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# **Fundamentals of Pipeline Coatings**

2023 AUCSC

Coatings Session

Jeff Didas – Kinder Morgan - Tucson, AZ



Appalachian Underground Corrosion Short Course

# Remember This!

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- Coatings are the #1 defense against corrosion.
- Surface preparation is the most important step in the coating process.
- This is true for underground, transition, internal and above ground service.

# Today's Discussion - Coating Types

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



# Underground Pipeline Coatings - Discussion

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





# Mill or Plant Applied

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- 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 plants allows for some coated pipe storage



# Field Applied

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- 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
- Keyhole applications can be a problem
- Includes Field Joint – FJC / Weld Joint – WJC Coatings



# Line Coatings

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- Coal Tar Enamel
- Asphalt Enamel
- Extruded Polyethylene
- Fusion Bonded Epoxy
- Somastic
- Pritec
- Liquid Epoxies
- 3 Layer – 3LPE & 3LPP
- ARO – Abrasion Resistant Overlay or Overcoat



# Repair Coatings

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- Tapes
- Wax
- Shrink Sleeves
- Shrink Tape
- Two - Part Epoxy
- Mastic
- Epoxy Mastic
- Visco-Elastic
- Misc.



# Coatings Discussion

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- Most important component of a pipeline
- High quality holiday free coating requires almost no cathodic protection current
- However, Coatings need to be specified
- However, Coatings need to be tested & Qualified
- Remember, every coating has a use and a procedure, coatings, however are used improperly – follow procedures



# Coating Cost

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



# Coating Quality

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- 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

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- 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

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- 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

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



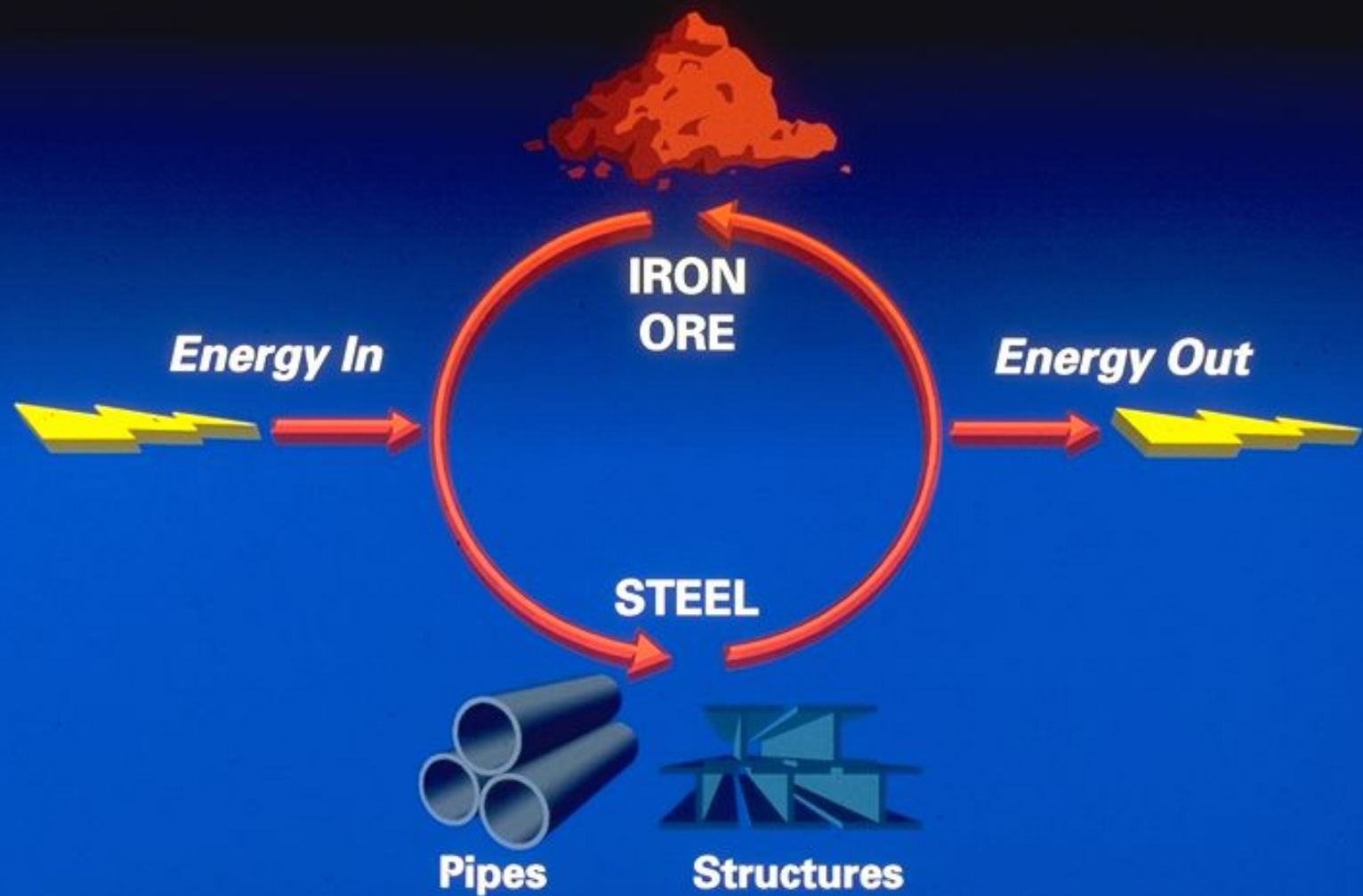
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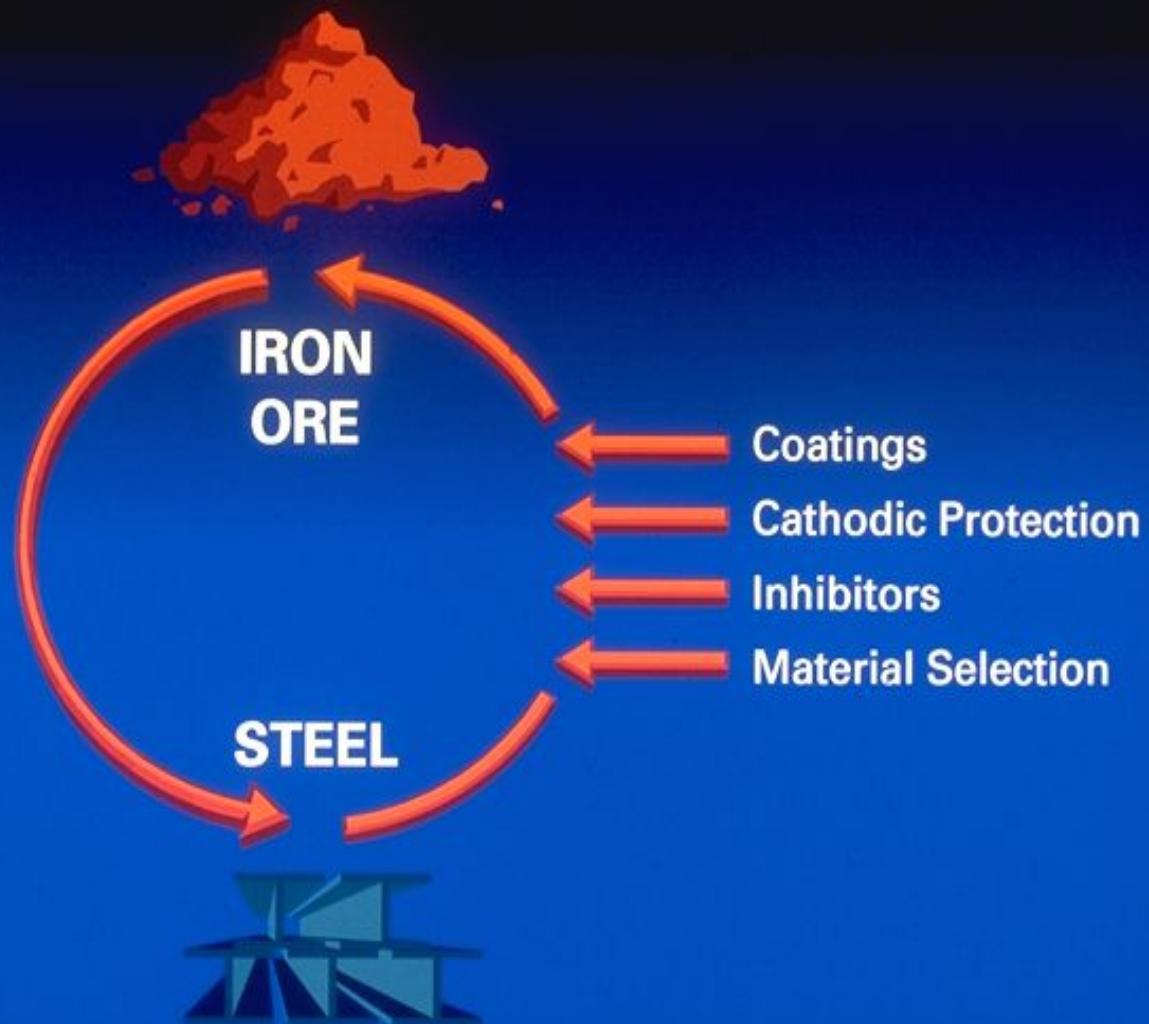
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# WHAT IS CORROSION?

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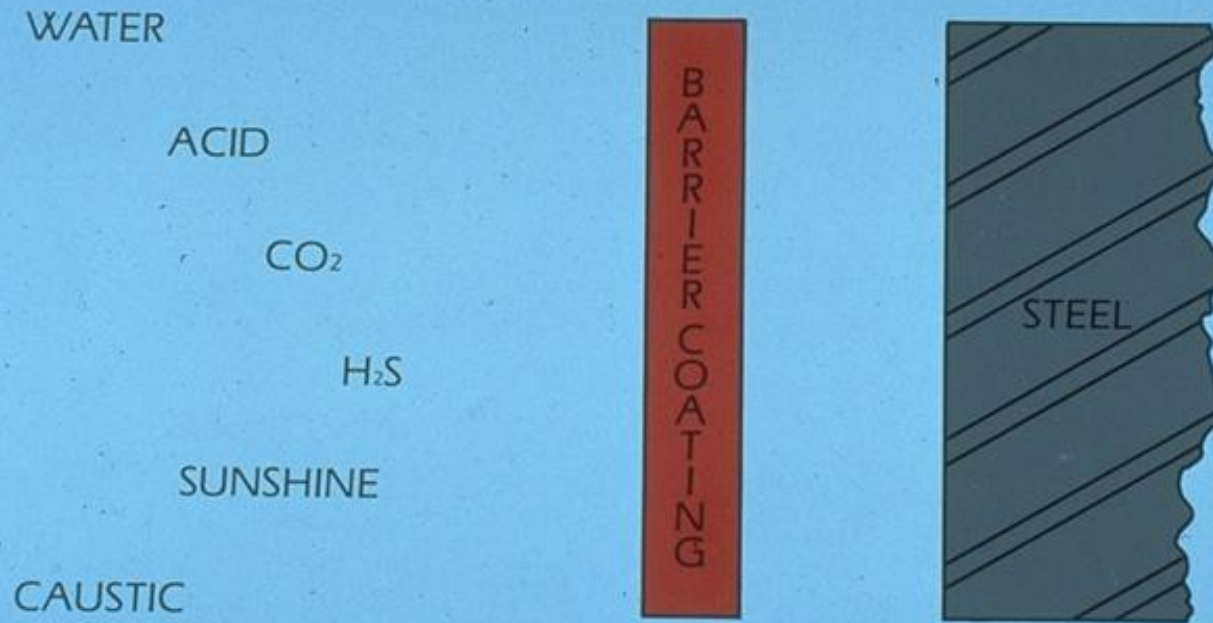
**CORROSION IS THE DESTRUCTION  
OF A SUBSTANCE, USUALLY A METAL,  
OR ITS PROPERTIES BECAUSE OF  
A REACTION WITH ITS ENVIRONMENT.**







# COATING DEFINITION



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

# The Perfect Coating

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- 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.



