
Pipeline Coatings

2019 AUCSC

Fundamentals Session

Jeff Didas – Matcor - Tucson, AZ



Appalachian Underground Corrosion Short Course

Remember This!

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



Discussion of Coating Types

- Underground coatings – 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
- Keyhole applications can be a problem



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



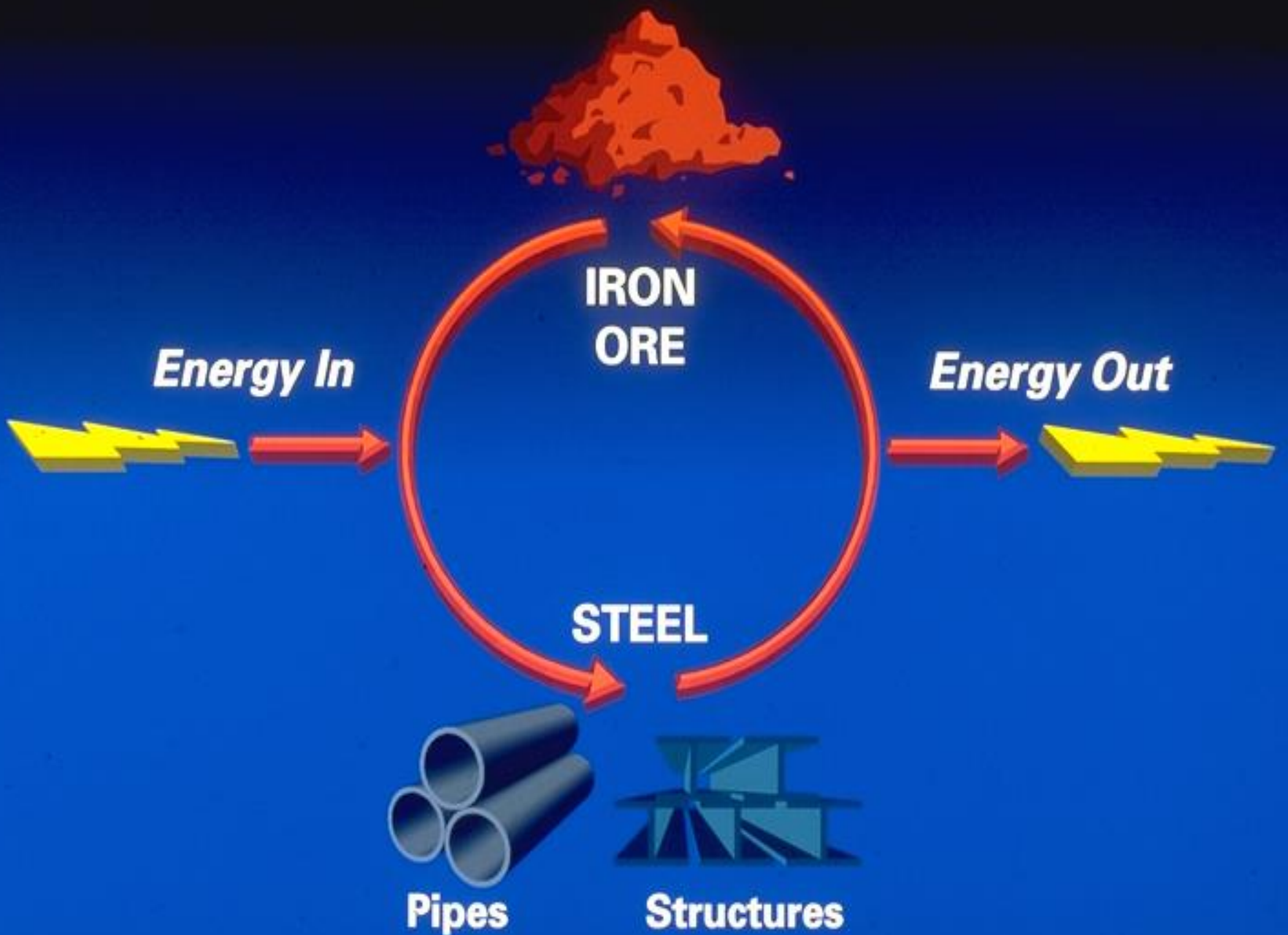
Atmospheric Coatings

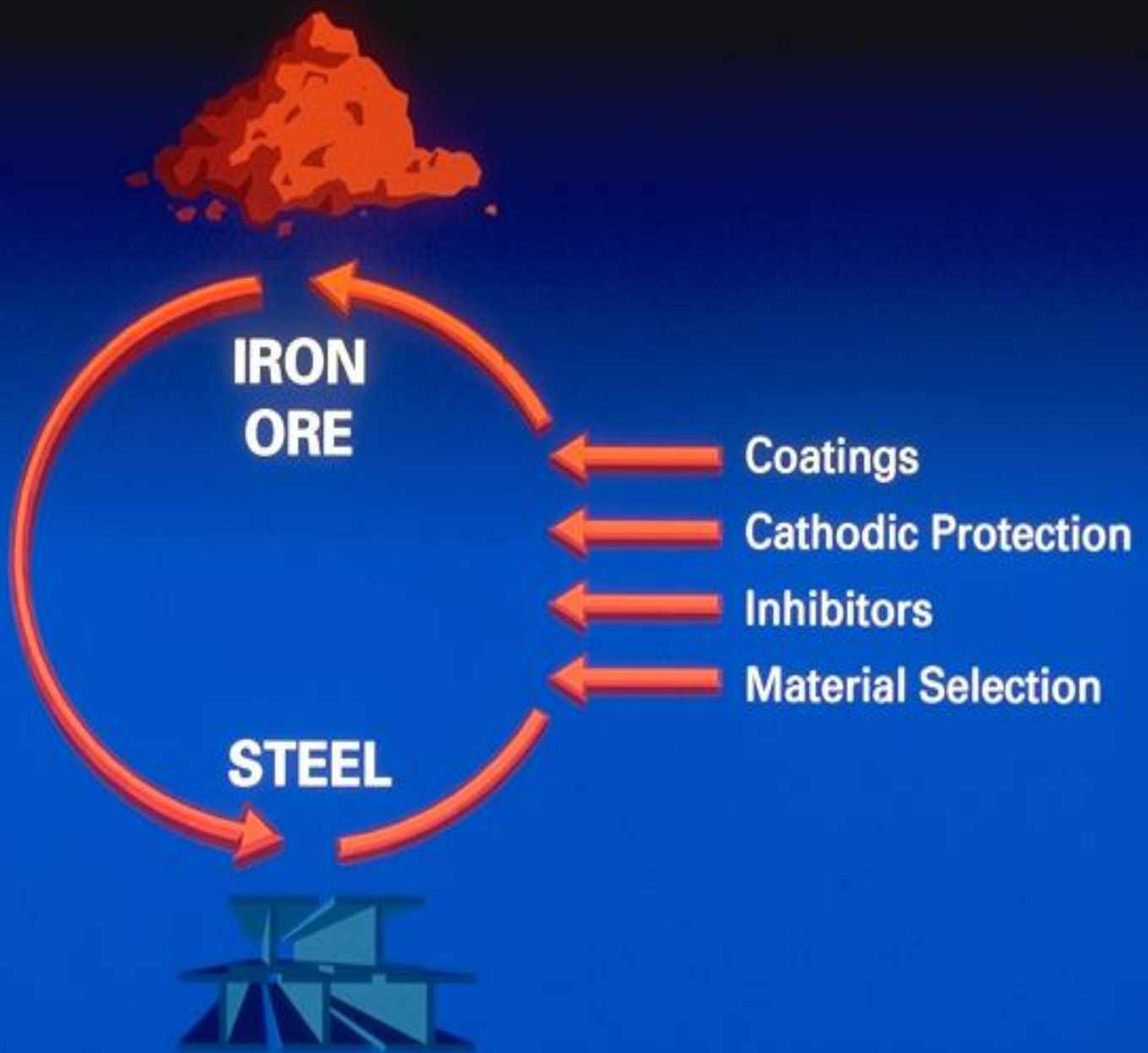
- Various types, quality and expected life
- Primary purpose is corrosion prevention, secondary purpose is appearance
- Problem areas, flanges, nuts, bolts, hold down clamps, high temperature service, beneath insulation, through walls/foundations, etc.

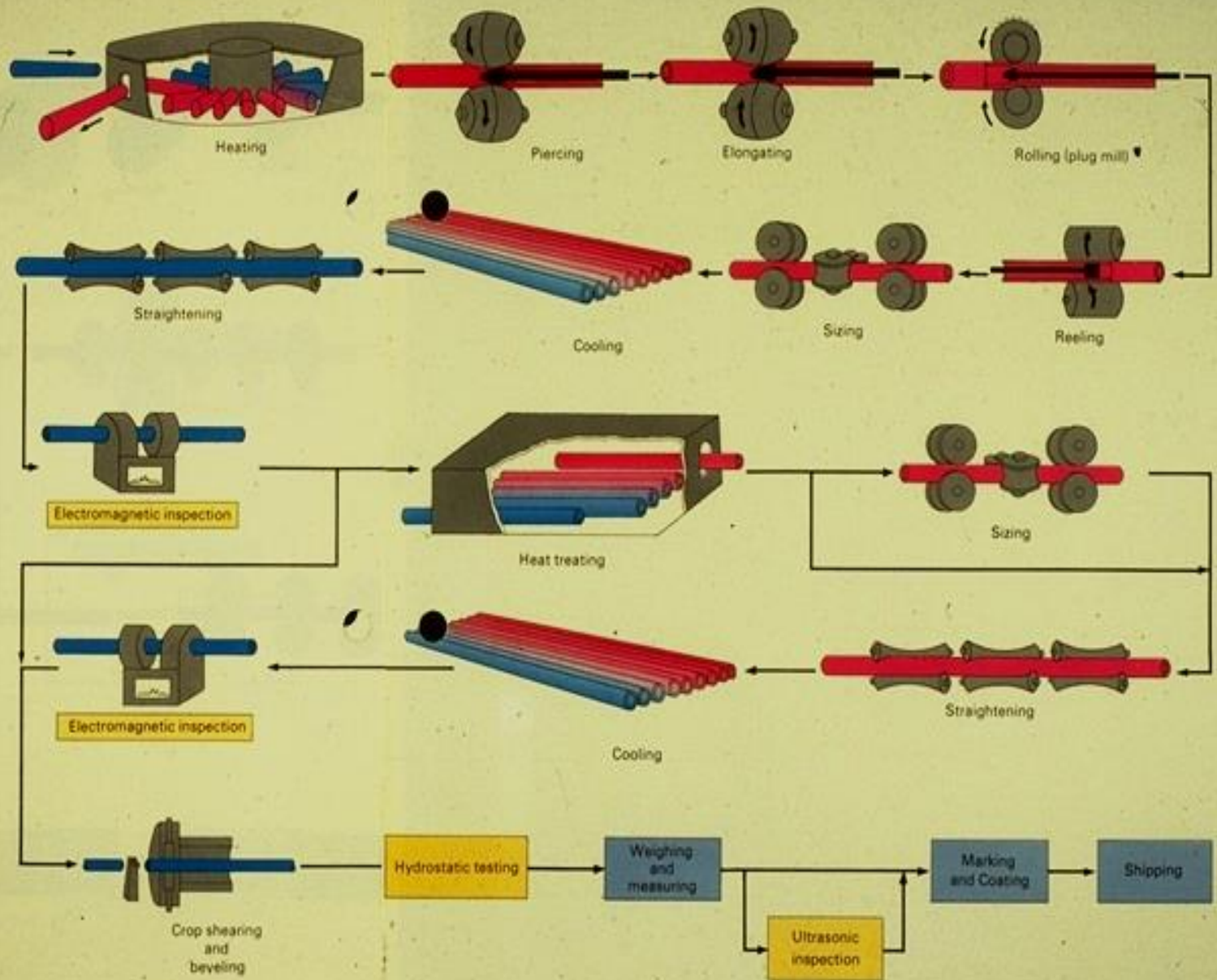


**WHAT IS
CORROSION?**

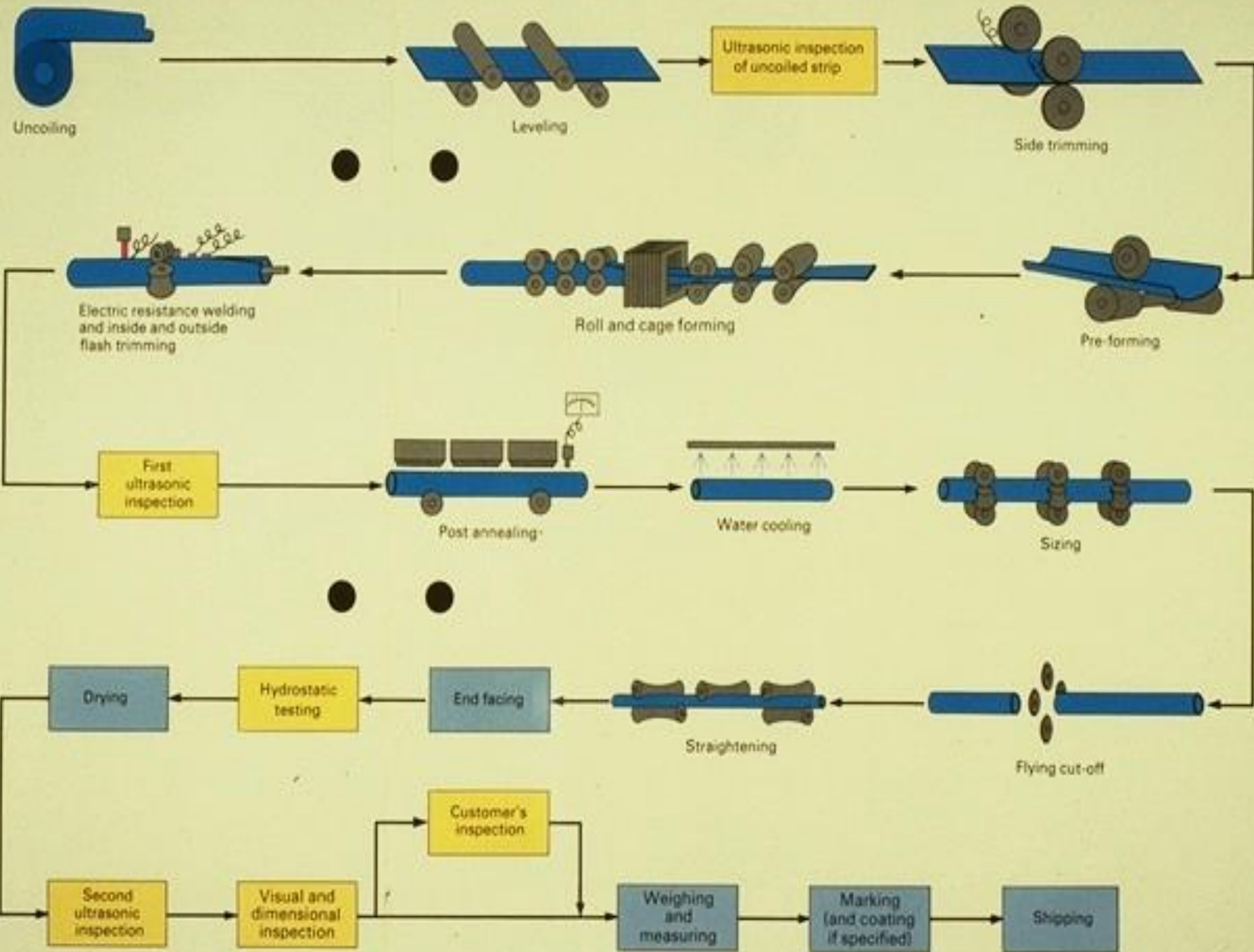
CORROSION IS THE DESTRUCTION OF A SUBSTANCE, USUALLY A METAL, OR ITS PROPERTIES BECAUSE OF A REACTION WITH ITS ENVIRONMENT.

