Introduction to Pipeline Coatings

Doug Klingensmith, AMPP Senior Coating Inspector, Certified No. 27309

Unconventional Solutions, INC.

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Coatings

- Corrosion control is not a perfect science.
- There is not one instrument that does everything.
- There is not one test that tells us everything.
- There is not a perfect coating that will work in every scenario.

Coatings

- Most integral part of the cathodic protection system.
- Required to create a cost-effective corrosion control program.
- Extends pipeline design life.

Coatings

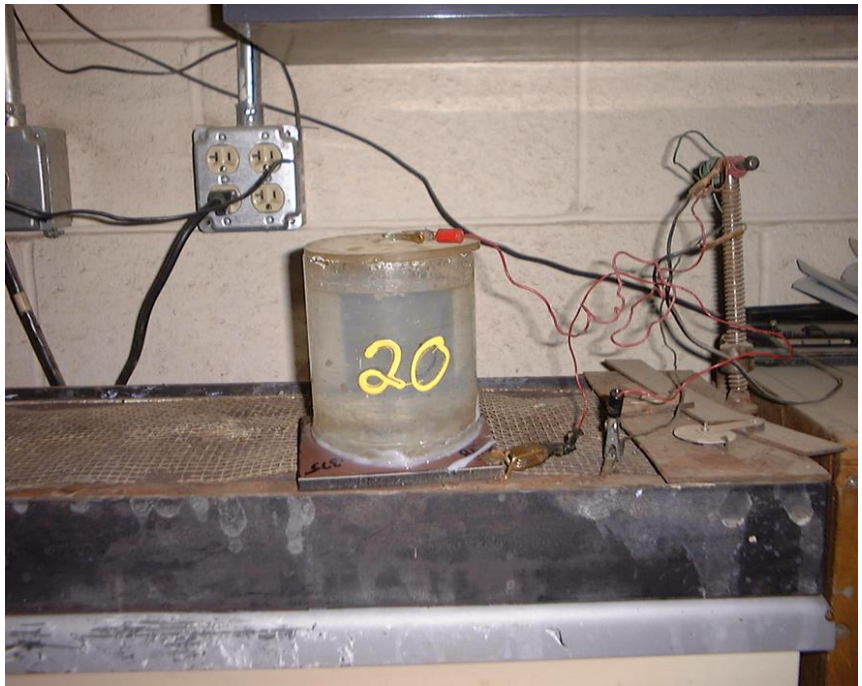
- A pipeline coating acts as a barrier between the pipe and the electrolyte.
  - NACE definition of a coating:
    - A coating is film forming material that protects the surface to which it is applied.
  - What are the 4 components of a corrosion cell?
    - Anode
    - Cathode
    - Electrolyte
    - Metallic Path
  - The coating breaks the circuit by isolating the pipe from the electrolyte.

Coatings

- Some of the characteristics of a good pipeline coating
  - Must have excellent cohesive and adhesive bond strength to pipe.
    - ***Cohesive****: Physics* . of or pertaining to the molecular force within a body or substance acting to unite its parts.
    - **Adhesive**: *Physics* . of or pertaining to the molecular force that exists in the area of contact between unlike bodies and that acts to unite them. (Dis-bondment)
  - Be impervious to water penetration.
  - Provide good electrical resistance.

Laboratory Tests

- Some of the laboratory tests
  - Salt Crock Cathodic Disbondment Test ASTM G-8
  - **Dielectric resistance is the amount of voltage necessary to break down a given coating of specified coating thickness.**
  - ASTM G-9 lab test is for water penetration.



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- Salt Crock Cathodic Disbondment Test ASTM G-8

Pipe Straps for Bend Test

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Dolly's For Adhesion Test

Performing Adhesion Test

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Holiday Detection

- Holiday is a coating defect.
- Holiday detector is sometimes called a jeep – spring or brush type.
- ASTM G-62 is the test procedure for setting a Holiday detector.
- Typical criteria for detection is 100-125 VDC per mil of coating.
- When in doubt of setting, create a Holiday in existing coating.


Wet Sponge
Tail
Jeep

Jeeping Pipe At Mill & Field

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Checking Holiday Detector

- Check batteries at least once a day.
- Verify Calibration, The voltage you set is the voltage you get.
- Make sure the detectors tail is grounded.
  - Pipe should be Grounded
  - Detector should be grounded to pipe (if possible)
- Caution High Voltage!!

