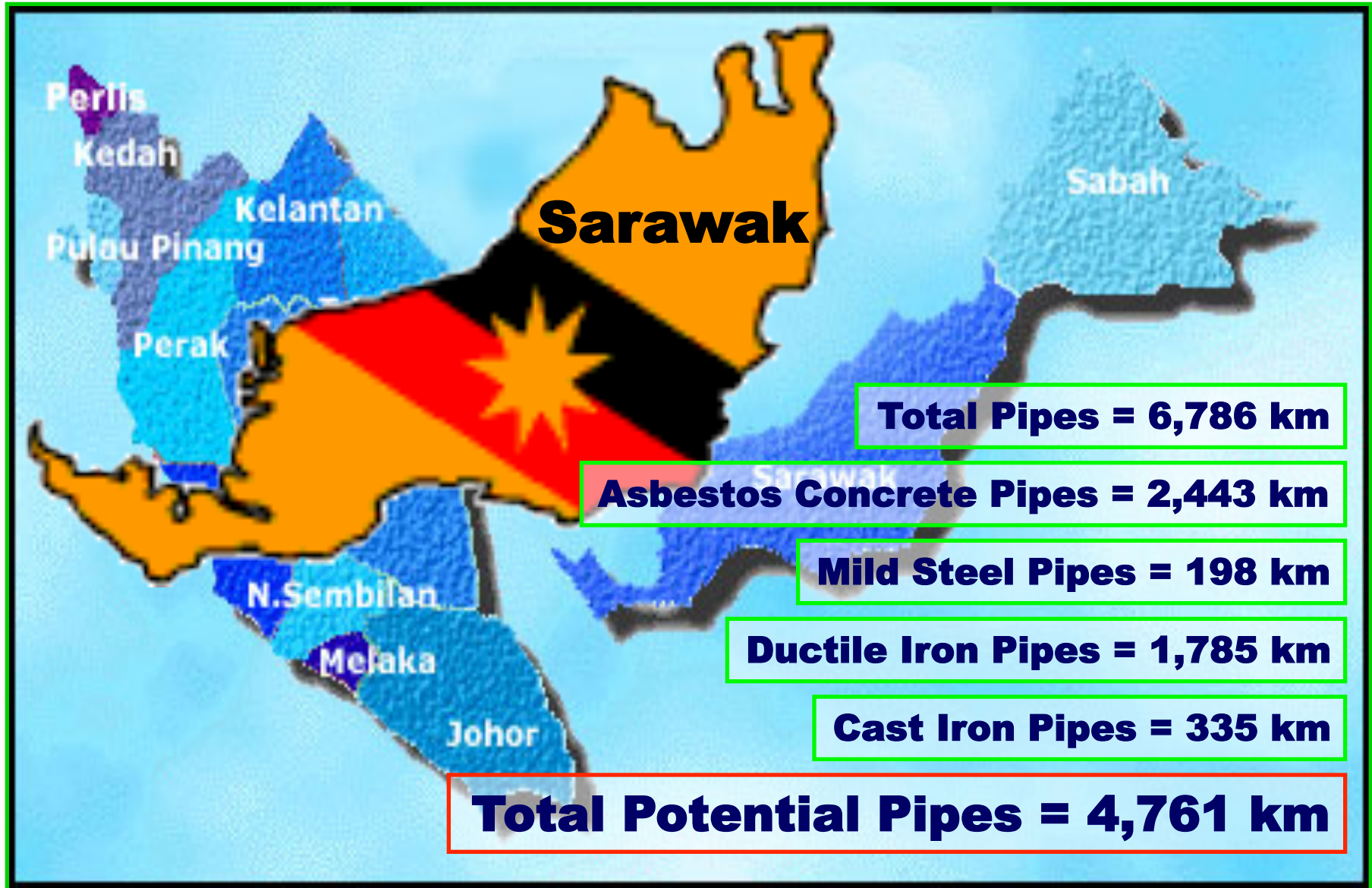
Melaka

Johor

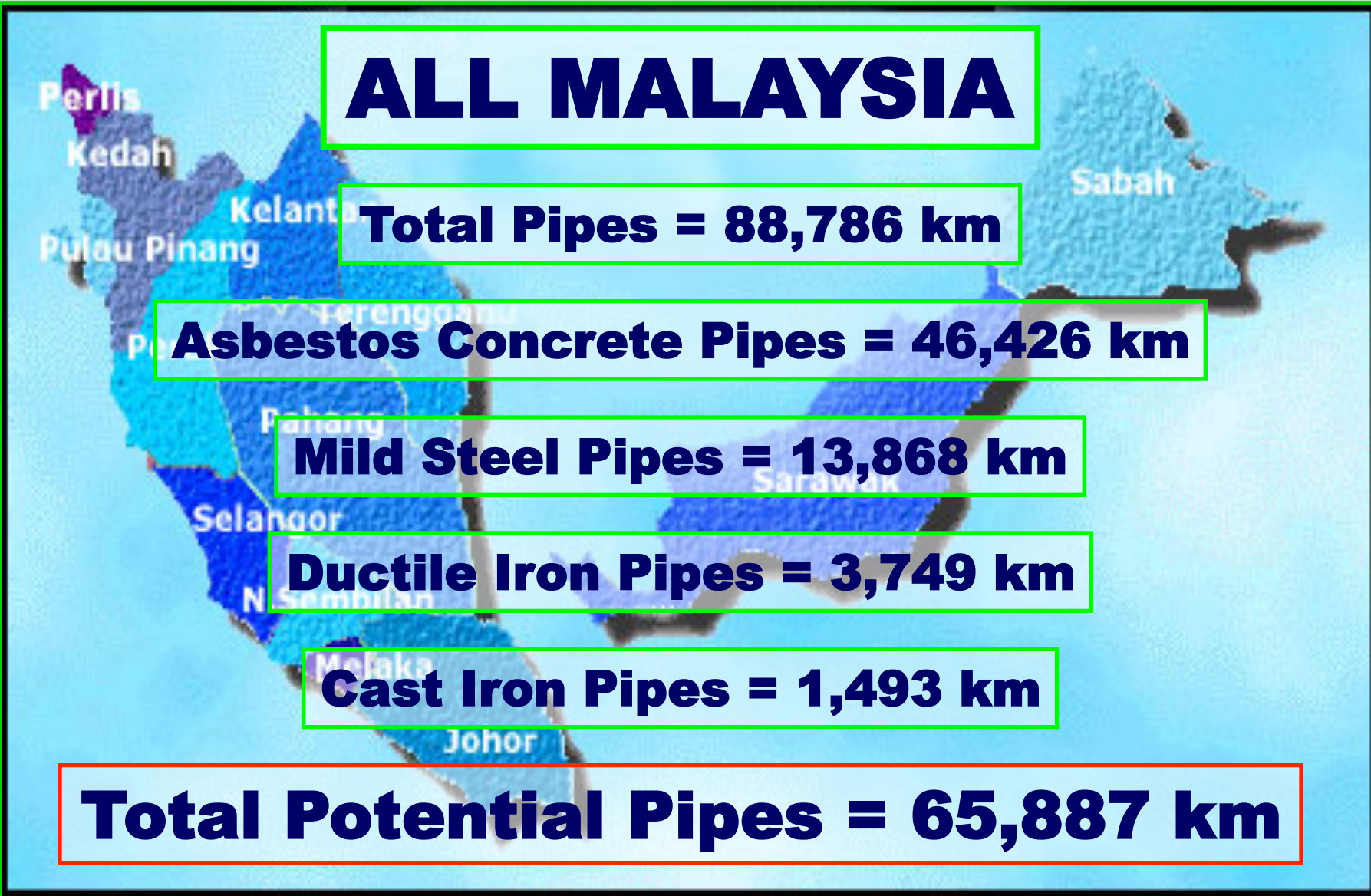
Sarawak

Sabah

Potential Market for 169HB



Potential Market for 169HB



ALL MALAYSIA

Total Pipes = 88,786 km

Asbestos Concrete Pipes = 46,426 km

Mild Steel Pipes = 13,868 km

Ductile Iron Pipes = 3,749 km

Cast Iron Pipes = 1,493 km

Total Potential Pipes = 65,887 km

Problems with existing pipes

- 1. FERROUS PIPES CORRODE
- 2. EXISTING COATINGS BREAK DOWN
- 3. PIPE WALLS BECOME THIN
- 4. TRANSMISSION IS AFFECTED
- 5. PIPES BEGIN TO LEAK
- 6. PRODUCT IS LOST
- 7. POLLUTION IS CAUSED