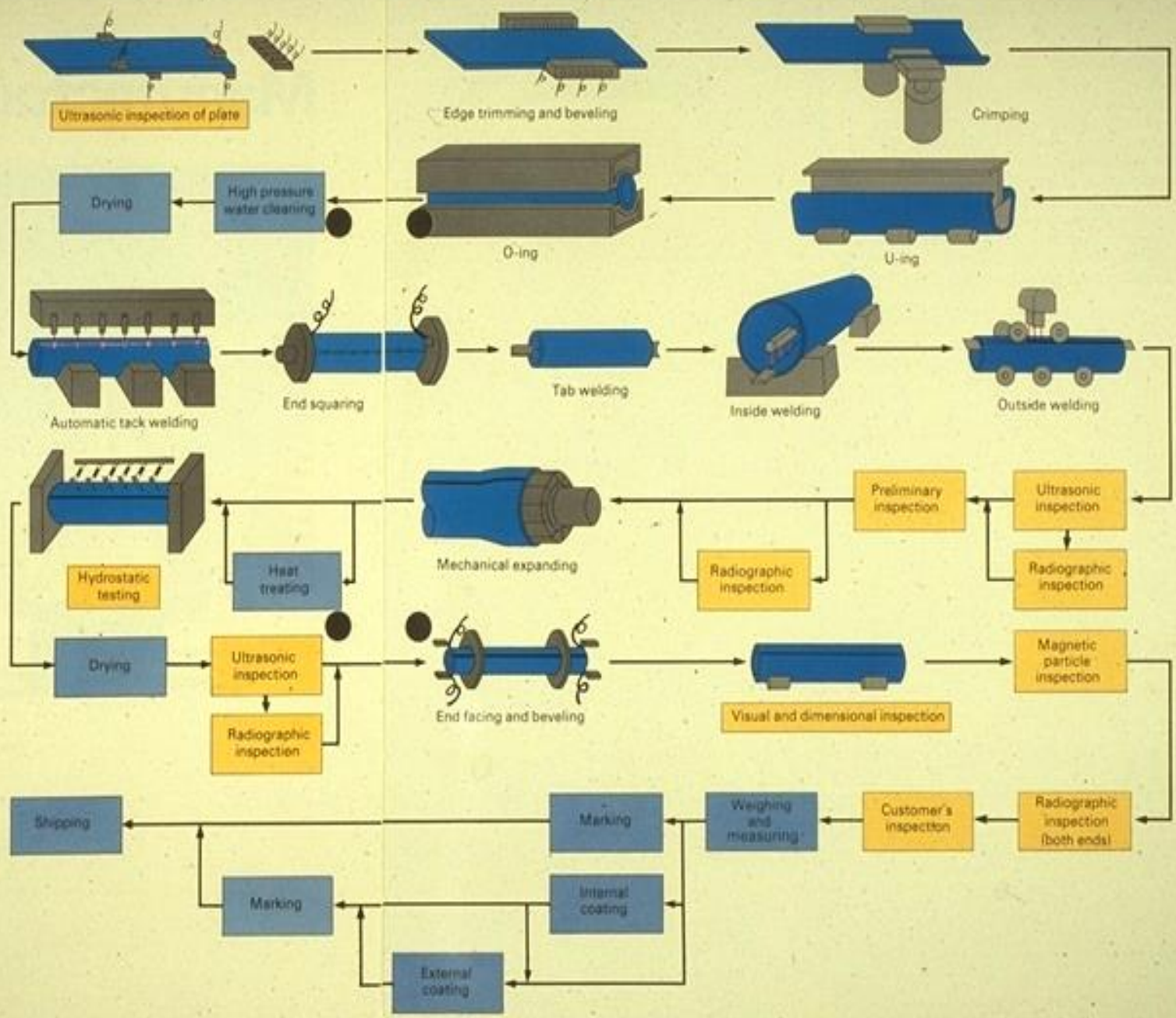






Rotary
shell is
The
outside
pipe is
section
speci-





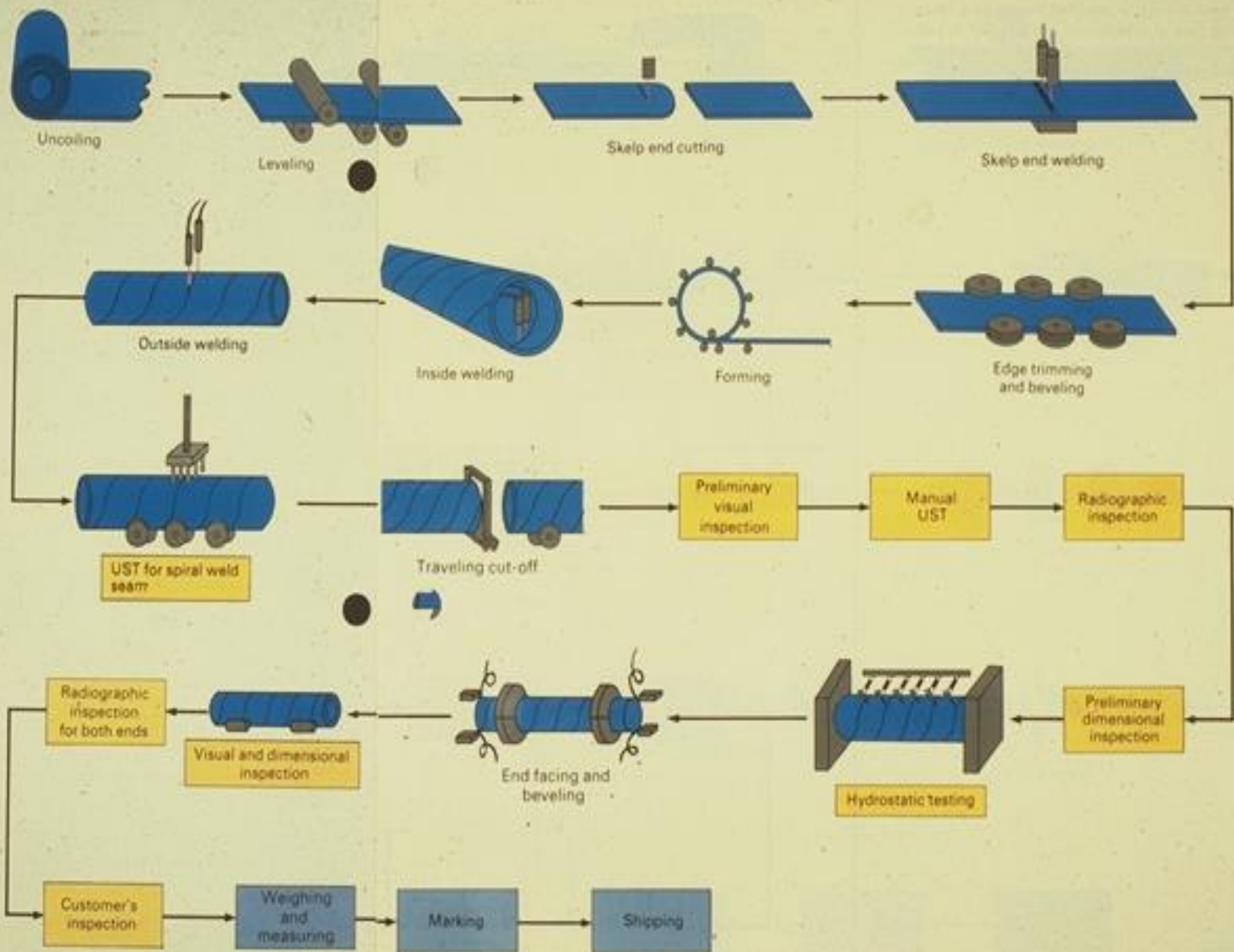
...ion as
 ... pipe mill
 ... on both
 ... cylindrical
 ... ssively,
 ... ater under
 ... ack weld-
 ... the auto-
 ... method first

...rocess in-
 ...sting. The
 ...nd radio-

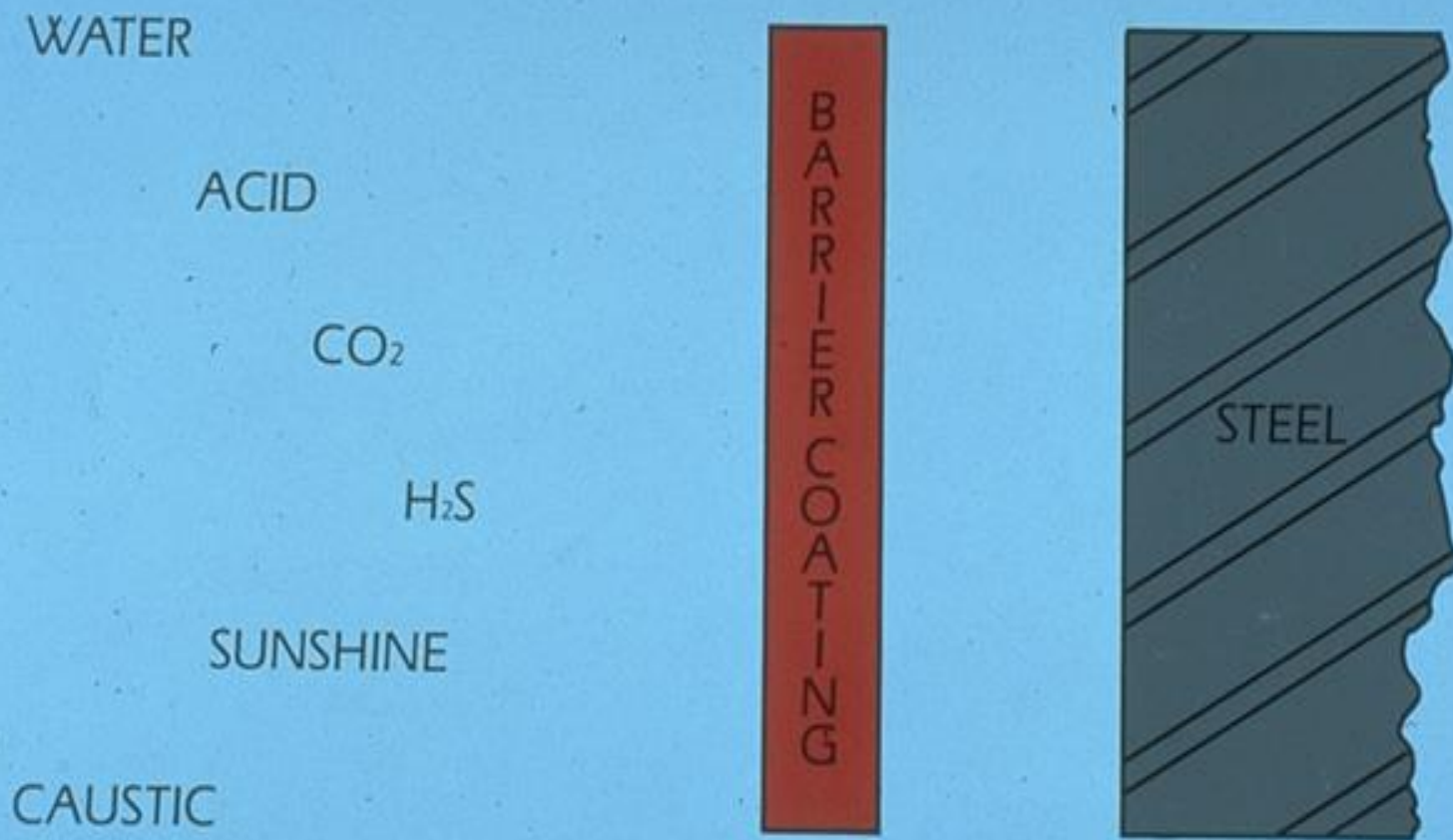
...gh-tough-
 ...subjecting
 ...tempering.

strip mill
trailing end
submerged
trip is con-
firming and
The form-
with a spiral
ent first in-
to the re-
a plasma

1975, in-
traveling
developed



COATING DEFINITION



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

Perfect Coating

- Ease of Application - It can be applied 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.



Appalachian Underground Corrosion Short Course

In Reality a Perfect Coating

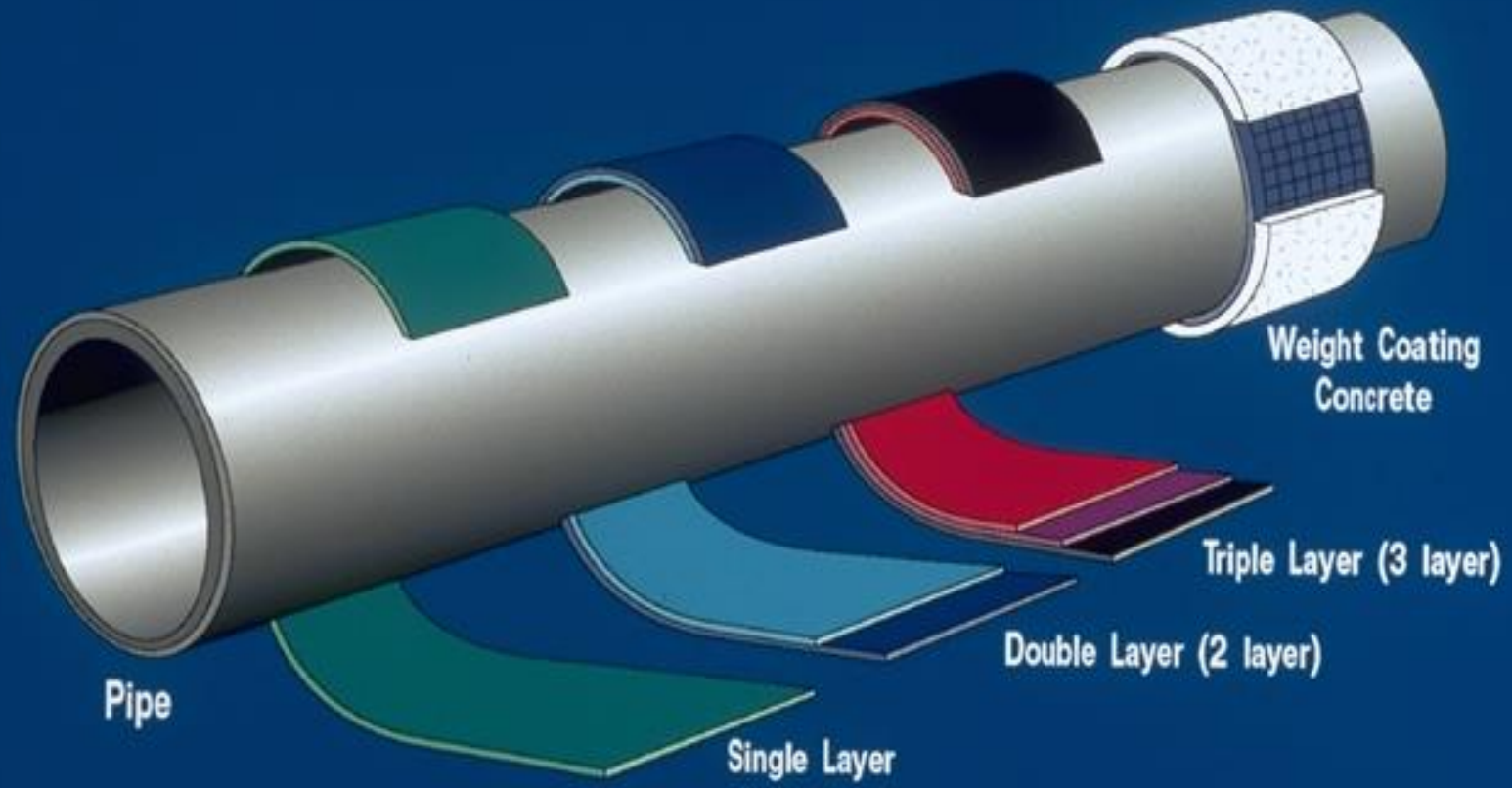
- Requires a quality standard
- Requires a quality specification
- Requires a quality coating mill
- Requires a quality material or materials
- Requires a quality inspector or inspectors



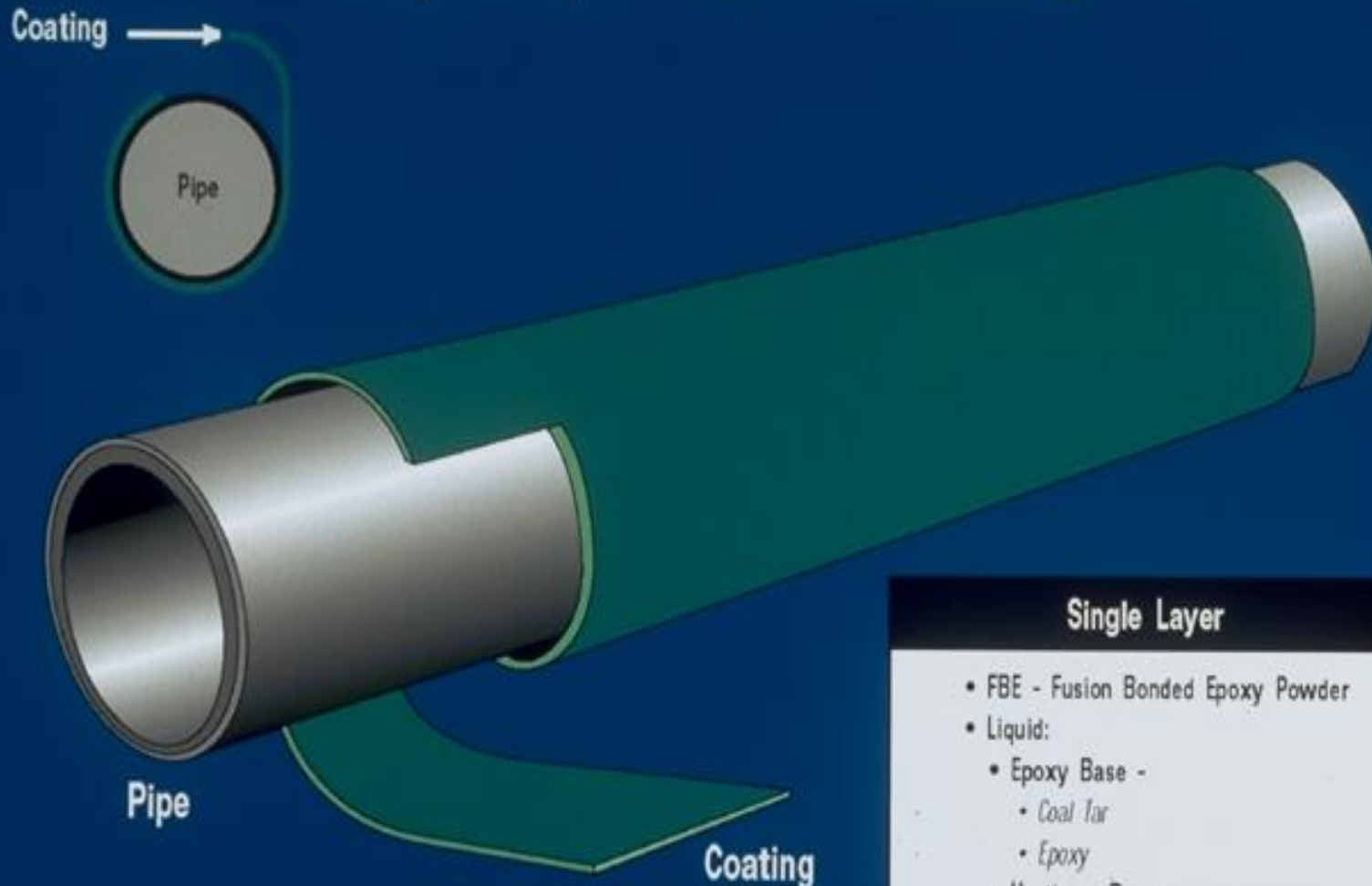
General Requirements of a Pipeline Coating