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# In Reality a Perfect Coating

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- Requires a quality standard
- Requires a quality specification
- Requires a quality coating plant/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**



# ***SURFACE PREPARATION***

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## ***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**

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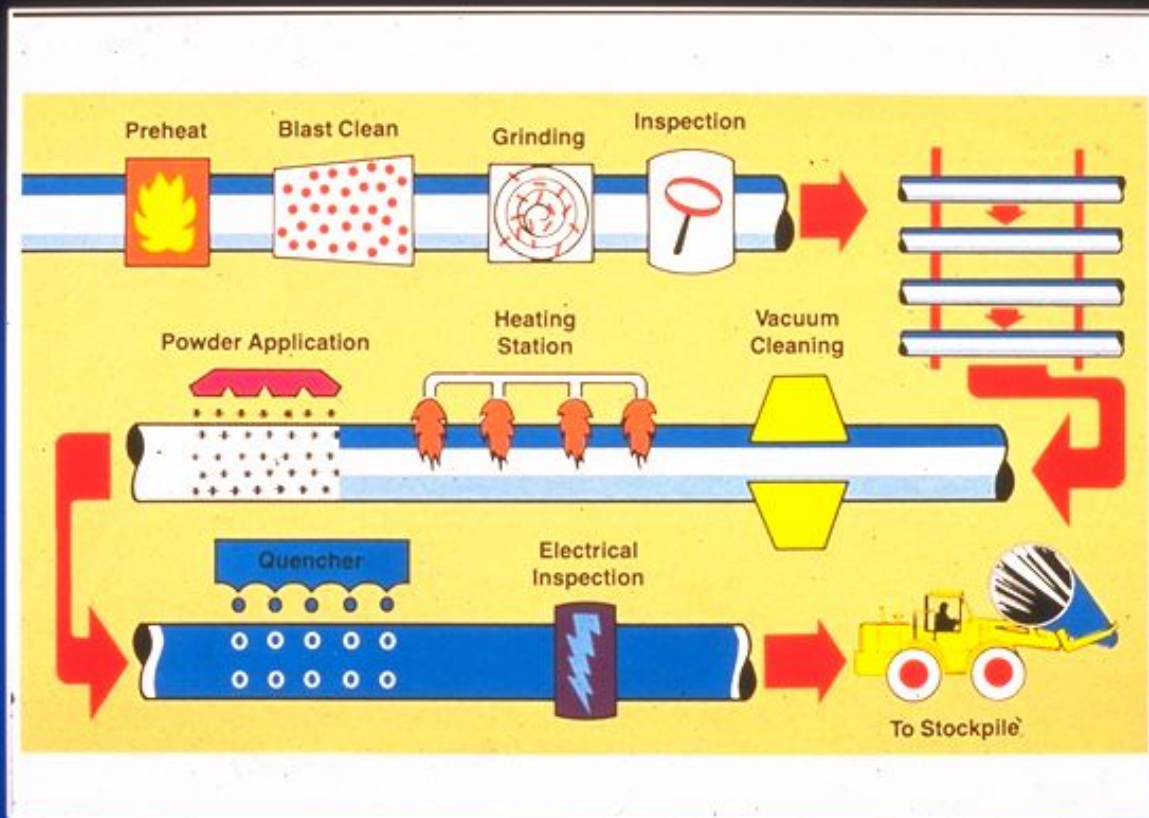
# **FUSION BONDED COATINGS**

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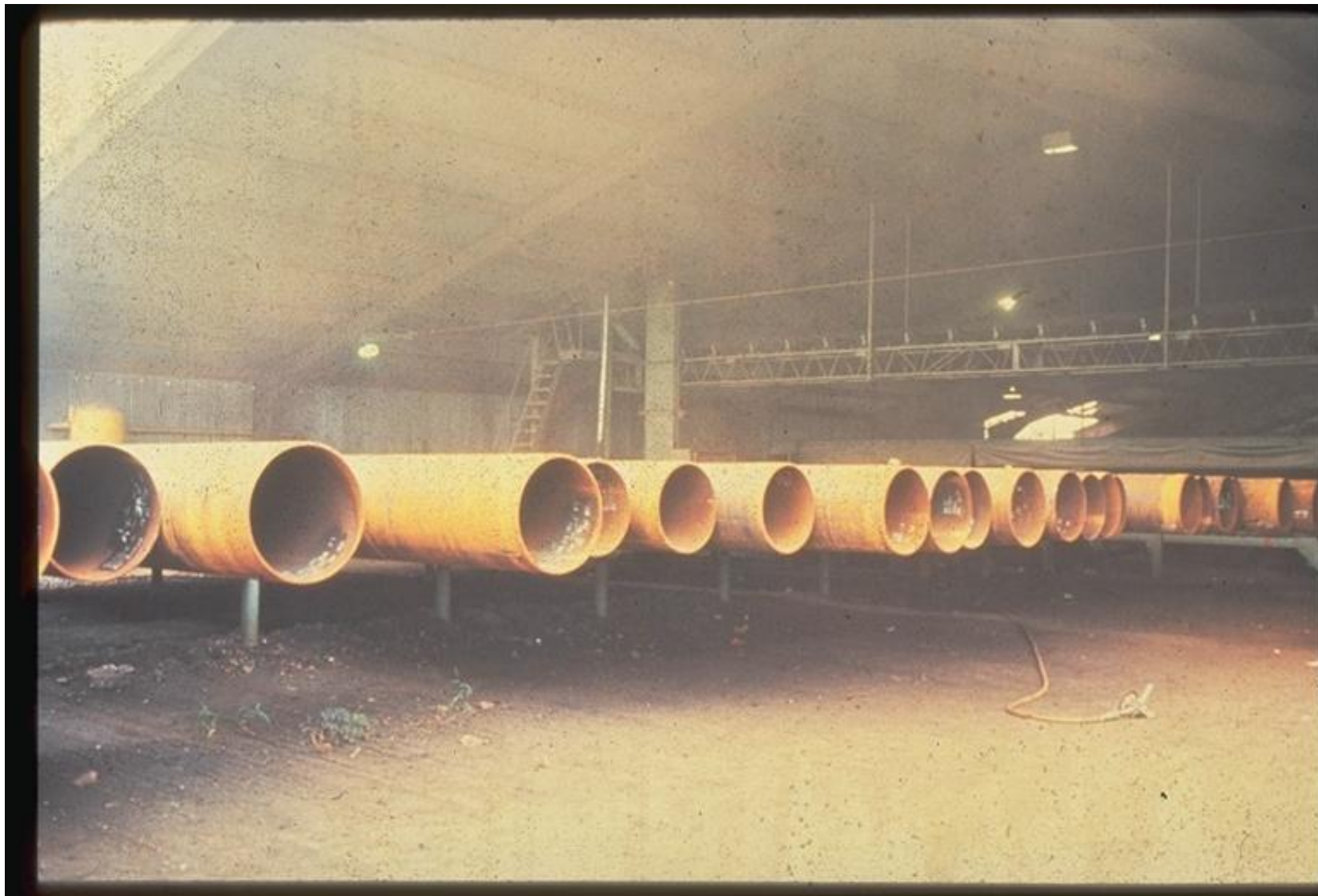
# APPLICATION PROCEDURE

