Fundamentals of Pipeline Coatings

2012 AUCSC

Coatings Session

Jeff Didas – Matcor, Inc. – Mechanicsville, VA

Remember This!

- Coatings are the #1 defense against corrosion.
- This is true for underground, transition, internal and above ground service.

Coating Types

- Underground – buried or immersion service
- Transition area coatings
- Atmospheric coatings
- Internal coatings & linings

Underground Pipeline Coatings

- Mill or Plant Applied
- Field Applied
- Line Coatings
- Repair Coatings
- Coating Discussion
- Coating Cost
- Coating Quality

Mill or Plant Applied

- Most economical method to apply coatings
- Highest level of quality and quality control
- Plant/Mill conditions allow use of higher performing coatings
- Normally, high quality storage, handling and shipping
- Normally allows for some coated pipe storage

Field Applied

- Costly method either over the ditch or in the ditch
- Hard to manage quality control due to environmental conditions
- Normally lower performing coatings
- Newer field coatings do allow higher productivity

Line Coatings

- Coal Tar Enamel
- Asphalt Enamel
- Extruded Polyethylene
- Fusion Bonded Epoxy
- Somastic
- Pritec
- Liquid Epoxy
- 3 Layer

Repair Coatings

- Tapes
- Wax
- Shrink Sleeves
- Two - Part Epoxy
- Mastic
- Misc.

Coatings Discussion

- Most important component of a pipeline
- High quality holiday free coating requires almost no cathodic protection current
- Coatings need to be specified
- Coatings need to be tested
- Every coating has a use, but most coatings are used improperly – follow procedures

Coating Cost

- Cost of material
- Cost of application
- Cost to repair
- Handling
- Expected life
- Dielectric strength

Coating Quality

- Quality determines price
- Quality is normally dependent upon surface preparation & application methods
- Quality is assured with competent inspection
- Quality is determined by good procedures and good specifications

Transition Area Coatings

- Used where piping transitions from buried service to atmospheric service
- Used to protect from mechanical damage – freeze/thaw cycle, weed whackers, gravel, etc.
- Used to protect buried service coatings from Ultraviolet light when used above ground

Atmospheric Coatings

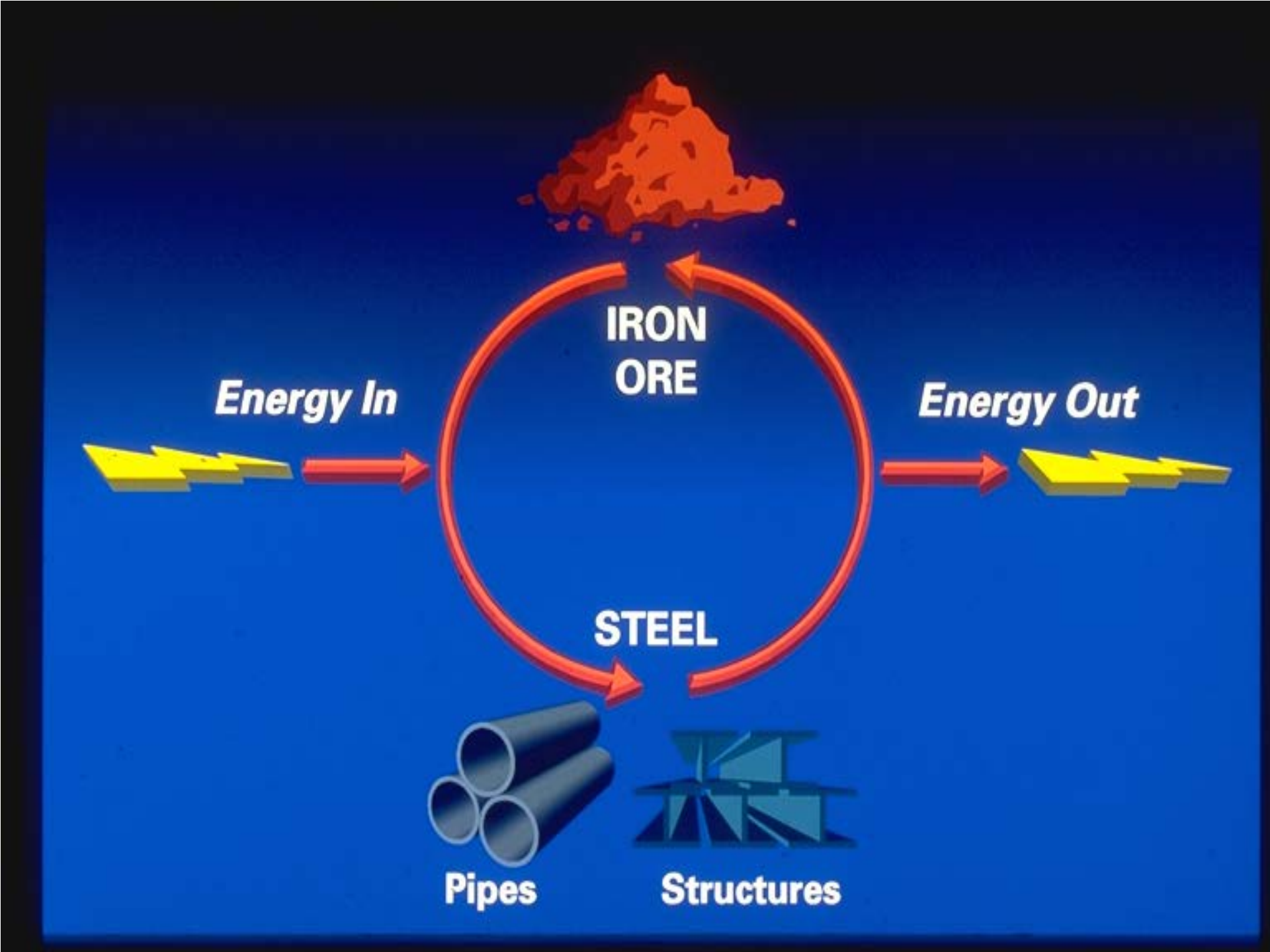
- Various types, quality and expected life
- Primary purpose is corrosion prevention, secondary purpose is appearance
- Problem areas, flanges, nuts, bolts, hold down clamps, high temperature service, beneath insulation, through walls/foundations, etc.

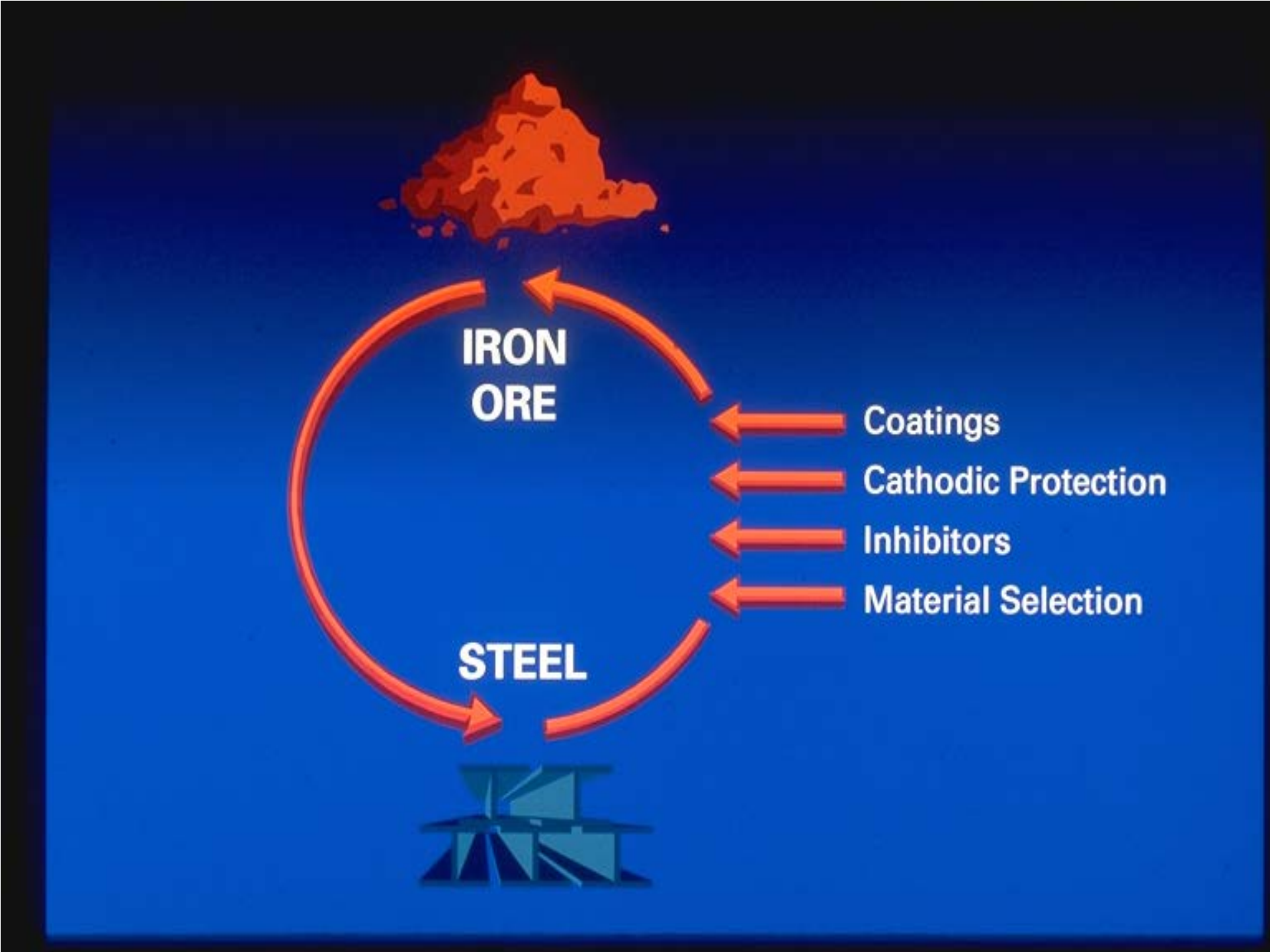
Internal Coatings & Linings

- Used to internally coat pipelines for corrosion protection and/or improved flow.
- Used to internally line tanks, process equipment & vessels for corrosion protection and/or product quality.

WHAT IS CORROSION?

CORROSION IS THE DESTRUCTION OF A SUBSTANCE, USUALLY A METAL, OR ITS PROPERTIES BECAUSE OF A REACTION WITH ITS ENVIRONMENT.


IRON
ORE
Energy In
Energy Out
STEEL
Pipes
Structures


IRON
ORE
STEEL
Coatings
Cathodic Protection
Inhibitors
Material Selection

COATING DEFINITION

WATER

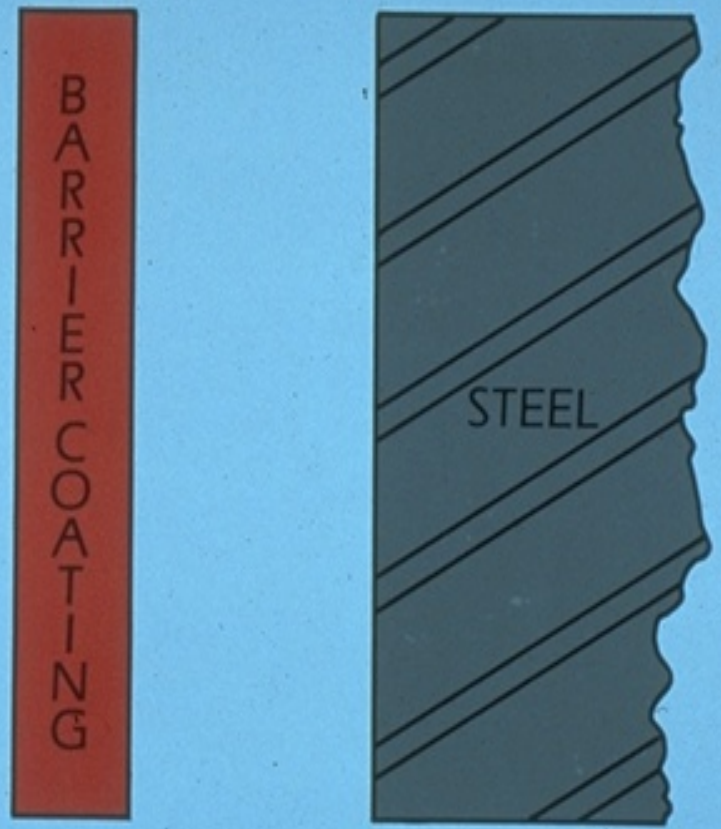
ACID

CO_2

H_2S

SUNSHINE

CAUSTIC



A coating is a barrier to protect steel from the environment.

Perfect Coating

- Ease of Application - Anyone can put it on with a mop on any surface or from above ground.
- Cost Effective - Cost $1.00/Gallon or less!
- Environmentally Safe and Friendly – OK to Drink it.
- Performance - Lasts forever.