- **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



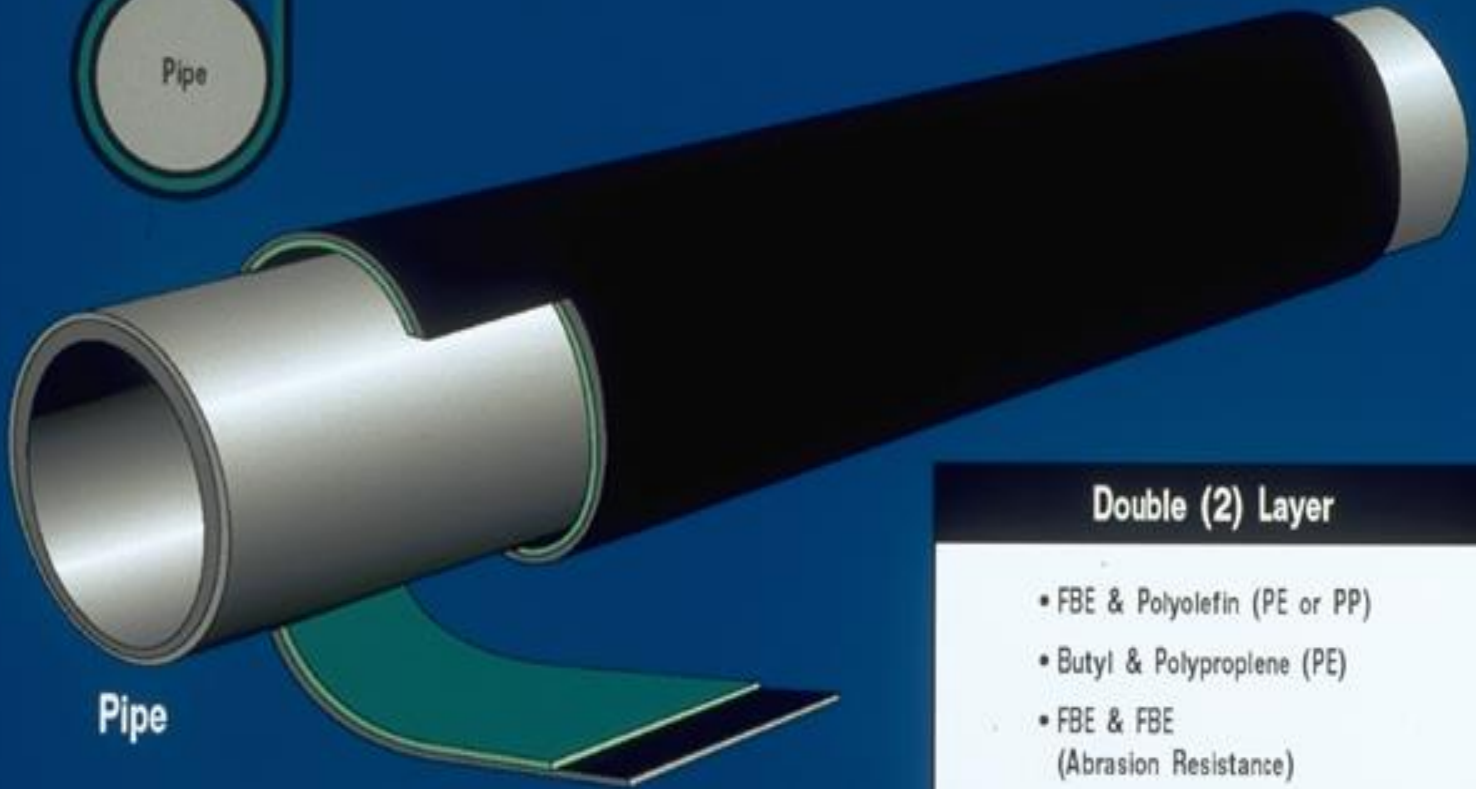
Single Layer

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

Double (2) Layer Pipeline Coating



2nd Coat →
1st Coat →



■ 1st Coat

■ 2nd Coat

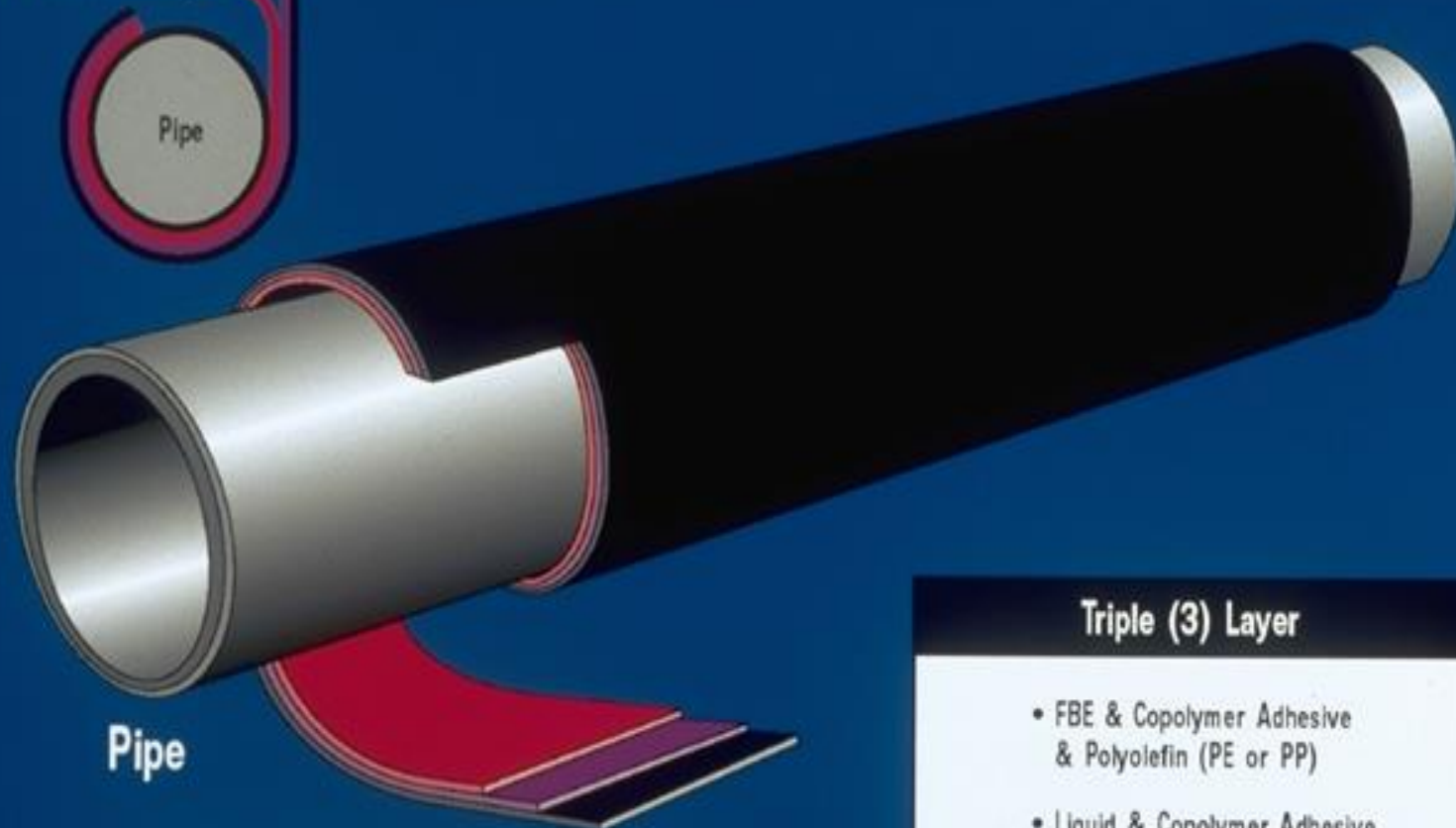
Double (2) Layer

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

Triple (3) Layer Pipeline Coating



3rd Coat →
2nd Coat →
1st Coat →



■ 1st Coat ■ 2nd Coat ■ 3rd Coat

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

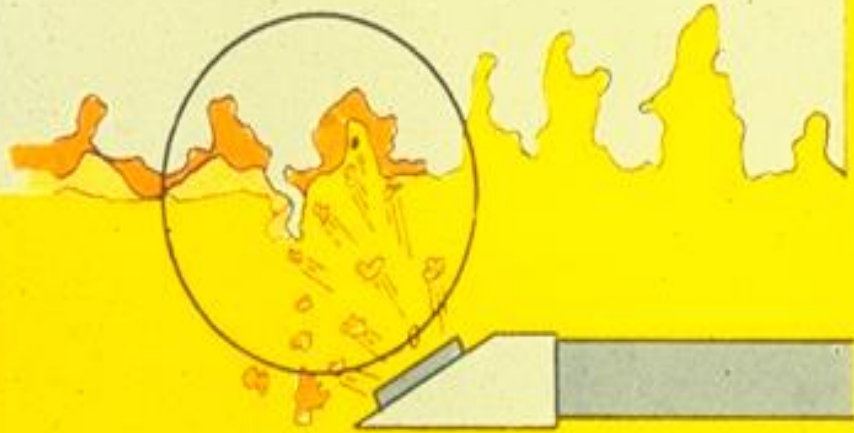


GREATER THAN 2 MILS

ANCHOR PATTERNS

Anchor Pattern Formation

Before



After

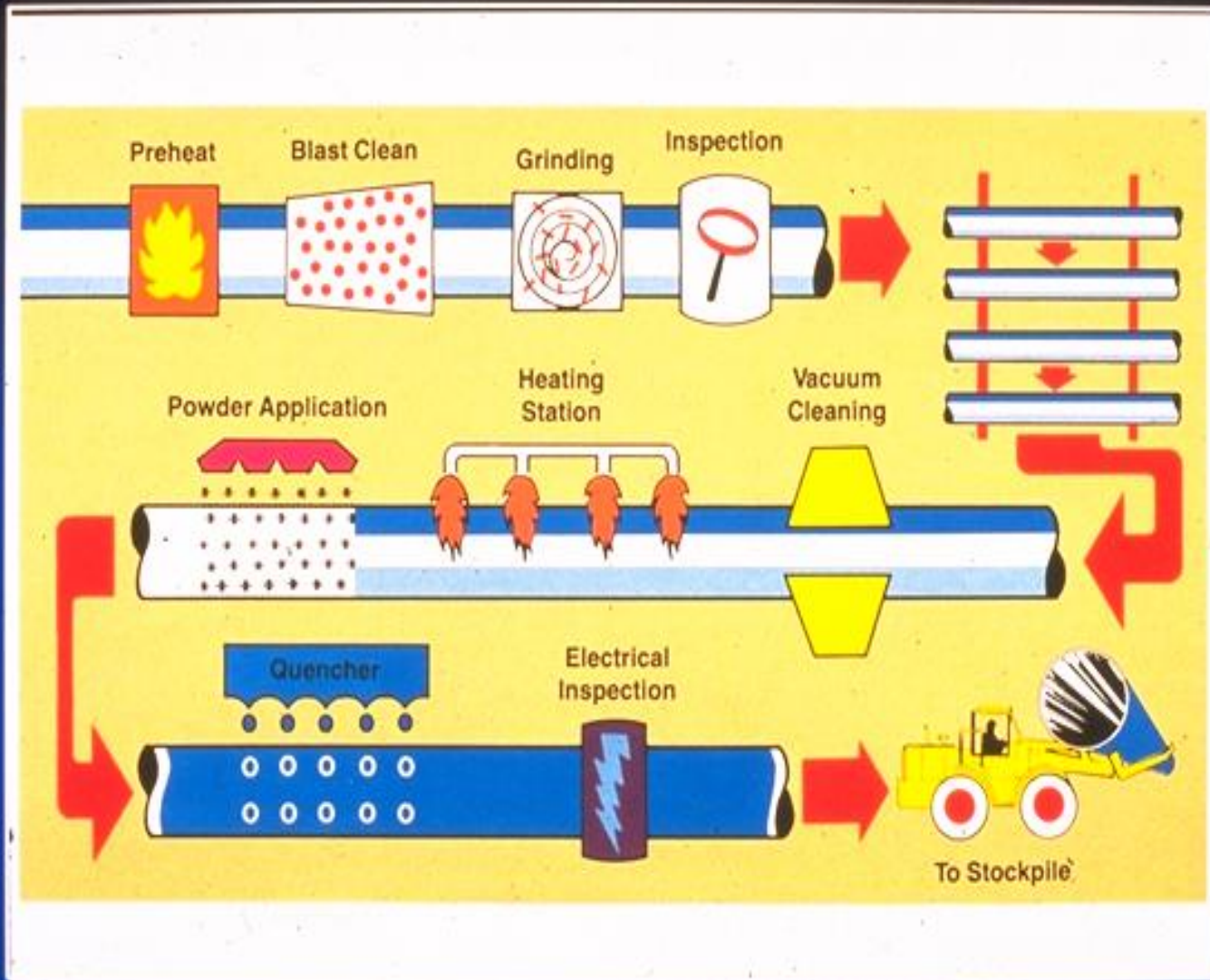


FUSION BONDED COATINGS

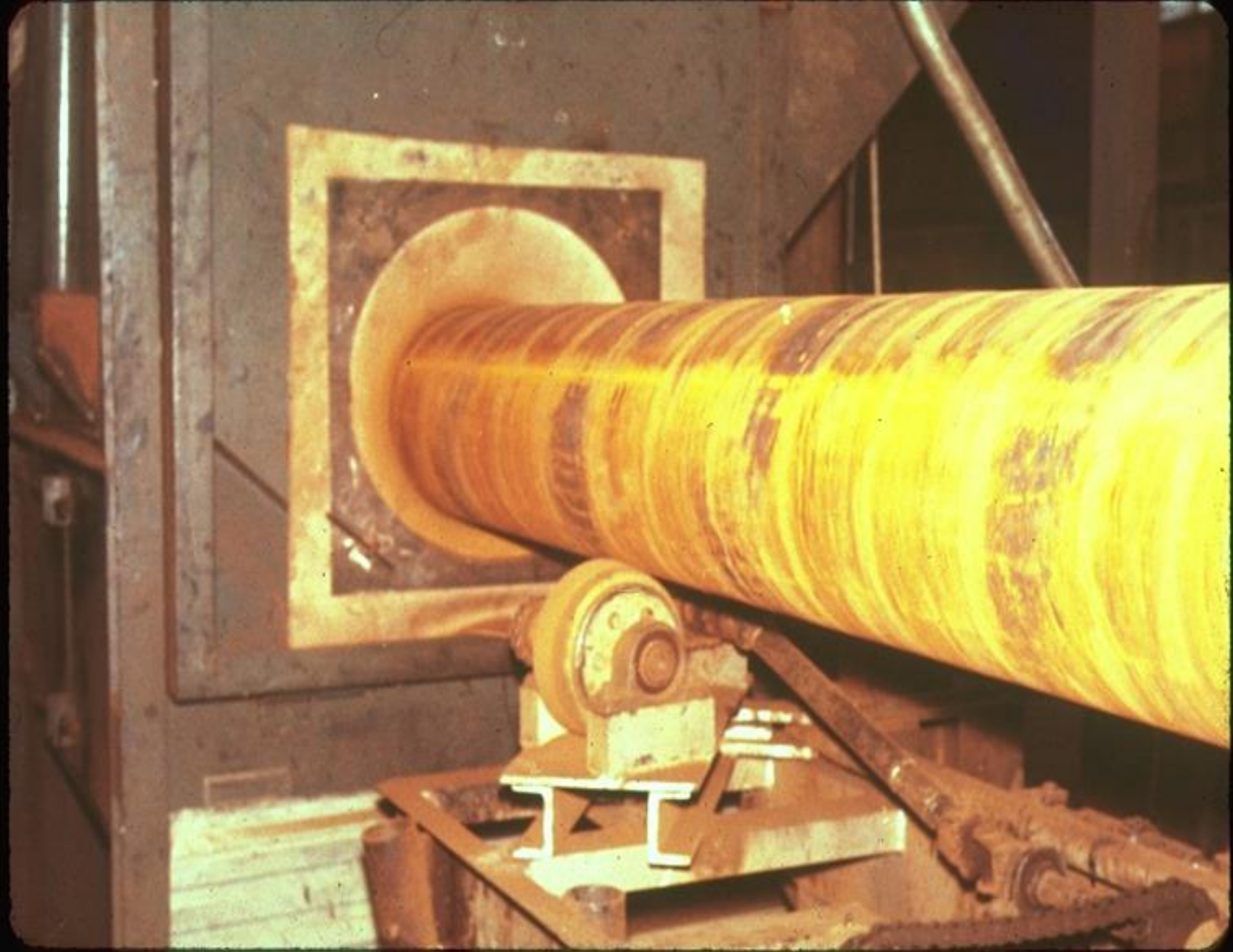
APPLICATION PROCEDURE

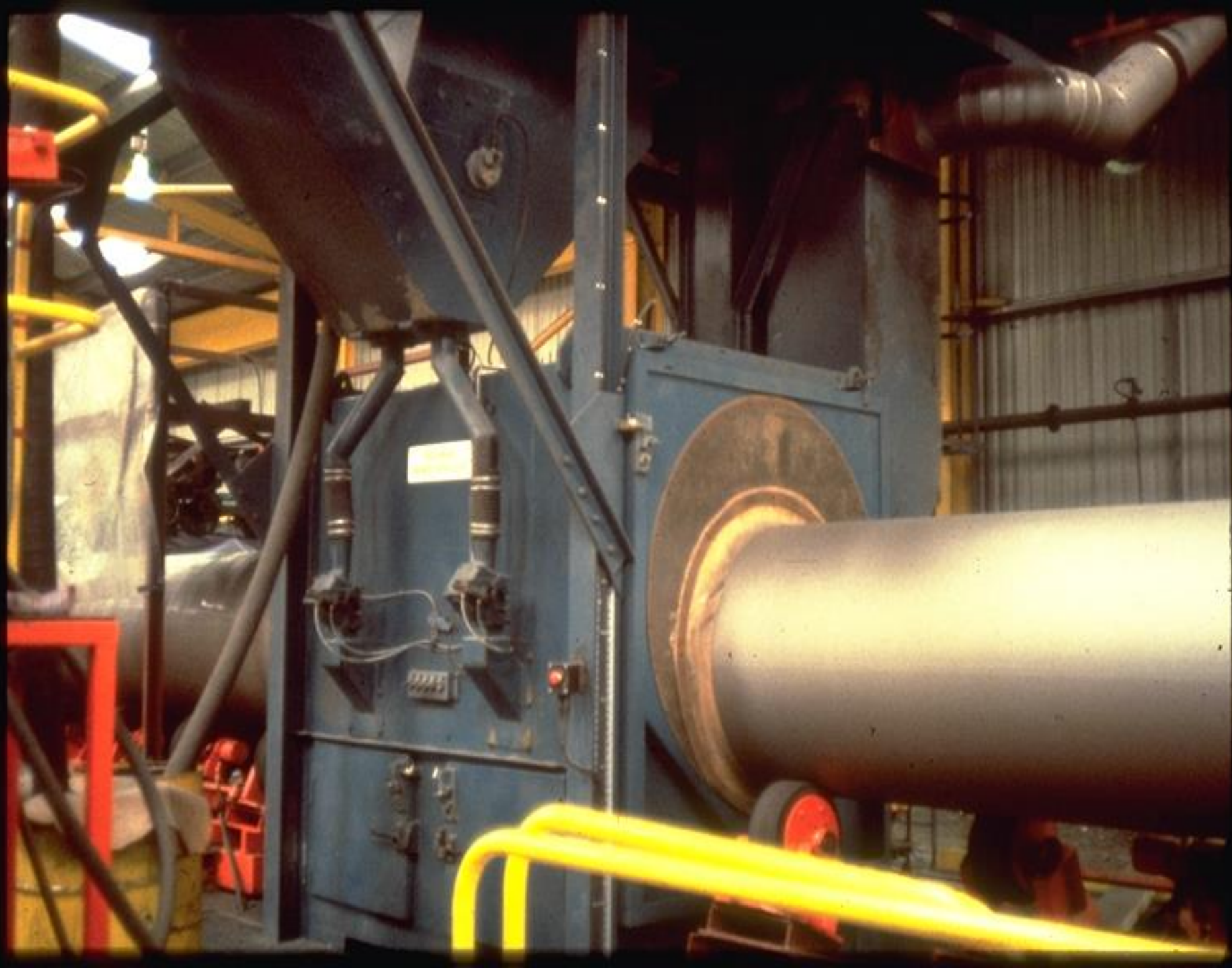
- 1. CLEAN**
- 2. HEAT**
- 3. APPLY**
- 4. CURE**
- 5. INSPECT**
- 6. REPAIR**

