

REINHOLD ENVIRONMENTAL Ltd.



**2015 APC Round Table
& Expo Presentation**

July 13 & 14, 2015, in Atlanta, GA / Hosted by Southern Company

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Ash Line Inspections

Gerry Klemm, Southern Company

2015 APC Round Table

July 14, 2014 – Atlanta, Ga.

Why is this Important?

- Recent Events
- Rededication to preventing non-permitted releases of CCR



Approach

- Dyke and Dam Inspections
- Pipeline Inspections
- Maintenance Procedure Review/Update



Maintenance Procedure

- Required a Test method
 - Different for various types of piping materials



Types of Ash Line Materials - Monolithic

- High Density Polyethylene (HDPE)
 - Available in different standards depending on operating pressure



- Ductile Cast Iron



- Steel Schedule Pipe



Types of Ash Line Materials - Composite

- Basalt-Lined Steel



- Ceramic-Lined Steel



- Ceramic-Lined Fiberglass (FRP)



Applications

	Abrasion Resistance	Temperature Rating	Coefficient of Thermal Expansion(α_L, α_V)	Weight/ft	Ease of Installation	Installed Cost/Ft	Joining	Applications
Monolithic								
HDPE	Poor	Low	Very High	Low	Very Good	Low	Welded, Flanged	Long Distance Transport, Cold, Clear Fluids
Ductile Cast Iron	High	Very High	Median	High	Difficult	High	Coupled	Short Distance Transport of Heavy, Hot Fluid Particulate
Steel Pipe	Poor	High	Median	Median	Median	Median	Welded, Flanged	Long Distance Pneumatic Transport of Light Particulate
Composite								
Basalt-Lined Steel	Very High	High	Median	High	Difficult	High	Flanged	Long Distance Transport, Hot Dirty Fluids
Ceramic - Lined Steel	Very High	High	Median	High	Median	High	Flanged	Primarily Fittings, High Impact Resistance
Ceramic - Lined FRP	Very High	Median	Median	Low	Good	Median	Flanged	Long Distance Transport, Cold Dirty Fluids

Wear Examples



HDPE Wear at Flange



HDPE Wear at Bottom



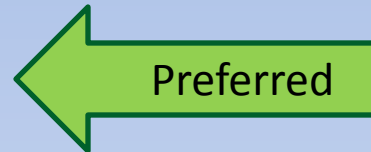
HDPE Wear Downstream from Turn



Ceramic-Lined Elbow Wear

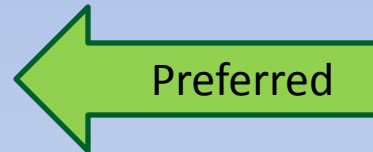
Test Methods- Monolithic

- High Density Polyethylene (HDPE)
 - Direct Measurement
 - Precise metrics
 - But, must be uncoupled
 - Ultrasonic (UT)
 - Easy to use
 - Little surface preparation required
 - Must be tested in a representative location
 - Radiographic (RT)
 - Provides visual image
 - Requires more set up than UT
 - Metrics must be interpolated
 - Robotic
 - Provides visual image
 - Limited to near horizontal orientation
 - Limited to umbilical length



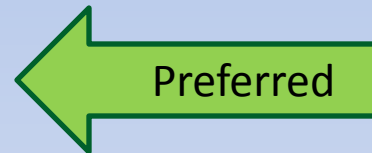
Test Methods- Monolithic (Cont.)

- Ductile Cast Iron and Steel Schedule Pipe
 - Direct Measurement
 - Precise metrics
 - But, must be uncoupled
 - Ultrasonic (UT)
 - Easy to use
 - Surface preparation required, especially with cast iron
 - Must be tested in a representative location
 - Radiographic
 - Provides visual image
 - Requires more set up than UT
 - Metrics must be interpolated
 - Robotic
 - Provides visual image
 - Limited to near horizontal orientation
 - Limited to umbilical length
 - Limited to minimum diameter



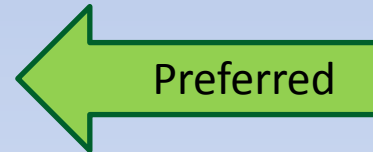
Test Methods - Composite

- Basalt-Lined Steel
 - Direct Measurement
 - Precise metrics
 - But, must be uncoupled
 - Ultrasonic (UT)
 - Not Possible
 - Radiographic
 - Provides visual image
 - Requires more set up than UT
 - Metrics must be interpolated
 - Robotic
 - Provides visual image
 - Limited to near horizontal orientation
 - Limited to umbilical length
 - Limited to minimum diameter



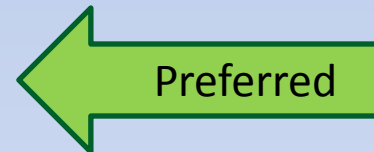
Test Methods – Composite (Cont.)