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

# Fusion Bonded Epoxy

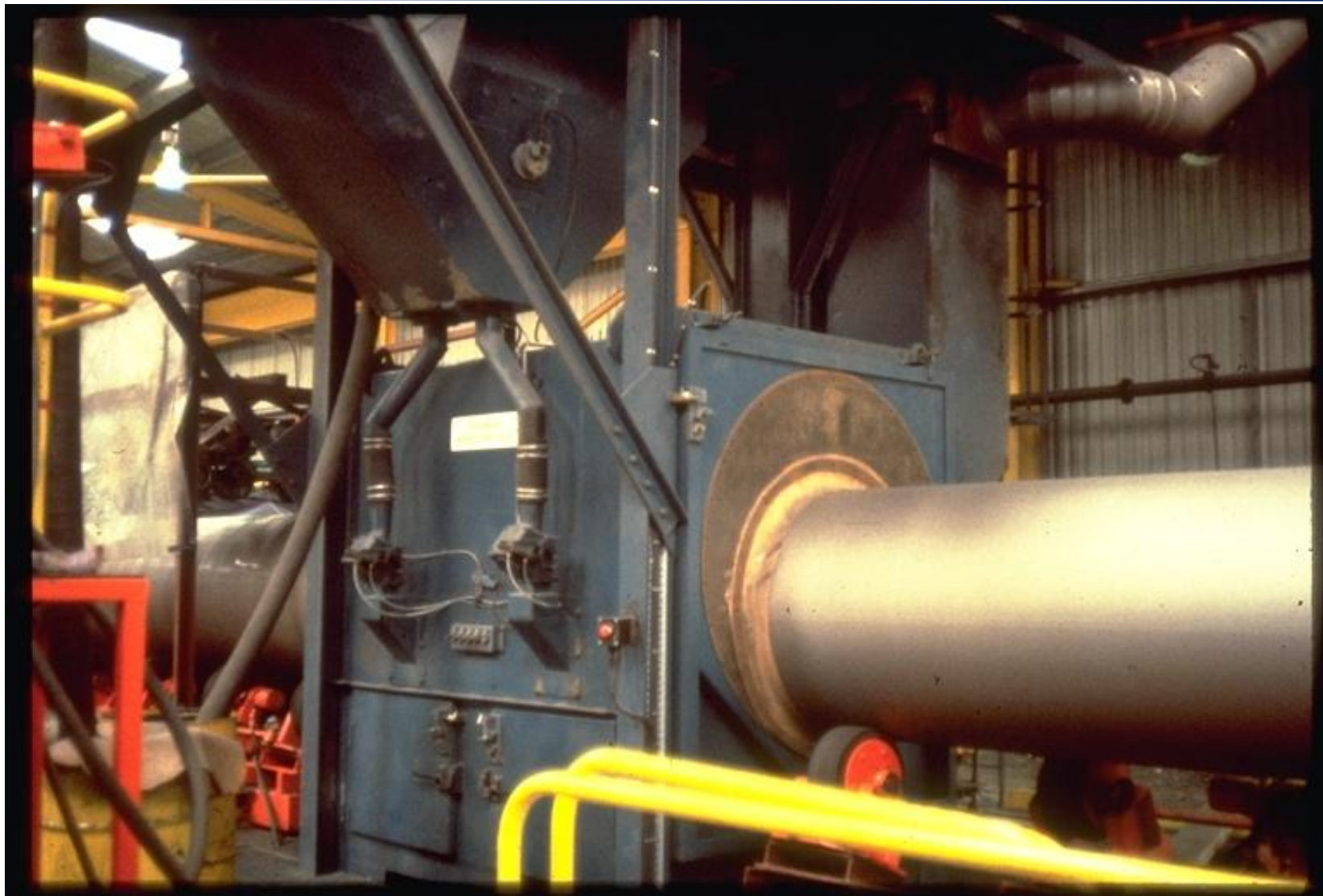


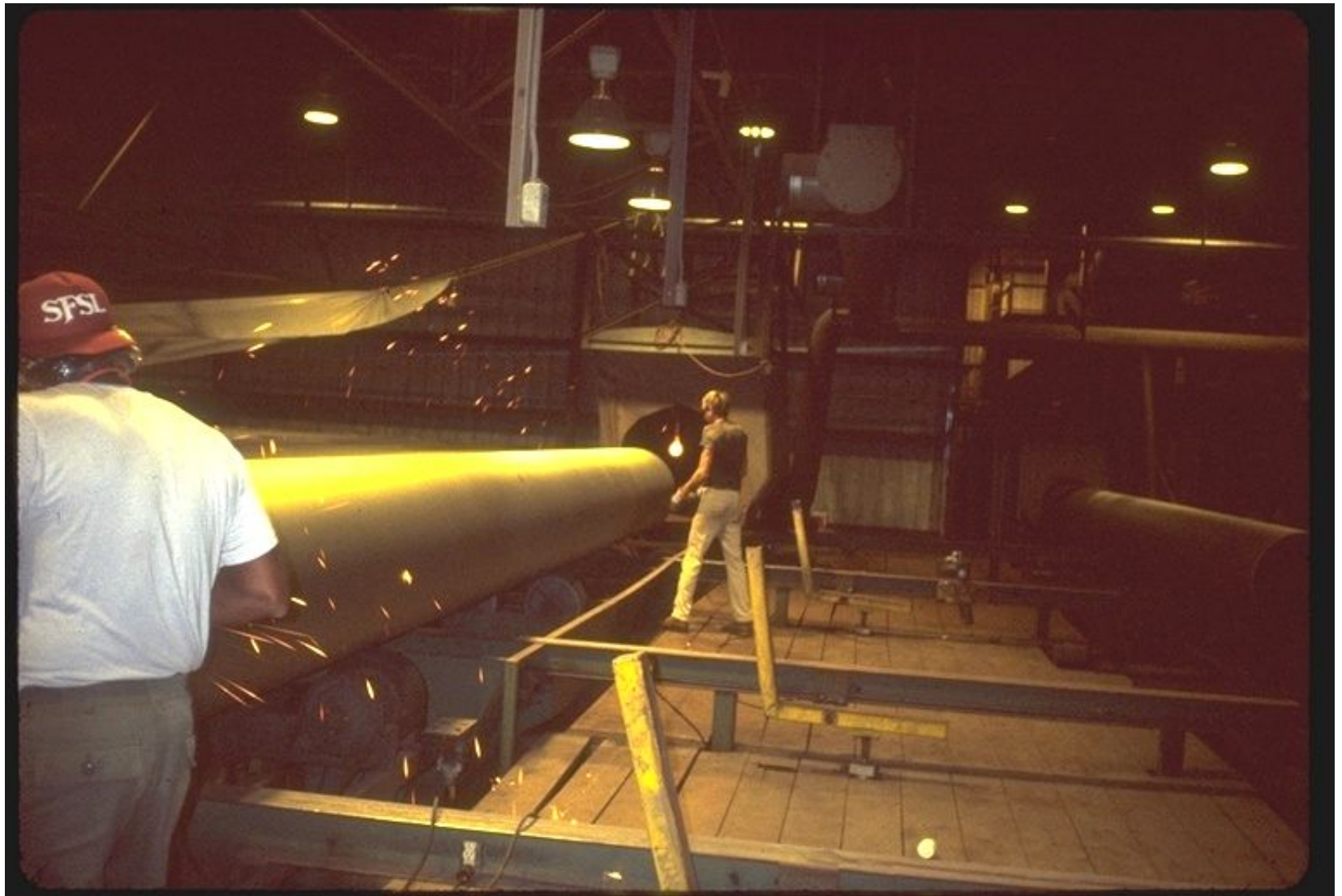












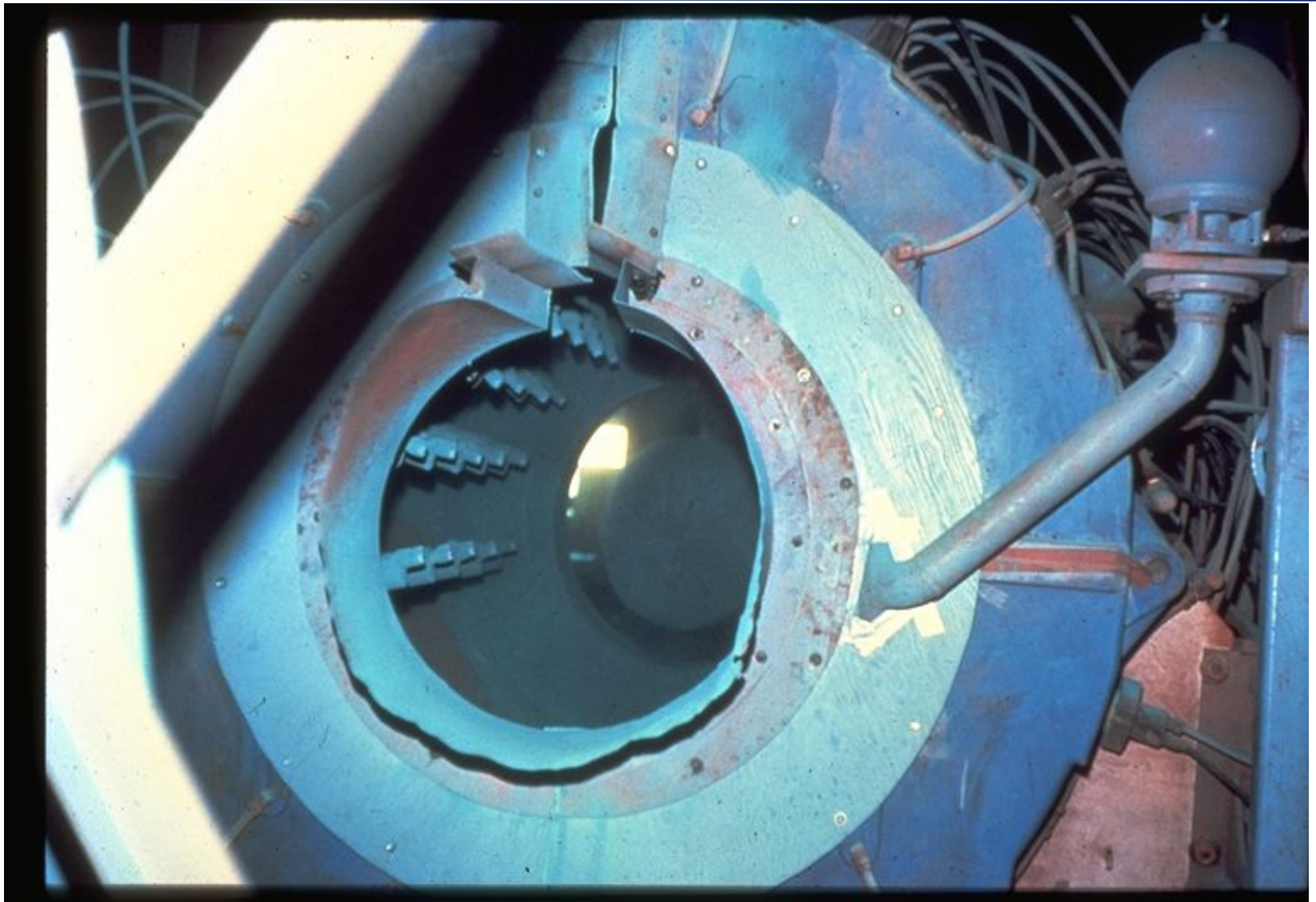