- 8. REINSTATEMENT COSTS INCURRED

The Problems

The Problems facing the Water Supplier...

- Supply pipes have been installed for decades (many ductile iron supplies laid in the 1930s)
- Pipes of this age tend to be heavily scaled internally and may be structurally damaged
- Replacing pipes is very costly, especially in urban areas.



Internal Deposits

To compound the problems these old pipes are often found to have cumulative deposits internally



Affecting

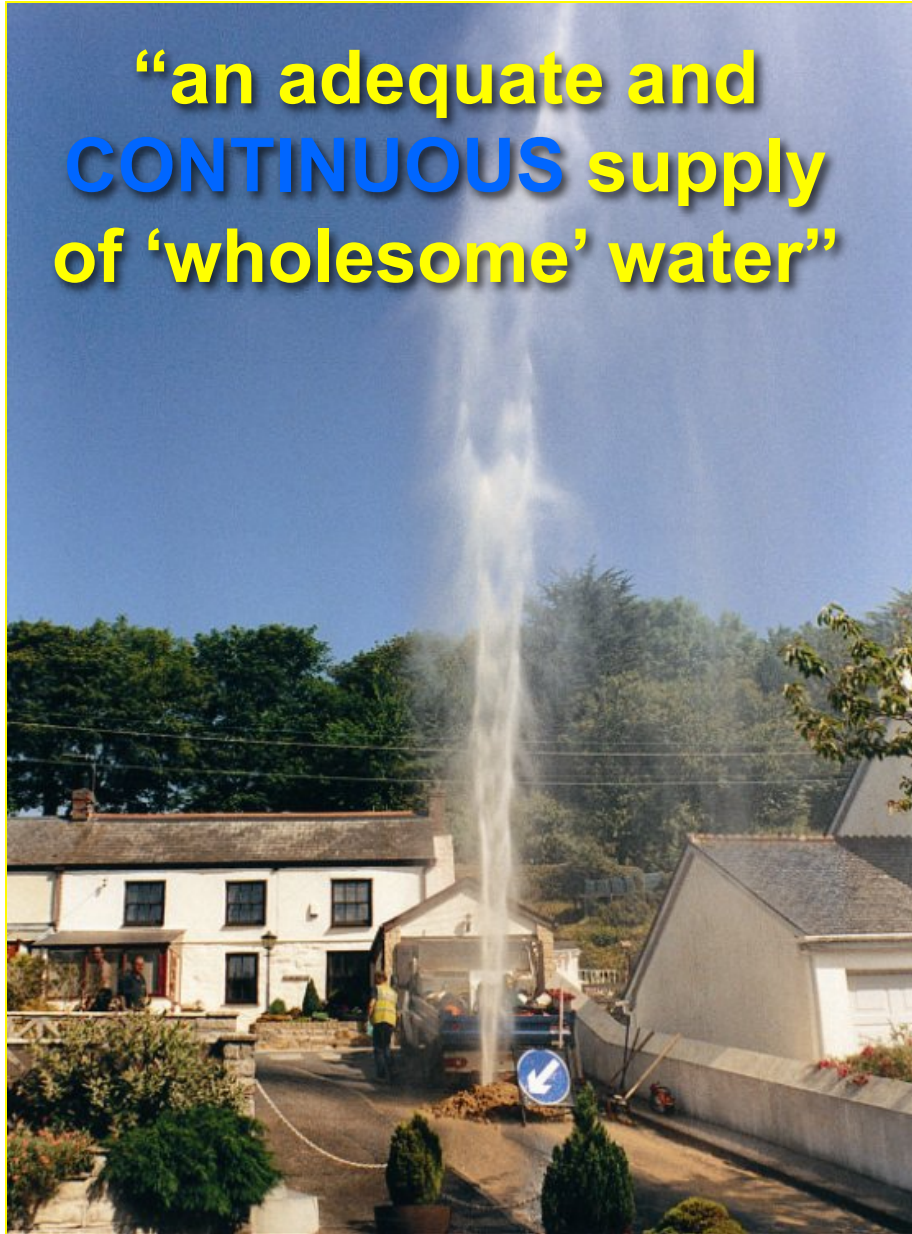
- Water Quality
- Internal Diameter
- Water Flow
- Water Pressure