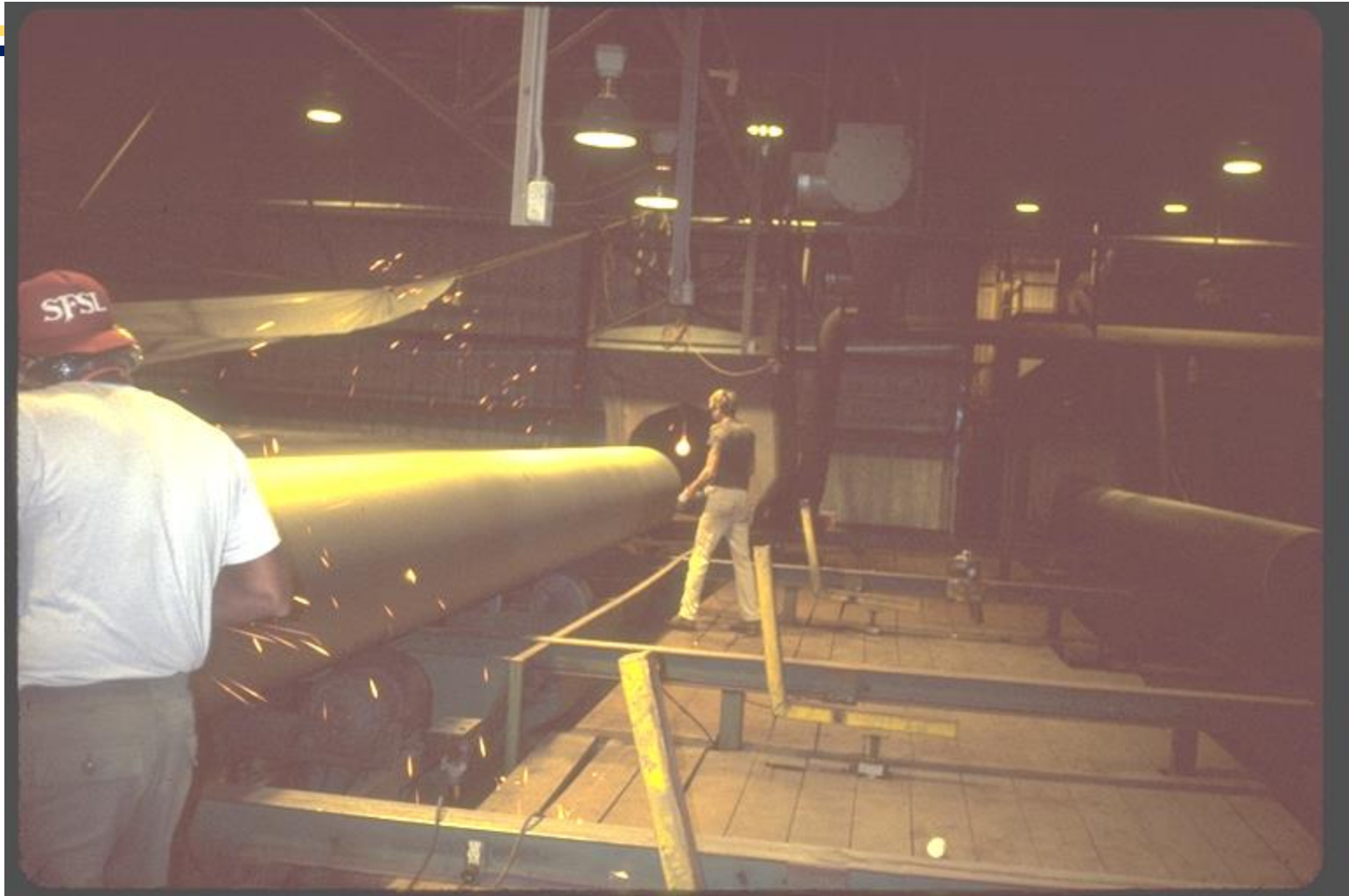
Fusion Bonded Epoxy









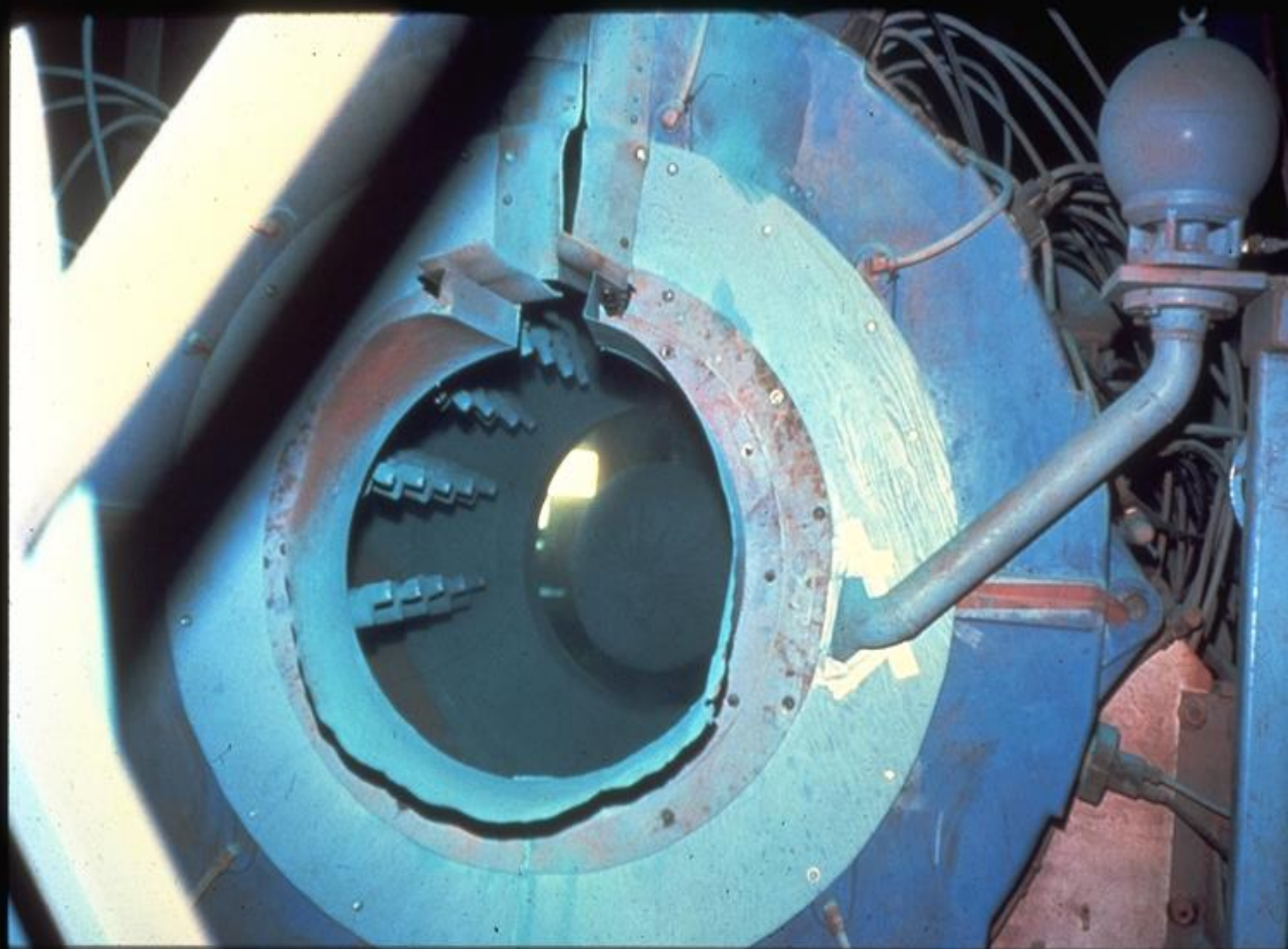




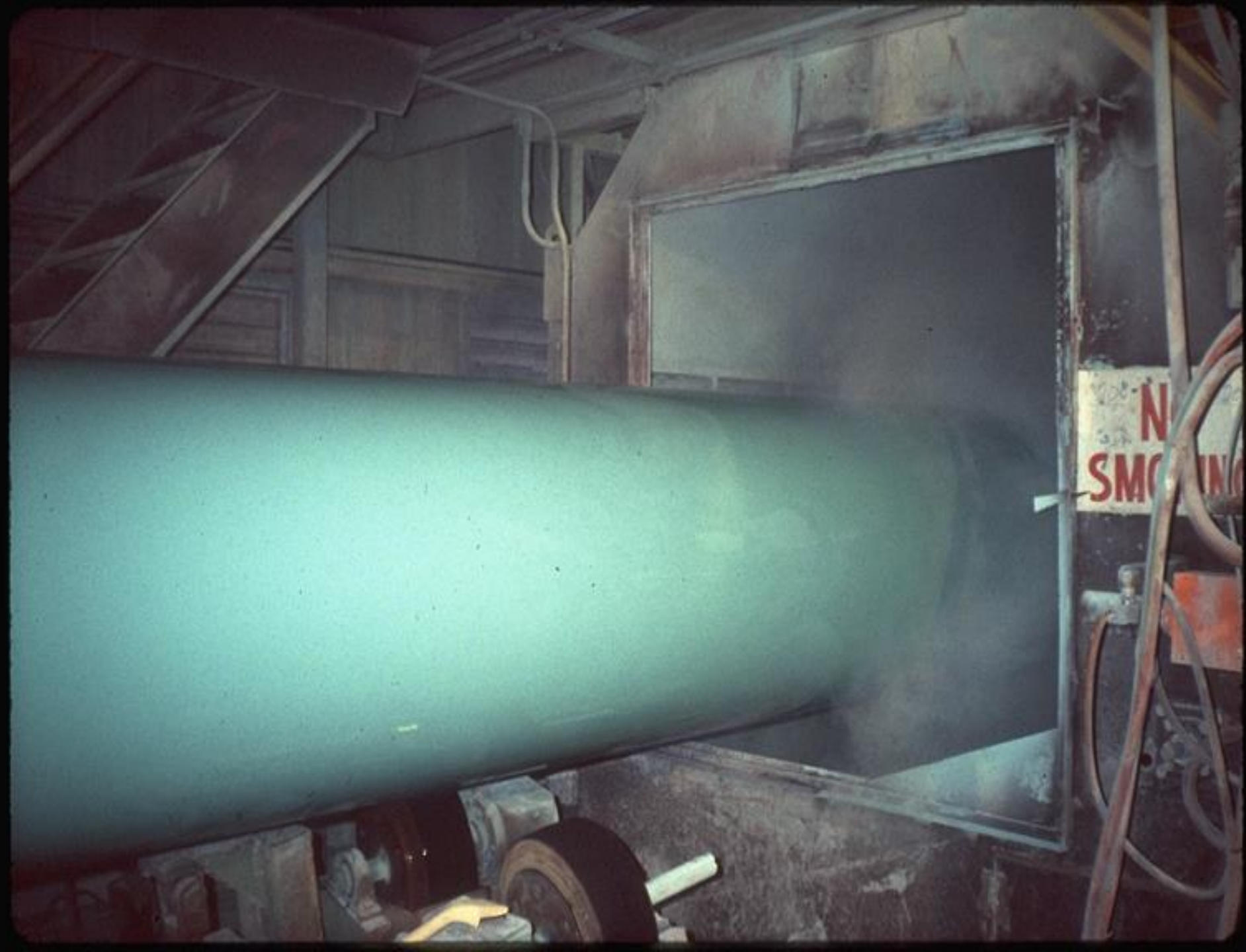




ER
OR OPEN
AREA

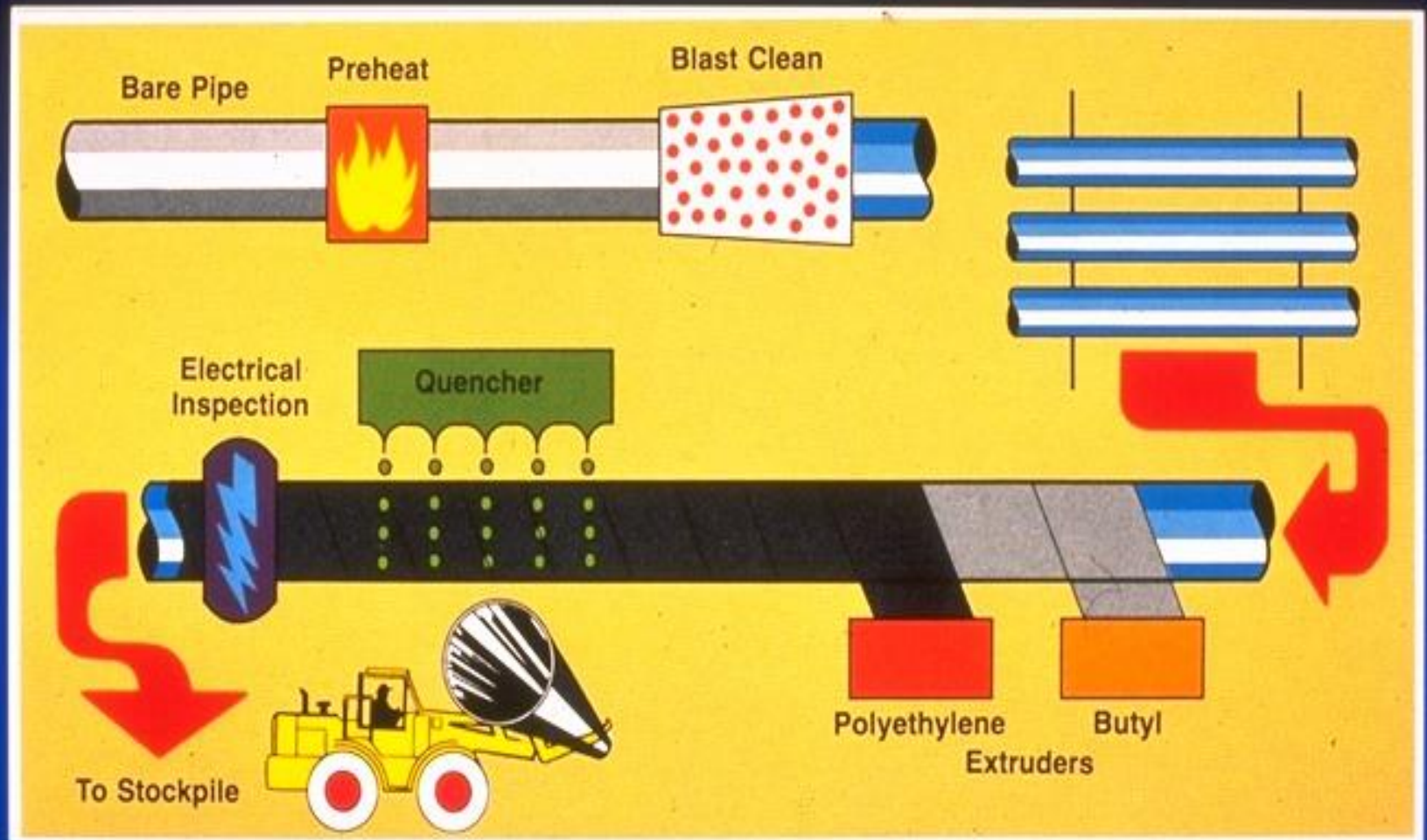






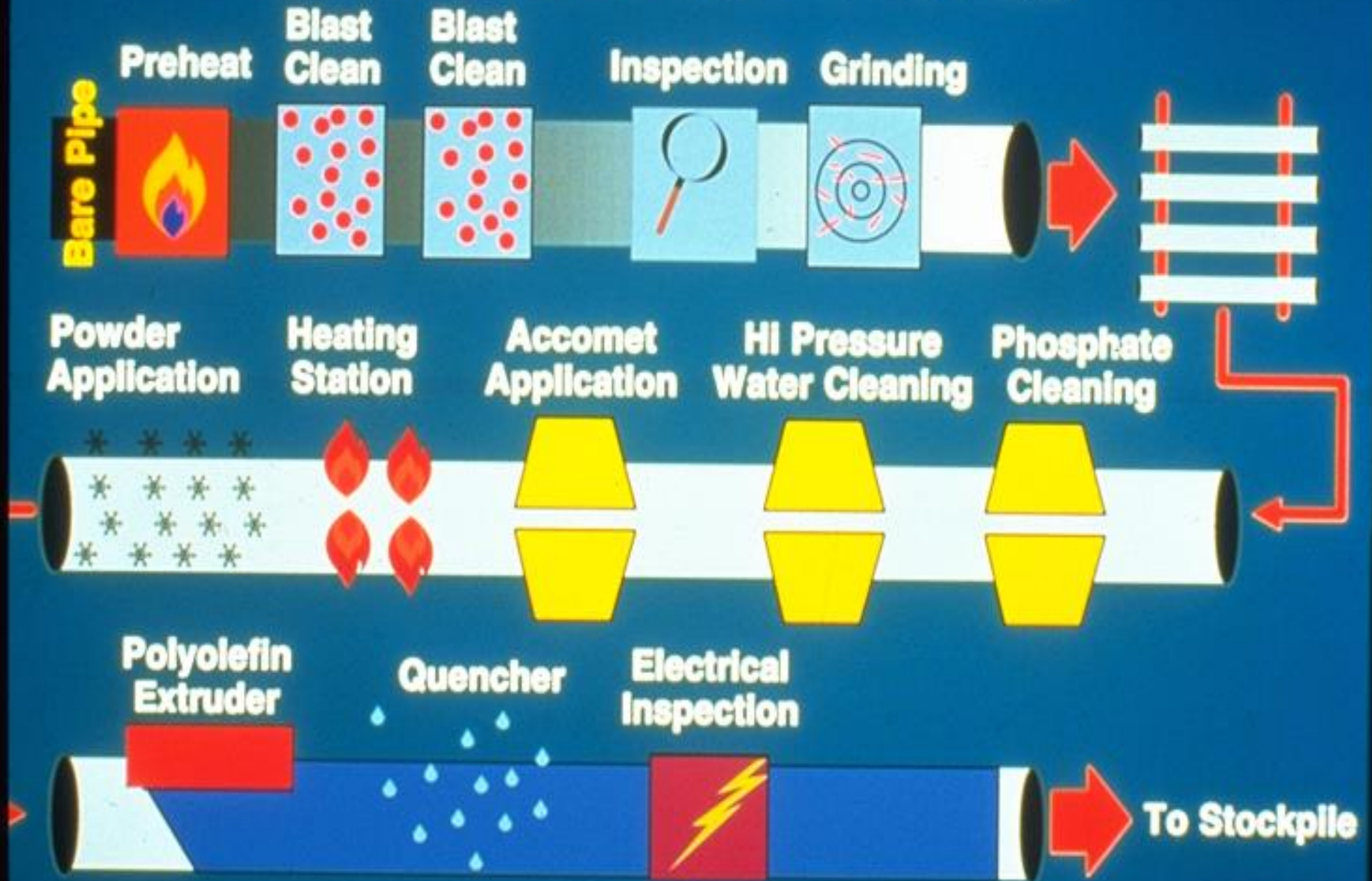
NO
SMOKING

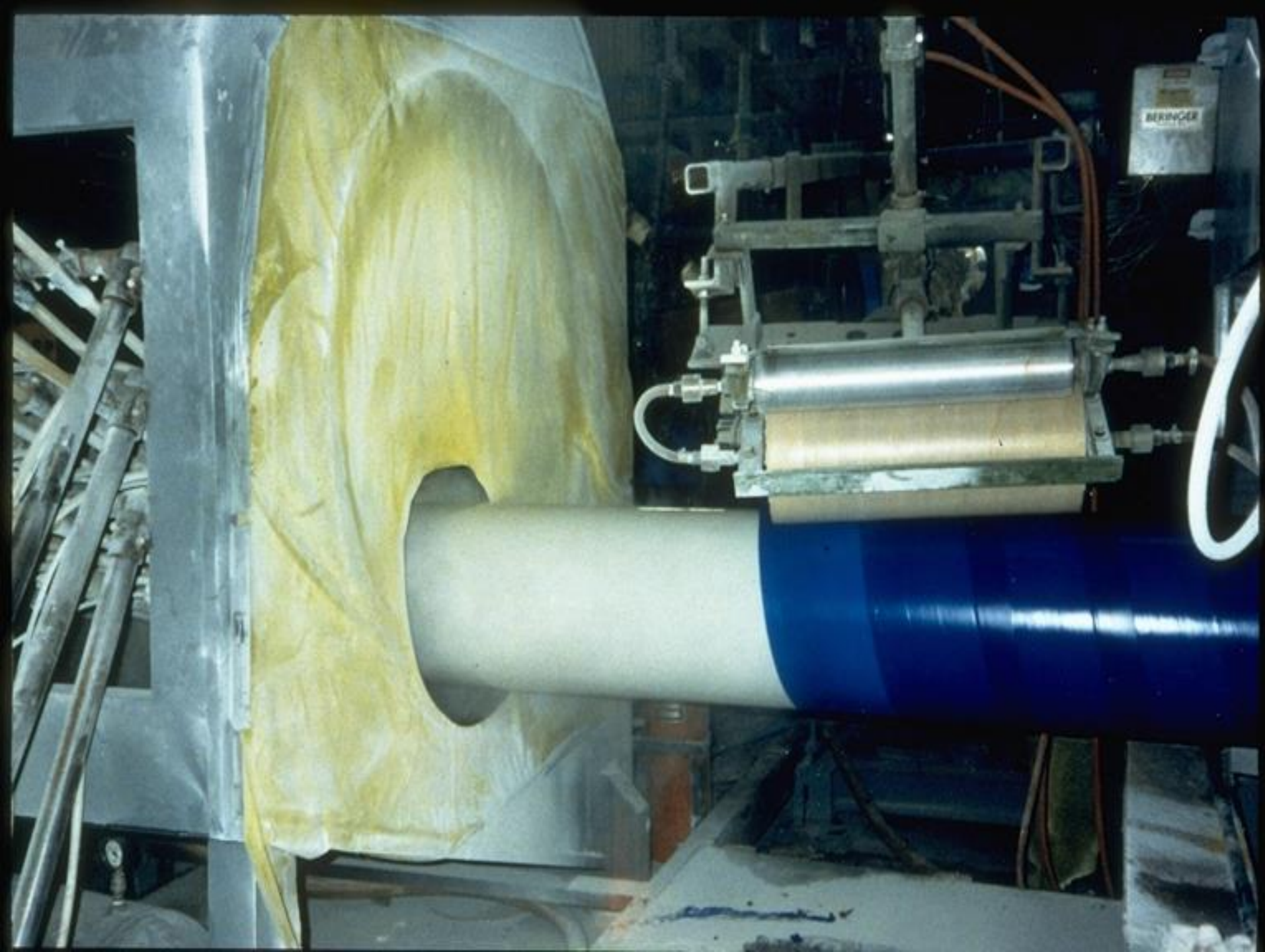
PE/BUTYL (Two Layer)