Coating Application

Coatings may be applied at a coating facility or in the field

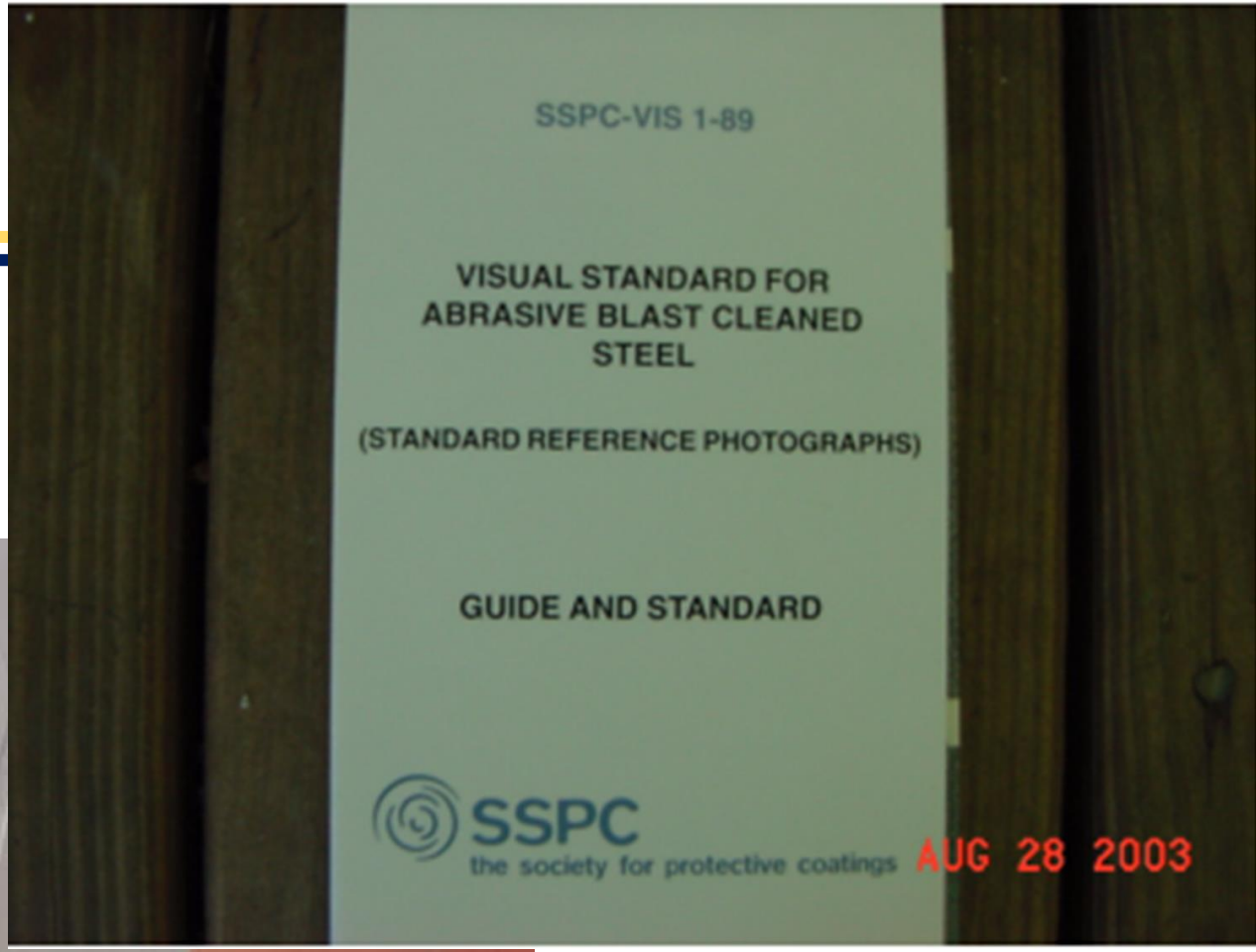
Coating Application: Surface Preparation

Surface preparation is determined by:

- Coating Type
  - (Wax, Liquid Epoxy, Shrink Wrap, Etc.)
- Field conditions if applied in the field
- Owners Coating Specification
- Manufacturer's recommendations
  - Manufacturer’s Application Data Sheet