**Corrosion of iron mains
may lead to...**

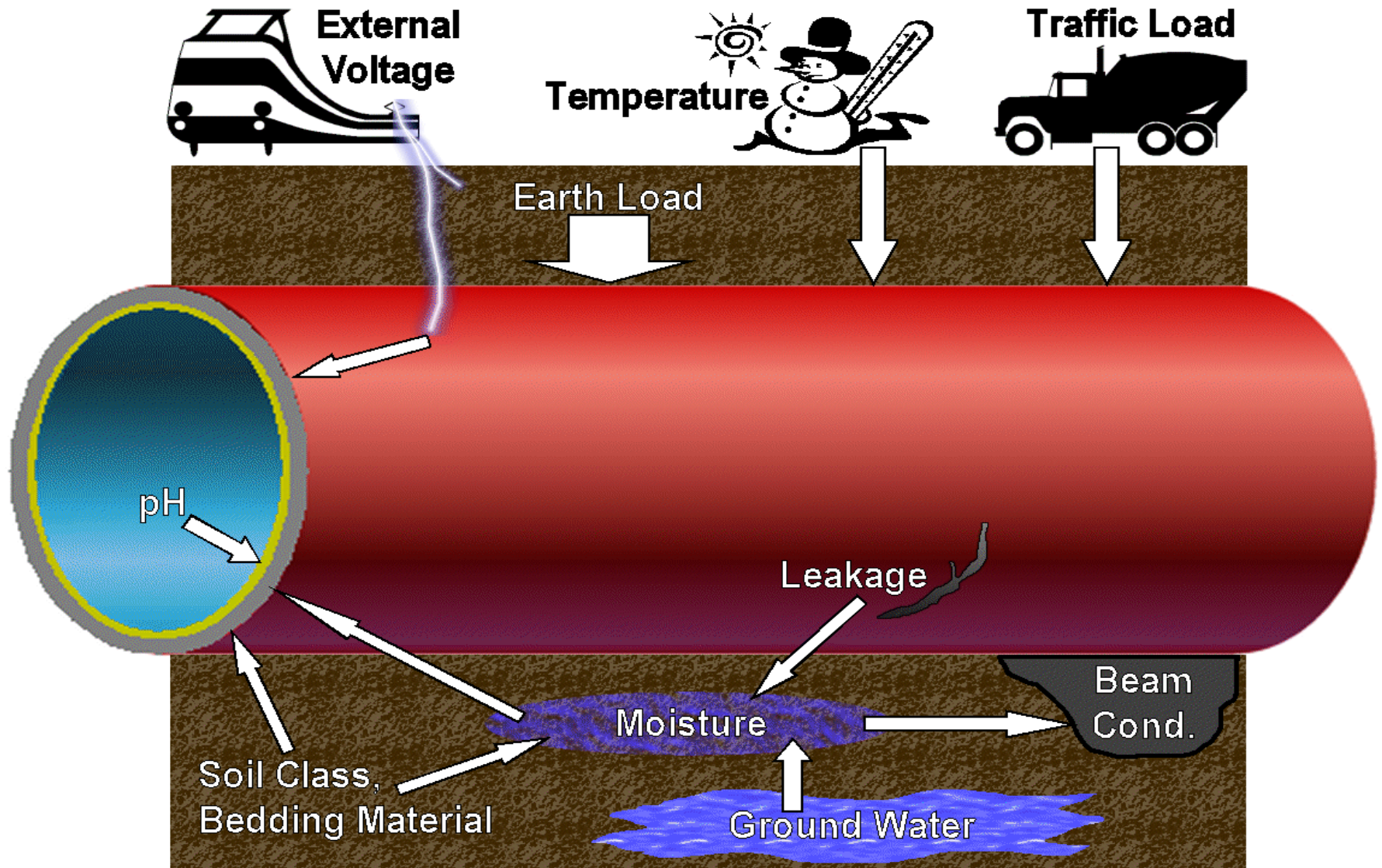
Structural Problems

“an adequate and
CONTINUOUS supply
of ‘wholesome’ water”