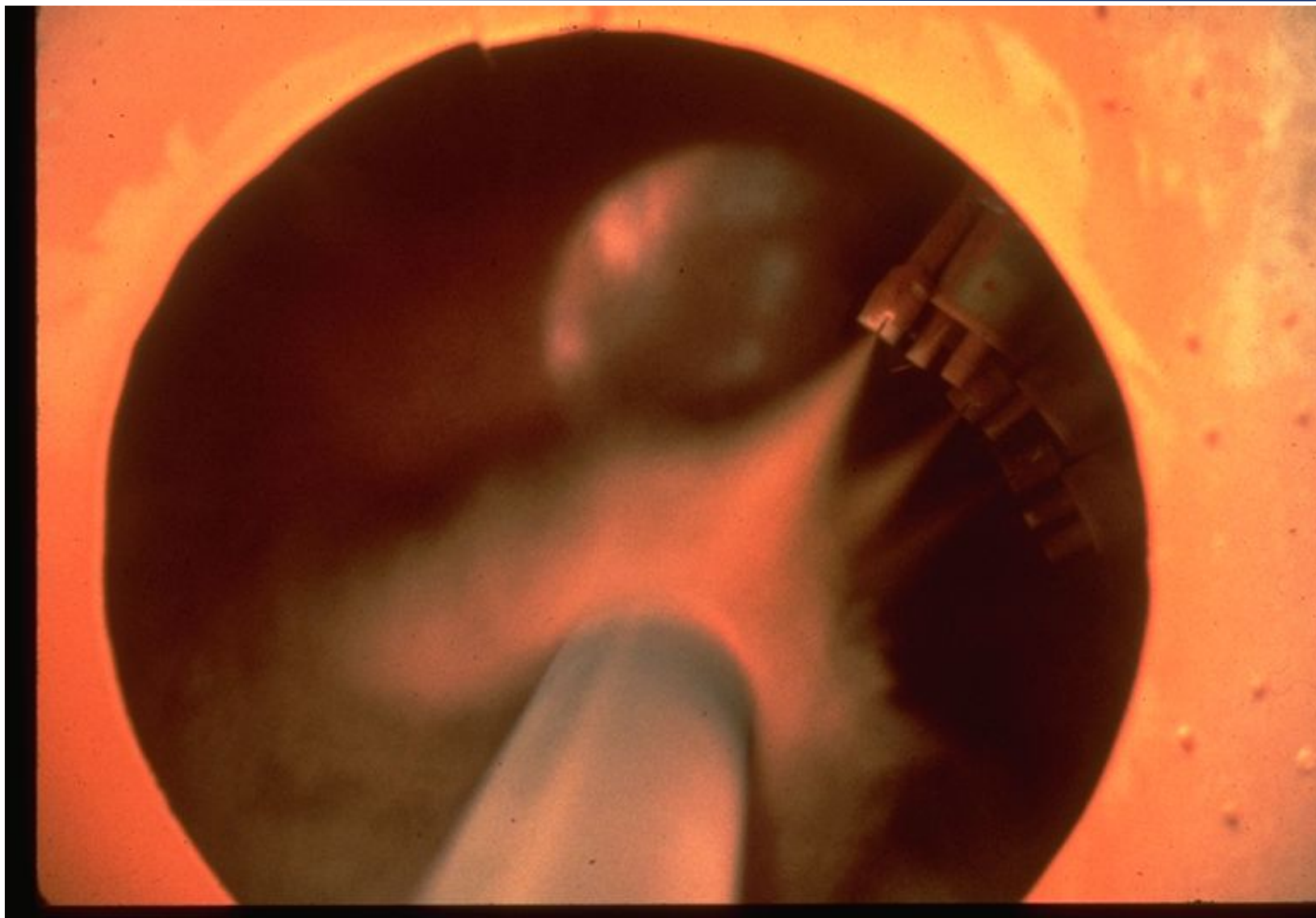


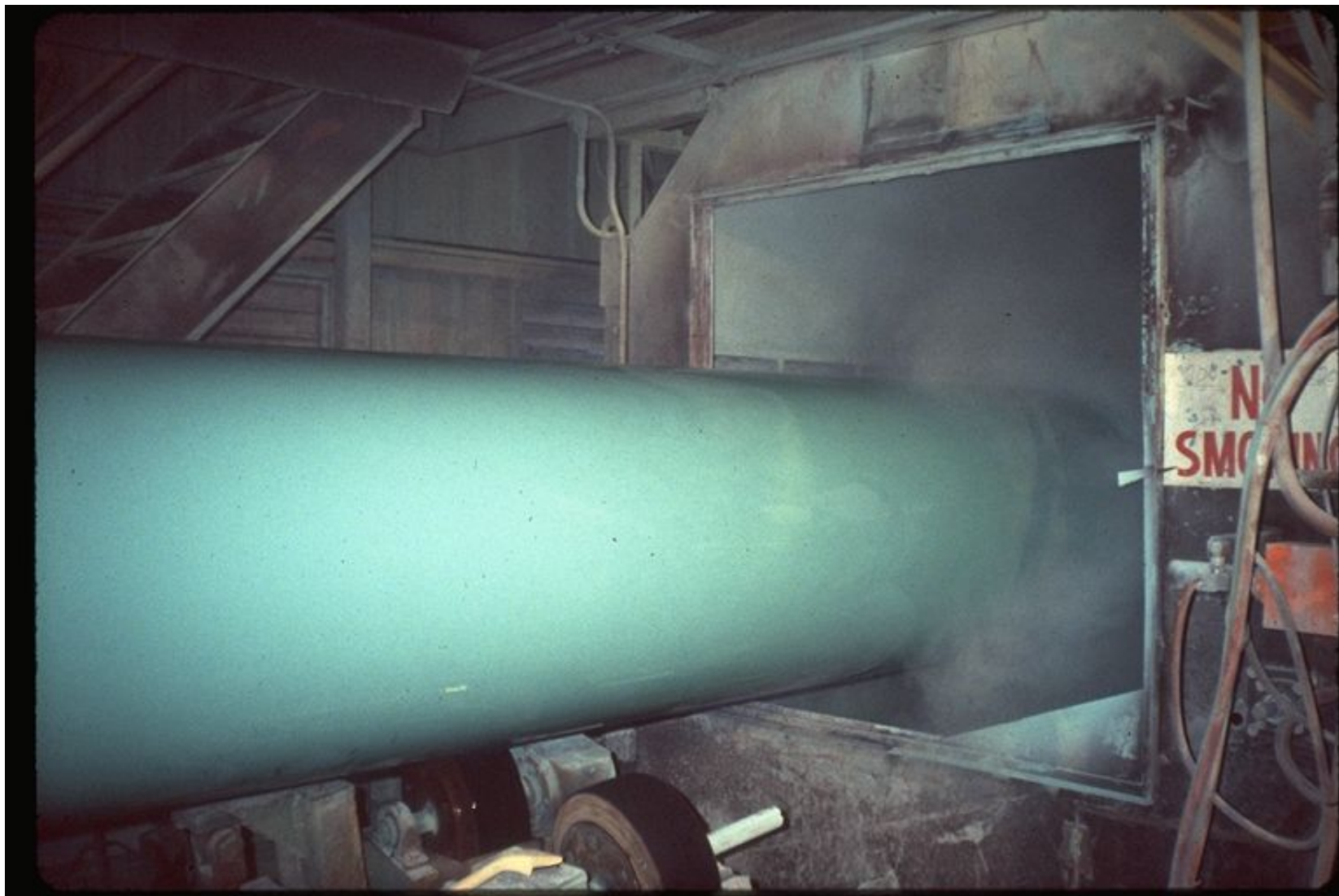




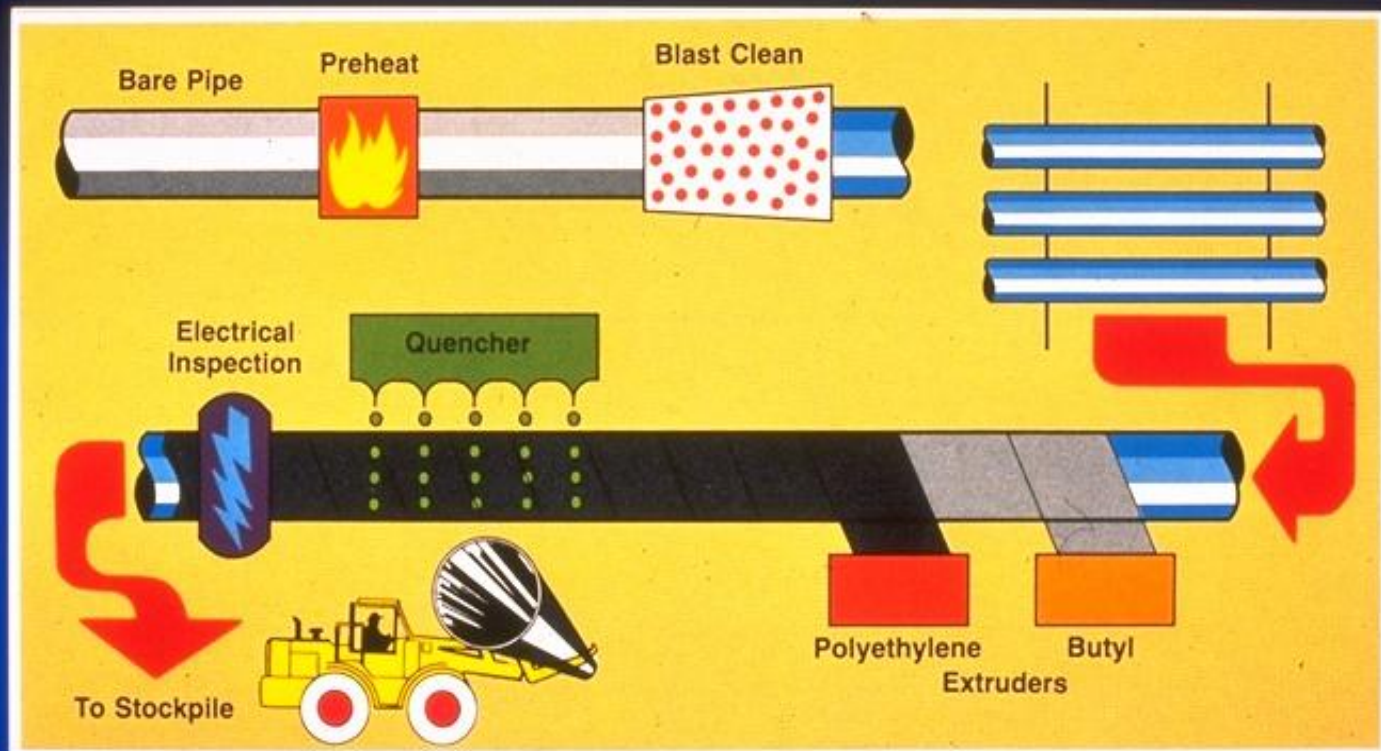








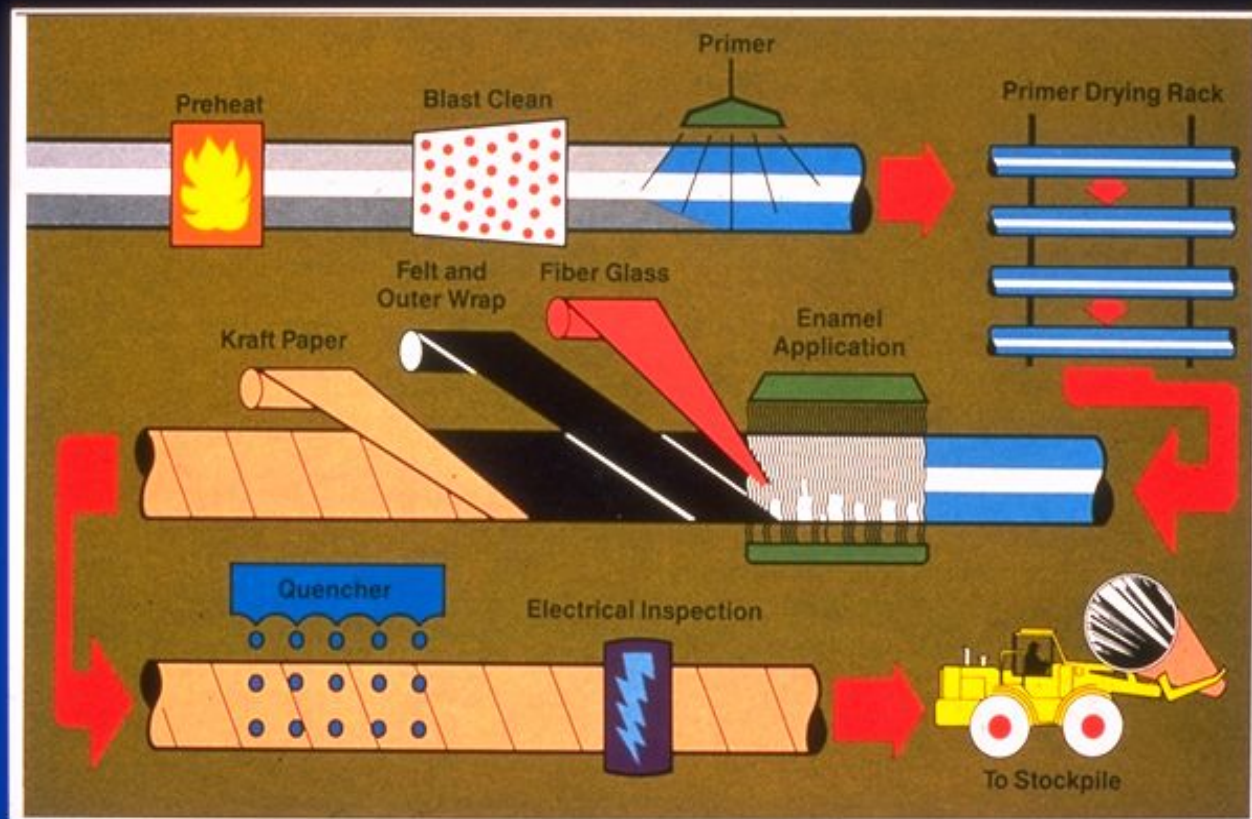
## PE/BUTYL (Two Layer)