Coating Application Surface Preparation: Cleanliness

- SSPC list various specifications. NACE has comparable specifications.
  - SSPC SP 7 – Brush Off Blast
  - SSPC SP 6 – Commercial Blast
  - SSPC SP 10 – Near White
  - SSPC SP 5 – White
  - SSPC SP 1, 2, 3 – Solvent Cleaning, Hand Tool Cleaning, and Power Tool Cleaning


SSPC-VIS 1-89
VISUAL STANDARD FOR
ABRASIVE BLAST CLEANED
STEEL
(STANDARD REFERENCE PHOTOGRAPHS)
GUIDE AND STANDARD
SSPC
the society for protective coatings
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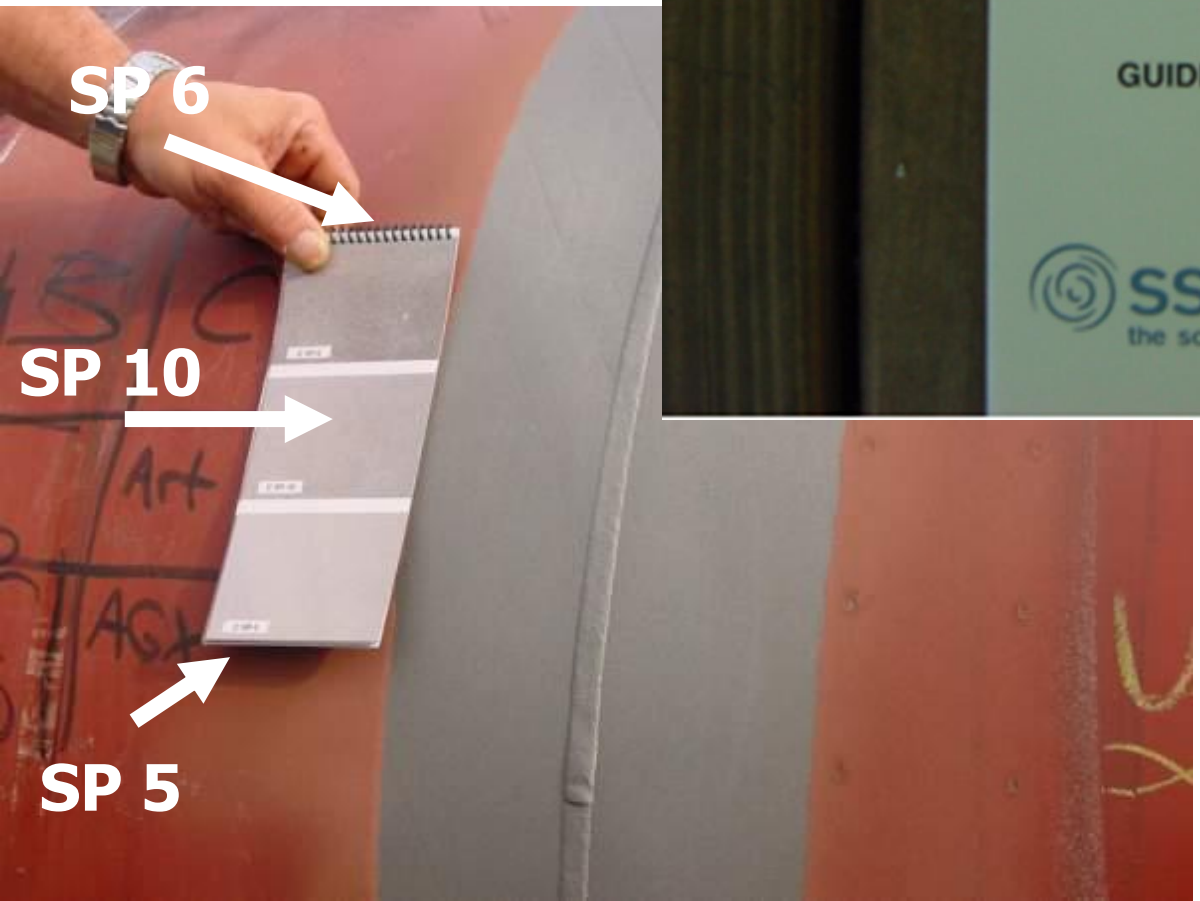