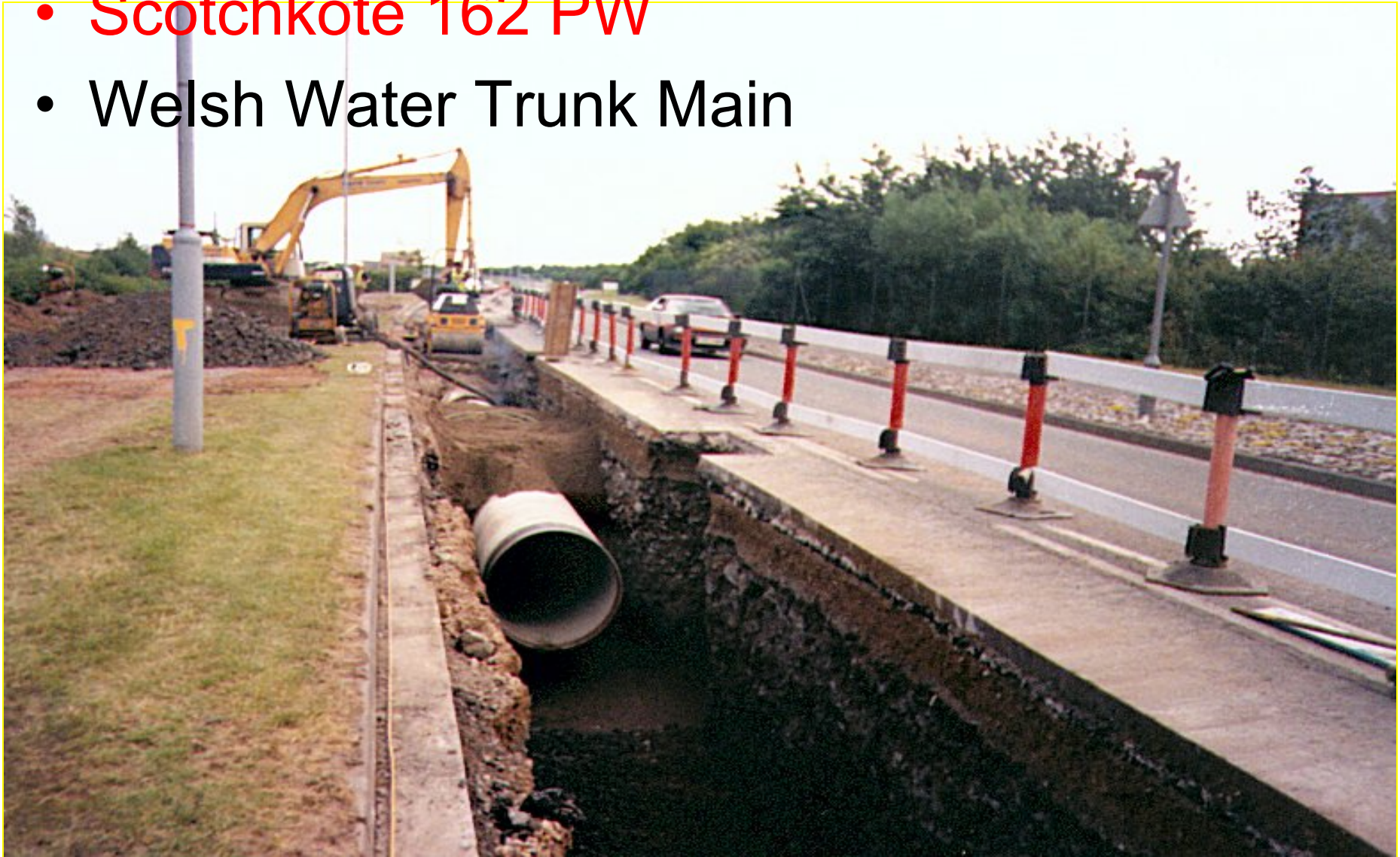
The Causes

Infrastructure Attack



Pipeline replacement

- Scotchkote 162 PW
- Welsh Water Trunk Main



Evolution

Cement mortar used since 1930's

- A “**partially**” approved material because of water quality problems related to high pH and durability
- Dissolves in softer water
- Possible leaching of Al and other metals
- Applied at 4–6mm, reducing effective internal diameter
- Rough surface allows rapid internal tuberculations
- Slow Curing



Evolution

Epoxy resins used since 1970's

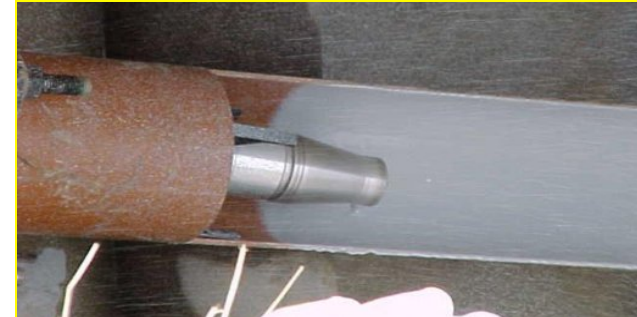
- A major tool in most water utilities non structural lining rehabilitation project
- May be susceptible to blistering
- Slow Curing



Evolution

Rapid-setting lining introduced 1999

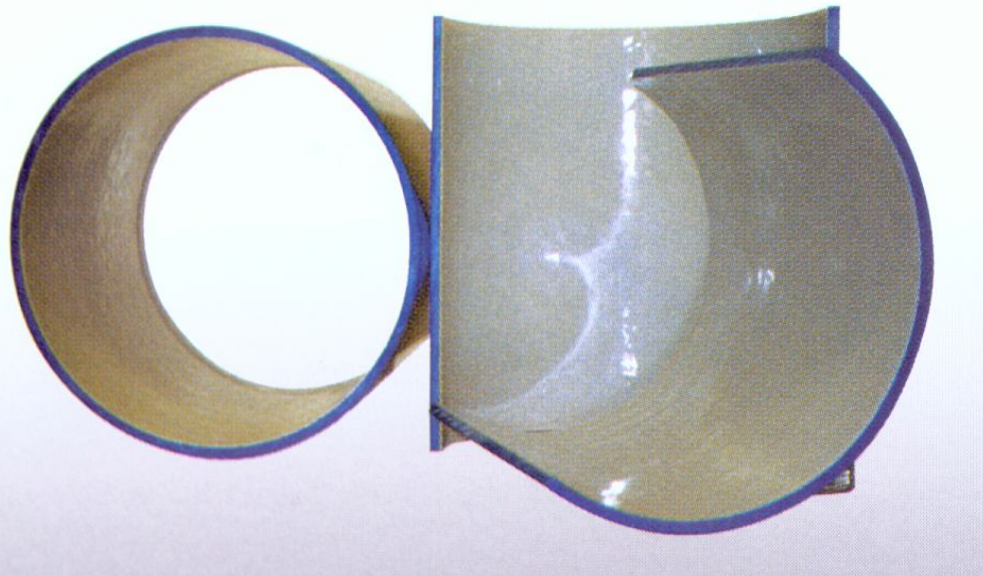
- Fully approved
- More tolerant of adverse conditions
- Immediate inspection
- Rapid return to service
- Superior performance & durability
- Structural grades possible



Skotchkote 169



Pipe Rehabilitation



- No need to dig up and replace your existing pipes, reline in-situ

Plural Feed Hot Airless Spray

An introduction to the Plural Feed Unit

- These units are used to spray...
 - 2 Pack materials that have a short “Usable Life” or
 - 2 Pack materials that are too viscous to spray at ambient temperatures.

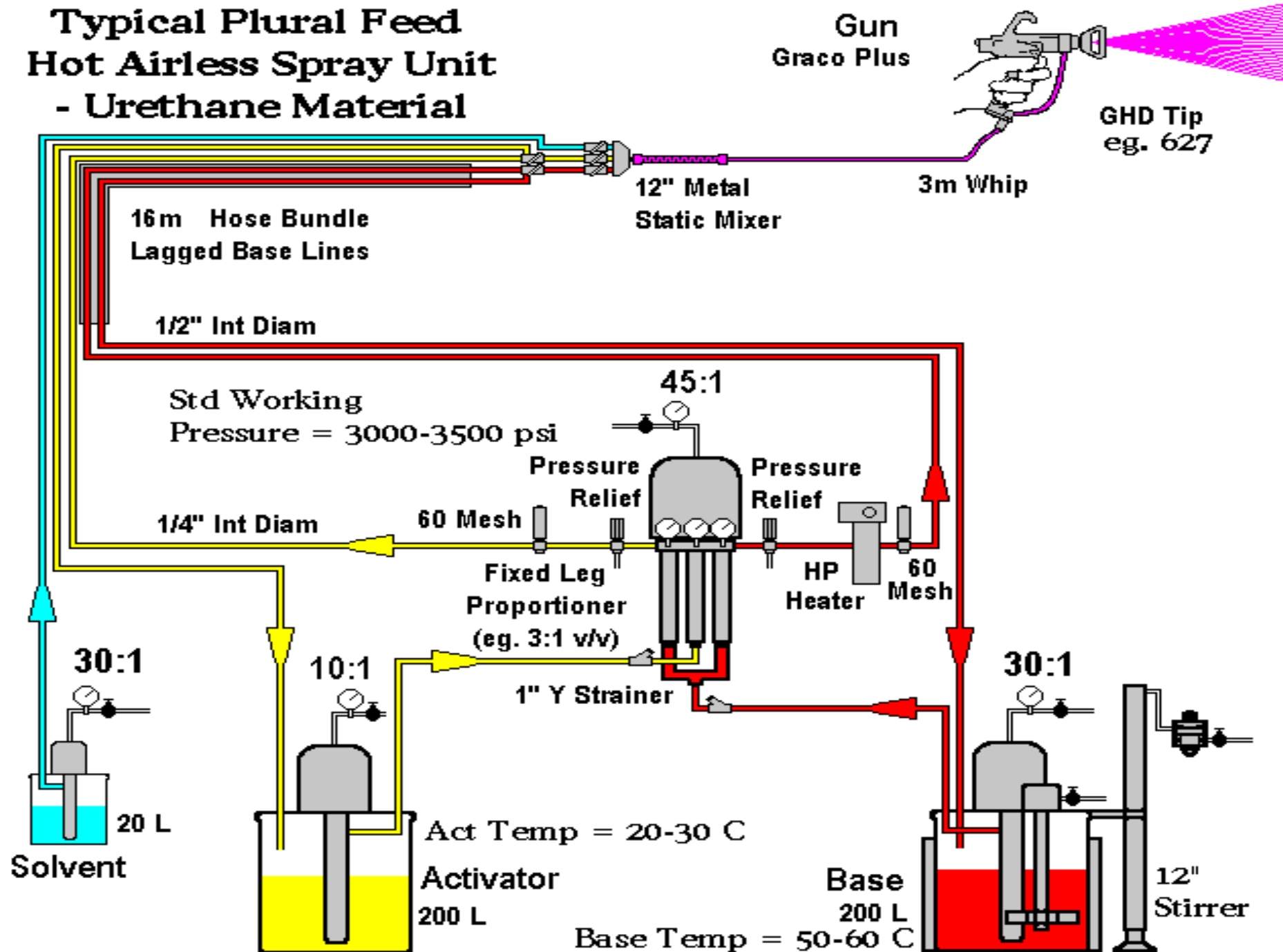
For example:

