Fusion Bonded Epoxy Pipeline Coatings & Mill Inspection Techniques

Bill Donald, Core Appalachia

Charleston, WV USA

AUCSC 2019

Appalachian Underground Corrosion Short Course

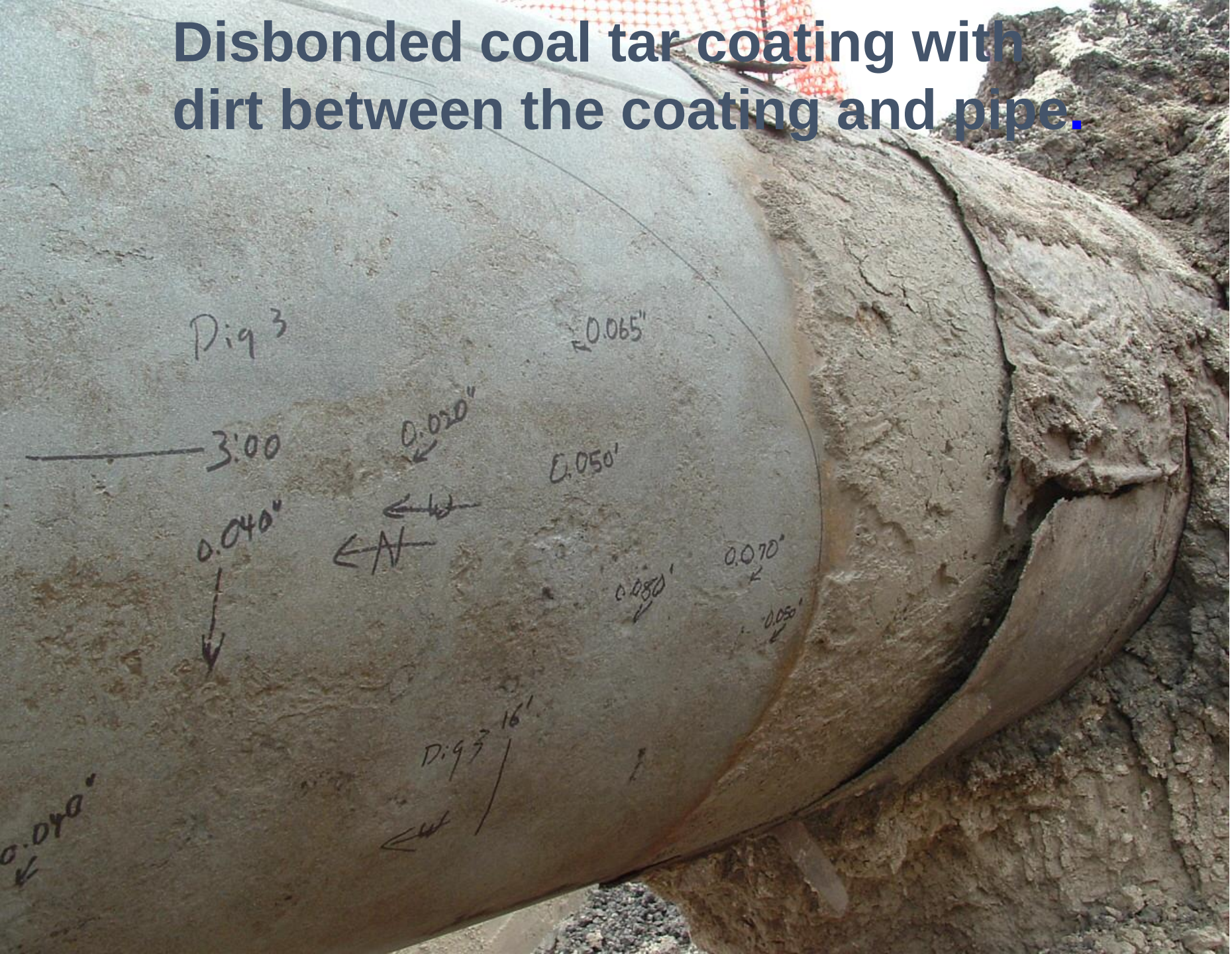
INTRODUCTION

This presentation will provide insight as to why Companies have chosen FBE as the standard pipeline coating. We will also discuss the steps for the application of Mill-Applied external thin film Fusion Bond Epoxy (FBE) coating. Additionally we will discuss one of the field procedures for coating the weld joints.