SP 6
SP 10
SP 5

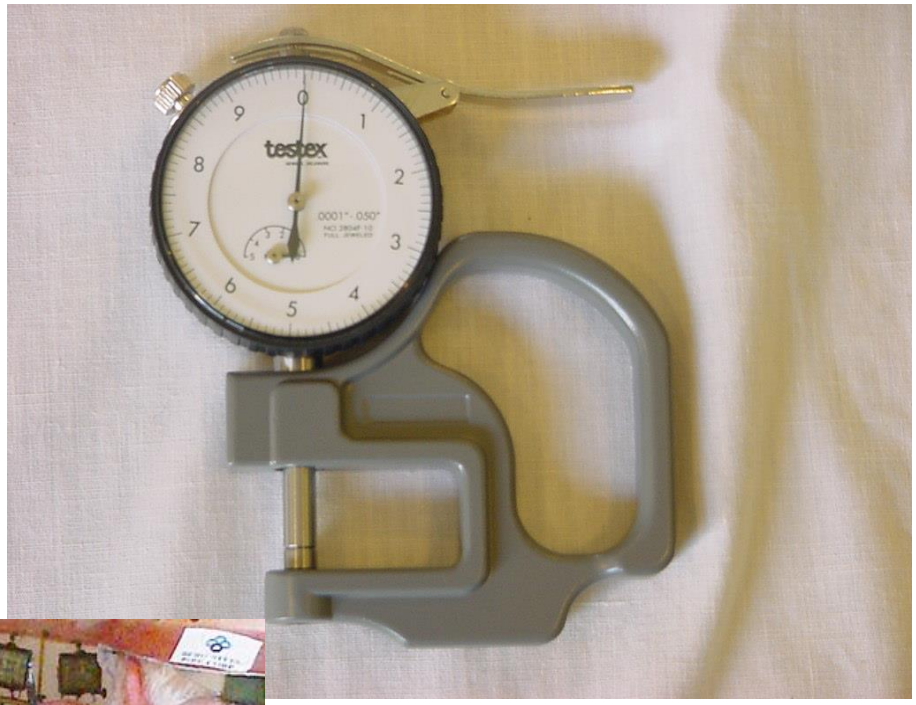
Coating Application
Surface Preparation: Profile

- Profile is the roughness of the surface as measures in mils (1/1000 inch)
- Increases surface area
- Profile is determined by coating manufacturer
- Profile is measured by various methods
  - One Method commonly used is replica tape

Coating Application
Surface Preparation: Profile

Replica Tape

Spring Micrometer



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Coating Application
Surface Preparation: Profile

- The Cleanliness level and profile are achieved by abrasive blasting in the field or shop.

Coating Application
Surface Preparation

Over 60% of all coating failures are due to improper or poor surface preparation!

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Coating Types: Mill Applied Coatings