- Many solvent free 2 component Epoxies or Urethane's

Plural Feed Unit

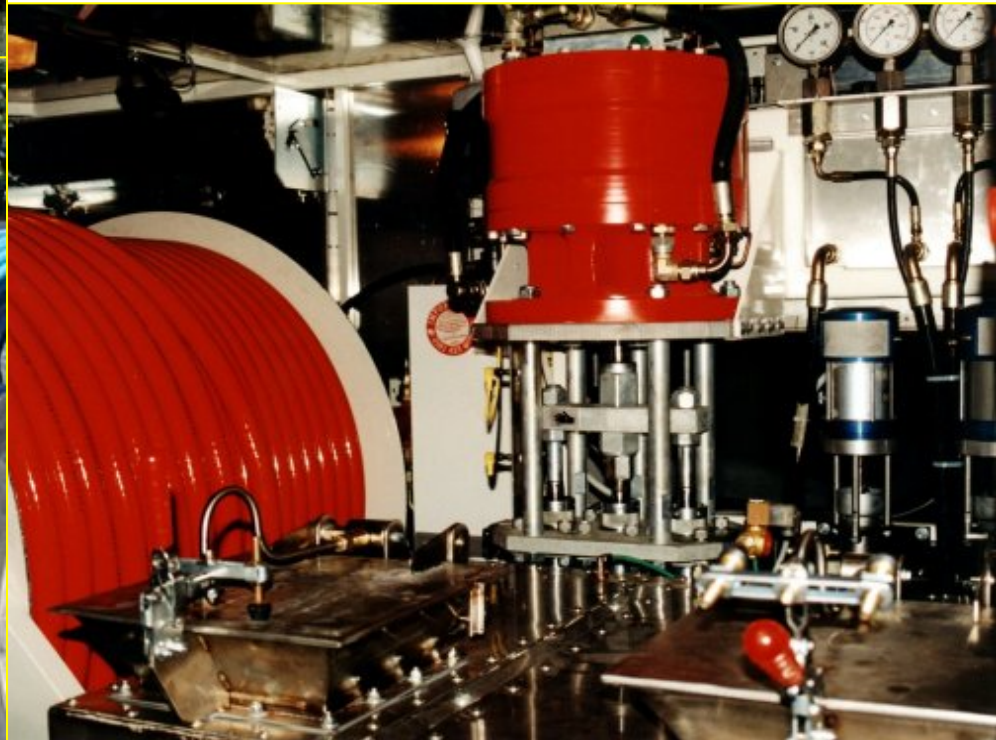


Typical Plural Feed Hot Airless Spray Unit - Urethane Material

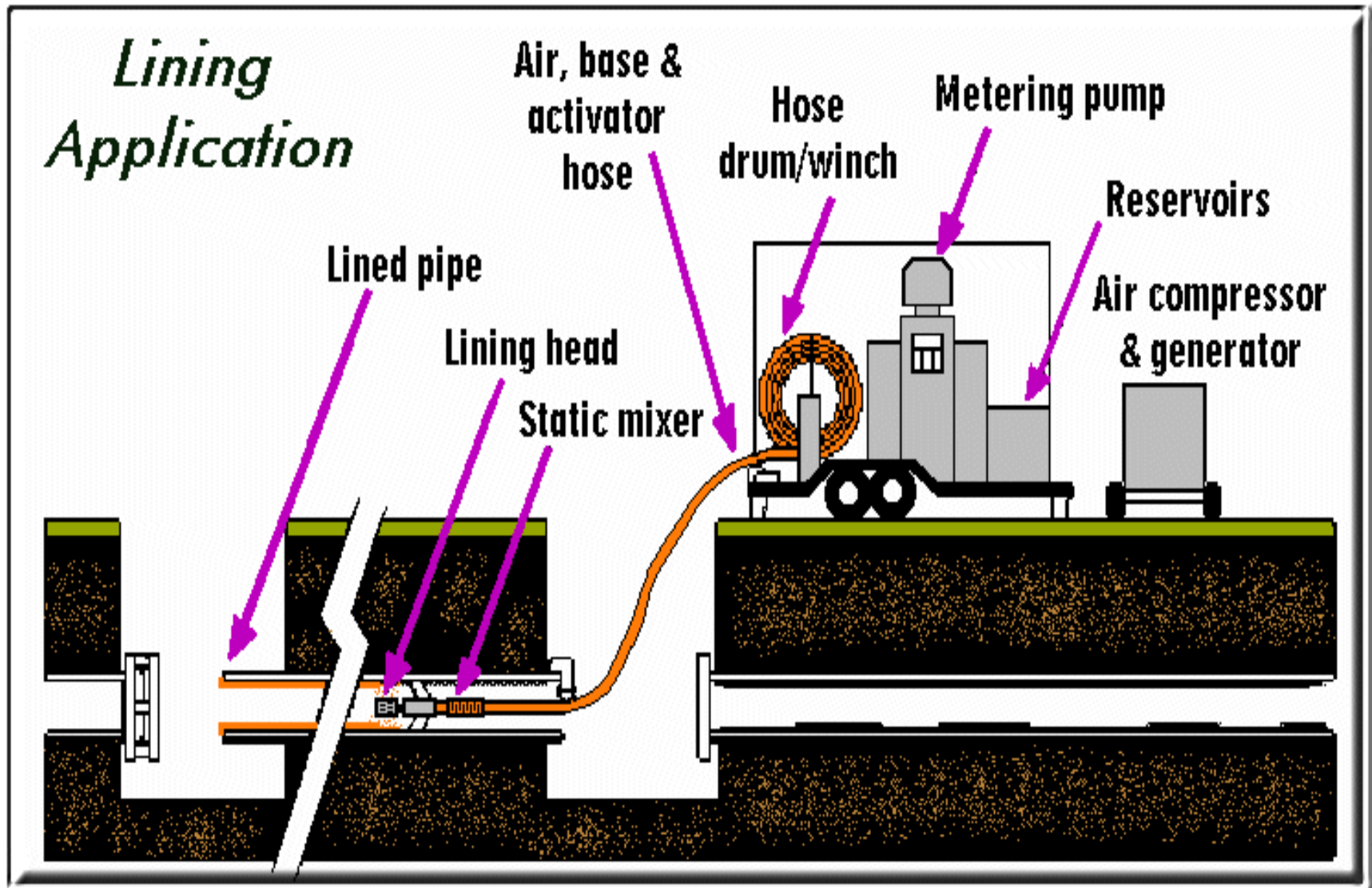


The Lining Rig

The Plural Feed concept is used inside the application units employed in Insitu Relining Programs



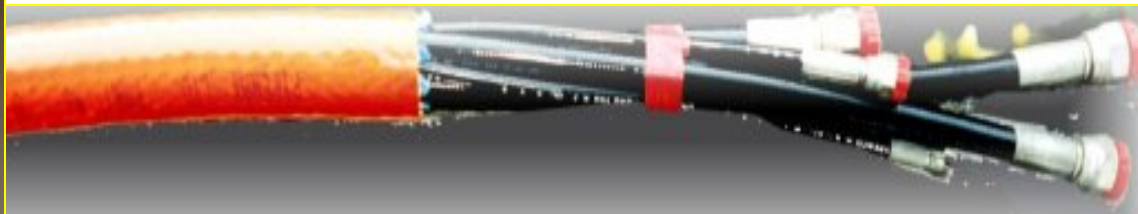
Pipe Rehabilitation



Umbilical Hose



- The Umbilical hose is wrapped around a rotating drum & combines
 - Base Line
 - Activator Line
 - Air Line
 - Heating Line
- Hose Length = 220-300m
- Ext. hose diameter = >47mm
- The heated materials are pumped down separate tubes of the Umbilical Hose



Metering



- Metering ensures correct mixing of product at the head, no pot life problems



Control



- Automatic Metering
- Computer Monitored Application
 - Working Pressure
 - Mixing Ratio
 - Flow Rate
 - Applied DFT
- Automatic Shut Down if “Off Ratio” ($\pm 5\%$)
- Security access codes

Hoses & Spray Nozzle



Base and Activator materials are forced through a Static Mixer
Applied by Spinning Head (25,000 rpm)

- Designed for optimum spray efficiency



Preparation Stages

● Planning