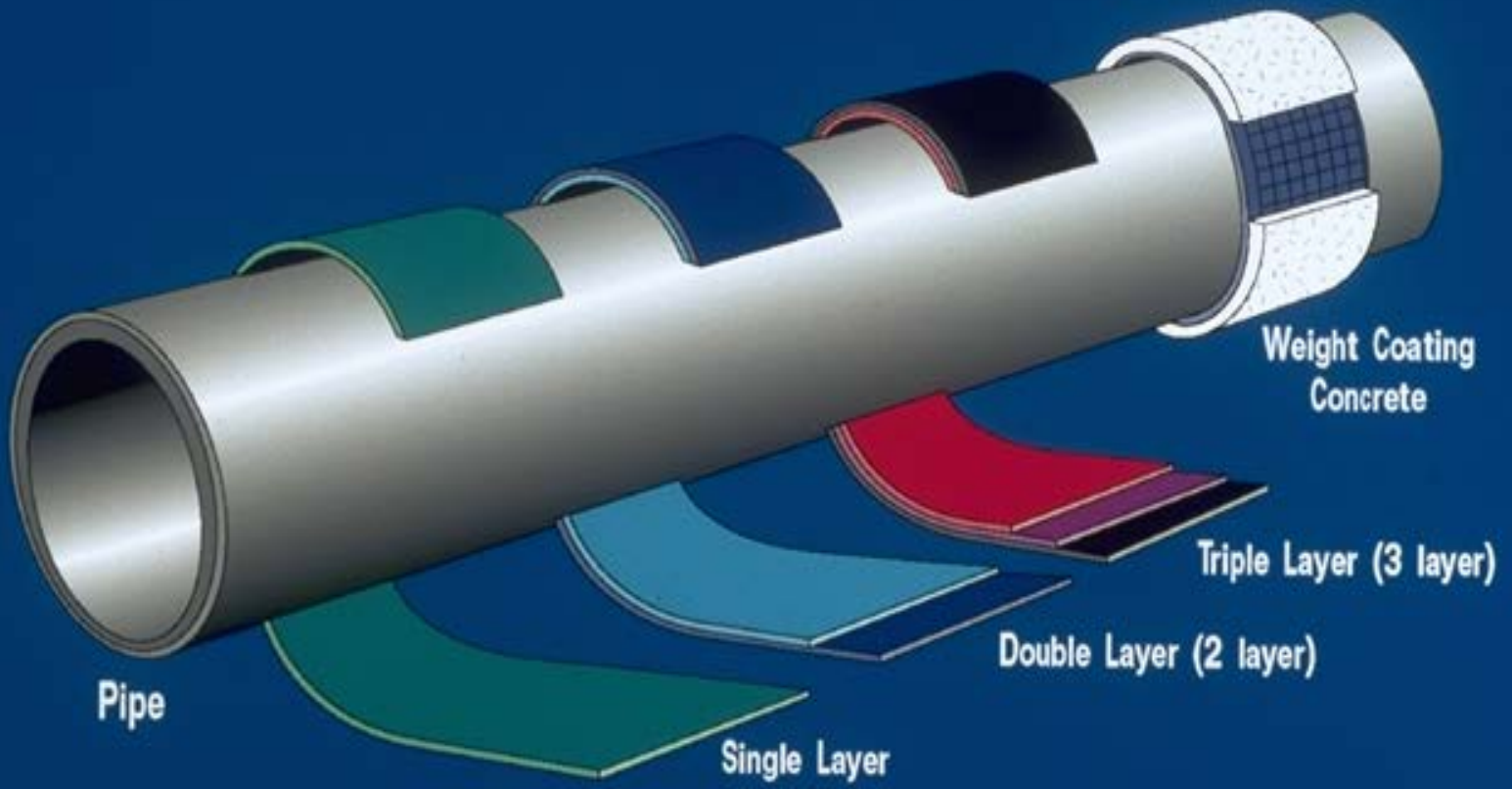
In Reality a Perfect Coating

- Requires a quality standard
- Requires a quality specification
- Requires a quality coating mill
- Requires a quality material or materials
- Requires a quality inspector or inspectors

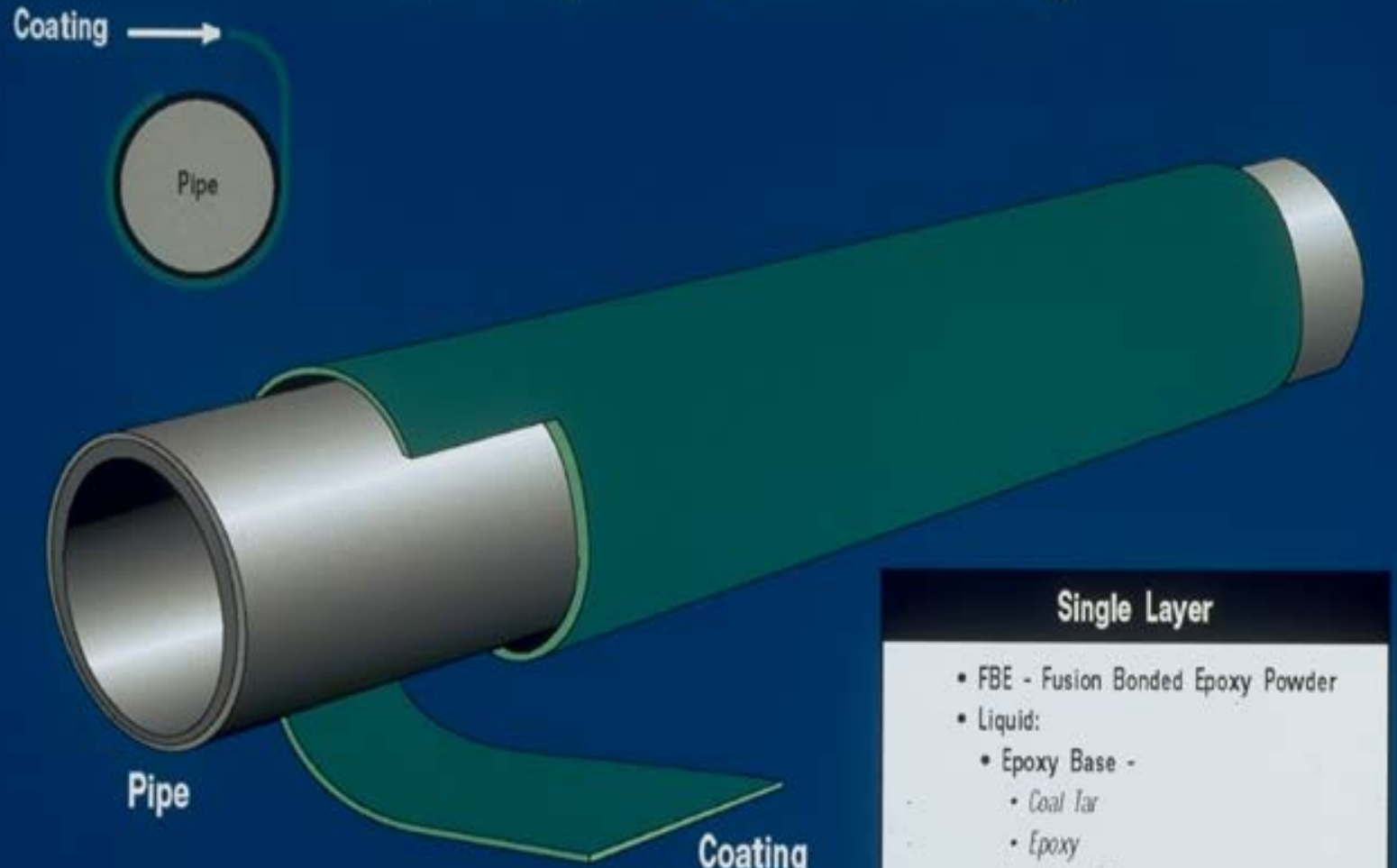
General Requirements of a Pipeline Coating

- Ease of Application
- Good Adhesion to Pipe
- Good Resistance to Impact
- Flexibility
- Resistance to Flow
- Water Resistance
- Electrical Resistance
- Chemical and Physical Stability
- Resistance to Soil Bacteria
- Resistance to Marine Organisms
- Resistance to Cathodic Disbondment
- Resistance to Soil Stress

Pipeline Corrosion Coatings



Single Layer Pipeline Coating

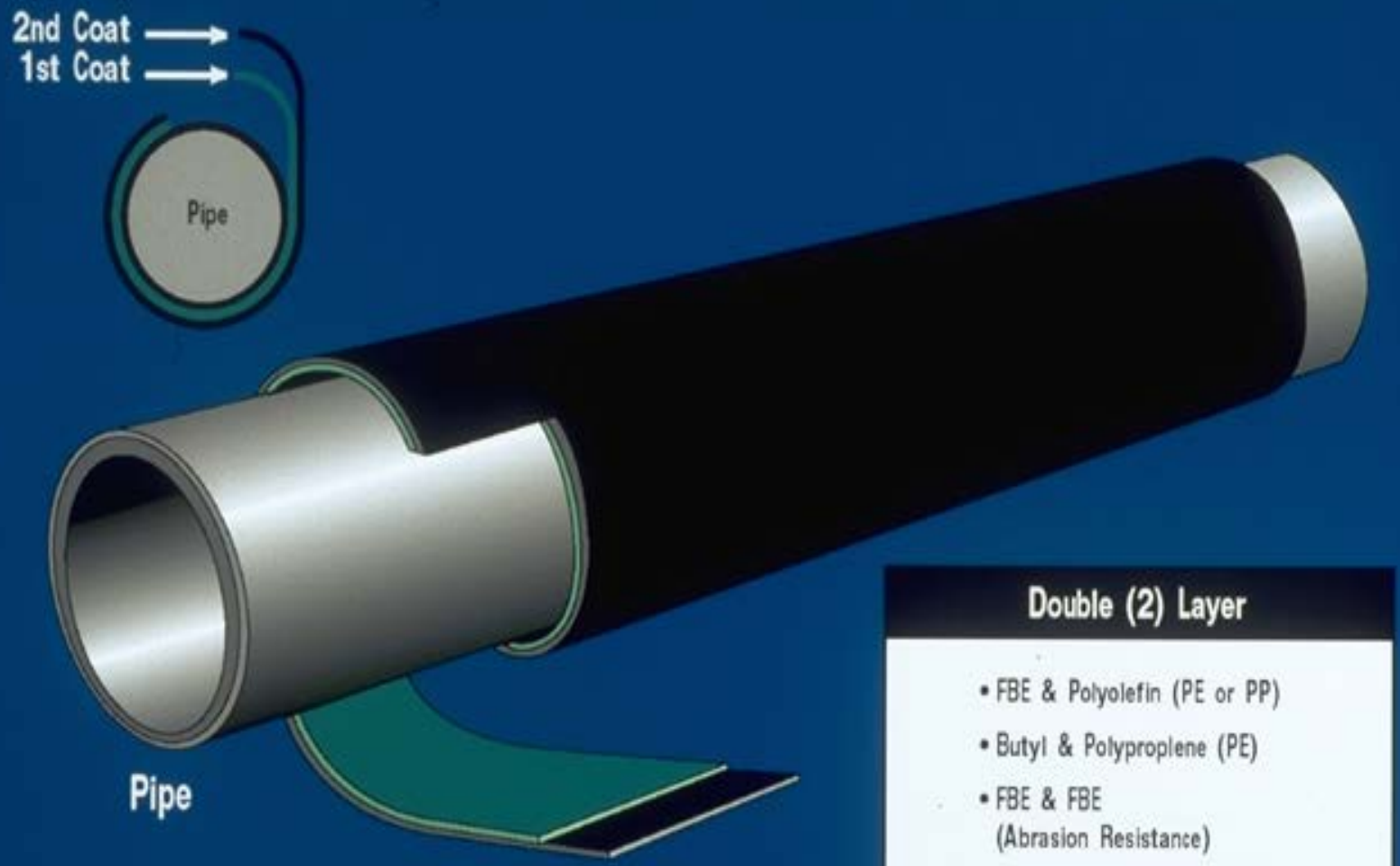


Single Layer

- FBE - Fusion Bonded Epoxy Powder
- Liquid:
  - Epoxy Base -
    - *Coal Tar*
    - *Epoxy*
  - Urethane Base -
    - *Coal Tar Urethane*
    - *Urethane*
- Wax Tapes

Double (2) Layer Pipeline Coating

Williams.



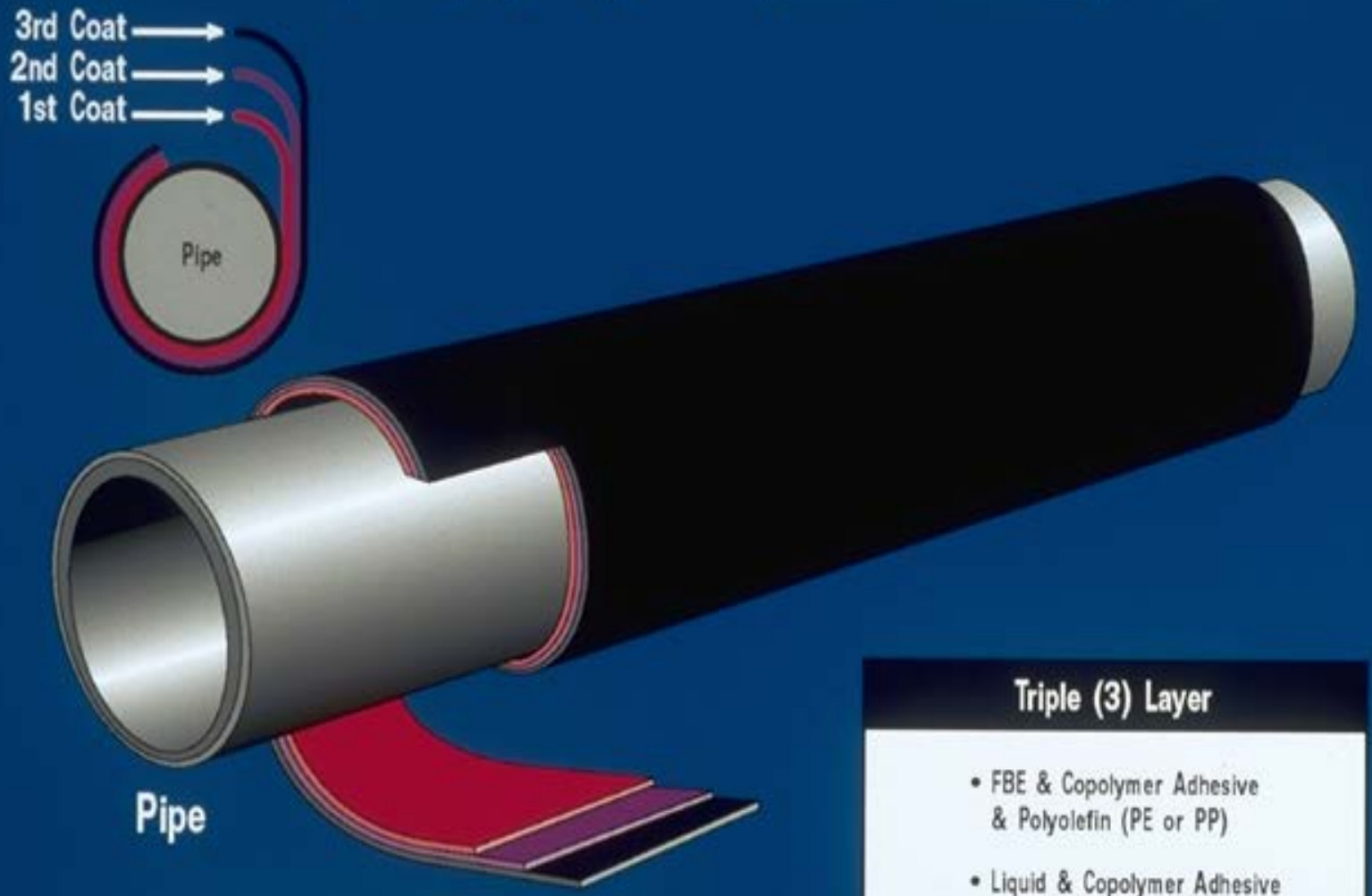
1st Coat 2nd Coat

Double (2) Layer

- FBE & Polyolefin (PE or PP)
- Butyl & Polypropiene (PE)
- FBE & FBE (Abrasion Resistance)
- FBE & Liquid Coatings (Abrasion Resistance)
- Cold Applied Polyolefin Tapes

Triple (3) Layer Pipeline Coating

Williams.