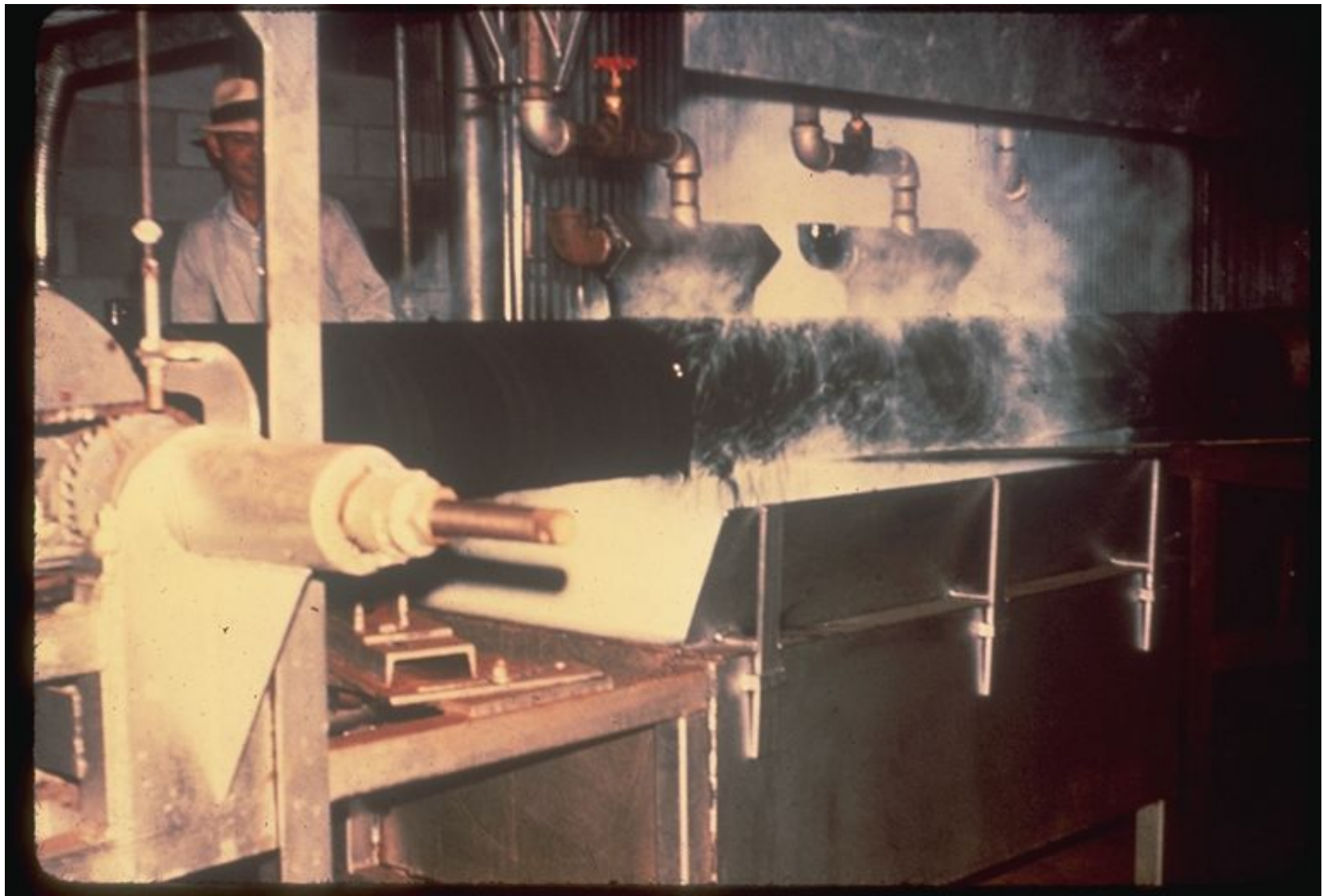




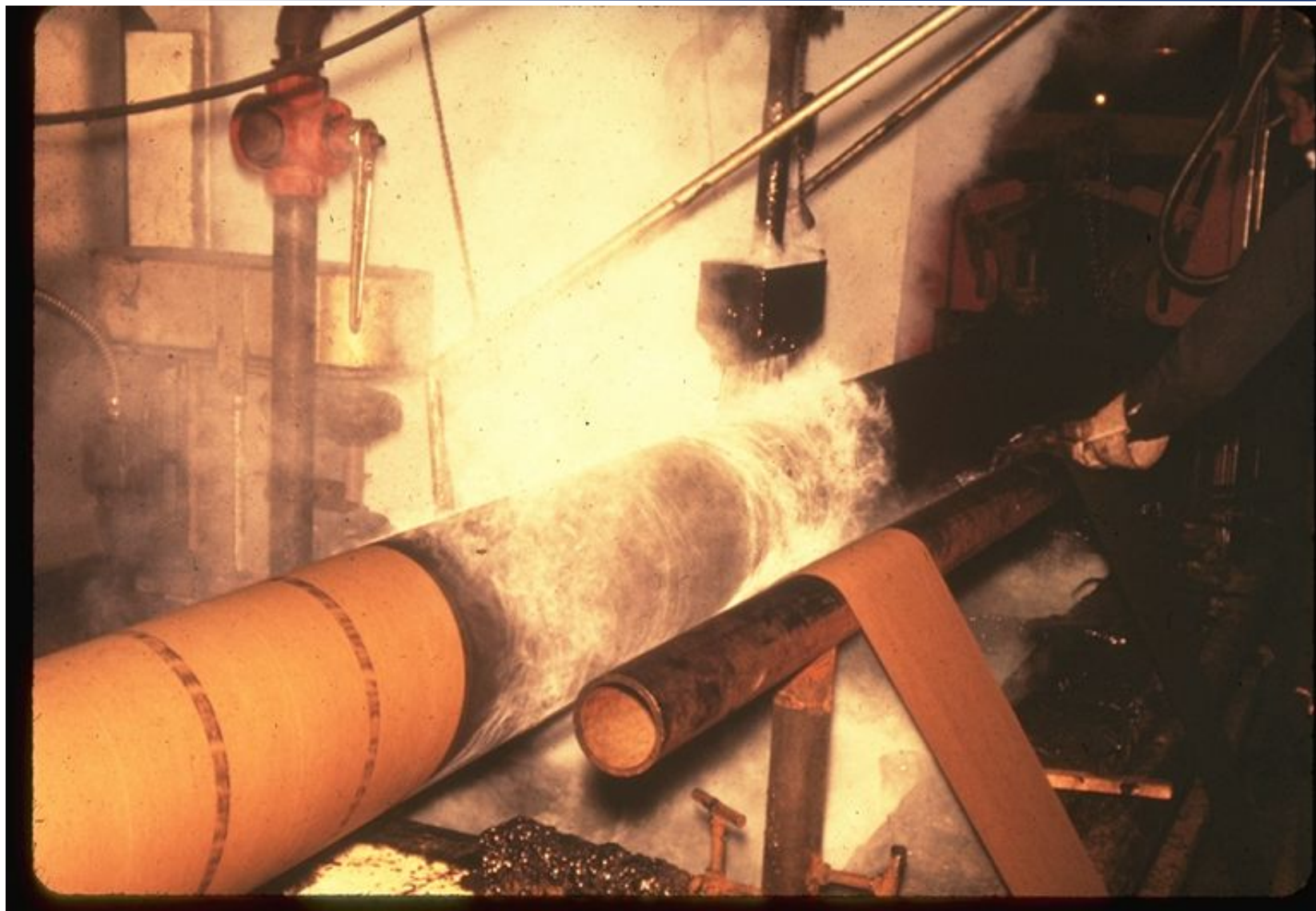


# Coal Tar Enamels

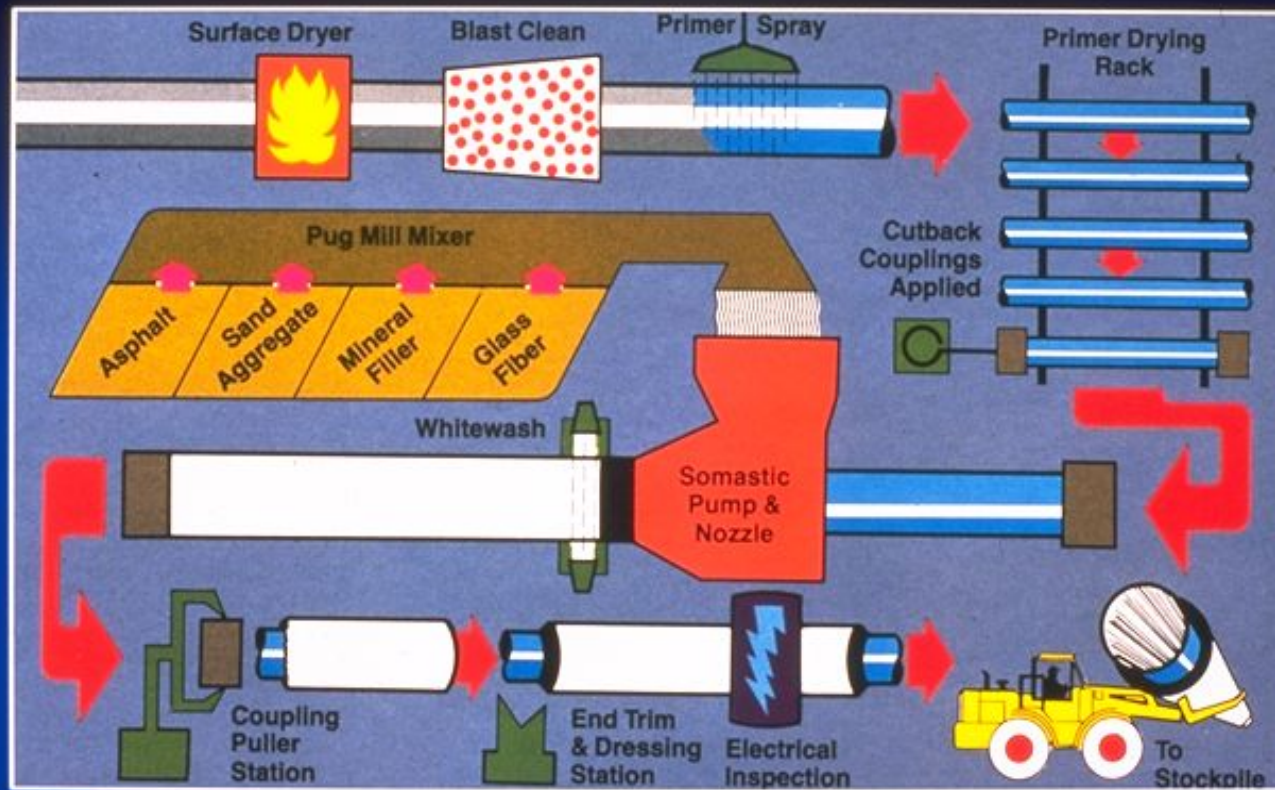




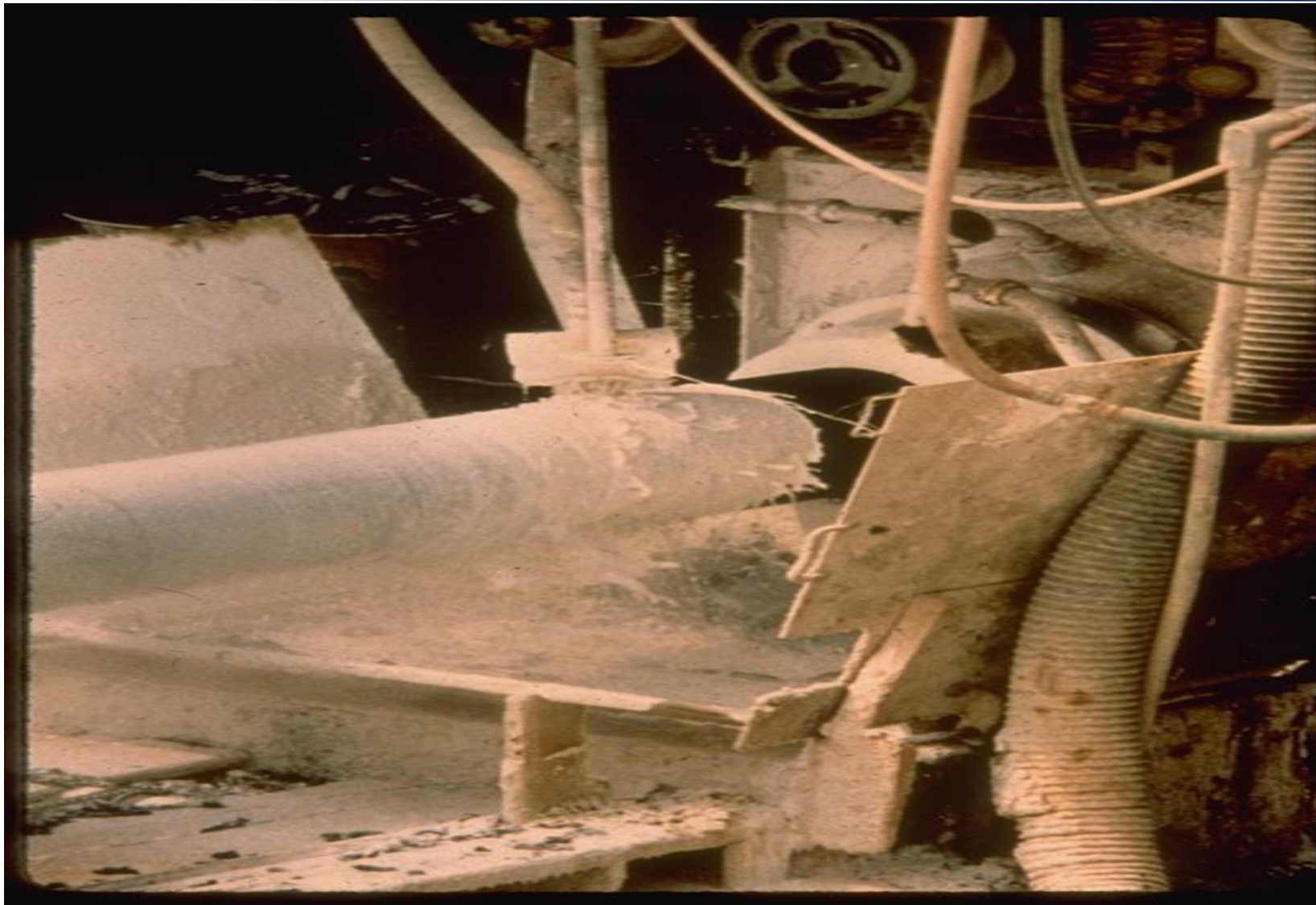