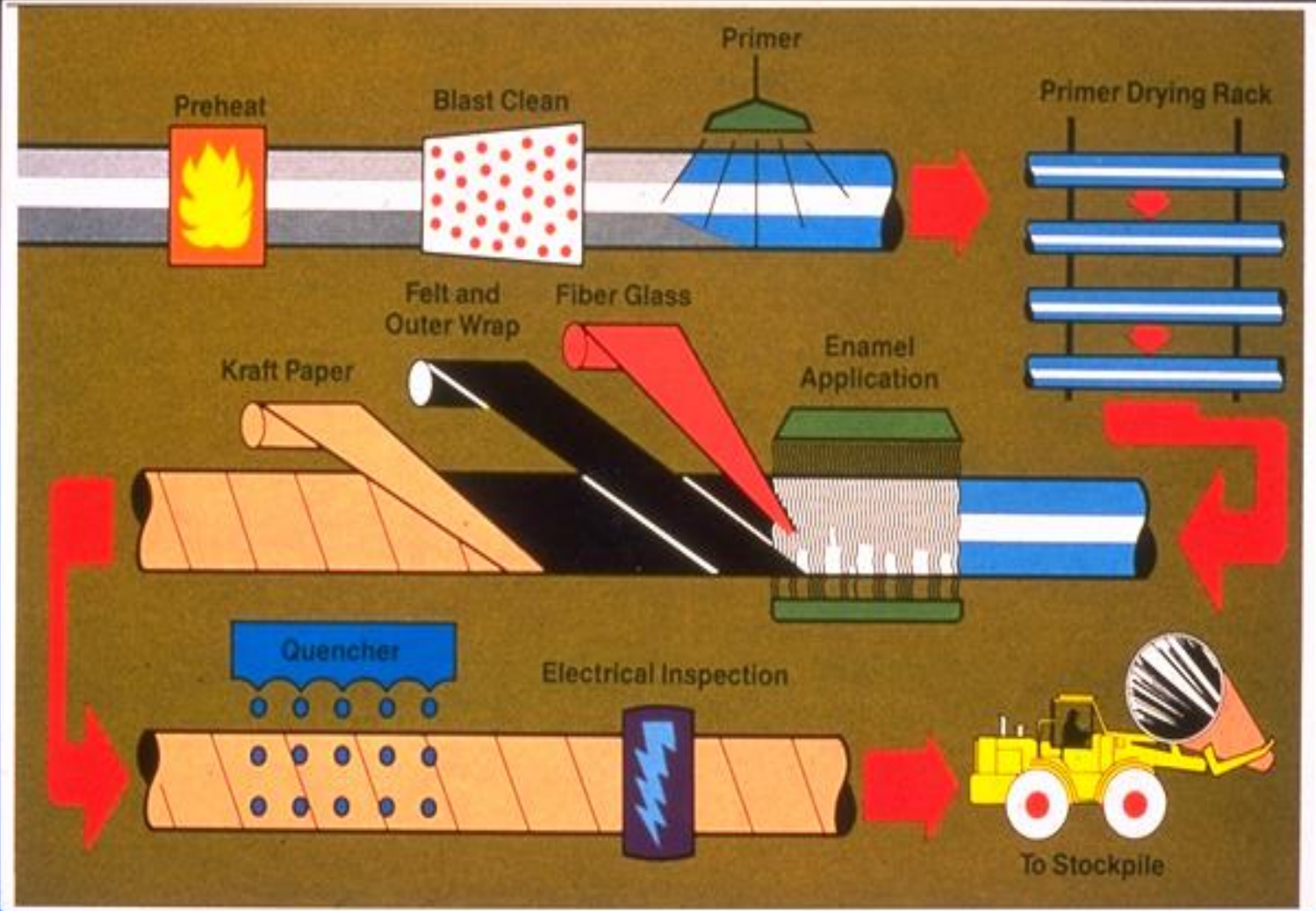


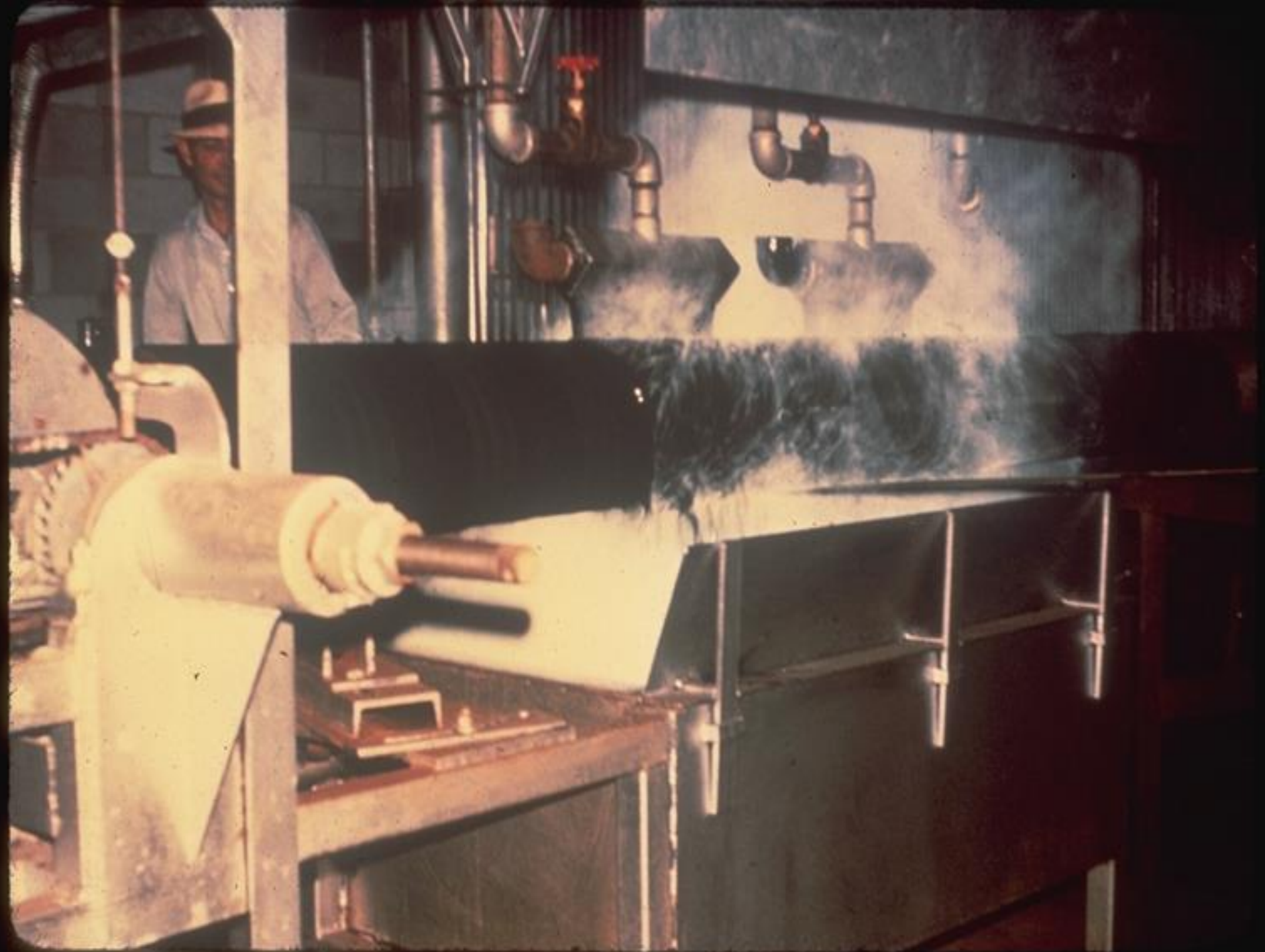
DUVAL COATING SYSTEM

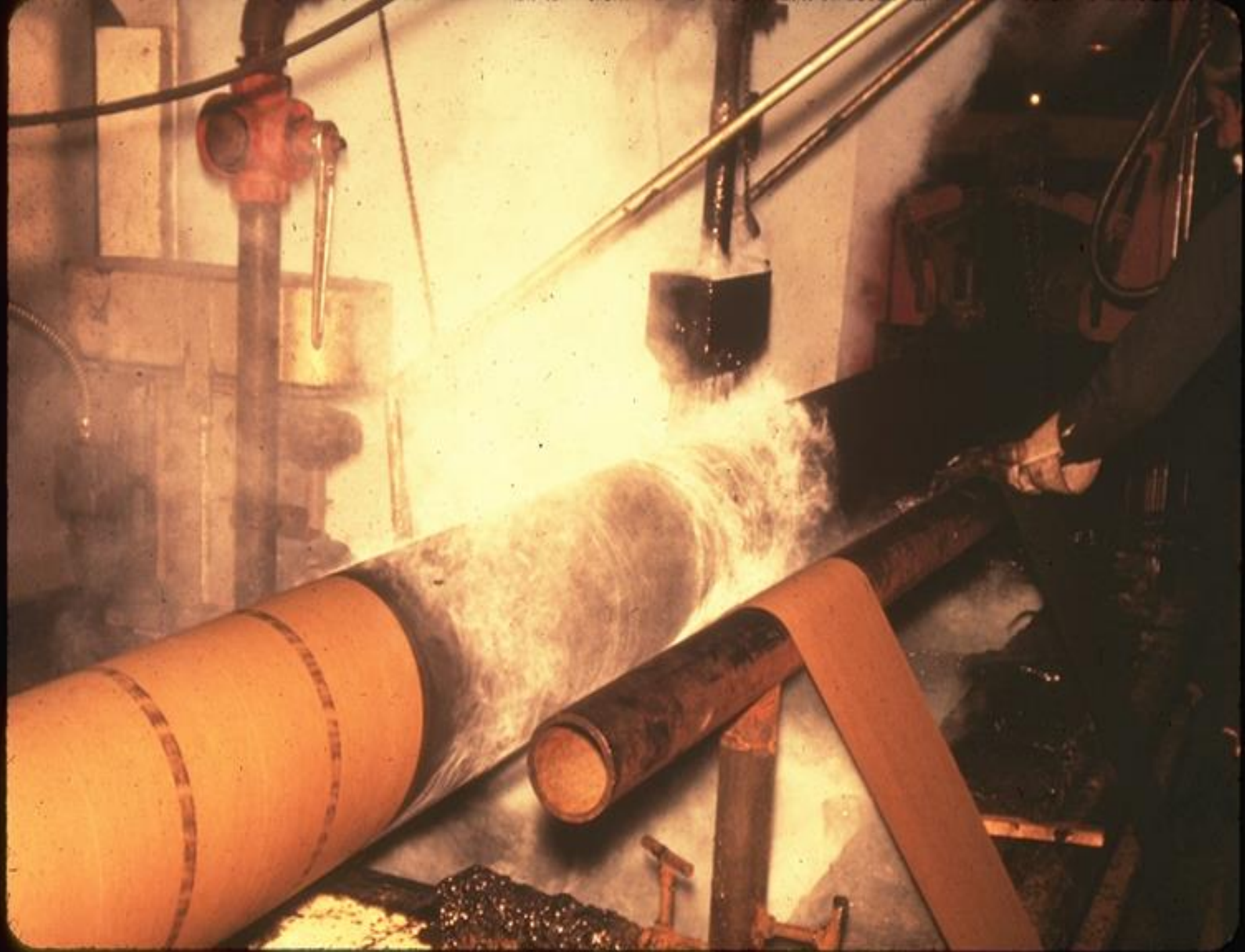




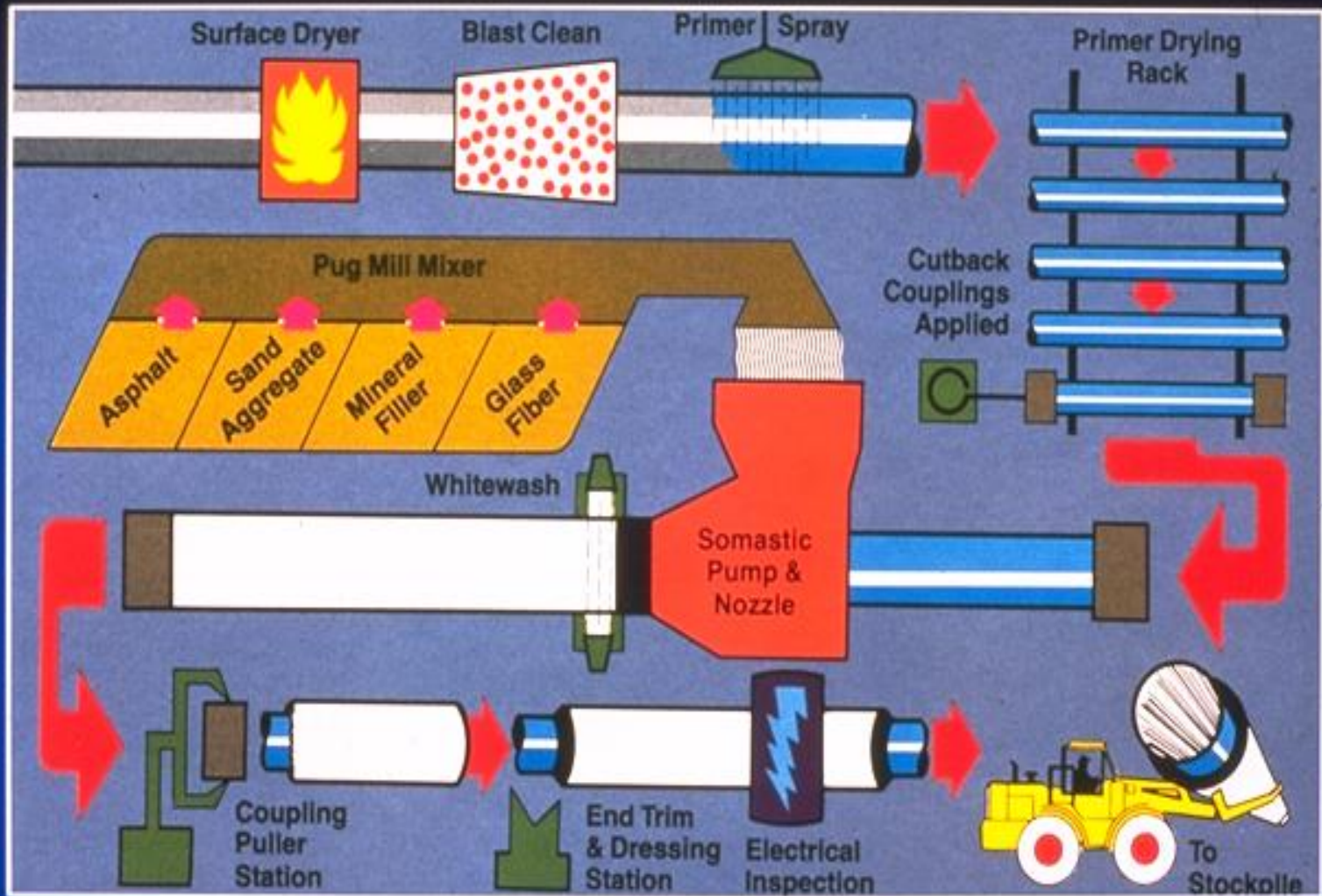
Coal Tar Enamels

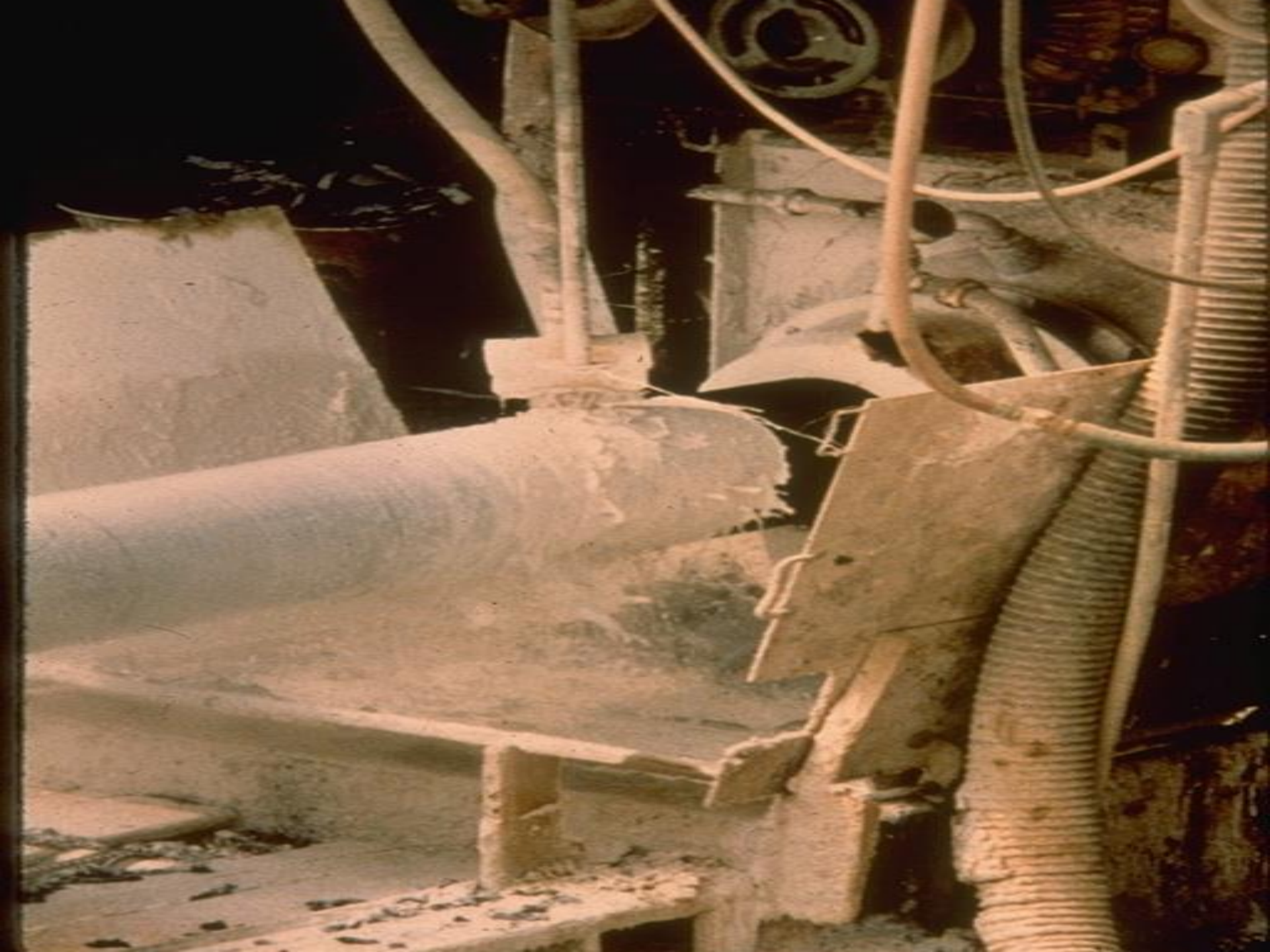