Triple (3) Layer

- FBE & Copolymer Adhesive & Polyolefin (PE or PP)
- Liquid & Copolymer Adhesive (PE or PP)

SURFACE PREPARATION

SURFACE PREPARATION

PURPOSE OF SURFACE PREPARATION

- To clean surface of materials which could cause the coating system to fail prematurely.
- To provide a surface that can be easily wetted for good coating adhesion.
- To provide an anchor profile.
- Paints adhere to the surface by mechanical bond.

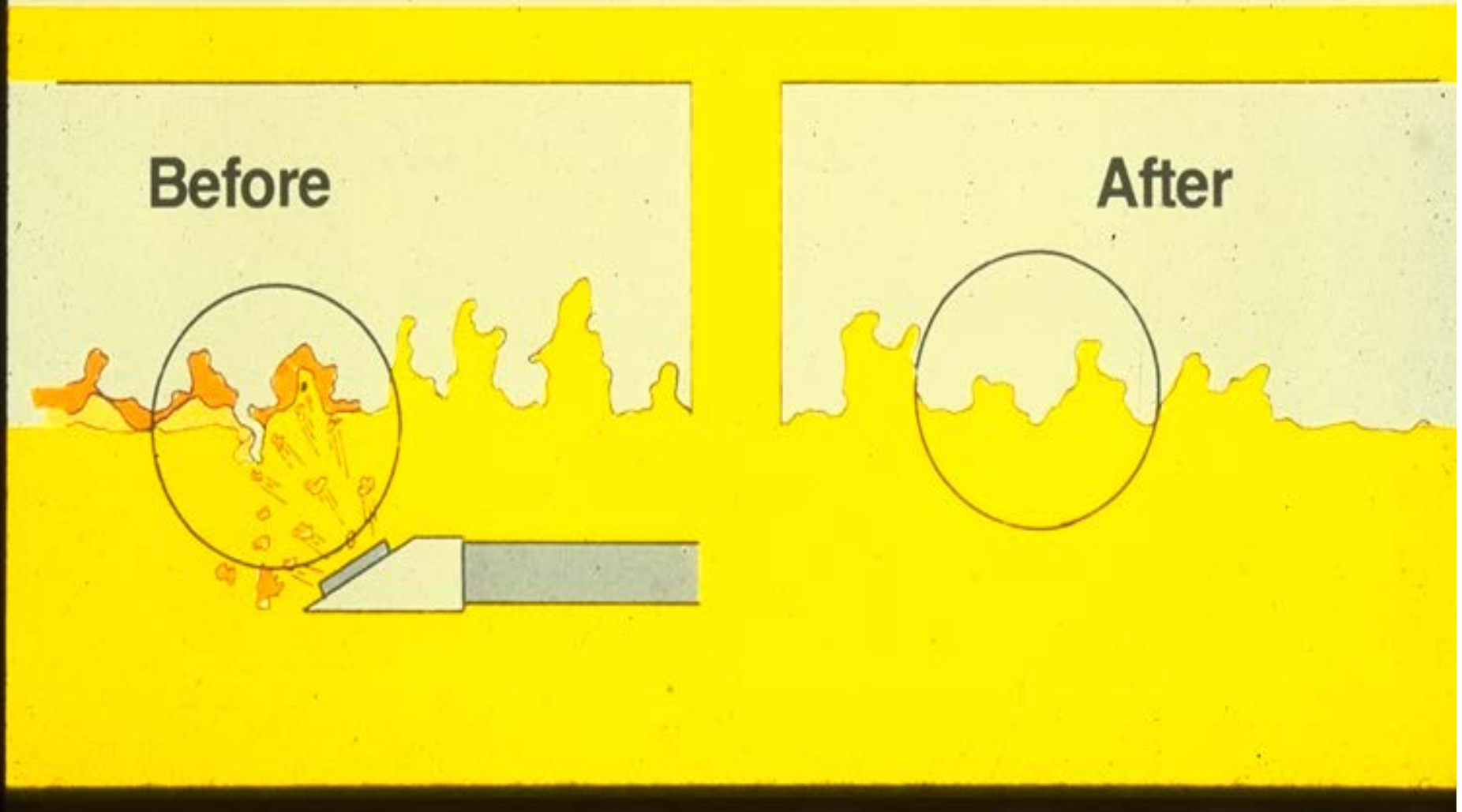
TOO LOW

1-2 MILS

GREATER THAN 2 MILS

ANCHOR PATTERNS

Anchor Pattern Formation

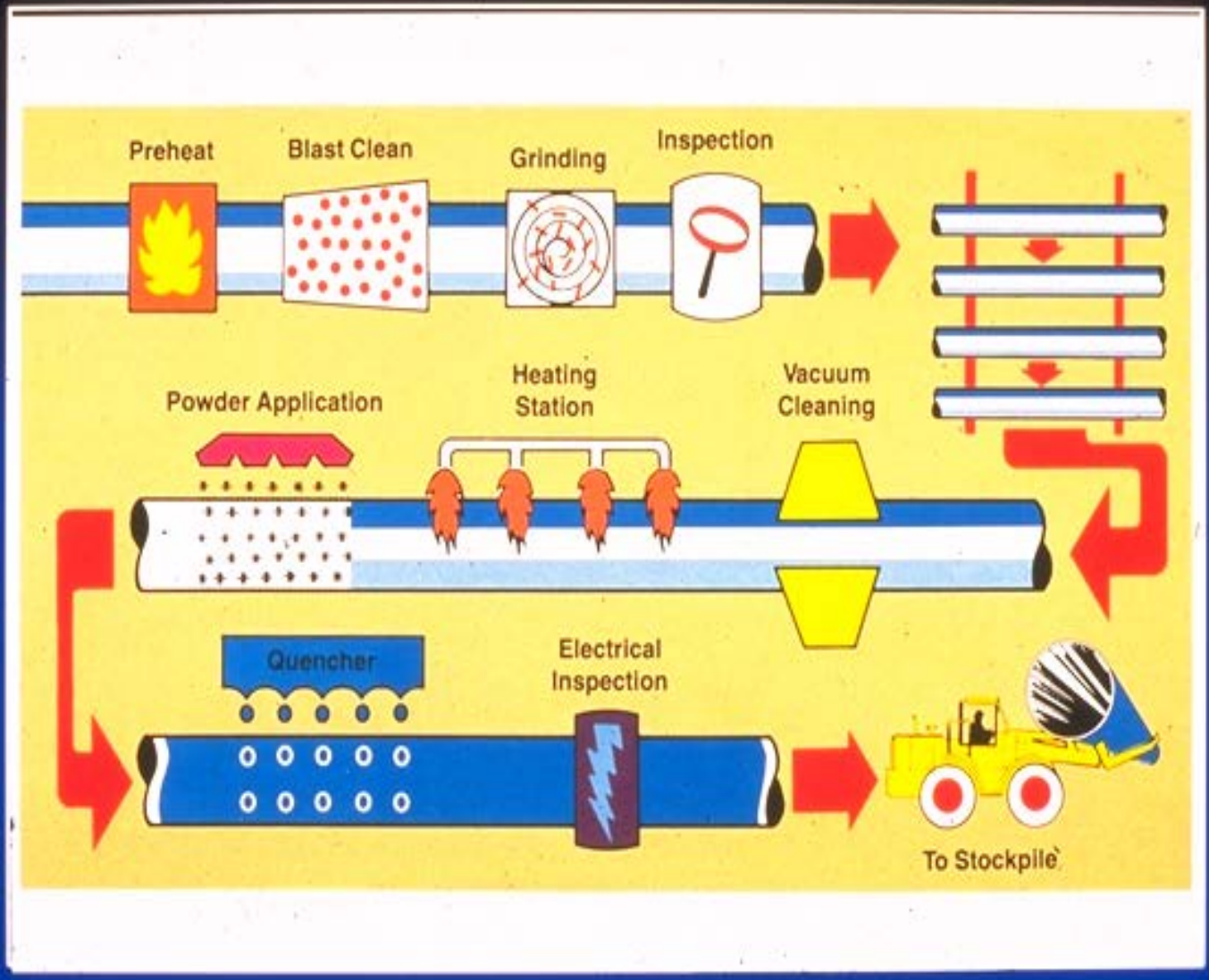


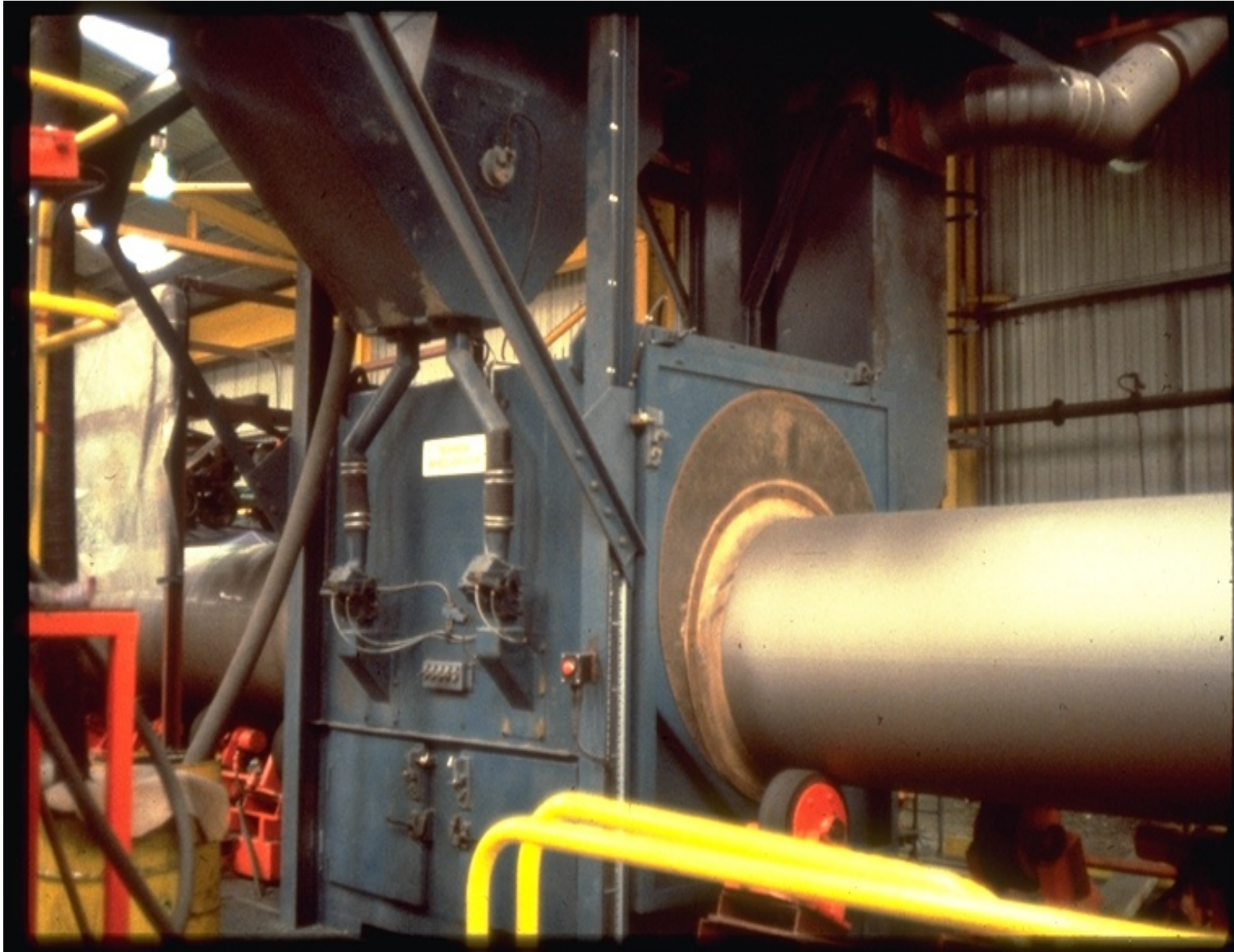
FUSION BONDED COATINGS

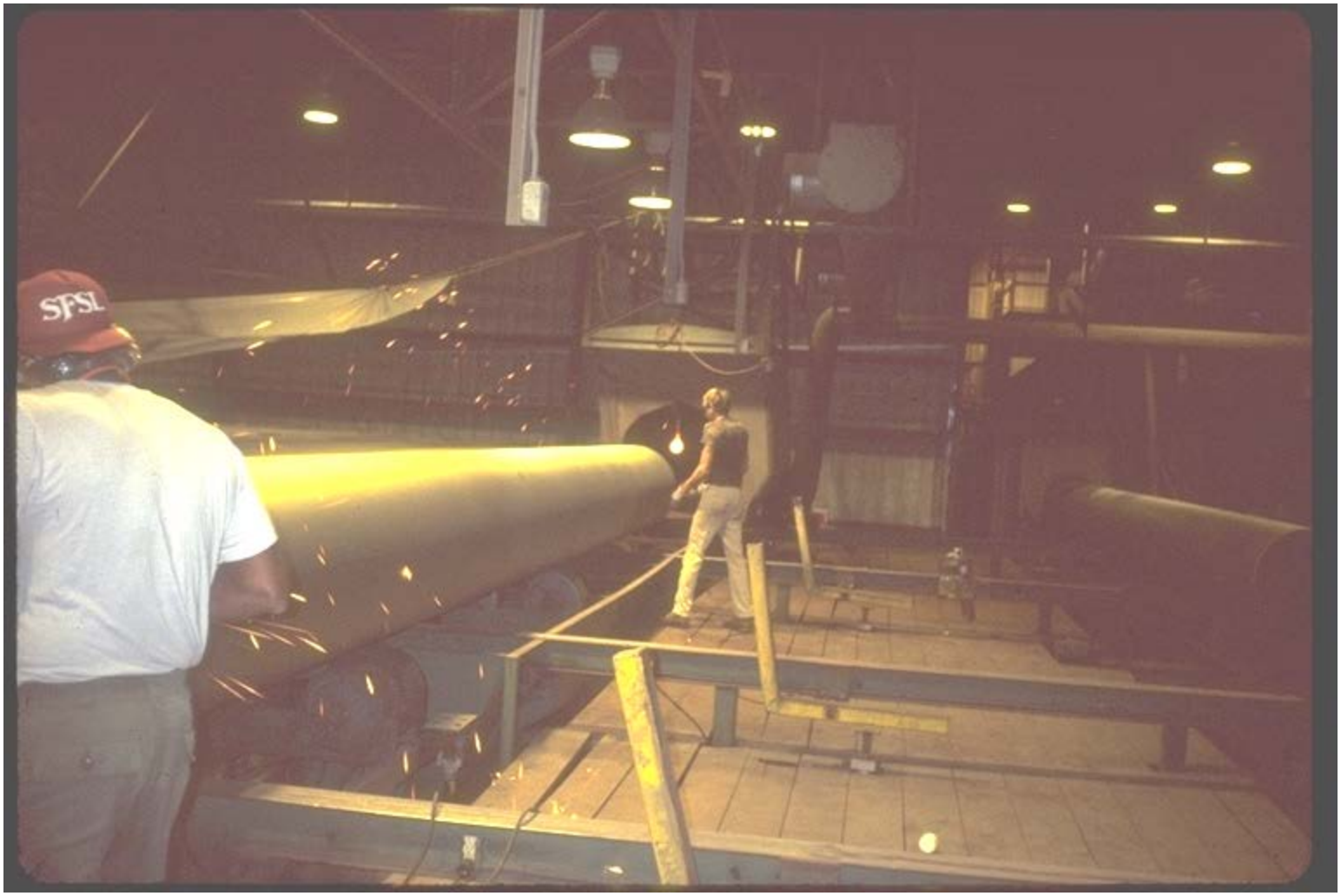
APPLICATION PROCEDURE

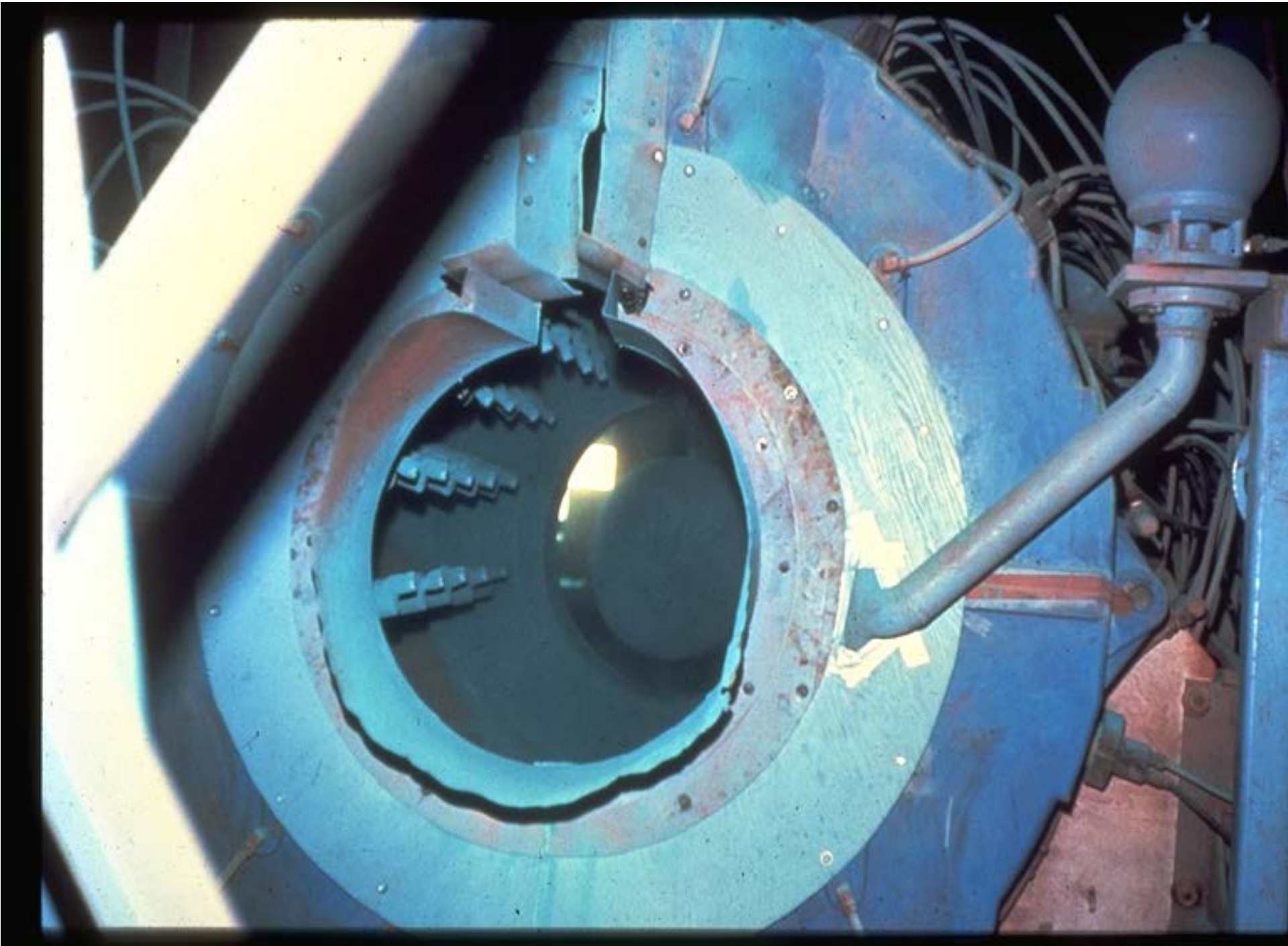
1. CLEAN
2. HEAT
3. APPLY
4. CURE
5. INSPECT
6. REPAIR