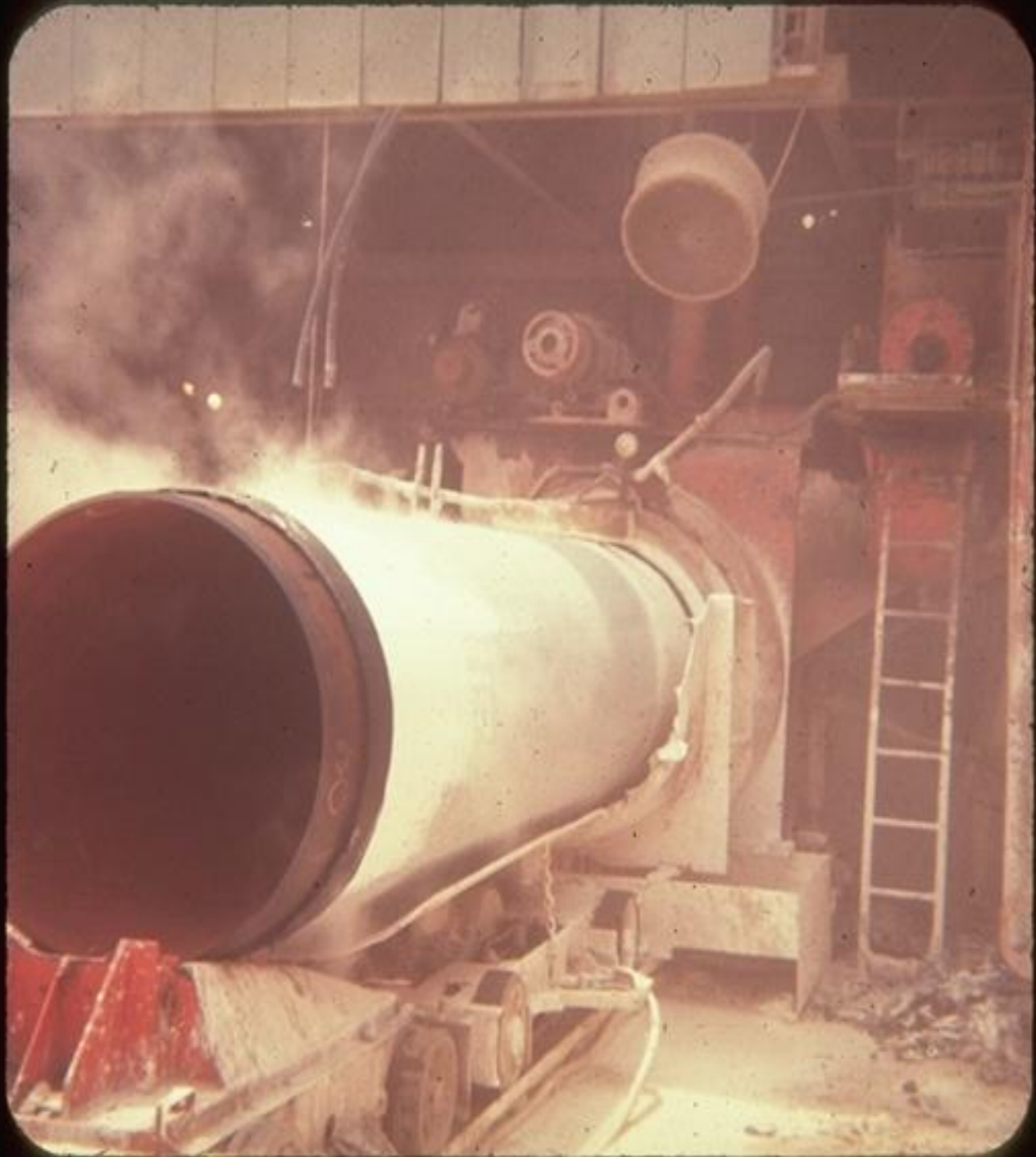


# Asphalt Mastic







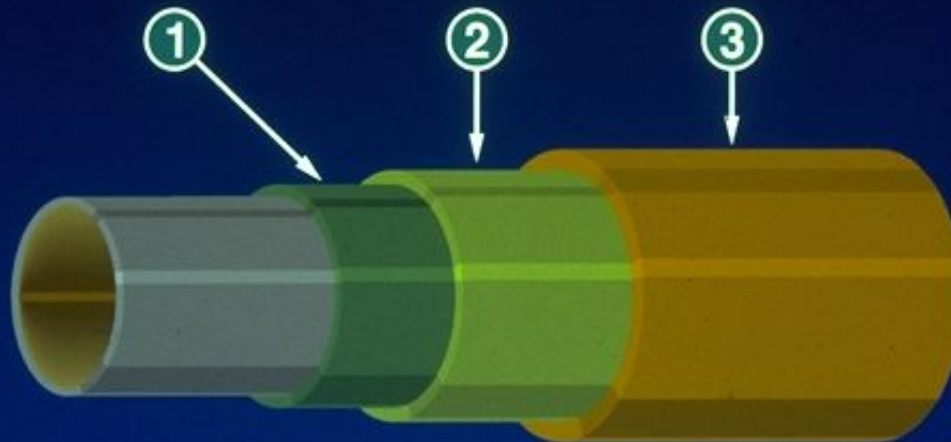








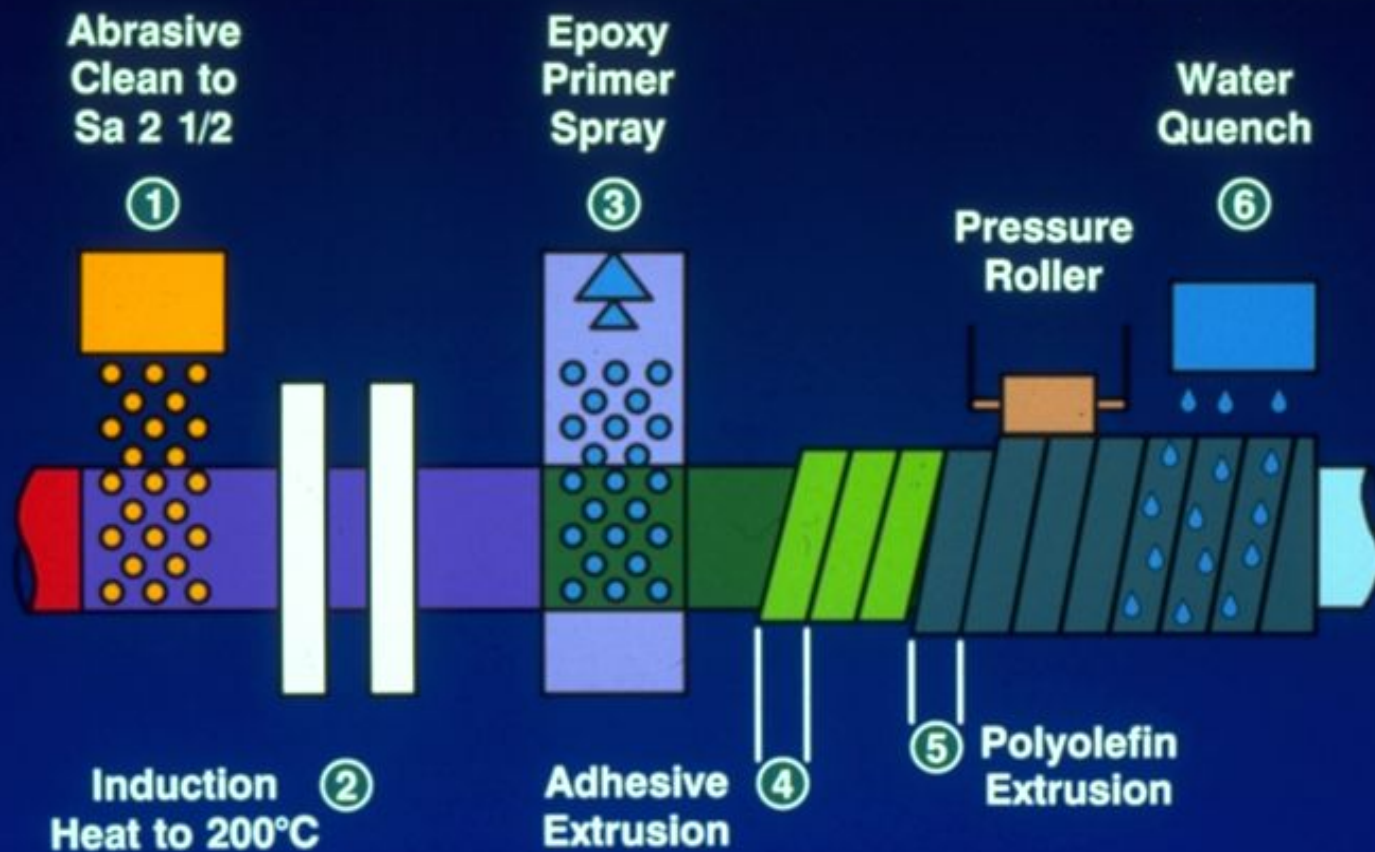
**Figure 1 Shows a Schematic Diagram of a  
Typical 3-Layer Pipe Coating**