WHY FBE ?

A large percent of corrosion failures on cathodically protected structures is associated with disbonded coatings of high dielectric strength that shield the cathodic protection current allowing corrosion to begin once water, soil and other contaminates to penetrate between the coating and the pipe.

Disbonded coal tar coating with dirt between the coating and pipe.



Close up of blisters on FBE coating
and pipe under blisters. No corrosion.

There are certain coating systems that are **“Fail Safe”.** “Fail Safe” means that if the coating system fails, corrosion on the metal being protected does not occur or is reduced when adequate CP is available.

At this time we can not say that Fusion Bonded Epoxy (FBE) coatings are 100% “Fail Safe”, but we can start to understand that some coatings systems do provide us with a definite advantage over other types when coating failure occurs.

MATERIAL & EQUIPMENT SPECIFICATION

MS-02.01

SPECIFICATION FOR PLANT APPLIED FUSION BONDED EPOXY PIPELINE COATING

1.0 Scope Of Work

This specification covers the minimum requirements necessary for proper performance and applicat
mill-applied external fusion bonded epoxy – FBE (thin film) coating for metallic pipelines.

2.0 Definitions

Term	Definition
Company	Colonial Pipeline Company
Applicator	The organization responsible to the Company for the application of the coating
Supplier	The manufacturer and/or distributer of the coating mate
Coating Material	Any specified coating material prior to application on t pipe
SSPC	Society for Protective Coatings (Steel Structures Paint Council)
NACE International	National Association of Corrosion Engineers
Inspector	An authorized agent of Colonial Pipeline Company responsible for confirming adherence parts, or all of the specification
Holiday	A discontinuity of coating that exposes the metal surface the environment

Typical Mill Application of FBE

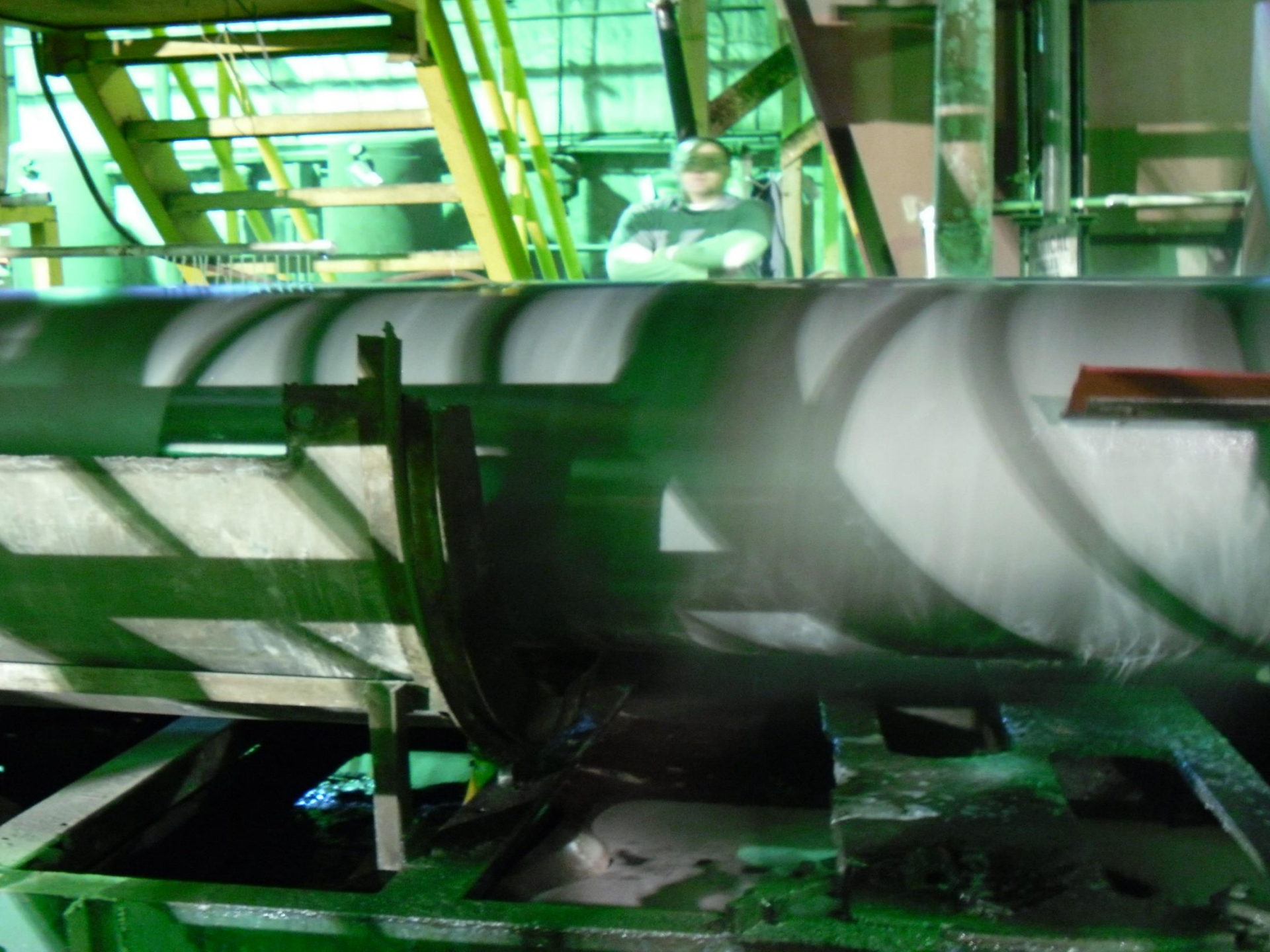
The pipe enters the pre-heat oven where its temperature is raised to approximately 130 degrees. It then enters the abrasive blasting booth.