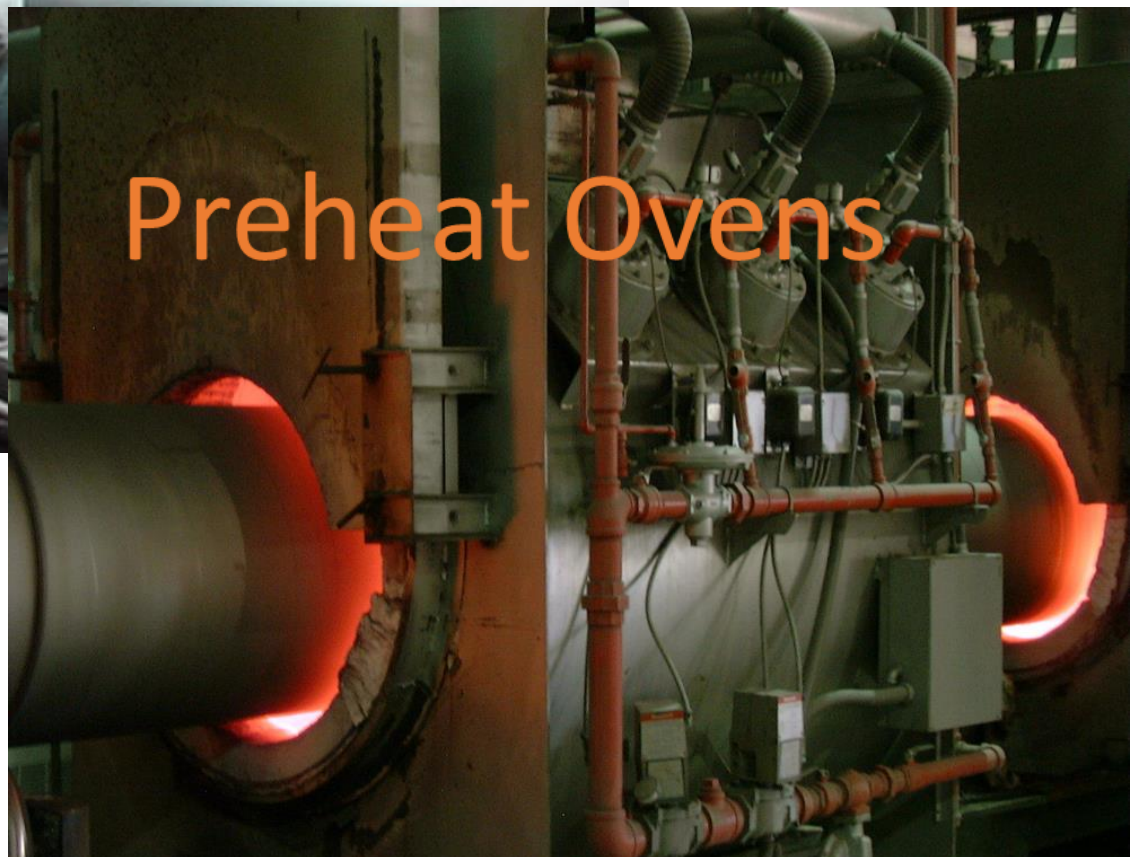
- Fusion Bond Epoxy (FBE)
- Liquid Epoxy
- Crosshead Die Extruded Polyethylene
- Calendar Type Multi-Layer Tape
- A variety of specialty type coatings

Coating Types: Mill Applied FBE Coating

- Applied 12 – 16 mils thick (per owner spec)
- Preparation is critical.
- All chlorides or soluble salts must be removed with an acid wash.
- The acid must be removed by de-ionized water wash.
- Water must be removed by heating.
- A near white blast surface is required. SP 10
- Pipe is heated to 450 – 500 ^{o}F, sprayed on as a powder, and melts onto the pipe.