- Pipeline inspection & diagnosis
- Qualification of materials & process
- Equipment sizing & selection
- Spool piece & access locations
- Job layout, logistics & temporary services
- Liner installation & reconnecting
- Acceptance testing

• Preparation

- Notify consumers of works
- Isolate lining section
- Excavate access pits
- Remove fittings - bends, tees, valves



Yorkshire Water - UK

- **Oughtibridge,**
Sheffield
- Drinking Water Main



- 5Km x 33"
- 2001
- Contracted to
Pipeway

Cleaning Stages

- **Rack Feed Boring**

- Rotating steel flail is pushed into pipe, dislodging deposits
- Used with water
- For pipe diameters 75 – 300mm

Or...

- **Drag Scraping**

- Sprung steel scrapers are pulled back & forth, dislodging deposits
- For pipe diameters 75 – 1000mm

- **Plunging**

- Circular squeegees are pulled through, removing remaining debris



South West Water - UK



- **Crownhill, Plymouth**
- **Drinking Water Trunk Main**

- **36" Cast Iron**
- **2002**



Cleaning Stages

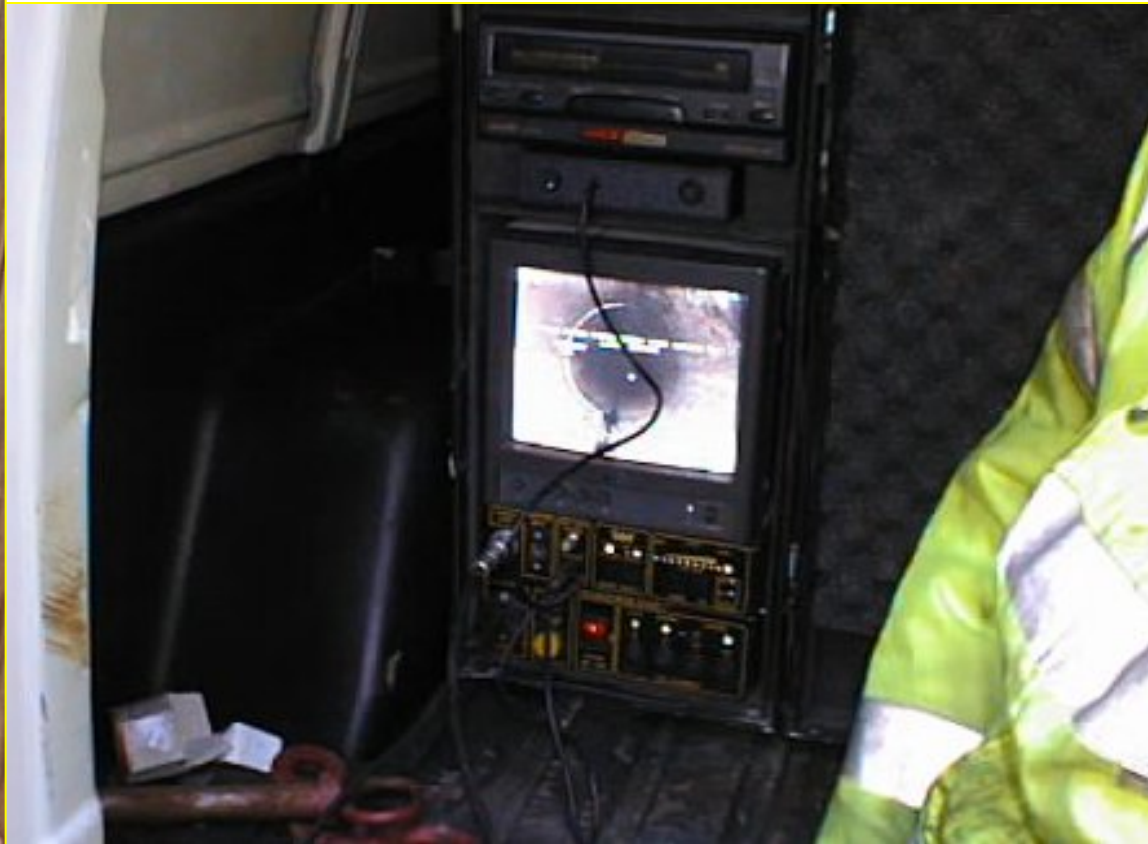
- **Swabbing**

- Foam Swab is propelled down the pipe using compressed air to remove standing water (normally 3 times)