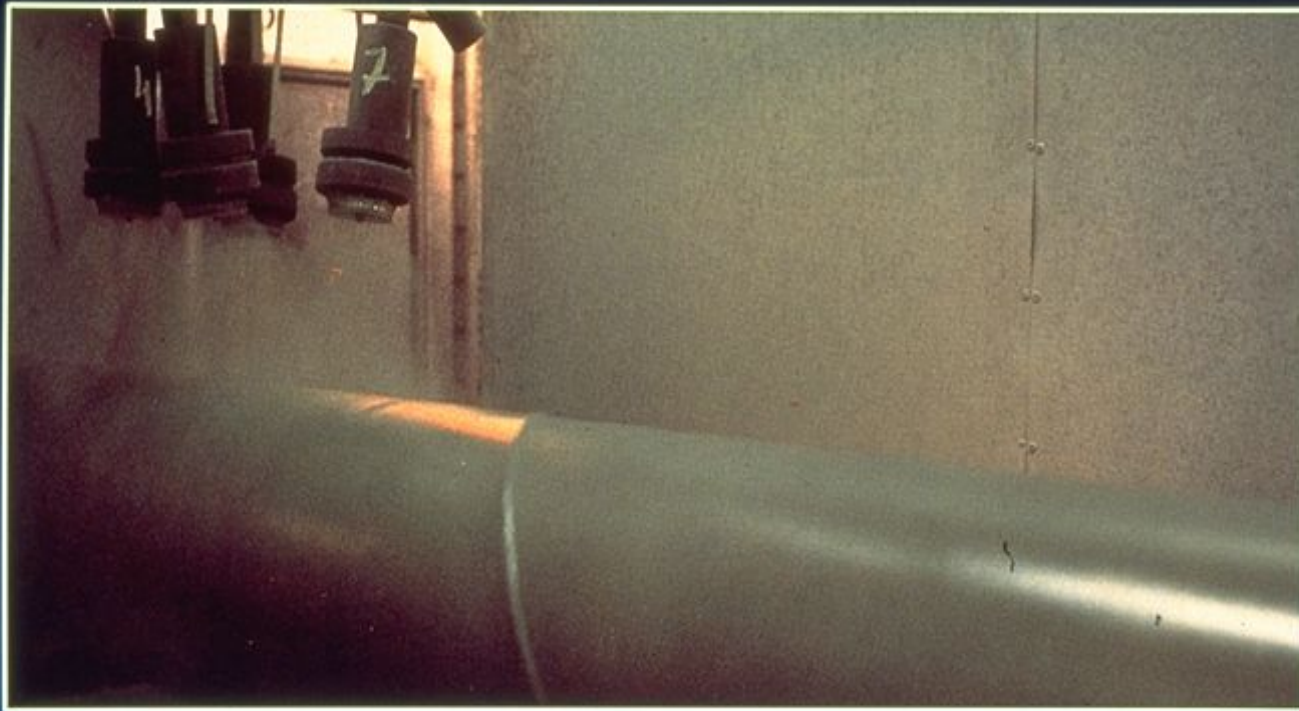


- ① EPOXY PRIMER**
- ② INTERMEDIATE ADHESIVE LAYER**
- ③ POLYOLEFIN TOPCOAT**



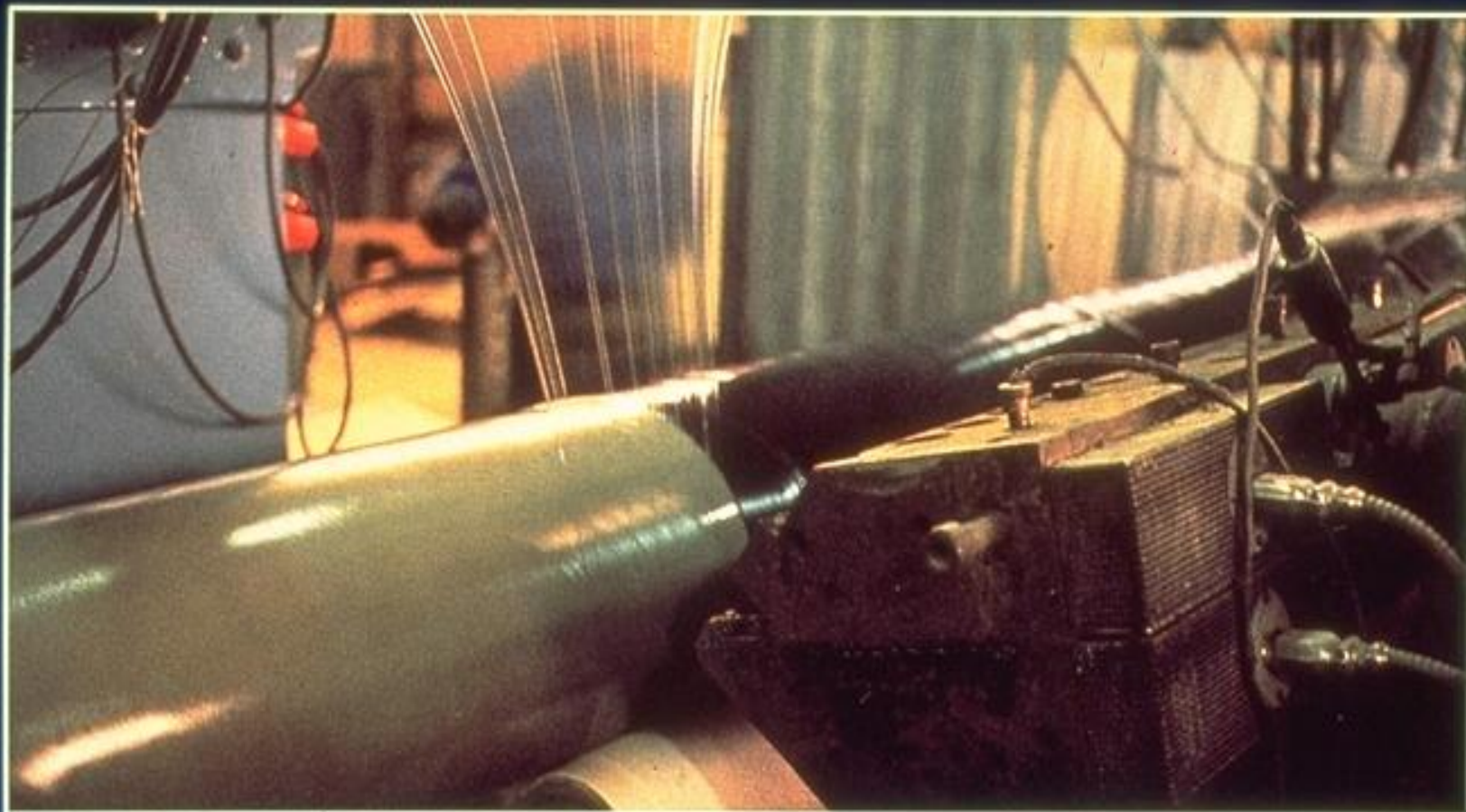
## Schematic Diagram of 3-Layer Pipe Coating





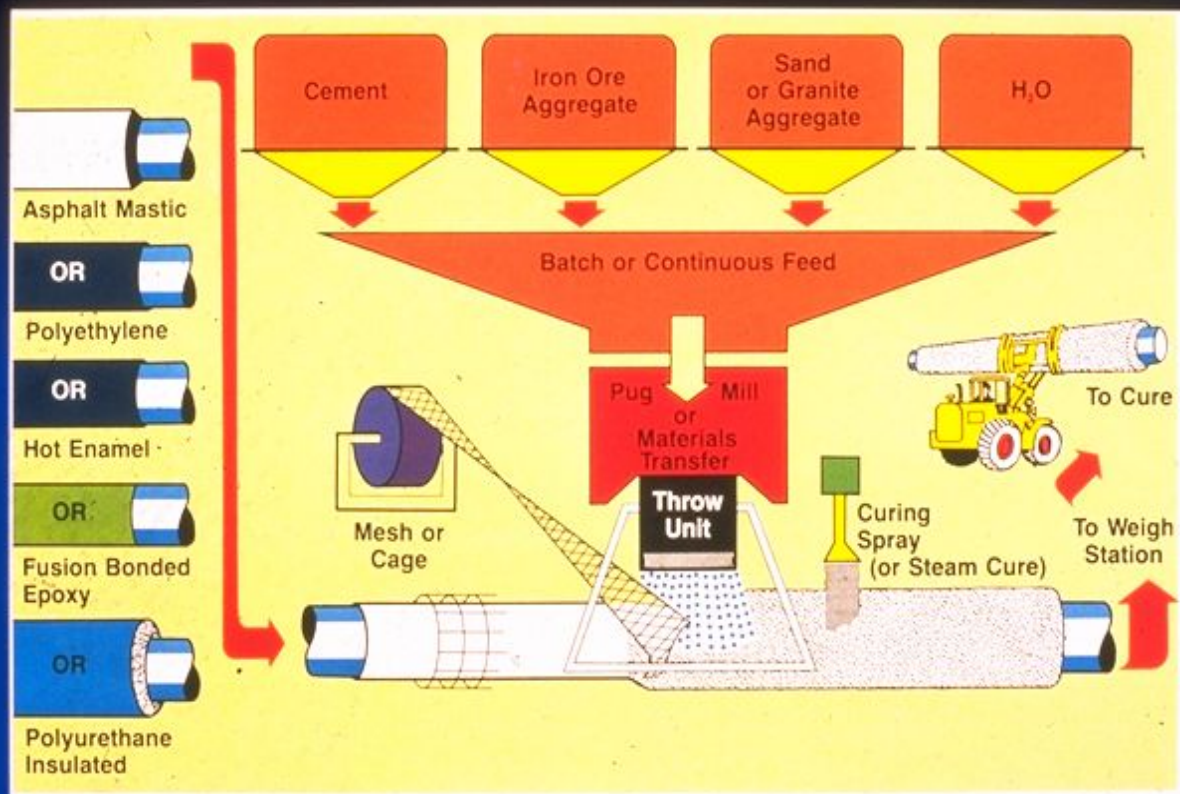
**Application of EUROKOTE Epoxy Powder Primer Layer**