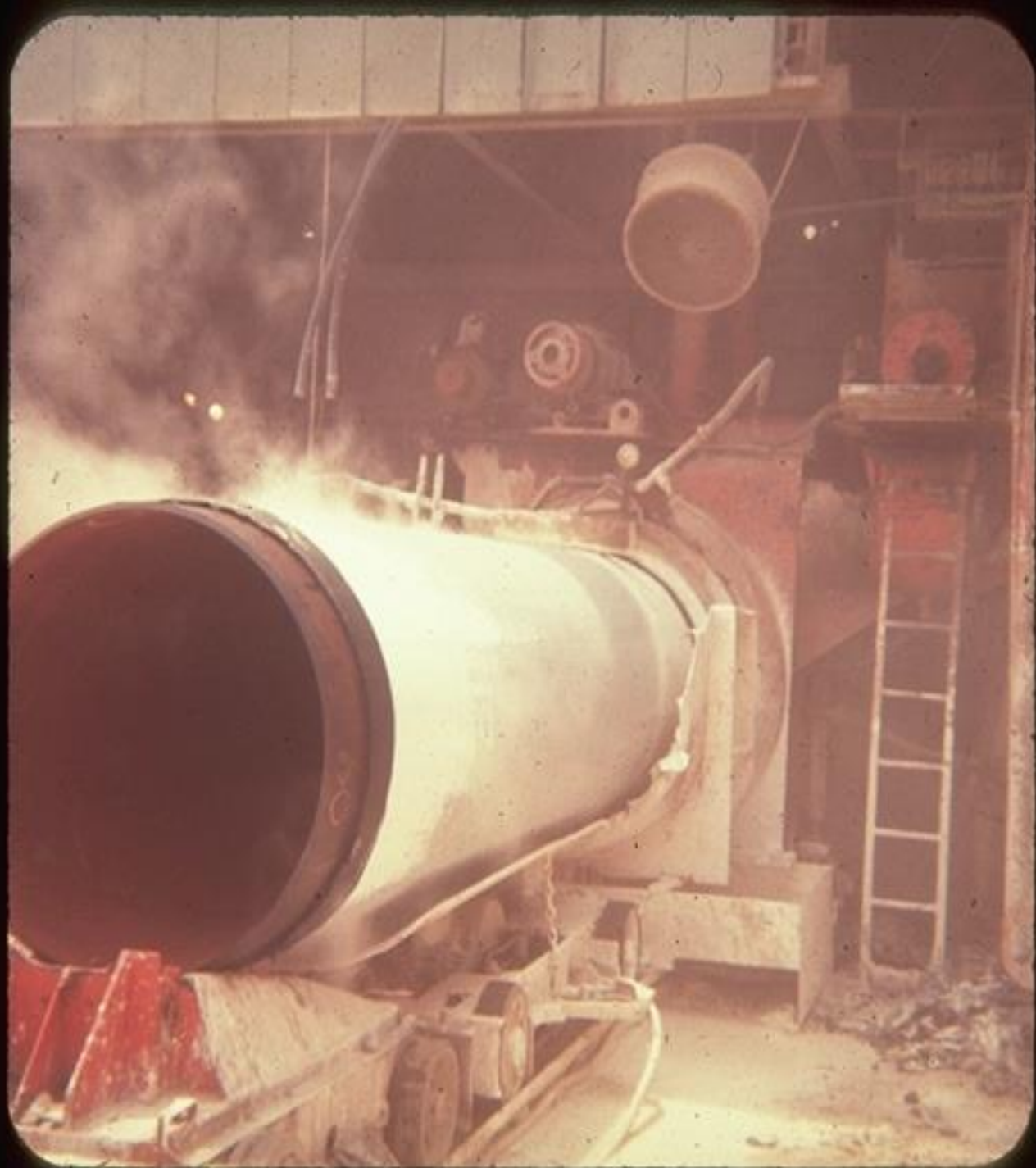




Asphalt Mastic



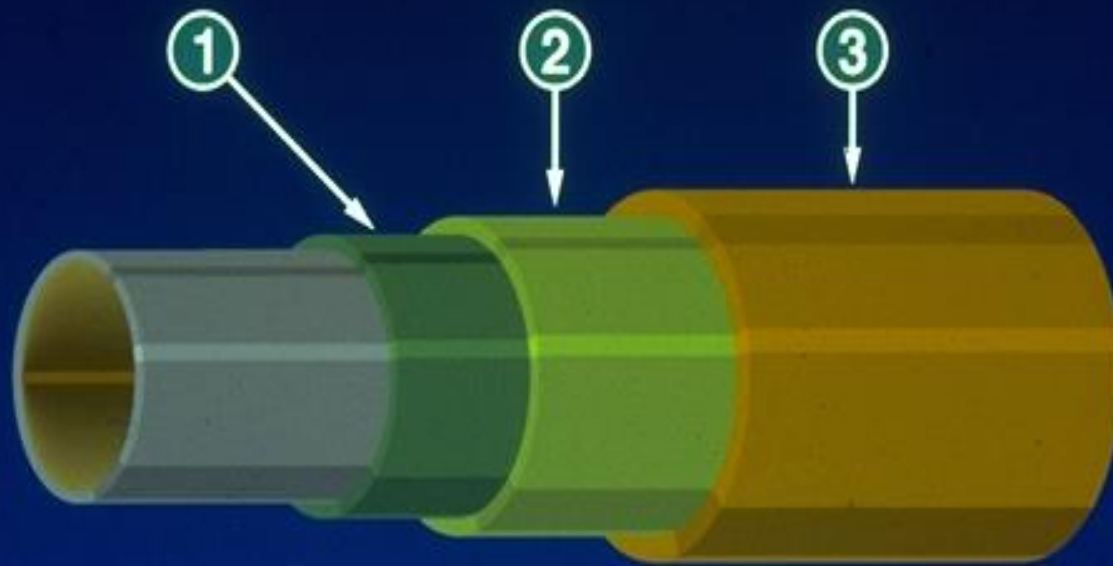






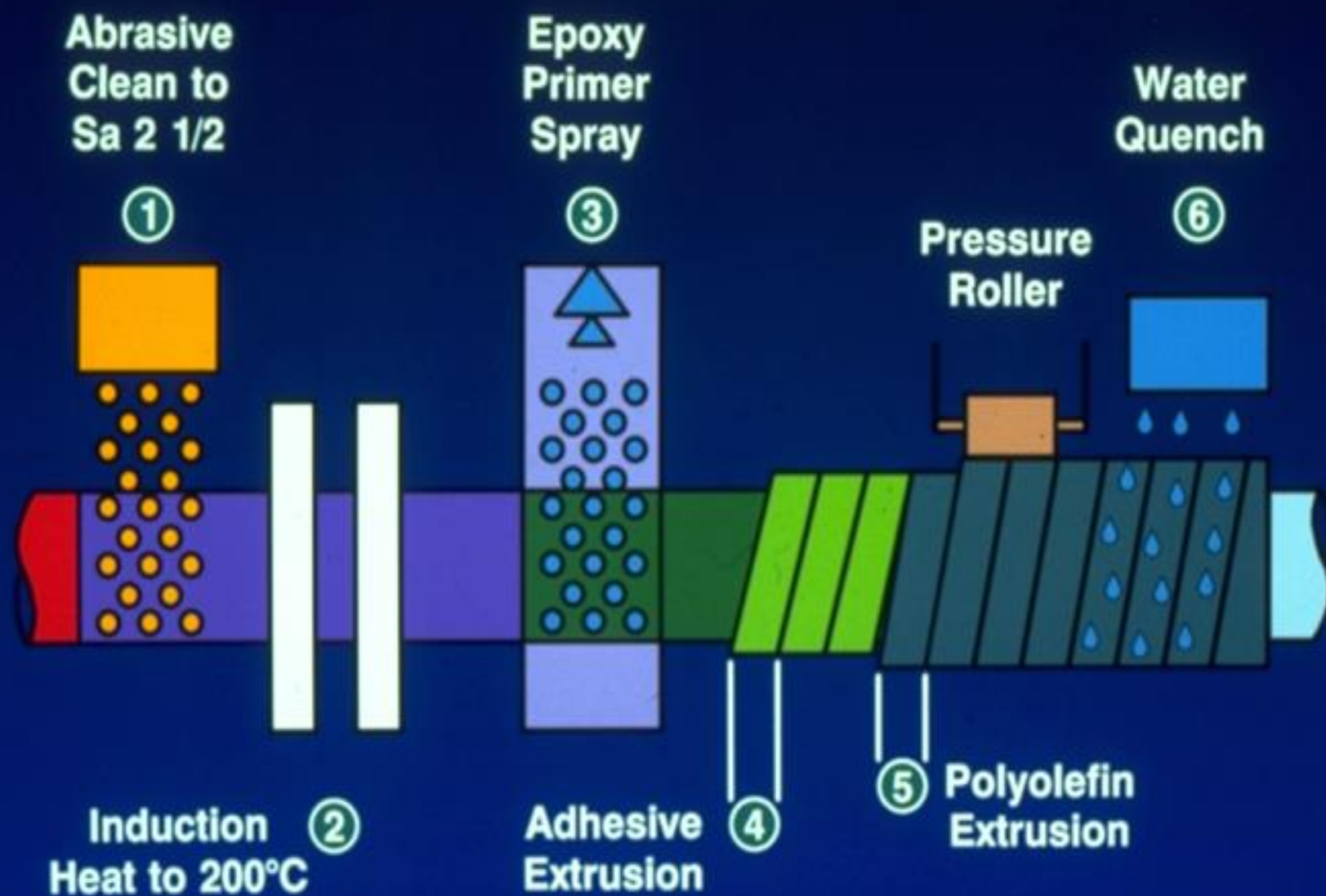


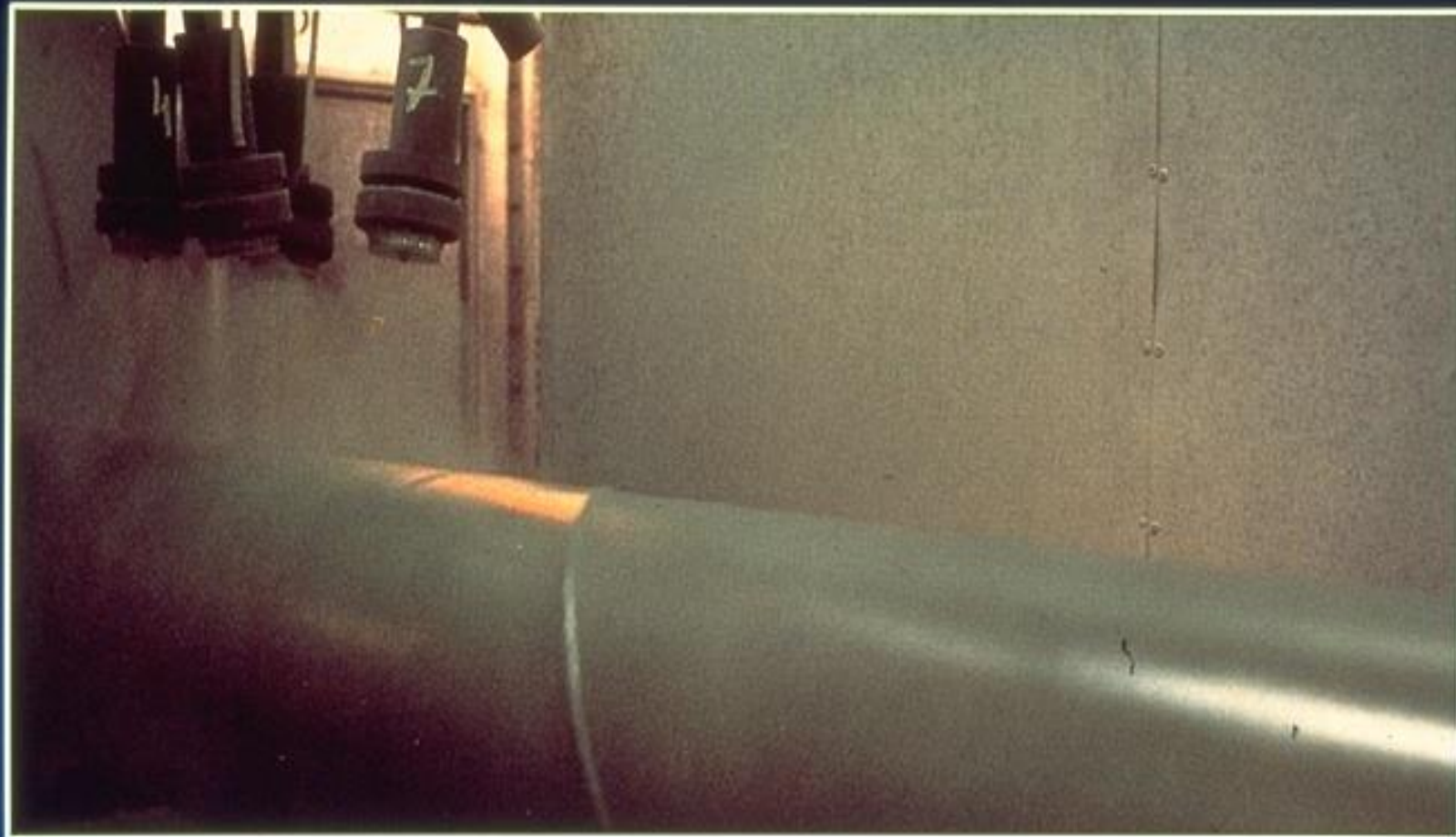
**Figure 1 Shows a Schematic Diagram of a
Typical 3-Layer Pipe Coating**