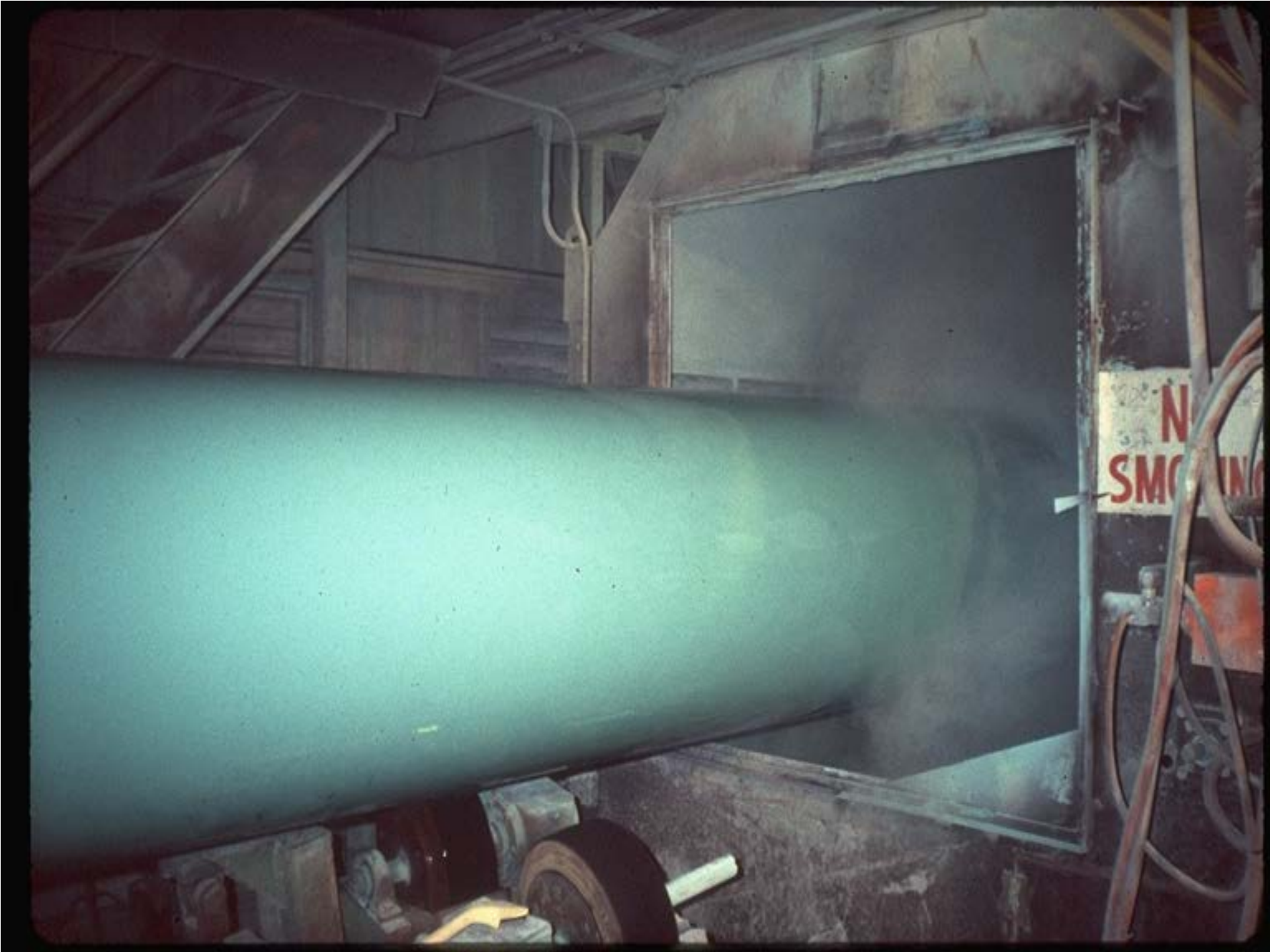
Fusion Bonded Epoxy



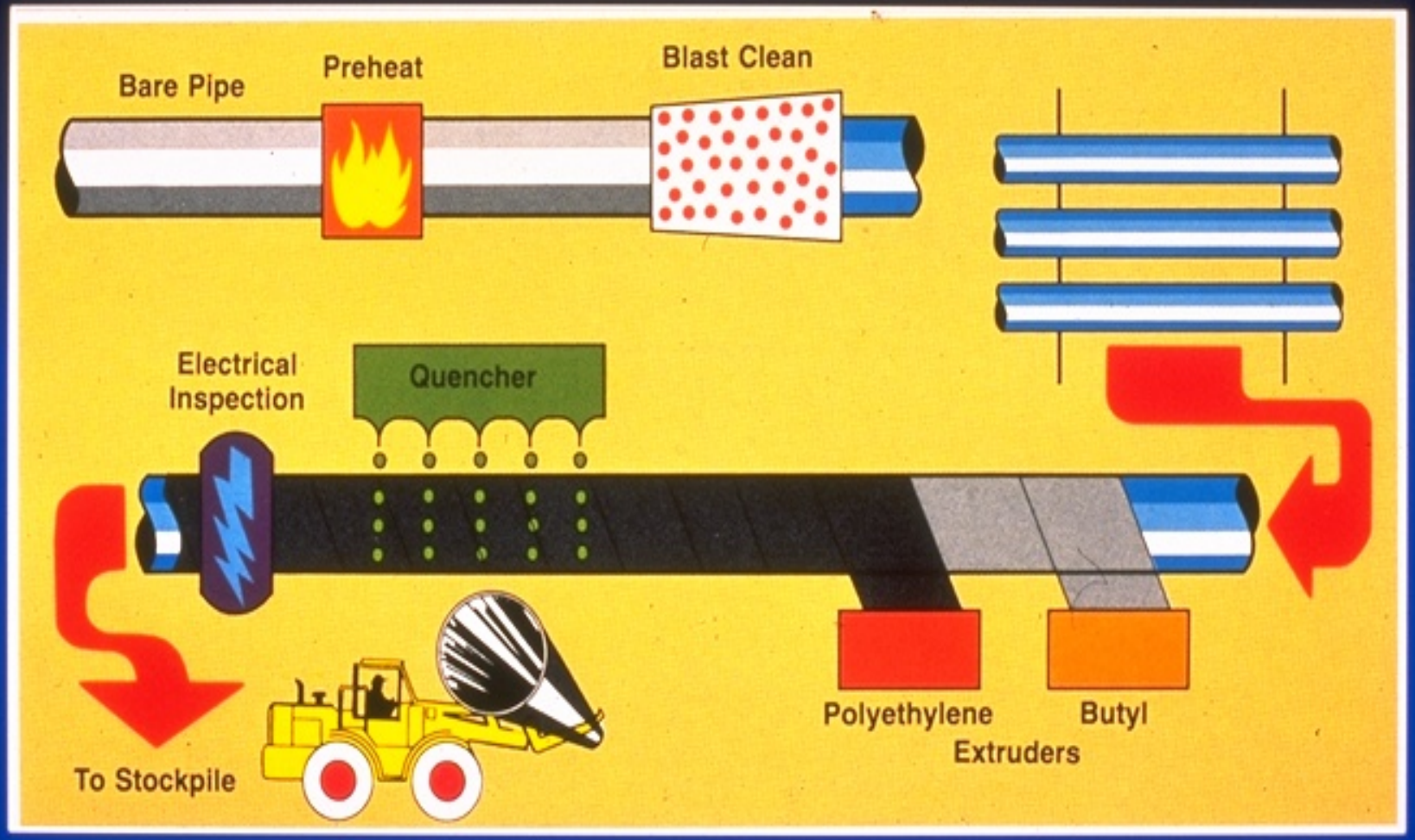


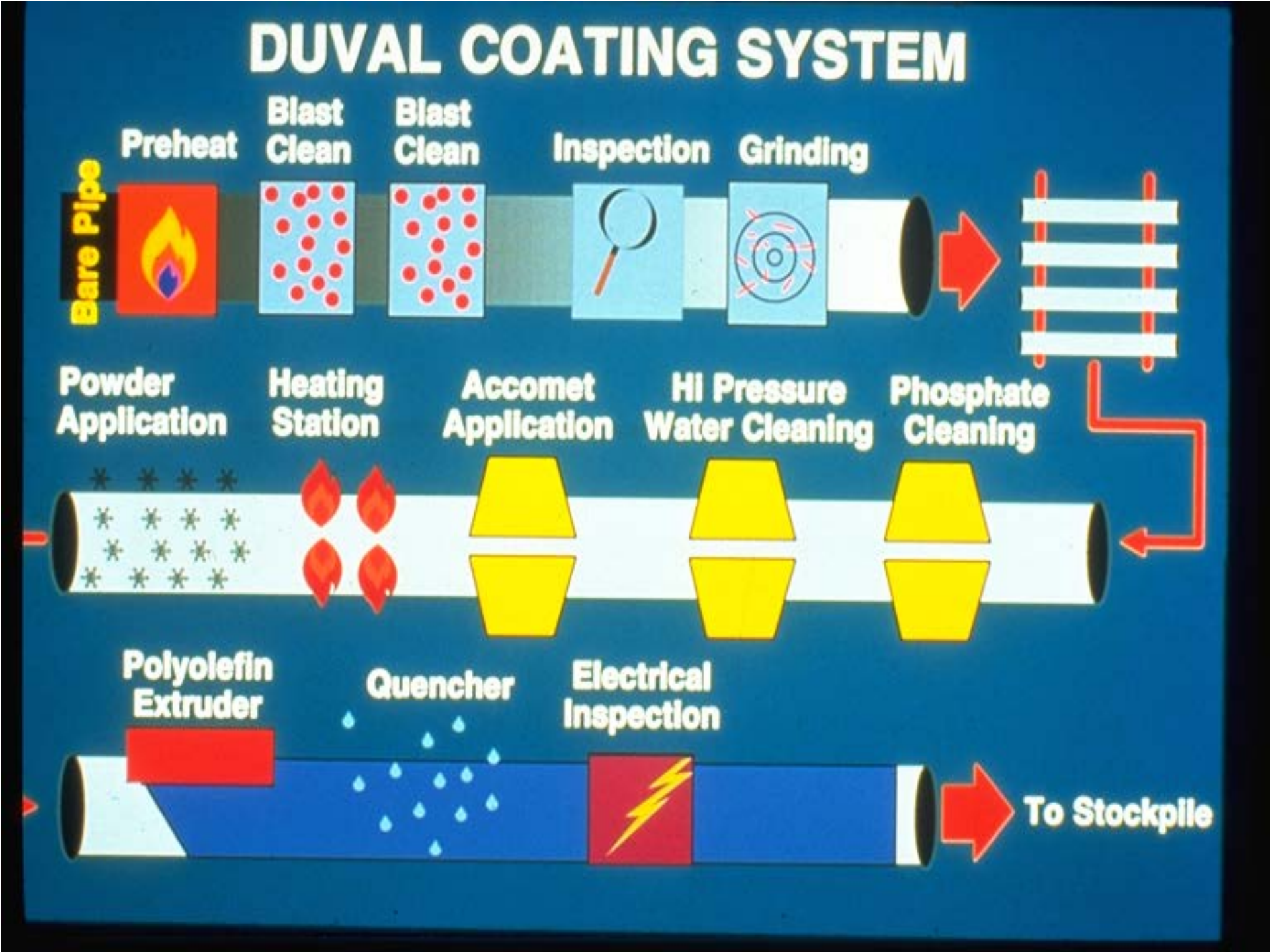

SFSL




N
SMO IN

PE/BUTYL (Two Layer)




DUVAL COATING SYSTEM
Bare Pipe
Preheat
Blast Clean
Blast Clean
Inspection
Grinding
Powder Application
Heating Station
Accomet Application
Hi Pressure Water Cleaning
Phosphate Cleaning
Polyolefin Extruder
Quencher
Electrical Inspection
To Stockpile

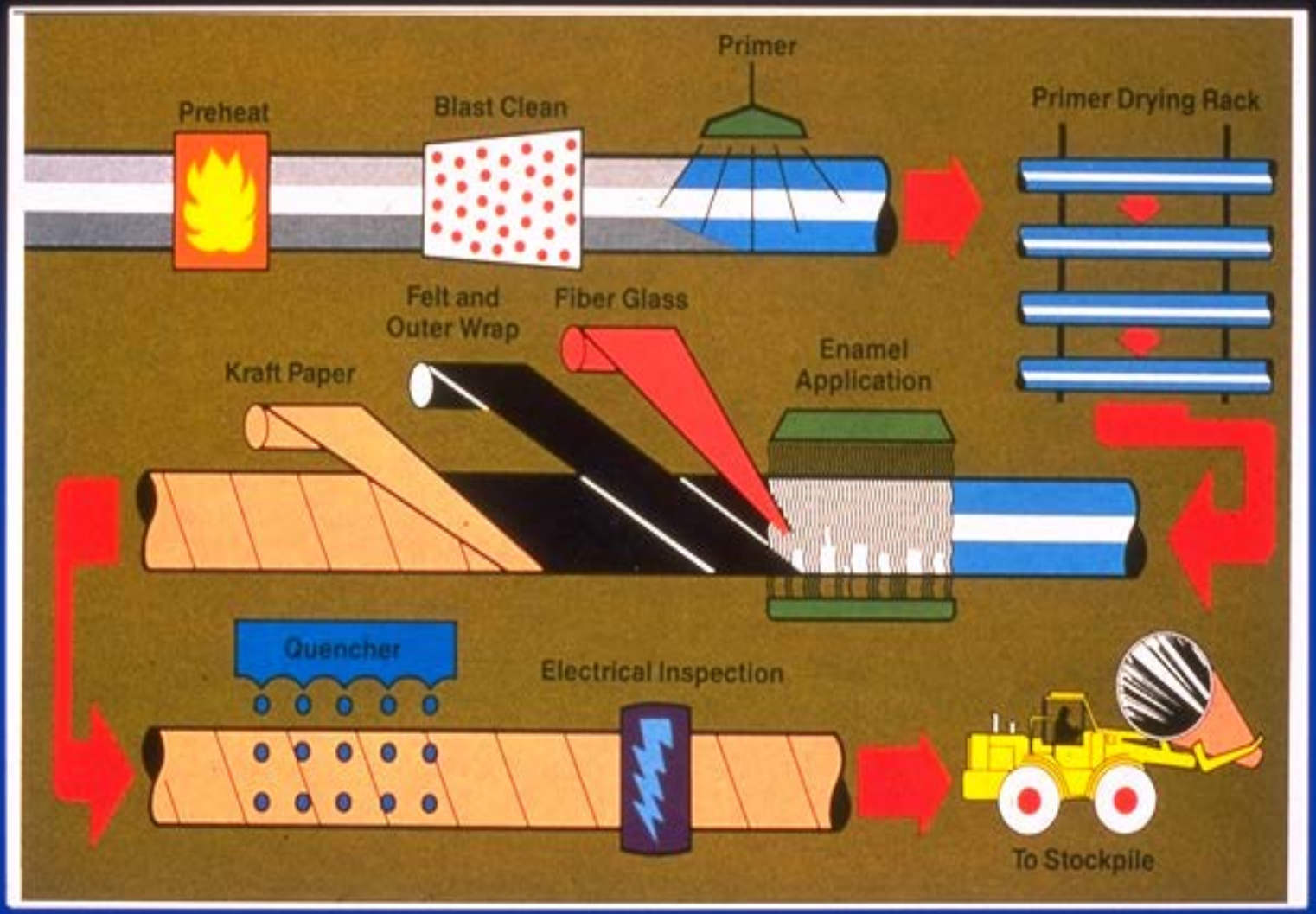
BERINGER

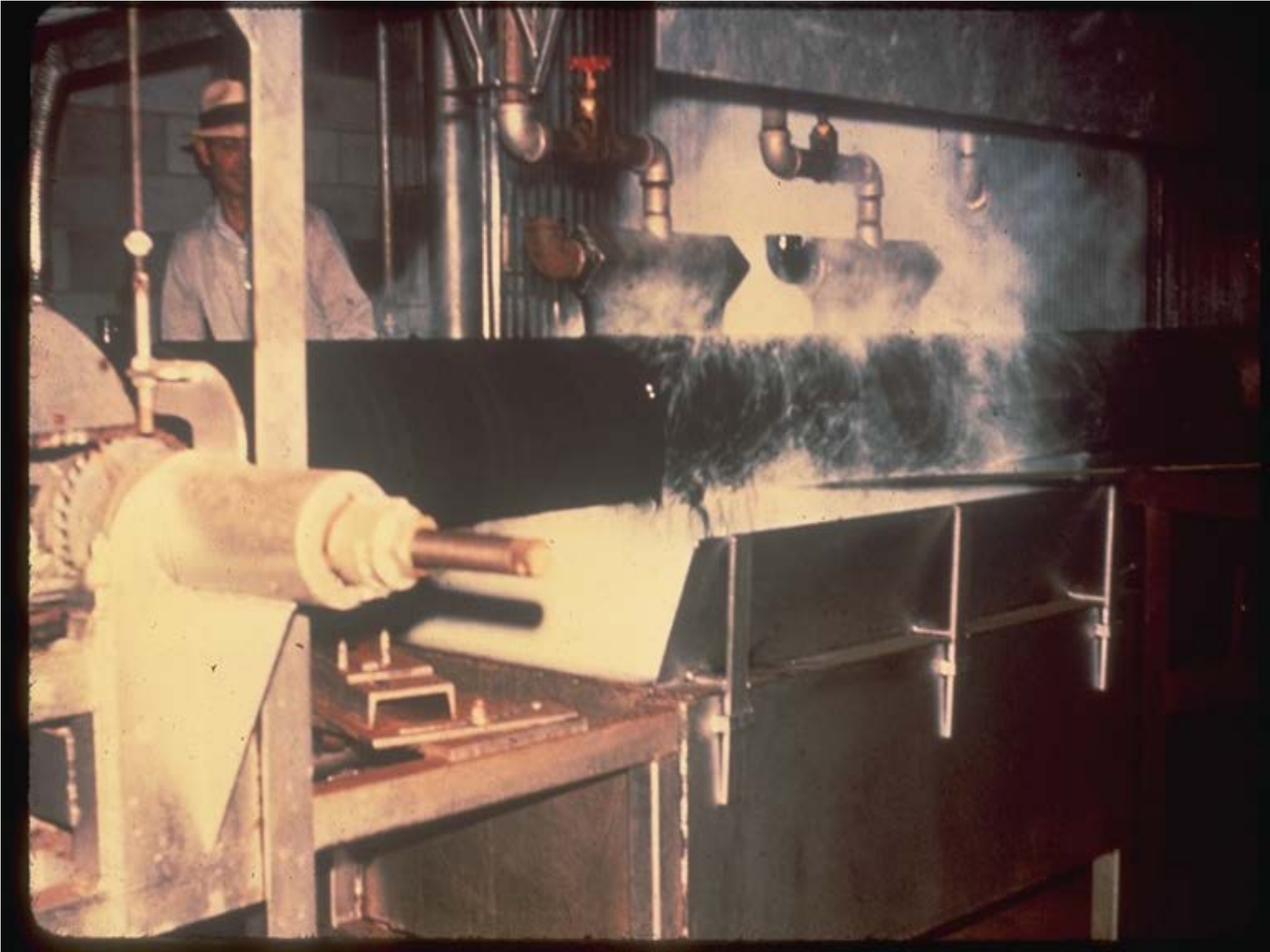
DUAL POWDER "GOLD"