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

# Impingement Concrete Coating































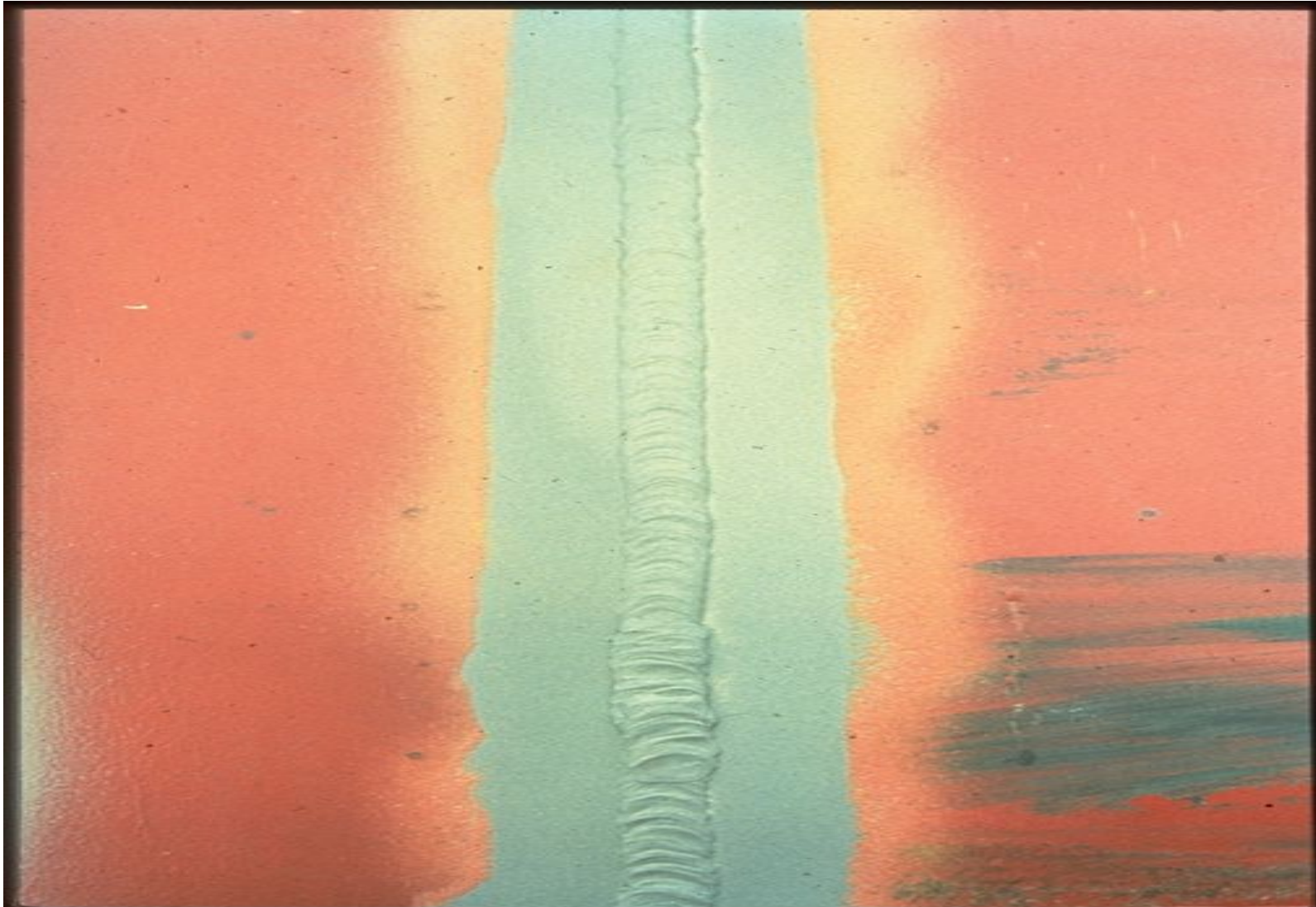
















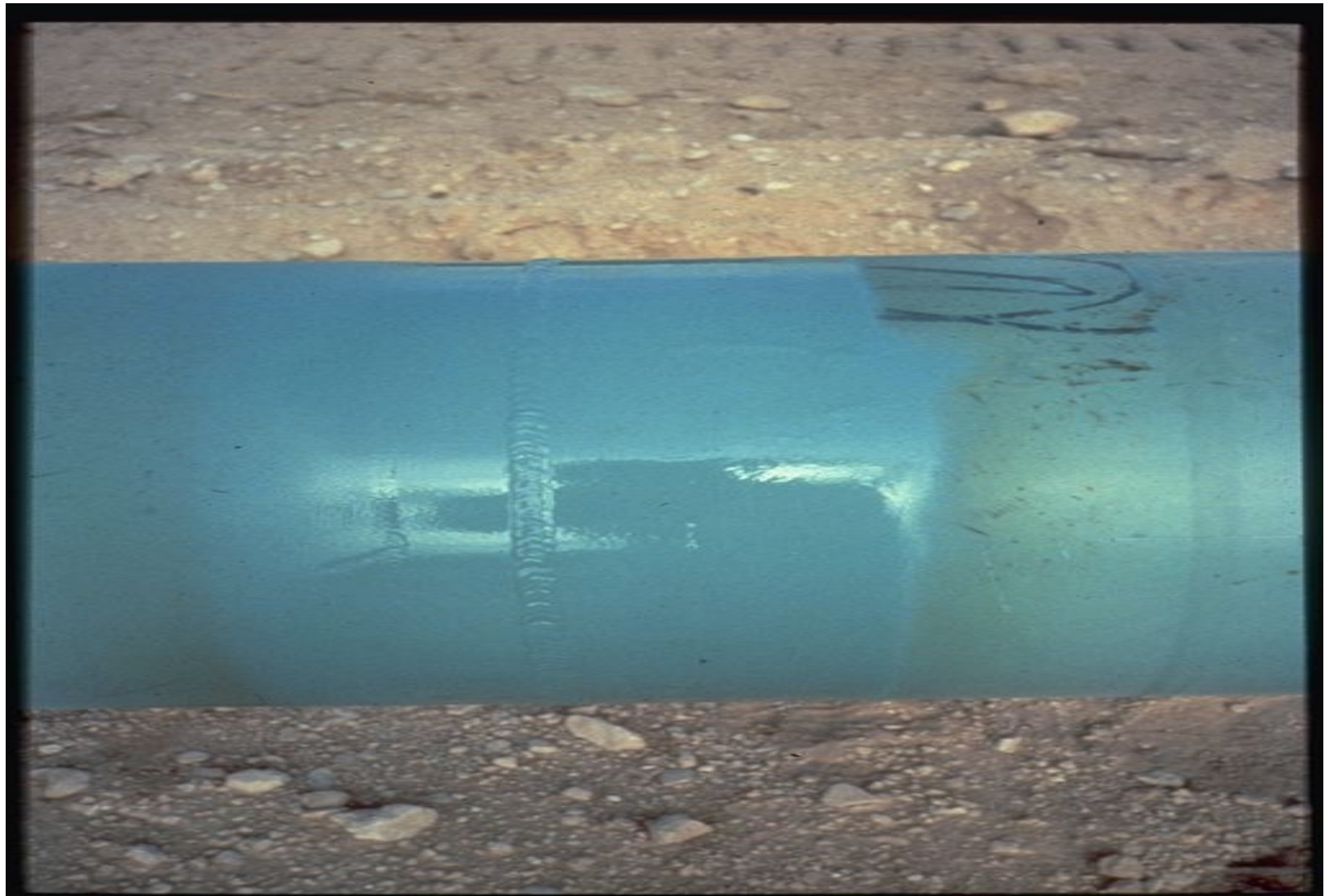
























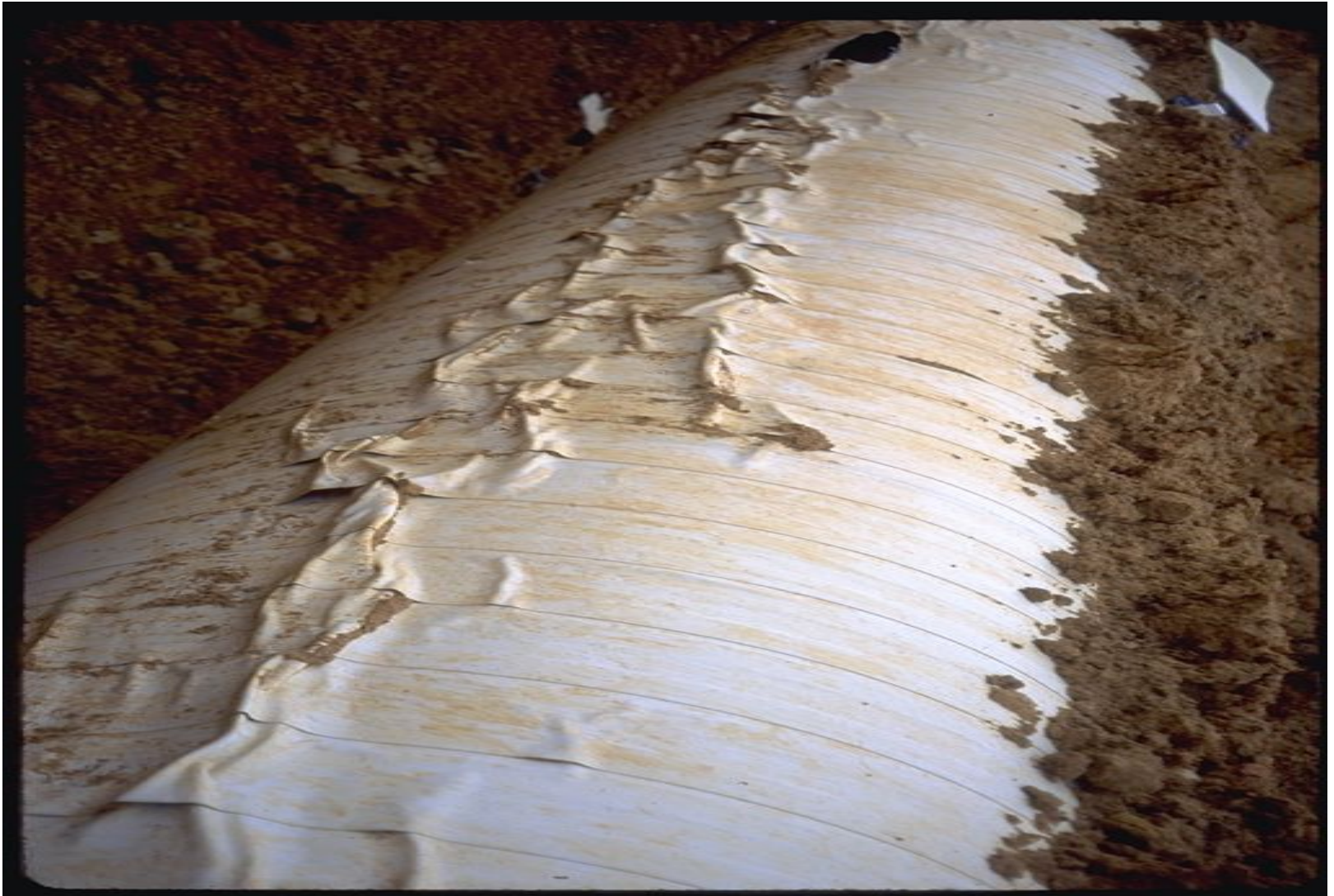


















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# **The End!**

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## **Wrap Up**

- **Questions**
- **Comments**
- **Concerns**

**Thank you for attending!**