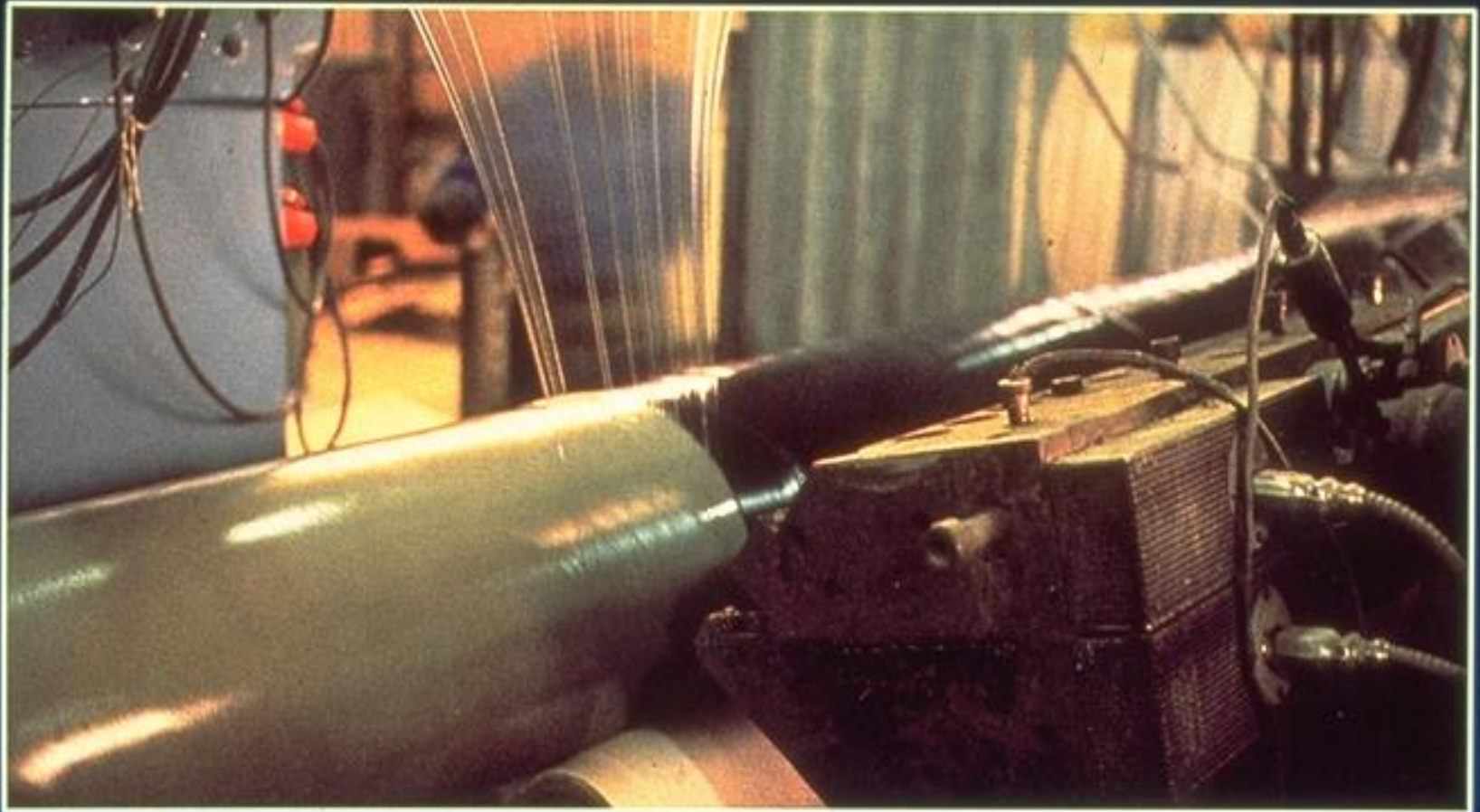
- ① EPOXY PRIMER**
- ② INTERMEDIATE ADHESIVE LAYER**
- ③ POLYOLEFIN TOPCOAT**

Schematic Diagram of 3-Layer Pipe Coating



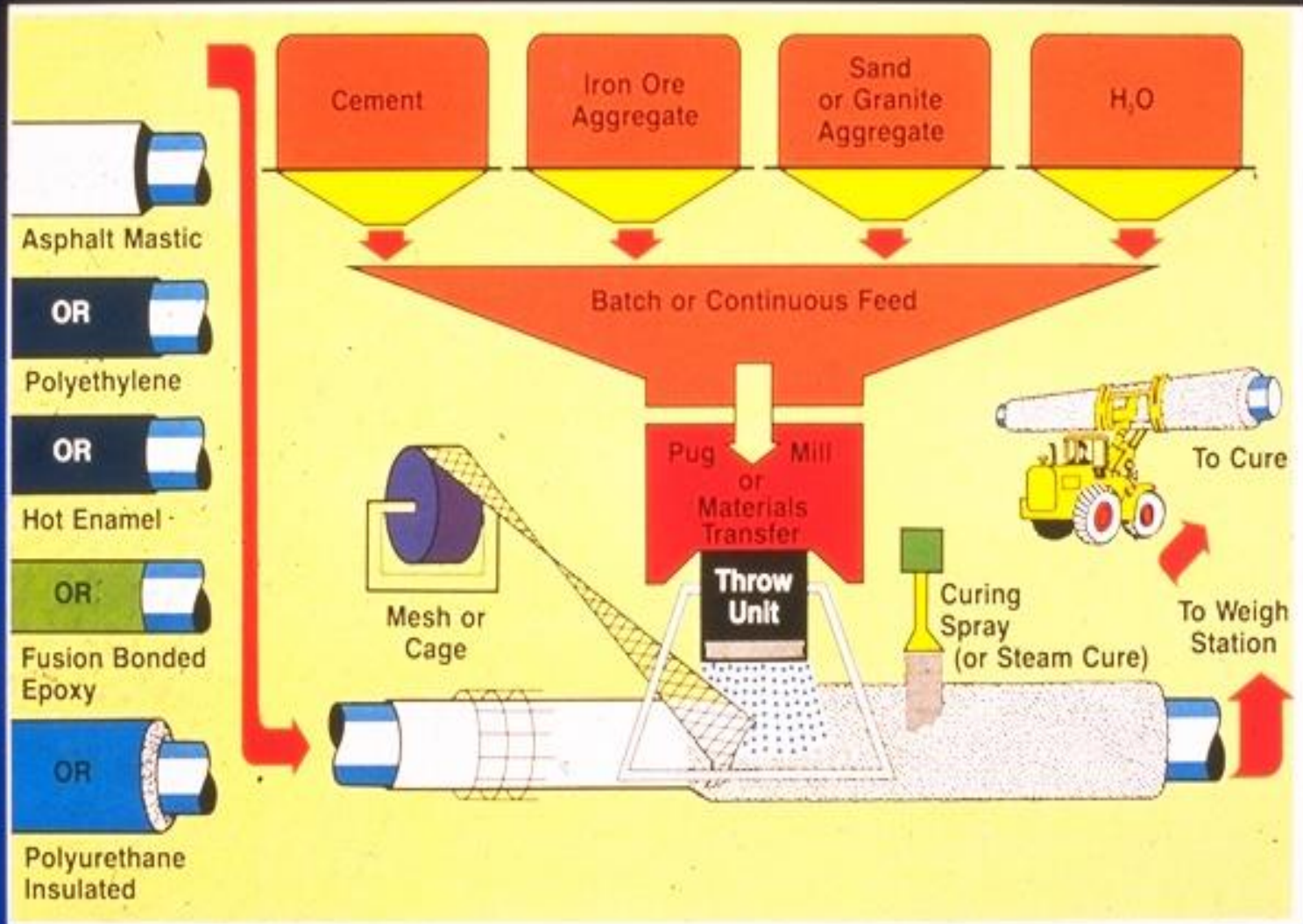


Application of EUROKOTE Epoxy Powder Primer Layer

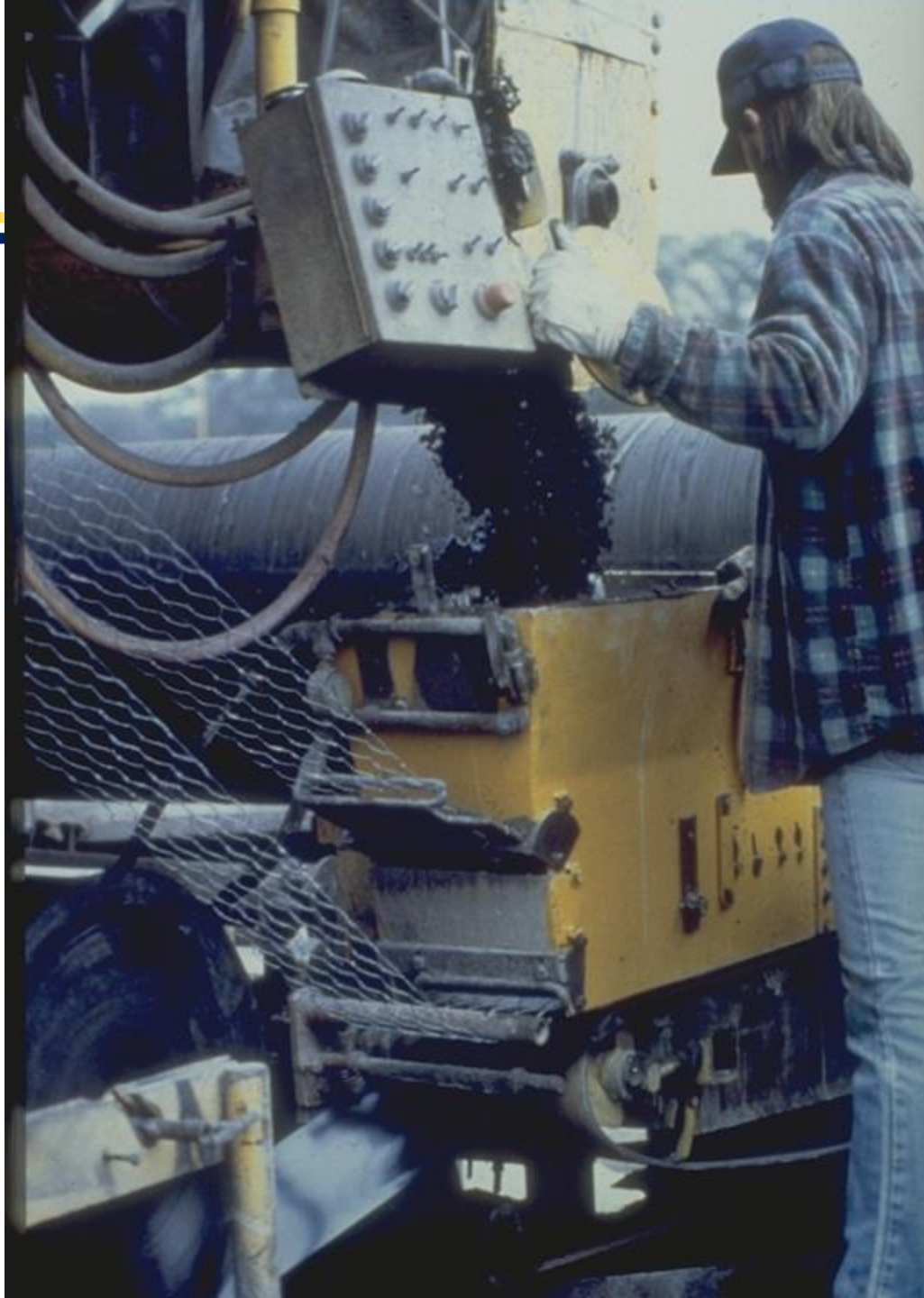


Extrusion of Adhesive and Low Density Polyethylene Over the Epoxy Primer Layer

Impingement Concrete Coating



















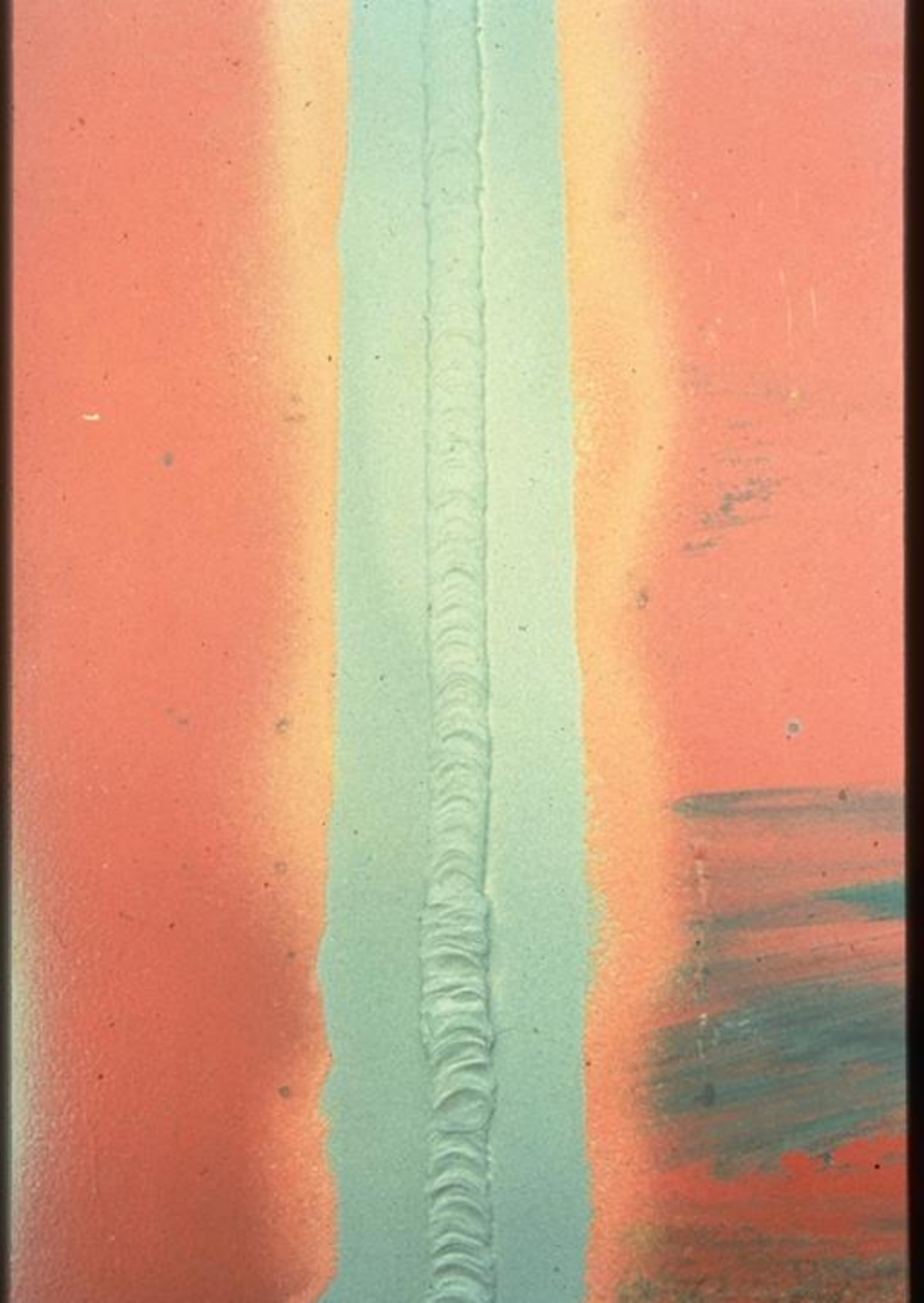










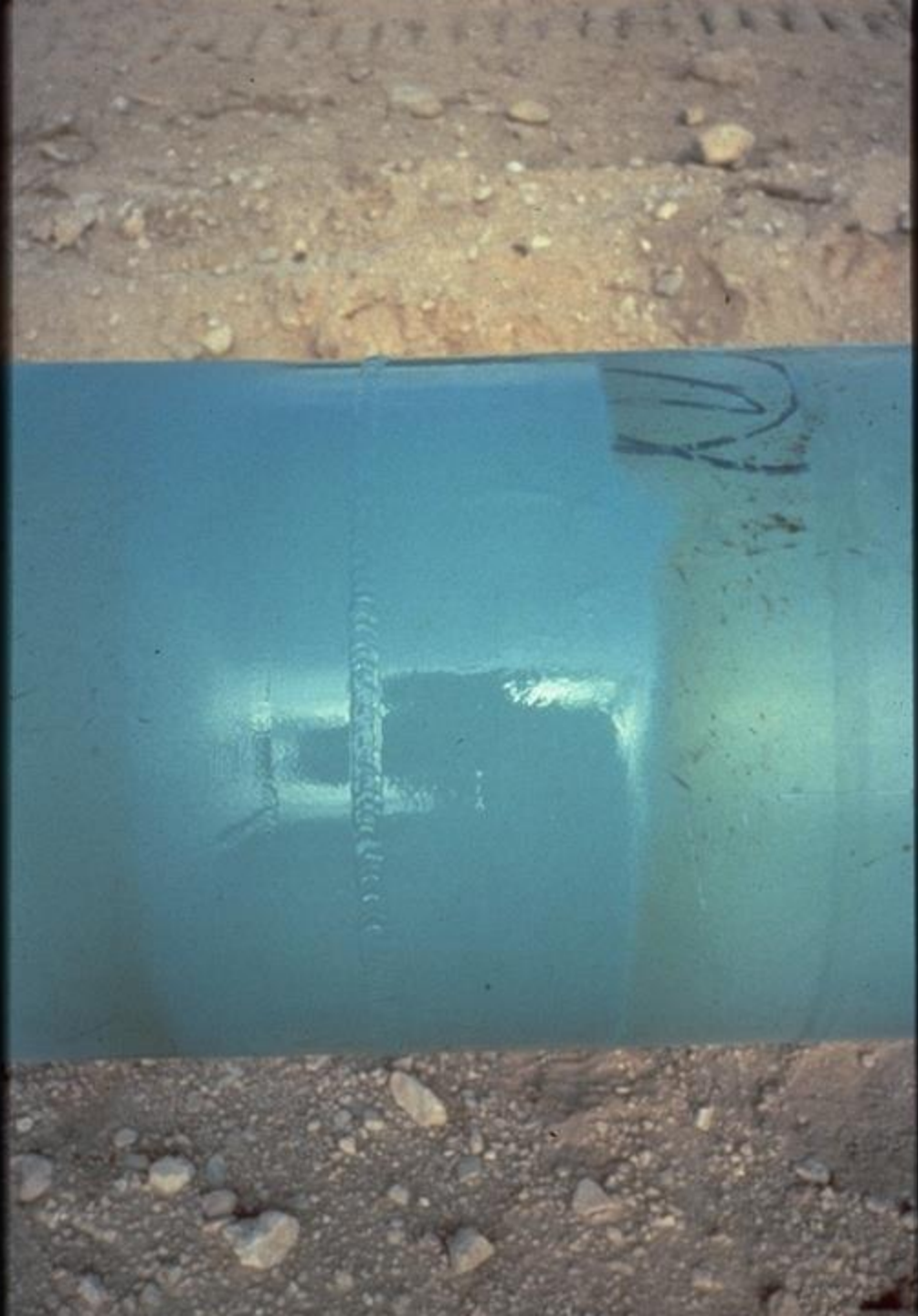


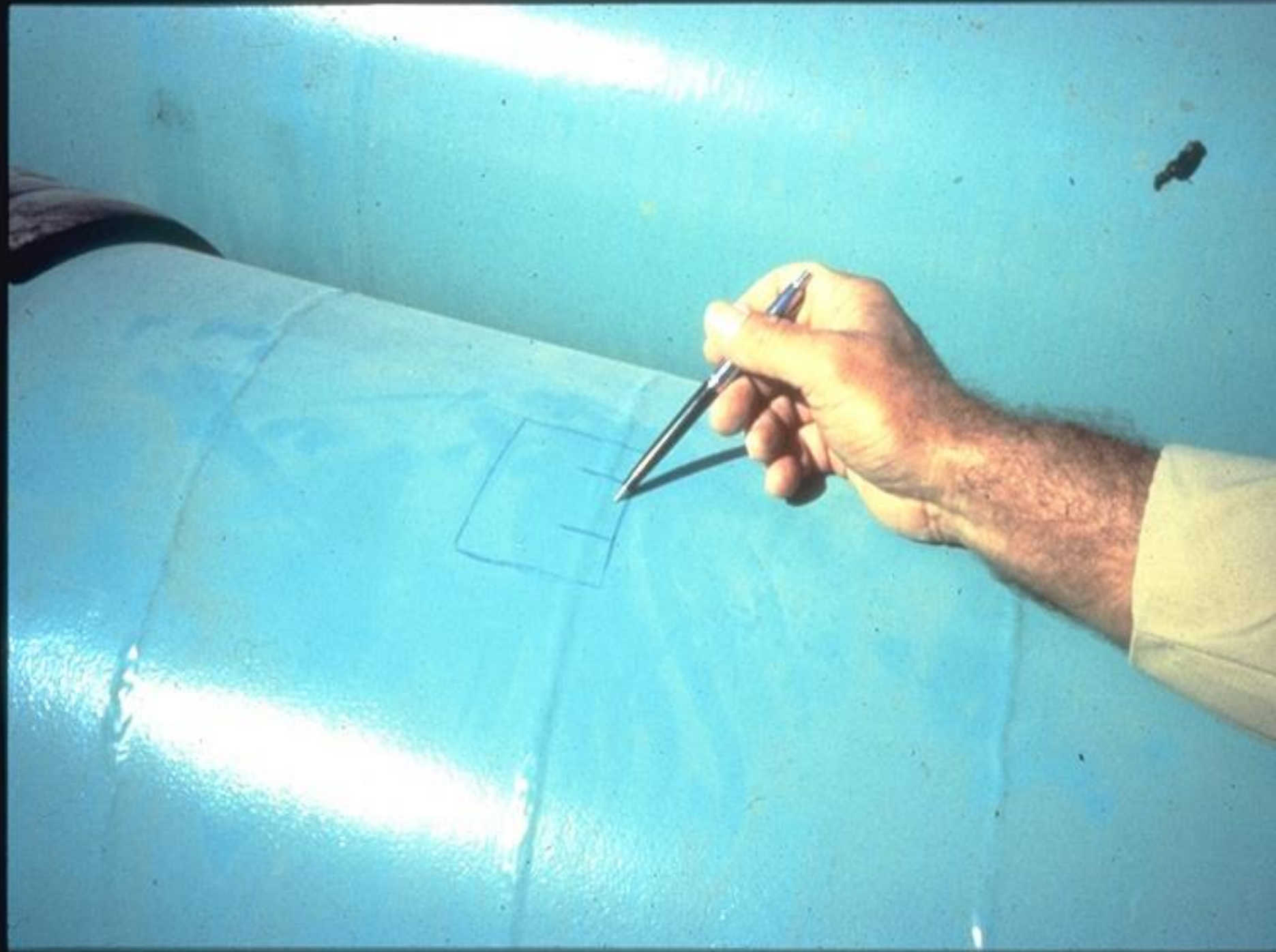
















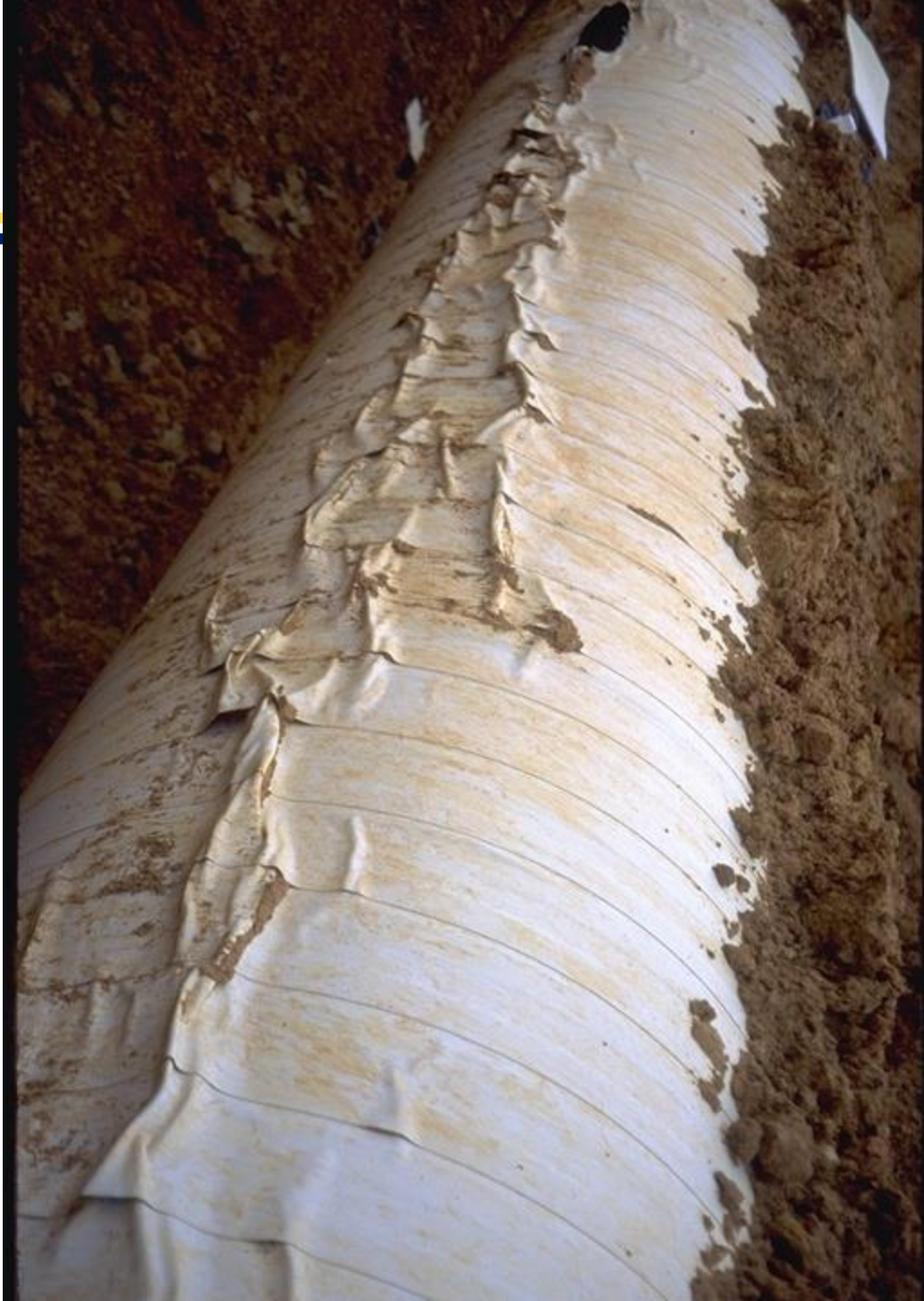














Line Pipe Coating Process



Appalachian Underground Corrosion Short Course

INTRODUCTION

This slideshow steps you through the process of Mill-Applied external thin film (FBE) coating. The guideline for this process is set forth in NACE Specification SP0394-94.

The pipe enters the mill and is ready for the abrasive blasting procedure.



The pipe enters the pre-heat oven where its temperature is raised to approximately 130 degrees. It then enters the abrasive blasting booth.



The pipe exits the blasting booth with a near-white surface finish and the required anchor profile.



At this stage, the blasted pipe surface is checked for raised slivers, scabs, laminations, or bristles which are removed by file or abrasive sanders. A coupler is then inserted into the end of each joint of pipe.



The coupler is used to connect and seal two joints of pipe together, so one pushes the other through the rest of the process.



Two pipe joints joined with coupler.



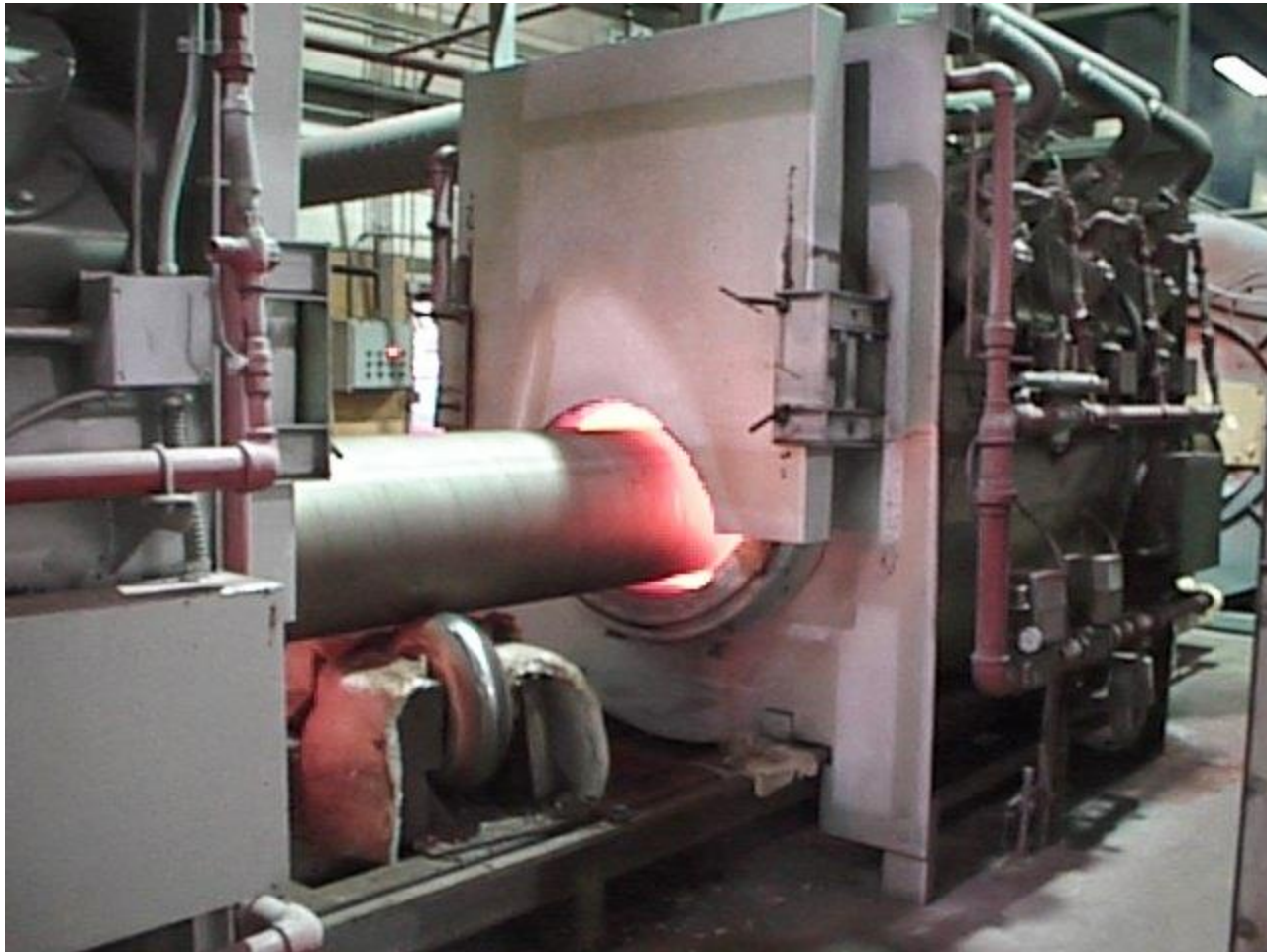
The pipe then enters an acid bath to remove surface contaminants.



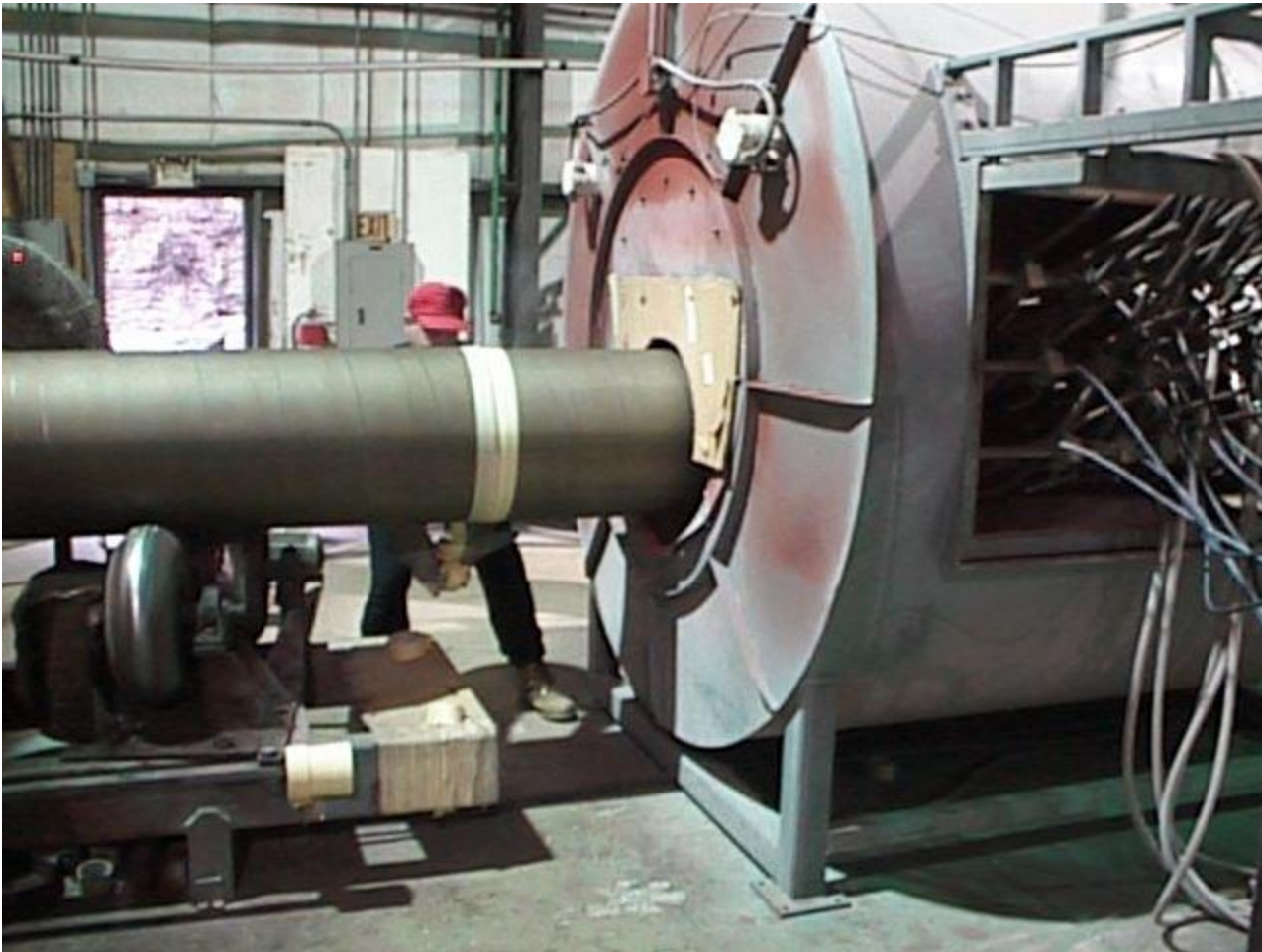