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

The blasted pipe surface is checked for raised slivers, scabs, laminations, or bristles while on the inspection rack. These are removed by file or abrasive sanders. A coupler is then inserted into the end of each joint of pipe.

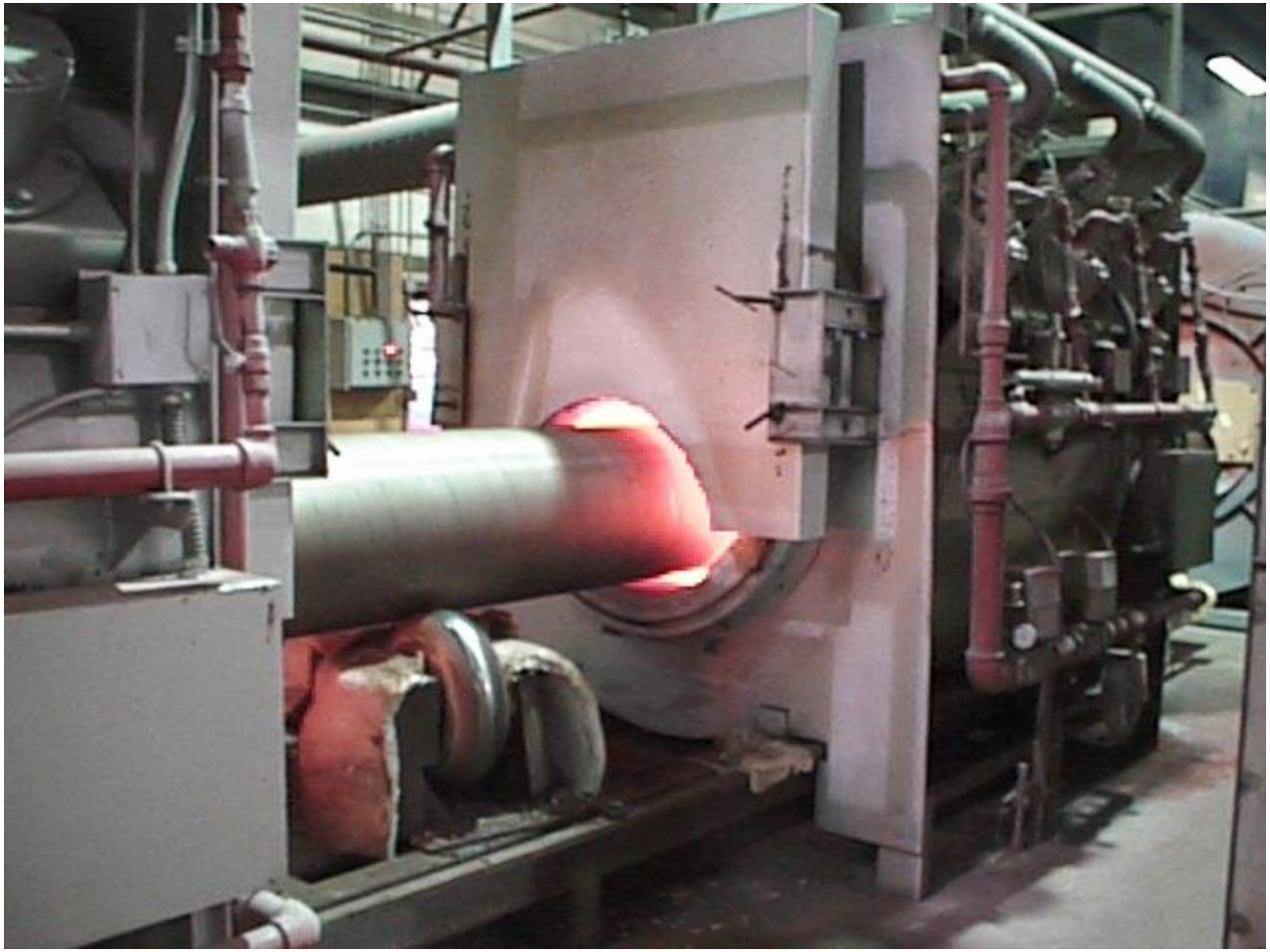
The coupler is used to protect bevels, connect pipe joints and seal joints of pipe together. The coupler allows one joint of pipe to push the other through the rest of the process.

Two pipe joints joined with coupler.