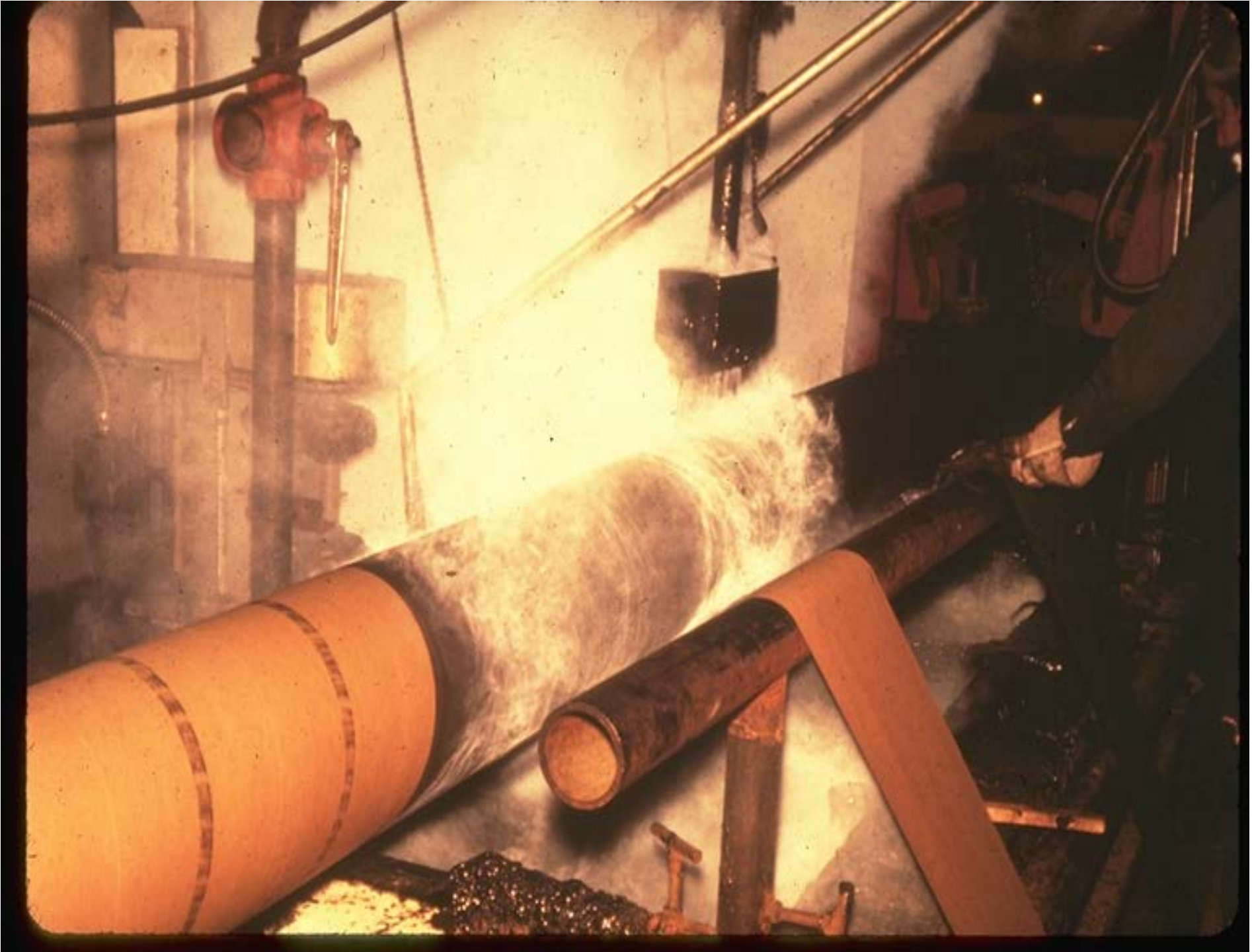
FBE AND A

PLASTICISED FBE TOP COAT

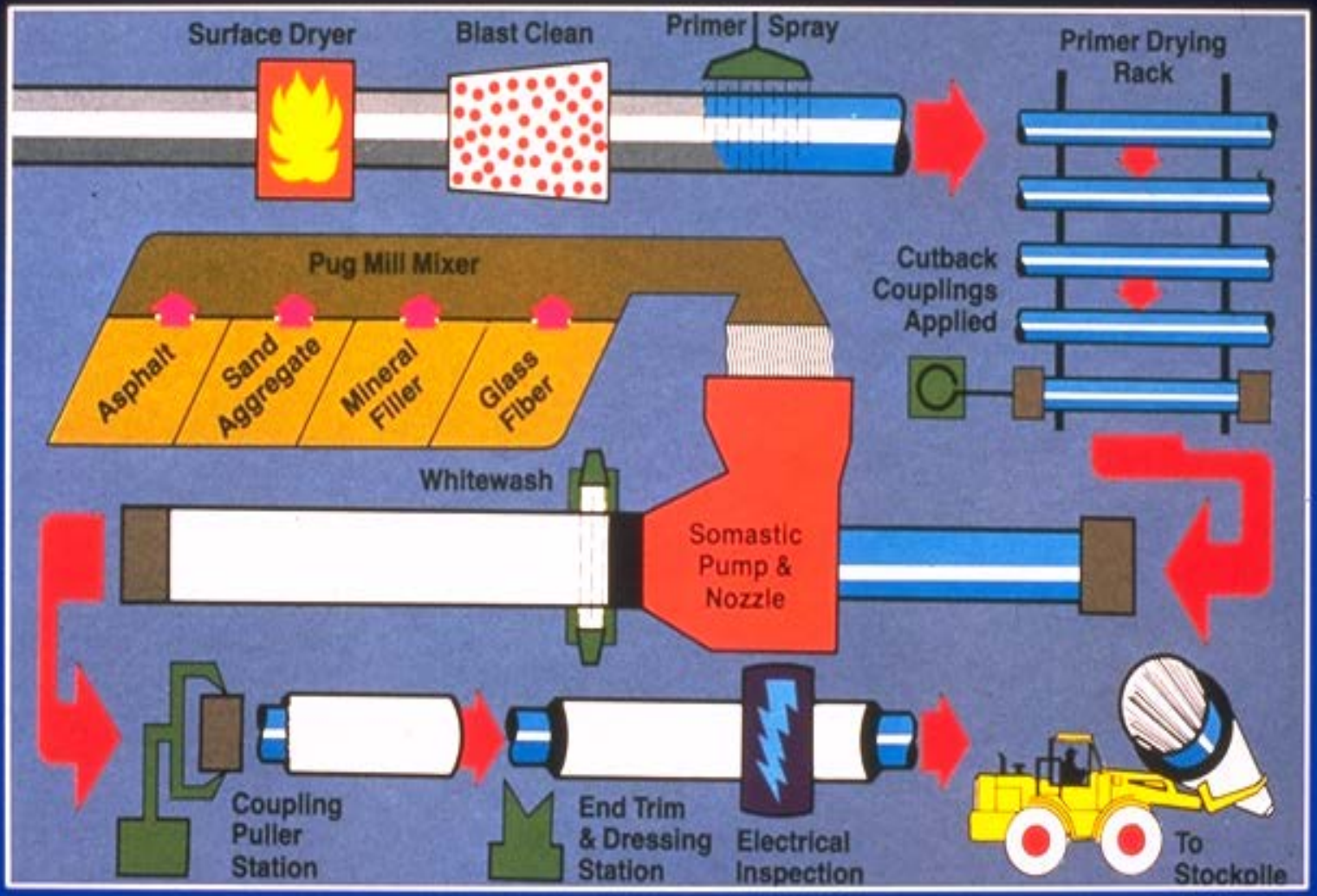
Coal Tar Enamels







Asphalt Mastic



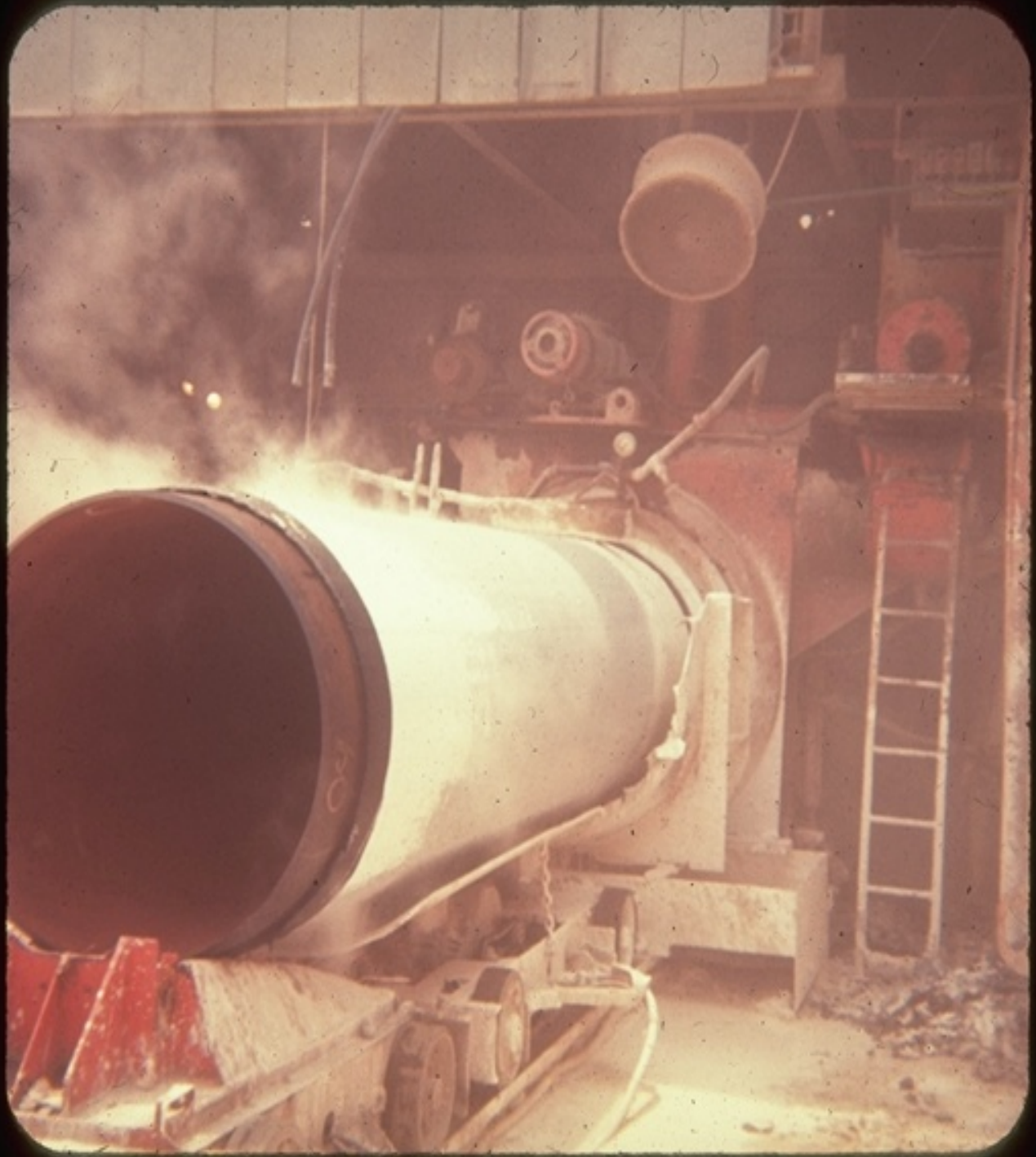
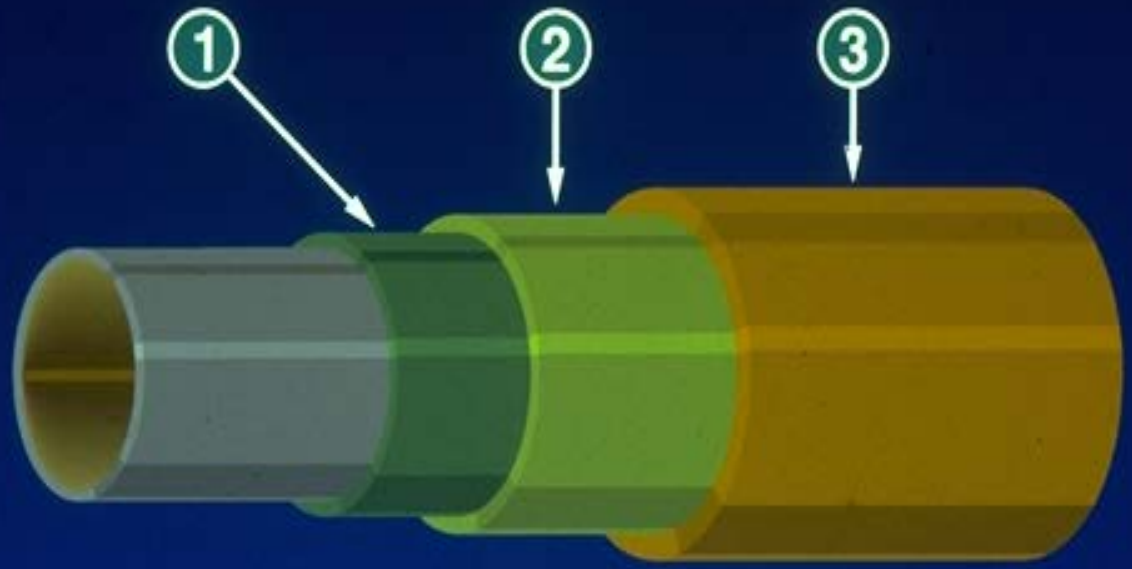
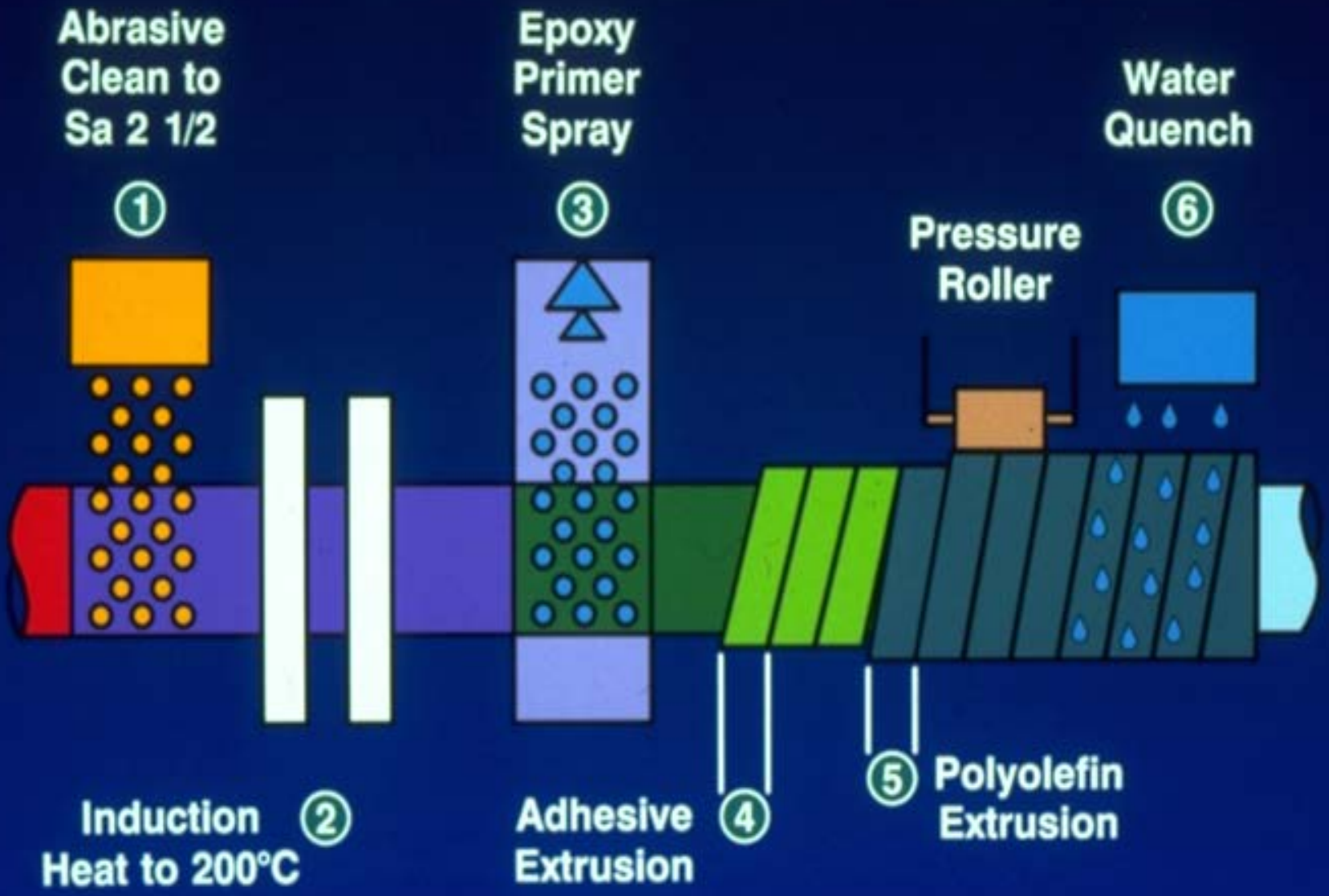