Pipe Starting on The Coating Line

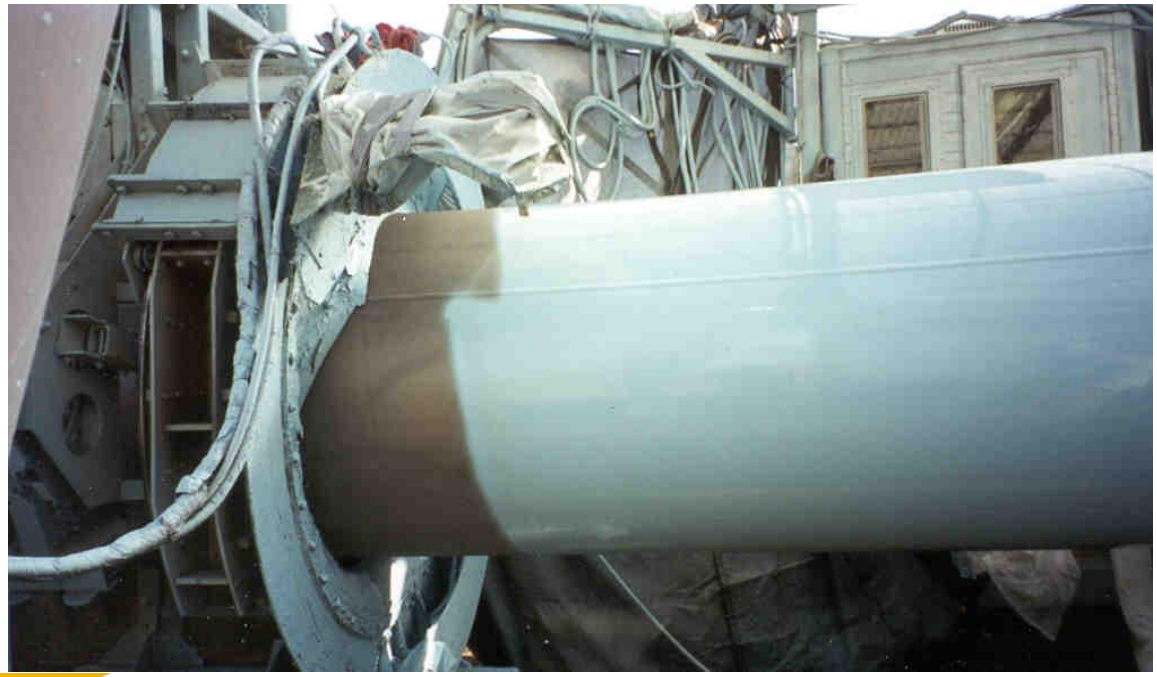
Preheat Ovens



FBE Being Applied To Pipe

Coating Types: Mill Applied Liquid Epoxies

Liquid Epoxies are normally applied externally for corrosion protection or as an ARO with and average thickness in mils of 20 to 30 mils



Checking The Pipe
For Holidays

Patching The Holidays Using Melt Stick

Checking The Coating Dry Film Thickness

FBE that has been Whitewashed to protect from UV degradation

Since 2020 Mega Rule, clear UV coating for traceability






Extruded Polyethylene Coating

- Requires commercial blast
- 10 mils of asphalt based rubberized adhesive
- Extruded polyethylene is normally 40 mils in thickness

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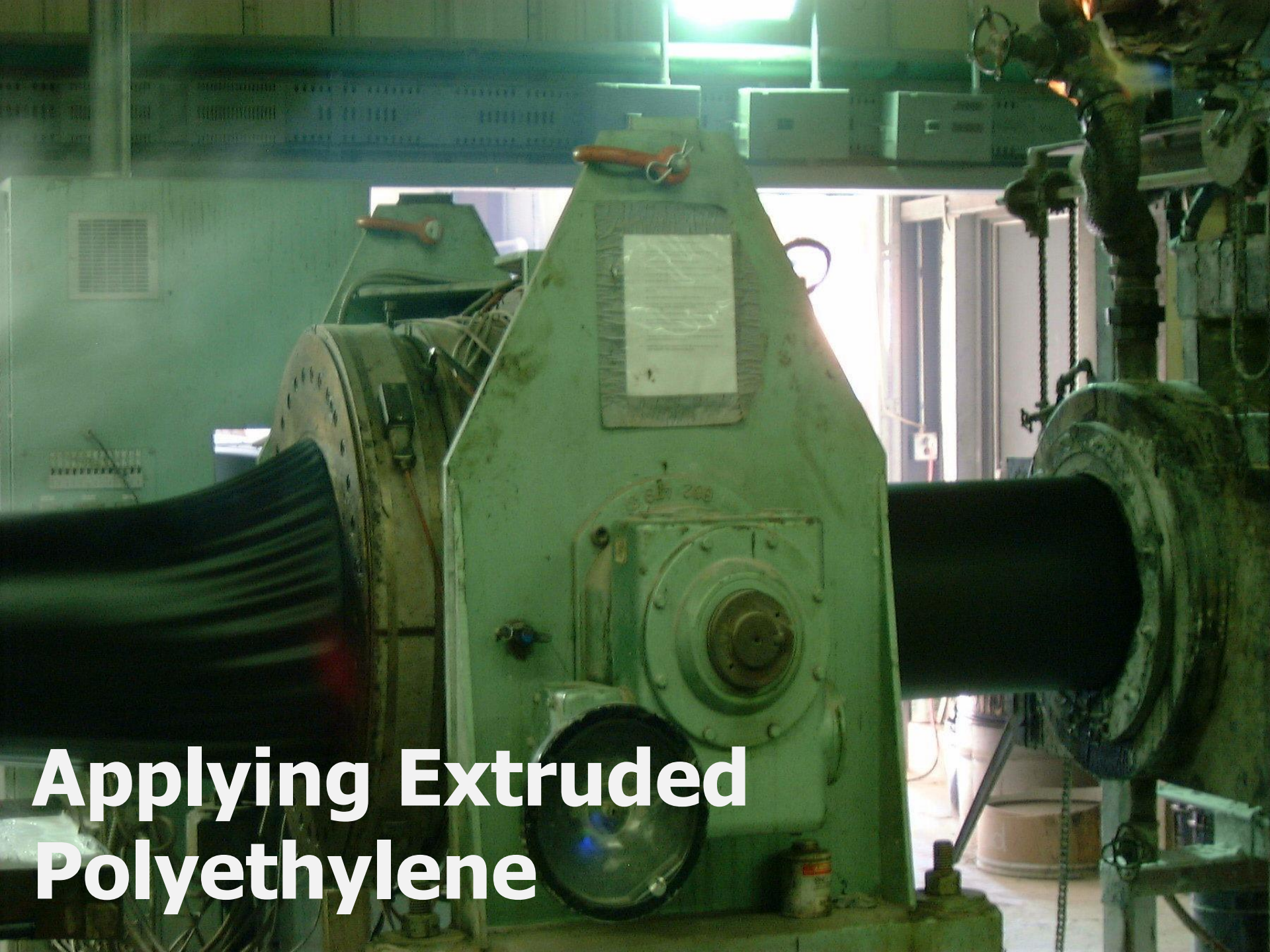