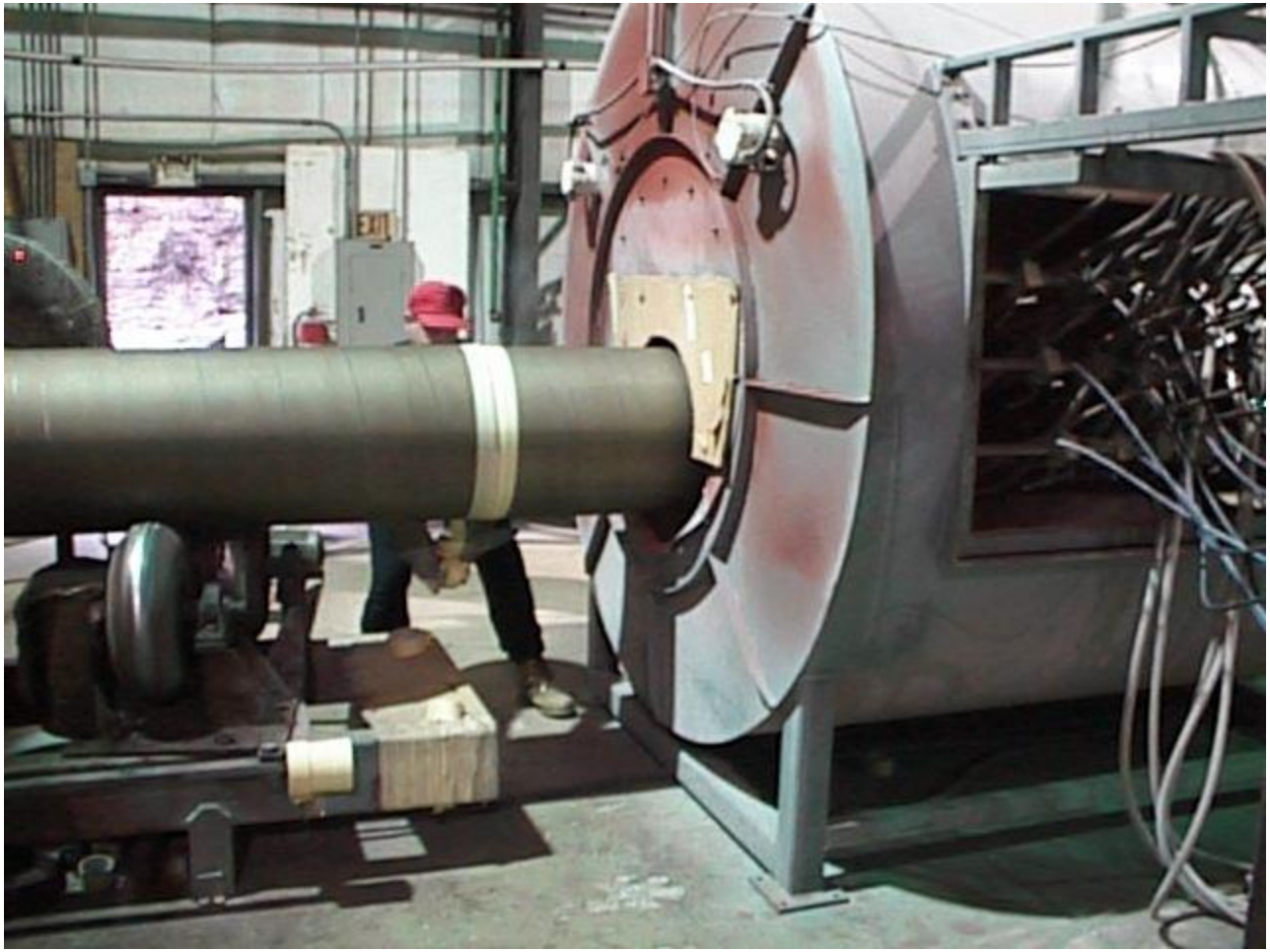


After the acid bath and rinse, the pipe enters a series of ovens that raise the temperature of the pipe to approximately 475 degrees before application of the coating.

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.

Coating Inspector confirming that the coating thickness is acceptable.

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

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.