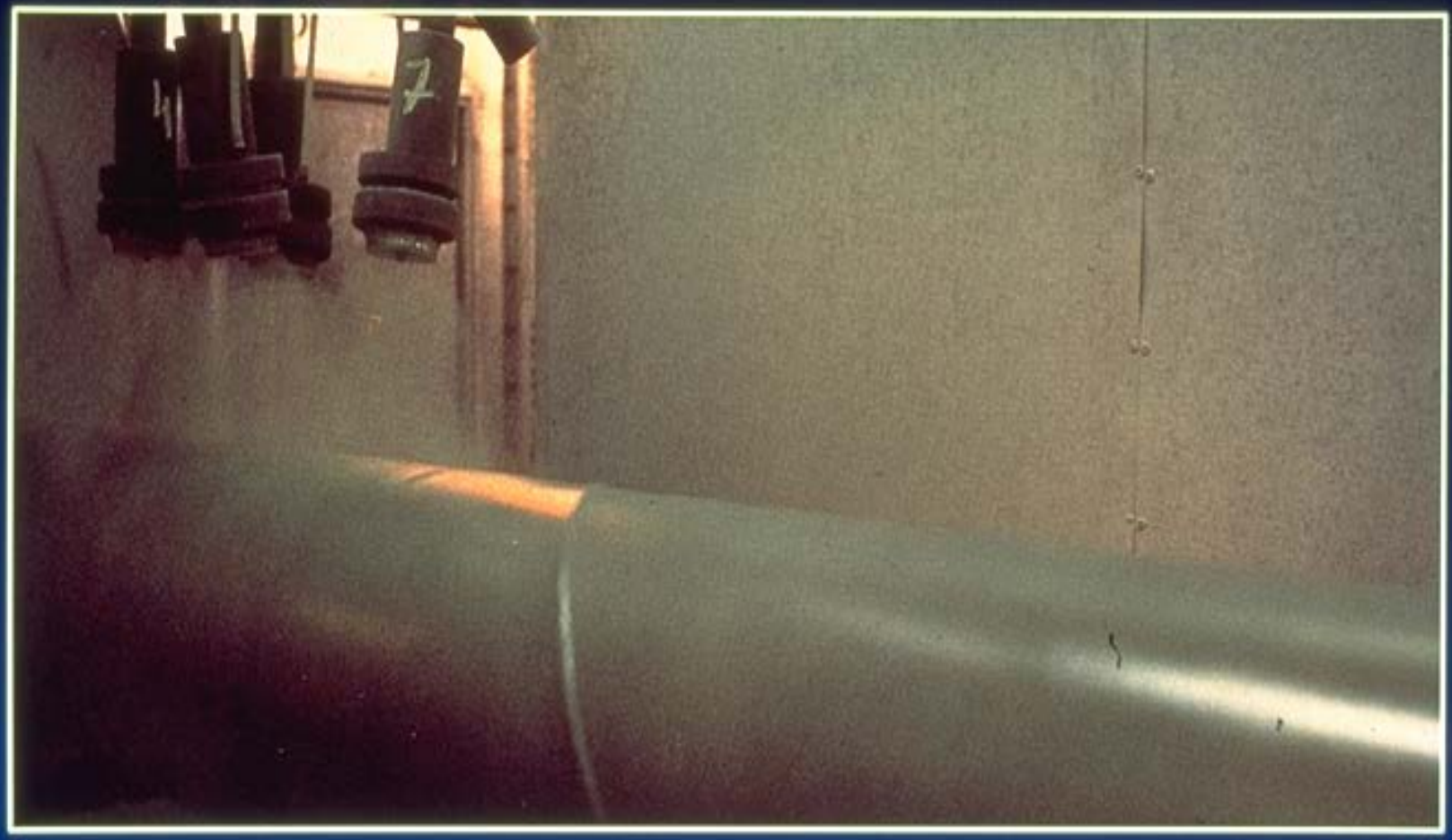
Figure 1 Shows a Schematic Diagram of a Typical 3-Layer Pipe Coating