Applying Extruded Polyethylene


Extruded Polyethylene
Coated Pipe

Calendar Type Multi-Layer Coating

- Requires a commercial blast
- Applied at 50 – 80 mils
- Not used very often

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Coal Tar Coating

- Used extensively in the past.
- Now used very little due to environmental and health concerns.
- Applied approximately 120 mils thick.
- In the past, coal tar was covered with asbestos felt wrap.
- Major concerns over large disbandment areas.

Applying Coal Tar Over-Ditch

Removing Hot Coal Tar From The "Dope Pot"

Field Applied Coatings

- Liquid Epoxies
- Hot applied tapes
  - Coal tar based
  - 60 mils with 50% overlap
- Cold applied Polyethylene tapes
  - Applied 30 – 65 mils with a primer
- UV resistant tape
- Heat shrink sleeves / tubes
- FBE field applied coating for girth welds
- Rock shield


Sandblasted Girth Weld

Installing Shrink Sleeves

Installing Shrink Sleeves & Installed

Maintenance Application Coatings

- Must be compatible with existing coating.
- Liquid Epoxies
- Hot applied coal tar tapes
- Cold applied polymer tapes
- Surface tolerant liquid polymer tapes
- Liquid mastics
- Sealants
- Hot applied waxes
- Cold applied waxes
- Petrolatum

Applying Cold Polymer Tape

Maintenance Application Coatings

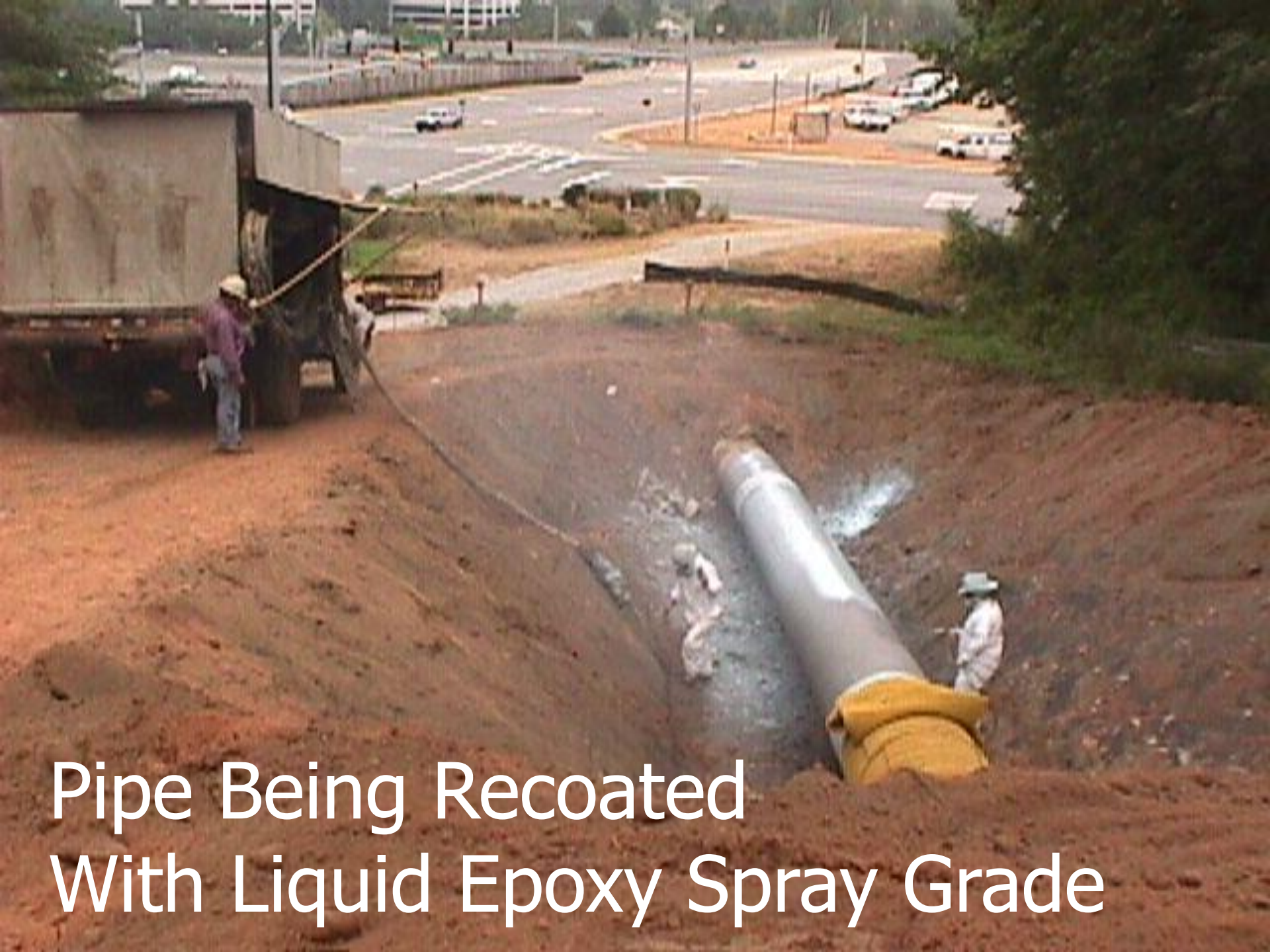
- Liquid coal tar epoxies
- Two-part epoxies
- High temperature tapes
- Flange fillers