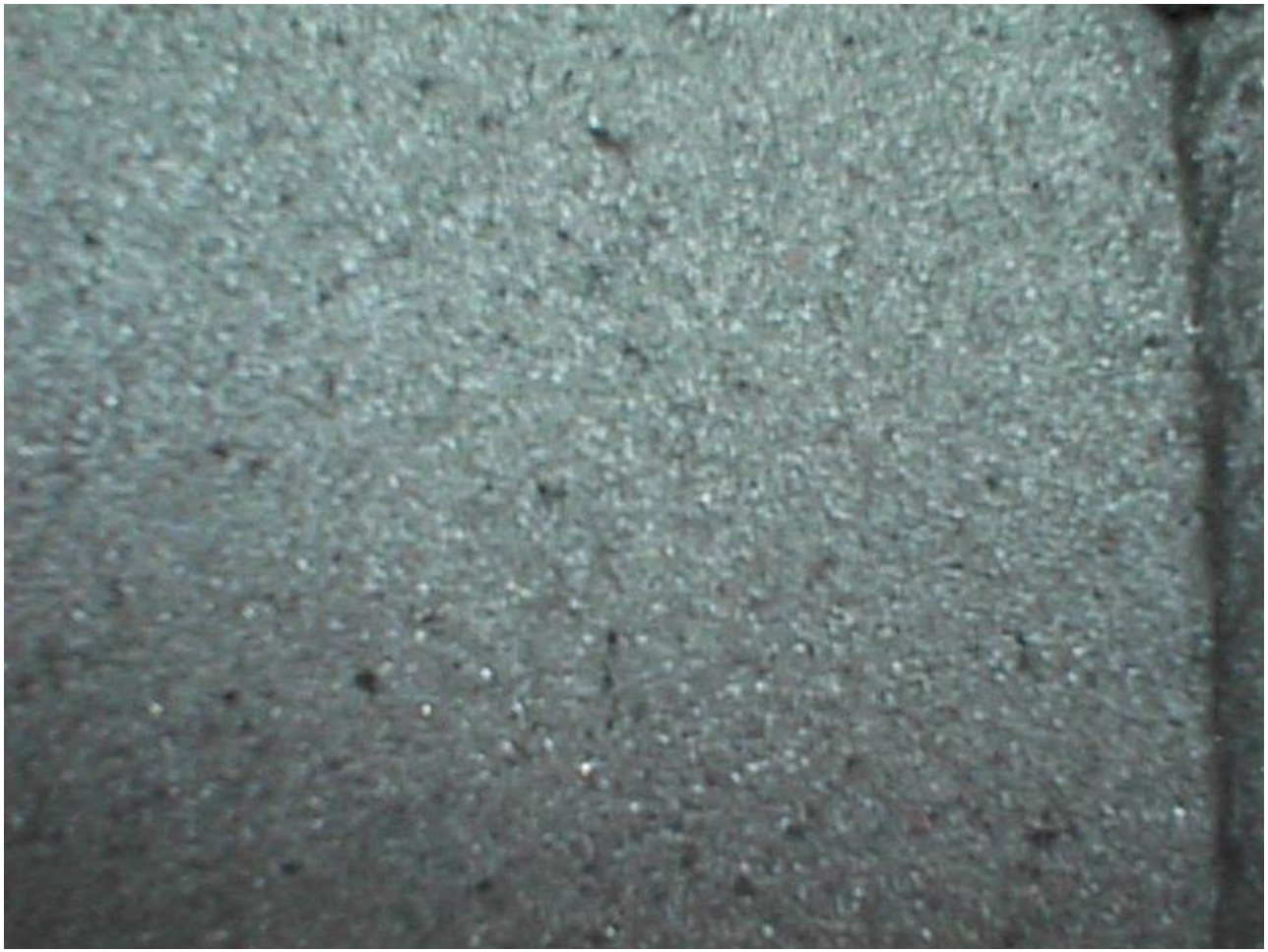

470
3-2-2010


150° HOT WATER SOAK
FisherScientific
Isotemp waterbath
ON
OFF
170°/175° HOT WATER SOAK
ISOTEMP
210
170.2
Fisher Scientific
Program
Run
Menu
Set
Increase
Decrease
Safety
ON
OFF
Power

Once the pipe reaches the field it is placed in the ditch. This is done with nylon slings to make sure the coating is not unnecessarily damaged. The pipe is then joined by welding.

After welding is complete, the joint is sand blasted and preheated in preparation for the coating.

Close-up view of blasted area.



Field Coating Weld Joints

- There are several methods for coating of weld joints. Typically FBE or “Two part epoxy” is used for field welded joint coating.

Rock Shield, An extruded plastic material used to protect the corrosion coating from damage from small rocks/stones during backfill process and after backfill settles and compacts. Various types of rock shields are used, the key is to ensure they do not have any shielding properties

TWO MOST COMMON REASONS FOR COATING FAILURE

- Poor Coating Application
- Poor Coating Selection Criteria

Poor Application Techniques

Each coating type has particular application methods that must be followed.

- FBE requires meeting many parameters for proper application.
- Pipe temperature
- Application of dry powder with electrostatic powder applicators
- Speed of application
- Cure time
- Cooling
- Surface Preparation

Poor Coating Selection Criteria

- Choosing coatings with extremely high dielectric strength that will shield CP currents if the coating fails may not always be the best choice. (Even SP0169 calls for high dielectric strength coatings, but does not give any values.)
- Soil Stress must be considered when choosing a coating system. FBE is rarely affected by soil stress and has excellent mechanical strength and adhesion.

Poor Coating Selection Criteria continued

- Internal and external operating temperature of the structure are critical. FBE can be affected by operating temperatures above those specified.
- Presence of bacteria and other organisms do not usually have an affect on FBE.

Thank You, Question, Comments or Concerns?

AUCSC

Appalachian Underground Corrosion Short Course