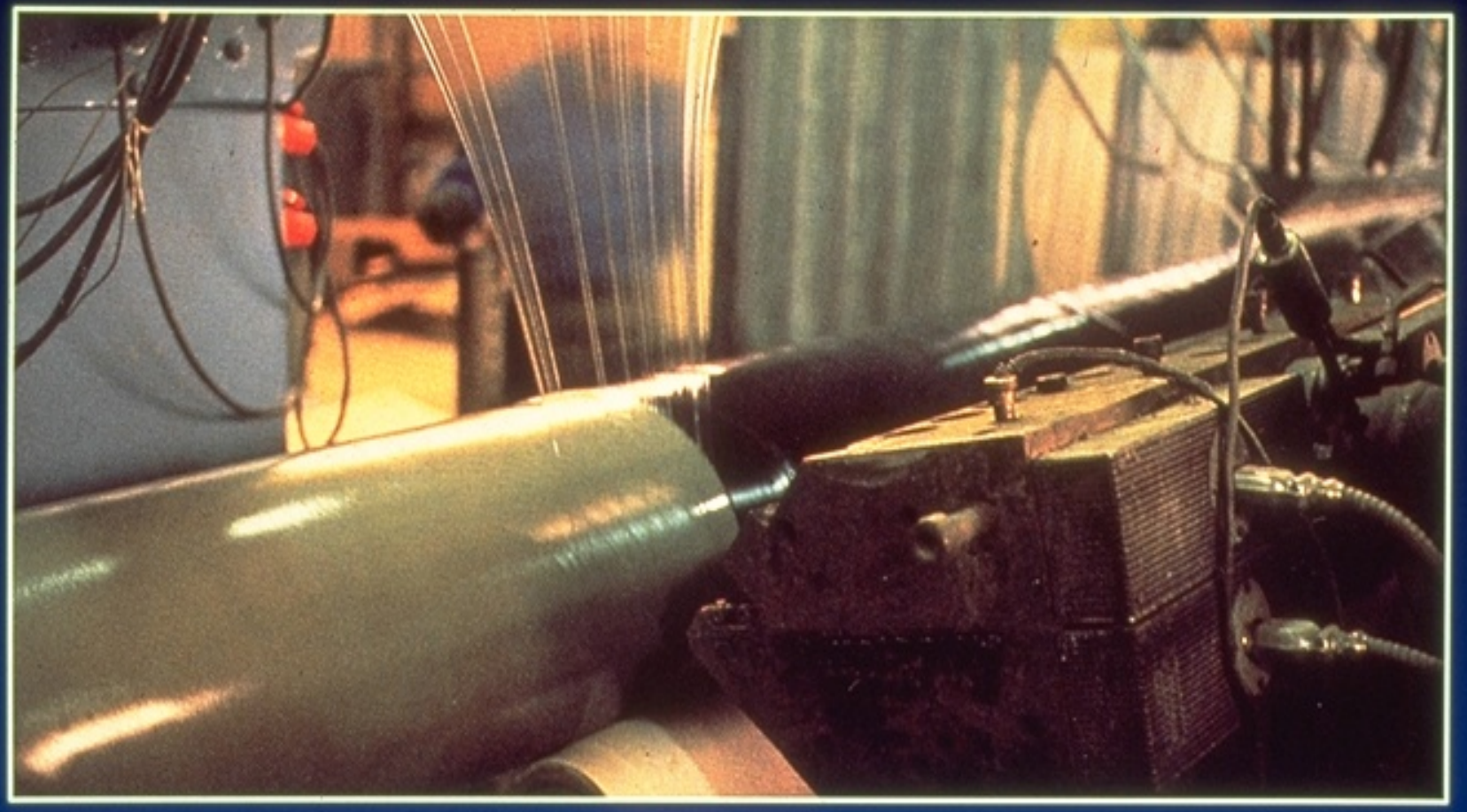
1. EPOXY PRIMER
2. INTERMEDIATE ADHESIVE LAYER
3. POLYOLEFIN TOPCOAT

Schematic Diagram of 3-Layer Pipe Coating



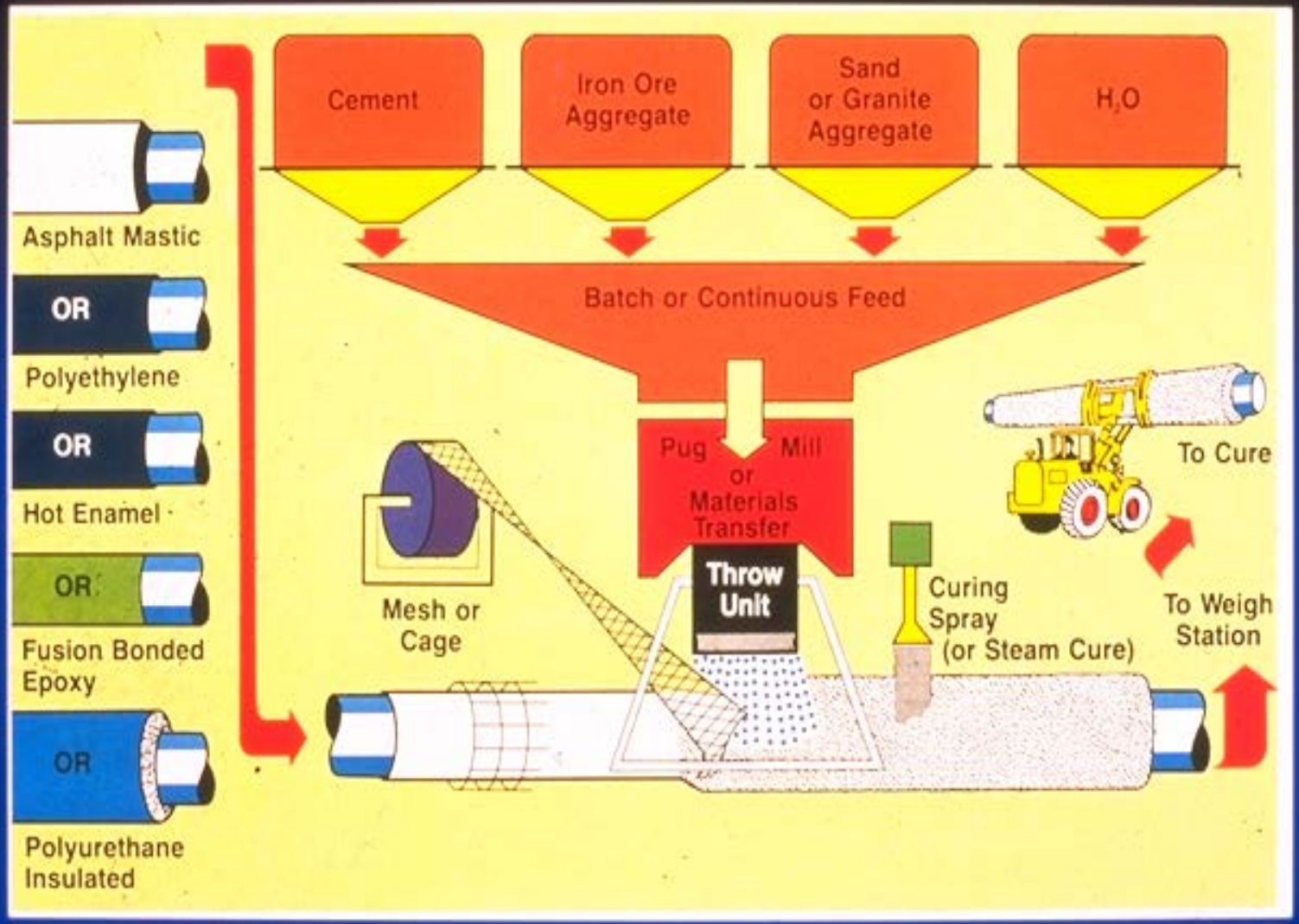


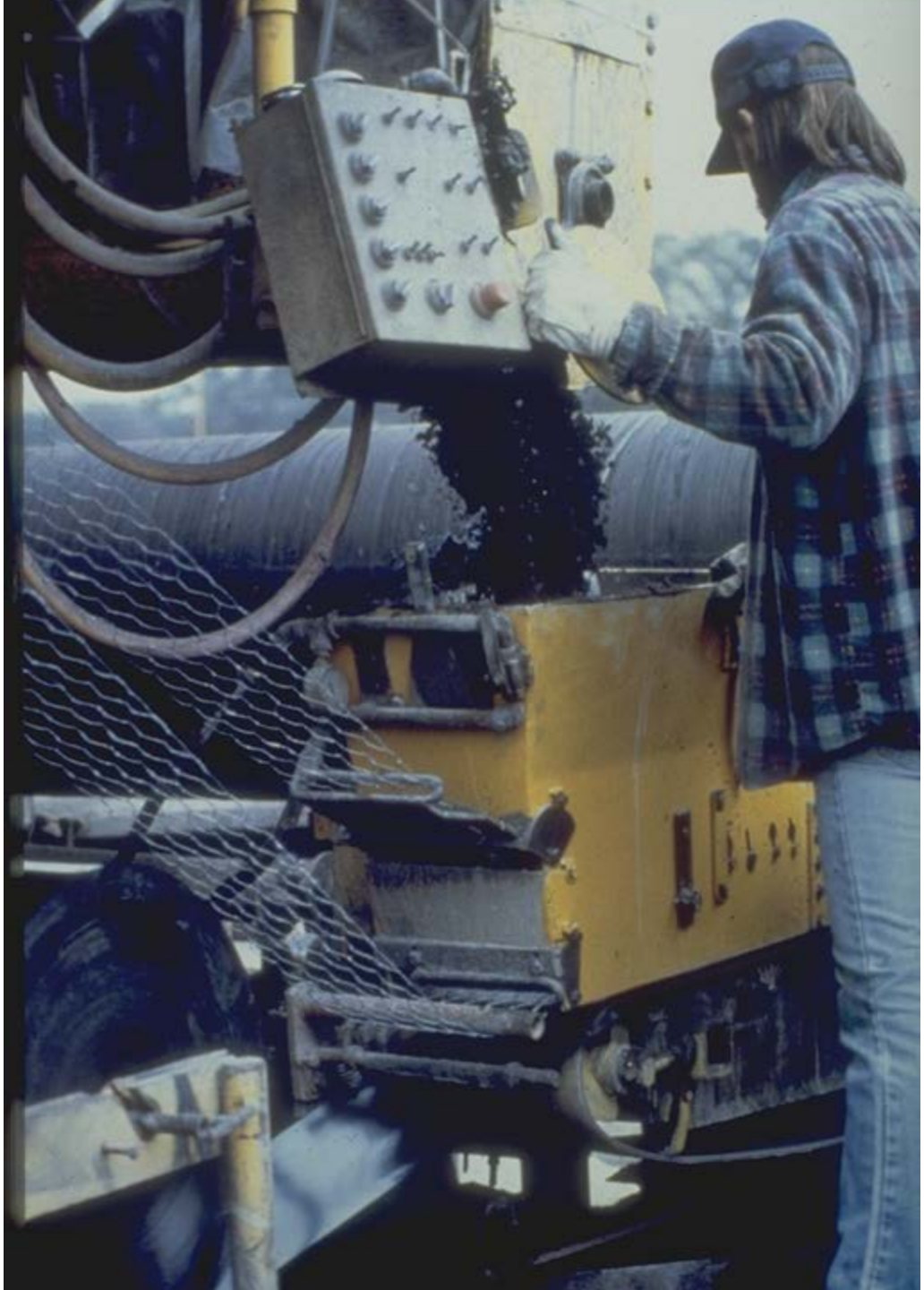
Application of EUROKOTE Epoxy Powder Primer Layer



Extrusion of Adhesive and Low Density