After the acid bath and rinse, the pipe enters a series of ovens that raise the temperature of the pipe to approximately 475 degrees before application of the coating.



Pipe entering last oven before coating.



The joint between pipes is covered, so that the ends of each joint are left free of coating. This is done to allow welding in the field.



The pipe exits the coating booth where jets have applied a coating to the hot pipe with an average coating thickness of 15 mils.



The tape around the joint is now removed and pipe continues to the quenching chamber.



In the next step of this process, the pipe enters a quenching chamber and is water cooled to around 250 degrees.



Pipe coming out of quenching chamber.



Stencil being added to pipe stating the company name, API information and size and wall thickness of pipe.



Company Coating Inspector verifying that the coating thickness is acceptable.



Ropes are put around pipe to keep joints of pipe separated and to prevent coating damage.



A 2,000 volt , nonpulsating, low ripple DC dry-type holiday detector is then used to detect any holidays that may exist in the coating.



Repair of a pinhole size holiday in the coating. Patching with these touch up sticks is only allowed in the mill ~~while the pipe is still hot. Preheating~~ the pipe properly is the limiting factor for field application.



Holiday repair using touch-up sticks.



Each pipe is measured and given a number.



The pipe is then carried into the yard. The forklift has protective padding on the jaws.



The pipe is stacked with padded boards between them to prevent damage to the coating.



The joints of pipe are unloaded on to the padded boards and the ropes separate the joints and protect them from damage when striking other pipes.



The End!

- Questions?



Appalachian Underground Corrosion Short Course