Applying Hot Wax In The Field

Applying Wax Paper

Applying Petrolatum Tape

Pipe Being Coated With Liquid Epoxy at Girth Welds



Pipe Being Recoated
With Liquid Epoxy Spray Grade

Pipe Being Recoated With Liquid Epoxy Spray Grade

Atmospheric Corrosion

- UV degradation
- UV resistant cold applied tape
- Cold applied petrolatum tape
- Various painting systems

Risers

- Some of the most severe corrosion is at the soil interface area at risers.
- Two-part epoxy with a polyurethane topcoat for UV protection
- Wax tapes with protective outer wrap
- Rock shield

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Irregular Bolted Couplings, Valves, Fittings, Etc.

- Liquid mastics
- Wax or petrolatum tapes
- Wet areas maybe covered with petrolatum.

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High Temperature Areas

- Coal Tar Epoxy
- Epoxy primer and high temperature tape
- Two-part epoxies

Flanges and Bolts

- Flange filler
- Flood coating with hot applied wax
- Must provide dielectric resistance
- Must be easily removed for re-entry into flanges

Hot Wax Being Poured In A Flange

Visco-Elastic Coatings

- Coat Wrap
  - 70 mil tape system
  - No sandblasting or primer required
  - 10% overlap
  - Sticks to steel, asphalt & concrete
  - 100% impermeable to moisture and gases
  - Paintable

Viscous Elastic Pastes and Sealants

This paste is a mastic-like material with synthetic properties.

- Adheres to almost any surface
- No primer required
- No cure time required
- A permanent solution for water leaks
- Used with a wrap for tank chimes

Synthetic polyolefin sealant

- Stops active water leaks
- Adheres to any surface
- Prevents water infiltration

Conclusion

There are many Excellent Pipeline Coatings.

However, Not Every Coating is Good For All Applications.

Good Surface Preparation and Overall Cleanliness of the Pipe Will Create a Better Environment For Coating Performance.

Thank you!

Comments, complements, questions and answers.

Questions???

Doug Klingensmith

AMPP Senior Coating Inspector formerly NACE Level 3-Certified Inspector #27309

Unconventional Solutions, Inc.

248.735.7000 (office) 248.830.2935 (cell)

S.W. Ohio (937) 704-4220 warehouse

N.W. Indiana (219) 733-0543

www.usigroups.com

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