Polyethylene Over the Epoxy Primer Layer

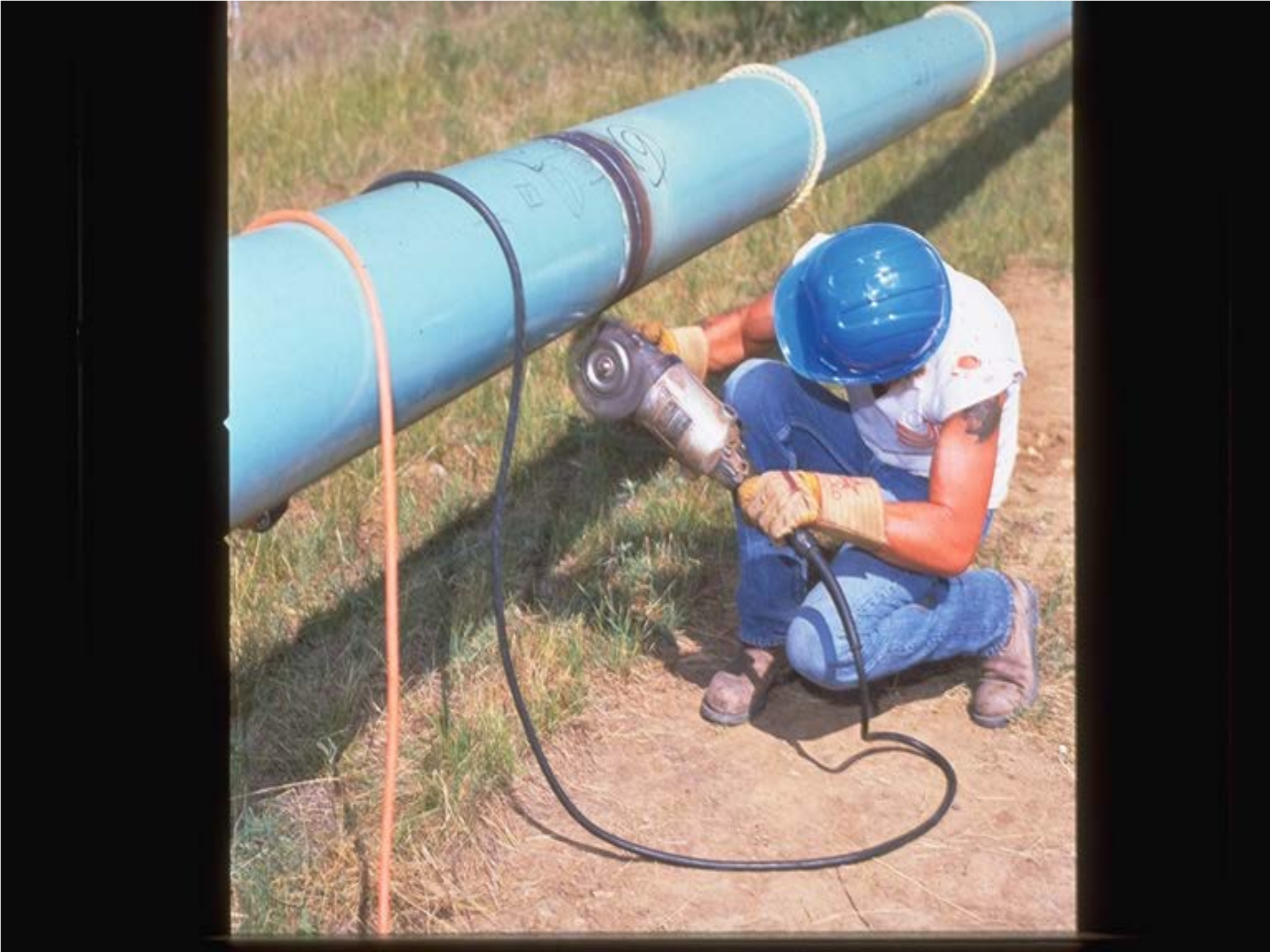
Impingement Concrete Coating

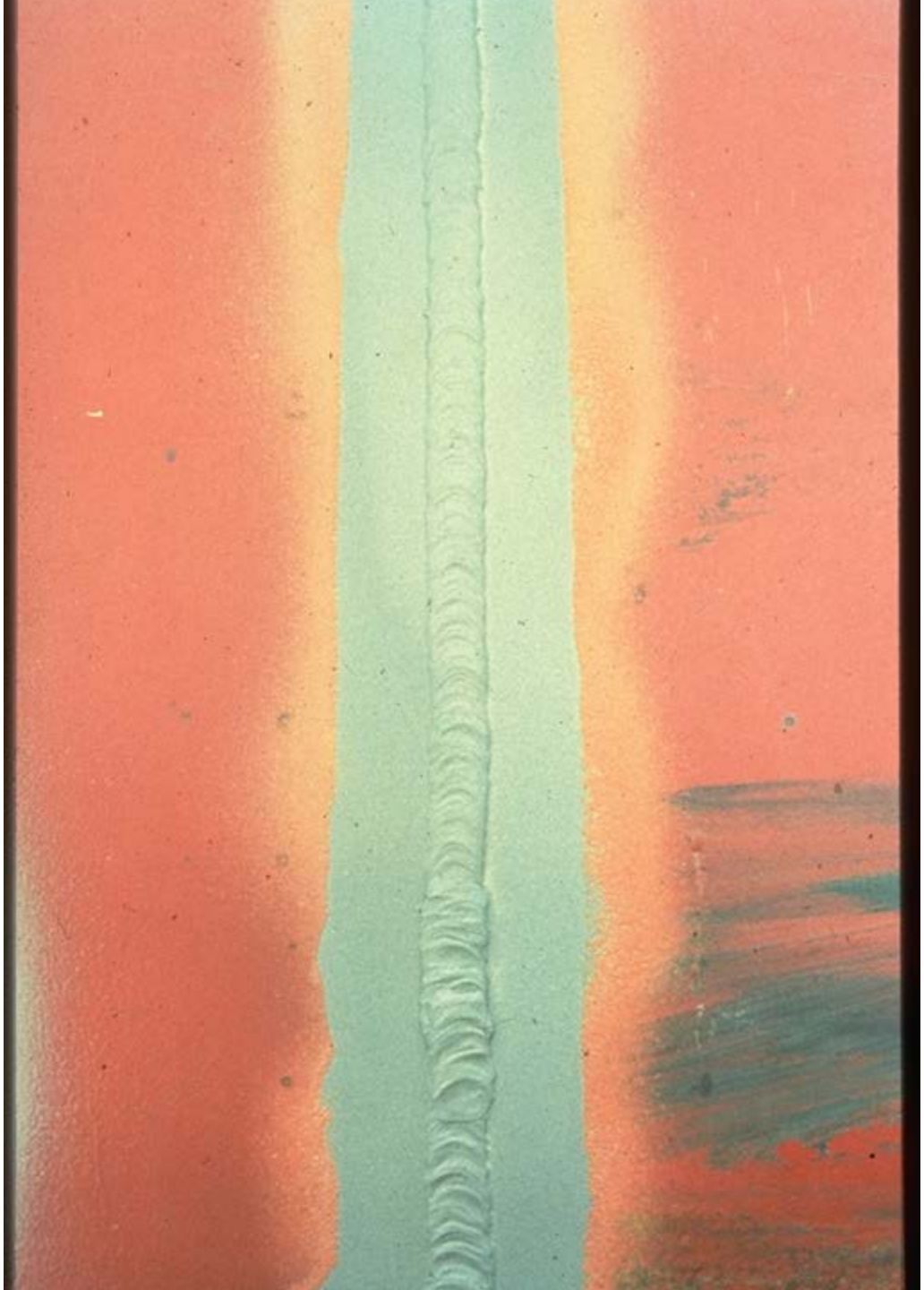


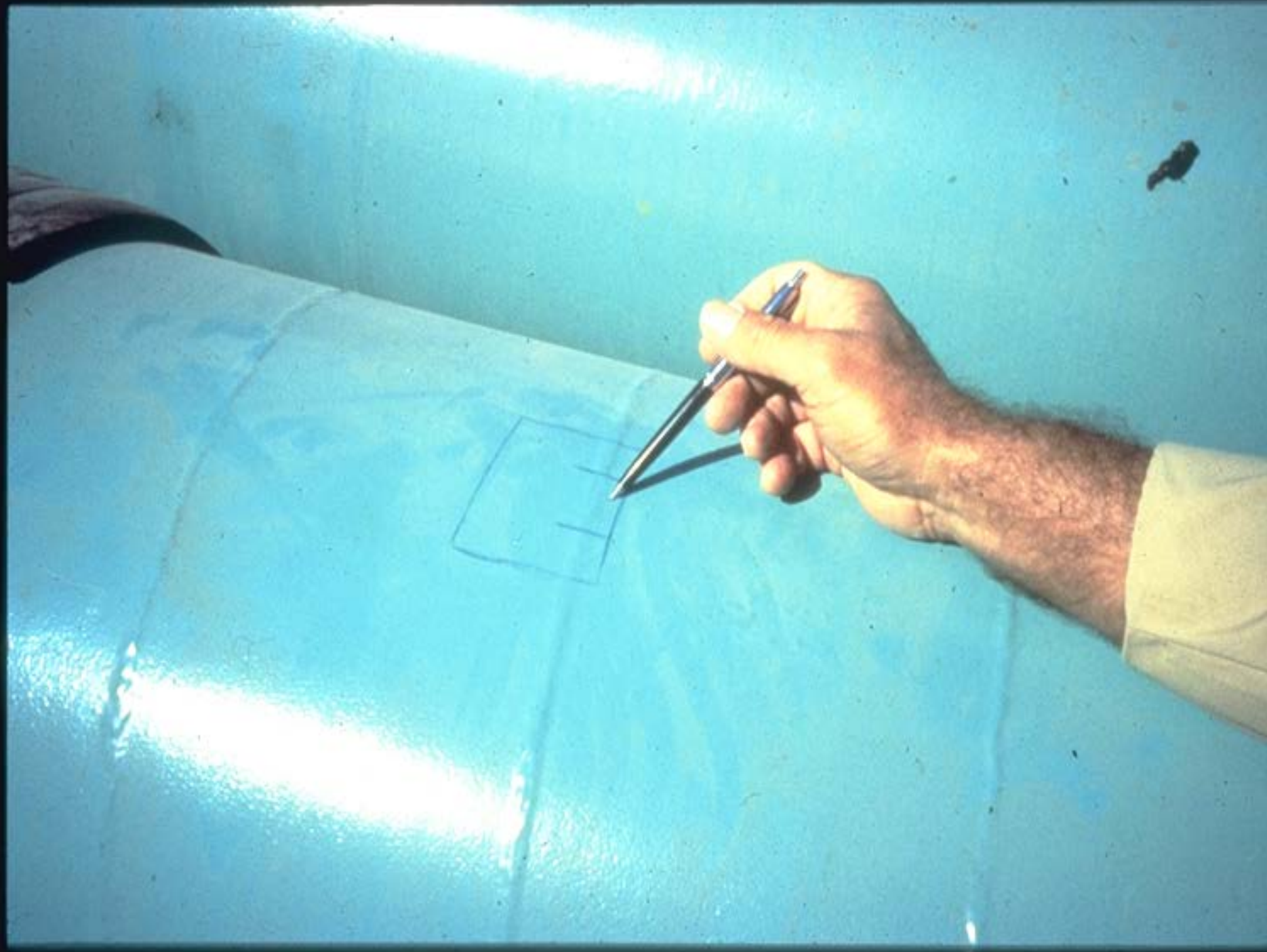



MARTIN
DECKER


2





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FLEXIT


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The End!

- Questions?