Cleaning Stages

- **Pre-Lining Inspection**
 - CCTV camera is pushed down the pipe to inspect cleanliness



Application



- Only need to expose pipe at 150 metre intervals

Application



- Spinning head is pulled back and material is “applied on return”
- Lining thickness is determined by winch speed & material flow rate

Application

- Scotchkote 169
- 1.5mm DFT



Application



Post Lining Stages

- Once spinning head has exited pipe, cap end & allow lining to cure
- Inspect lining with CCTV
- Reconnect & take cut-outs if required
- Disinfect & check residual chlorine
- Flush with drinking water
- Return main & customers to service
- Sample water for bacterial examination



Relining Materials

Drinking Water Rehabilitation

- **Skotchkote 169**

- Solvent Free Urethane
- Typical DFT = 1mm (up to 6mm)
- Curing to handle = inside minutes @25°C
- Return to Service = 30 minutes @7°C



Benefits of Scotchkote 169

- **Same day return to service.**
 - Shutdowns for individual properties can be as short as 8 hours although typically a 12 hour shutdown warning is given to customers.
- **Three lengths of main to be lined in a 12 hour day.**
 - These may be returned to service sequentially or in one length at the end of the day. Productivity increases over the epoxy resin lining process are achievable.
- **Temporary Supplies precluded.**
 - Precludes the need for rider mains and temporary supplies for all but the most essential users.

Benefits of Scotchkote 169

- **Lining of large diameter trunk mains**
 - Scotchkote 169 will enable lengths of trunk main to be isolated, cleaned, lined and returned to service overnight thereby negating the need for rider mains or endangering reservoir storage requirements.
- **Critical Supplies**
 - Similarly, night-time possession of mains in conjunction with these materials will allow the lining of pipes that supply key customers such as offices, shops and factory premises without the normal daytime disruption

Benefits of Scotchkote 169

- **Minimal Damage**

Curing is so rapid that there is minimal damage to the applied coating by passing water from service connections or valves, thereby removing much of the need to excavate to remove water damaged linings.

- **No formation of Blisters or Blowholes**

The rapid gelling and curing stops the formation of blisters and blowholes sometimes seen with epoxy resin coatings that have very much slower curing properties and therefore remain flexible for longer.

Benefits of Scotchkote 169

- **Immediate Inspection**

CCTV surveys can be conducted within 30 minutes of completion of lining. In addition any lining faults identified during the survey can be rectified immediately and will not jeopardise the potential for same day return to service.

- **Superior Coating**

As with epoxy resin coatings the applied lining provides excellent carrying capacity and outstanding long term corrosion protection compared with cement mortar lining.

Epoxy Resin

Scotchkote 169

● Initial set	4-6 Hours	2 Minute
● Sufficient cure for CCTV Survey	16 Hours	10 Minutes
● Return to service	16 Hours	30 Minutes
● Flexural strength (BS EN ISO 178)	50 MPa	55 Mpa
● Tensile Strength (BS EN ISO 527)	25 MPa	27 MPa
● Abrasion Resistance (ASTM D4060)	70mg loss /1000 cycles	50mg loss /1000 cycles
● Short Term Flexural Modulus (BS EN ISO 178)	3000 MPa	3200 Mpa
● Predicted 50 Year Flexural Creep Modulus (BS EN ISO 899-2)	< 80 MPa	200 Mpa
● Adhesion Strength (ASTM D4541)	7.5 MPa	15.0 Mpa

Drinking Water Pipes

- UK

Anglian Water
Trunk Main



Scotchkote 169



Work Contracts (2000-2007)

Company	Country	City/Region	Material	Description	Quantity	Date
Hyder Welsh Water	UK	South Wales	Hycote 169	Insitu Water Mains Rehabilitation for. 6 Lining Rigs operating. 7,200L. Laings	6500m ²	2001
Severn Trent Water	UK	Stafford Area	Hycote 169, Hycote 162PWX	Sub-contracted Insitu Water Mains Rehabilitation for. Contract 1. 2.6km of 4-18" diameter. 17,000L. AMEC Utilities Ltd	15000m ²	2000
South East Water	UK	East & West Sussex	Hycote 169, Hycote 162PWX	Insitu Water Mains Rehabilitation. 6 Lining Rigs operating. 180km re-lining up to 21" diameter. 360,000L.	324000m ²	2001-2007
South West Water	UK	Devon	Hycote 169	Insitu Water Mains Rehabilitation. 27km of 3-9" diameter. 6,000L. J Kennedy (Civil Engineering) Ltd	5500m ²	2000-2001
South West Water	UK	Plymouth, Devon	Hycote 169	Insitu Water Mains Rehabilitation. 3-18" diameter. 3 Lining Rigs operating. 36,000L. T J Brent Ltd	32500m ²	2000-2002
States of Guernsey Water	UK	Guernsey	Hycote 169	Insitu Water Mains Rehabilitation. Phase 12. 15.5km of 3-12" diameter. 9,000L.	8000m ²	2003
Sutton & East Surrey Water	UK	North & East Surrey	Hycote 169, Hycote 162PWX	Insitu Water Mains Rehabilitation of 58km of 3-4", 21km of 5-6", 11km of 8-9" and 17km of 10-12". 28,800L.	26000m ²	2001-2004
Sutton Water	UK	Sutton/Epsom	Hycote 169	Insitu Water Mains Rehabilitation. 36,000L pa	30000m ² pa	2003-2004
Yorkshire Water	UK	Oughtibridge, Sheffield	Hycote 169	Insitu refurbishment of drinking water supply pipes. 5Km x 33" diam. 1.5mm dft	13000m ²	2001

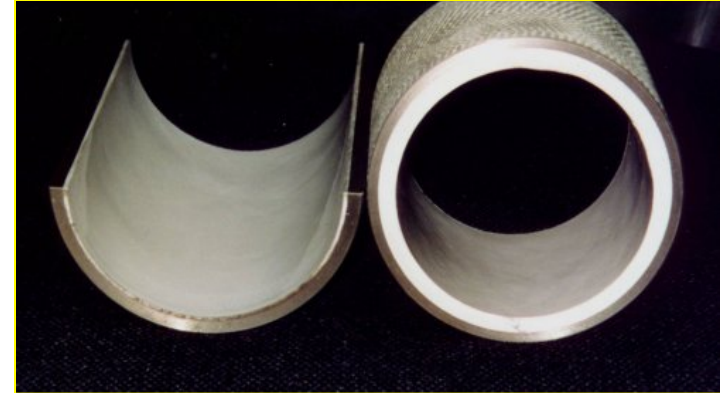
Yorkshire Water - UK

- **Ripon**
- Urban Drinking Water Supplies
- 3" - 6"
- 2001 - 2002
- By Laing Utilities
- Scotchkote 169 (1mmDFT)



Approvals

- **United Kingdom - DWI**
 - Scotchkote 162 PW
 - Scotchkote 162 PWX
 - Scotchkote 165 PW
 - Scotchkote 169
- **USA - NSF Standard 61**
 - Scotchkote 162 PWX
 - Scotchkote 169
- **Holland - KIWA**
 - Scotchkote 162 PW
 - Scotchkote 162 PWX

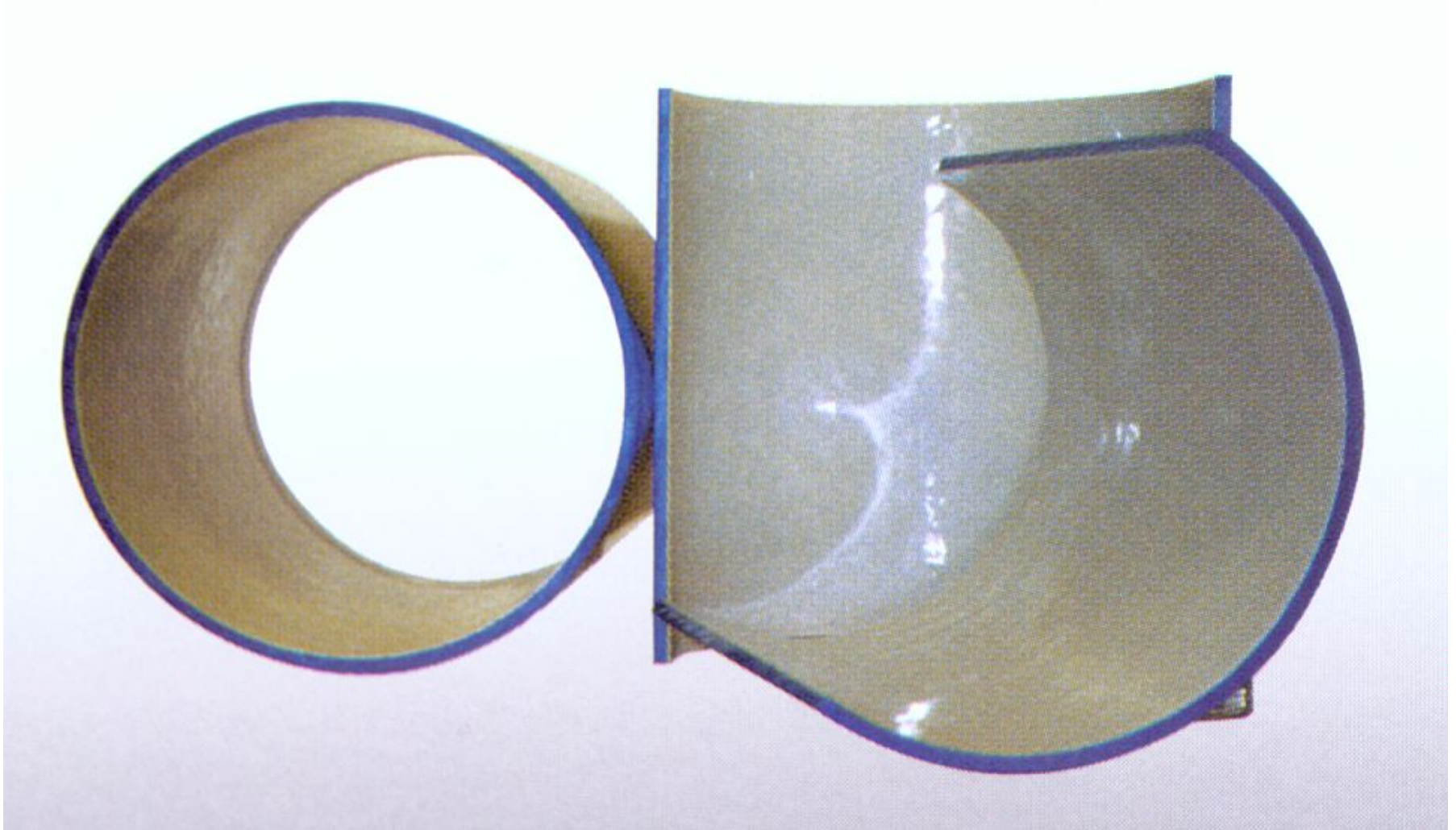


Approvals

- **France - NOFRA**
 - Scotchkote 162 PW
 - Scotchkote 162 PWX
- **Germany -**
 - Skotchkote 165 PW
- **Spain -**
 - Scotchkote 162 PW
- **Portugal -**
 - Skotchkote 162 PW
 - Scotchkote 165 PW
- **Czech Republic -**
 - Skotchkote 169



Scotchkote 175



Insitu Relining

- Scotchkote 175
 - Solvent Free 100% solids Epoxy
 - Typical DFT = 1 - 5mm (high build)
 - Curing to handle = 4 - 6 hrs @25°C
 - Return to Service = 24 hrs @25°C
- Excellent abrasion, mechanical, aggressive chemical and solvent resistance
- Designed for the Petrochemical Industry
SA2.5 / ST2 surface preparation (scrape)

Texaco Jetty- Pembroke Docks

- Rack Bored &
- Plunged
- Prepared St2



- **Scotchkote 175 HB**
- 2mm DFT
- 180m lengths
- By Pipeway

Future Developments

- Further European increase in the use of Rapid Set and decline in epoxy resin lining as standards of customer care are raised.
- Global adoption of Rapid Set.
 - Lining rigs currently operational in USA, Australia, Russia & Malaysia.
- Recent S.E.Asia contracts: China & Vietnam