- Ceramic-Lined Steel
 - Direct Measurement
 - Precise metrics
 - But, must be uncoupled
 - Ultrasonic (UT)
 - Not Possible
 - Radiographic
 - Provides visual image
 - Requires more set up than UT
 - Metrics must be interpolated
 - Robotic
 - Provides visual image
 - Limited to near horizontal orientation
 - Limited to umbilical length
 - Limited to minimum diameter



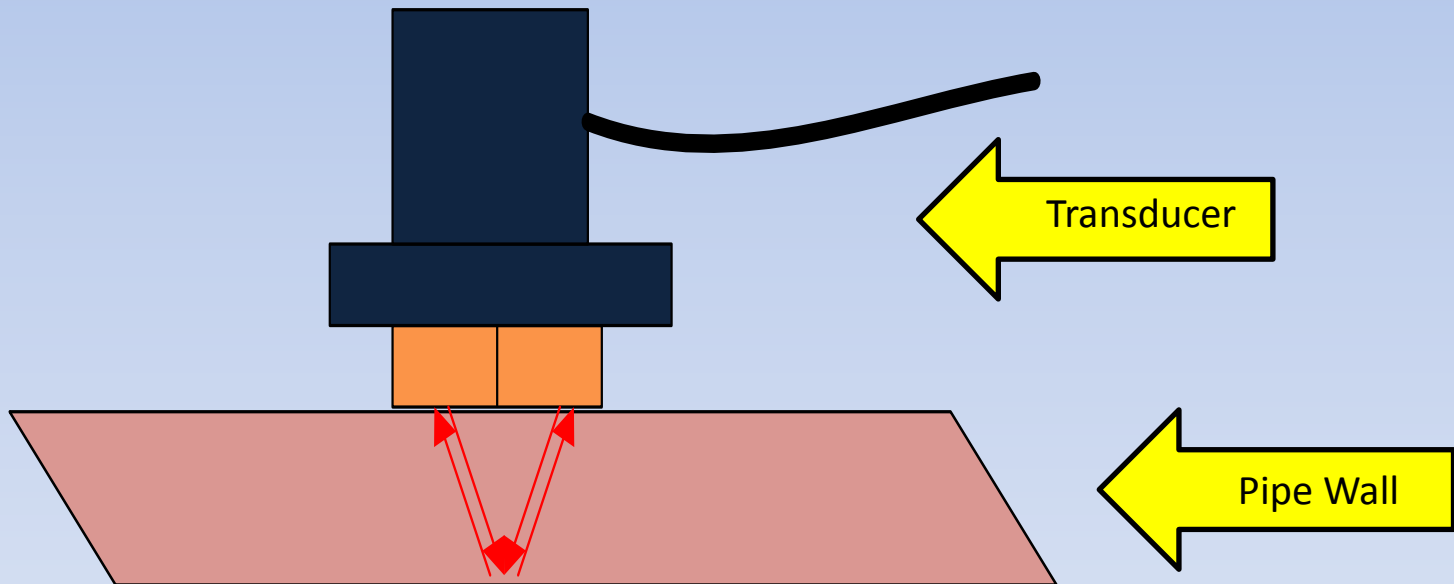
Test Methods – Composite (Composite)

- Ceramic-Lined Fiberglass (FRP)
 - Direct Measurement
 - Precise metrics
 - But, must be uncoupled
 - Ultrasonic (UT)
 - Not Possible
 - Radiographic
 - Provides visual image
 - Requires more set up than UT
 - Metrics must be interpolated
 - Robotic
 - Provides visual image
 - Limited to near horizontal orientation
 - Limited to umbilical length
 - Limited to minimum diameter



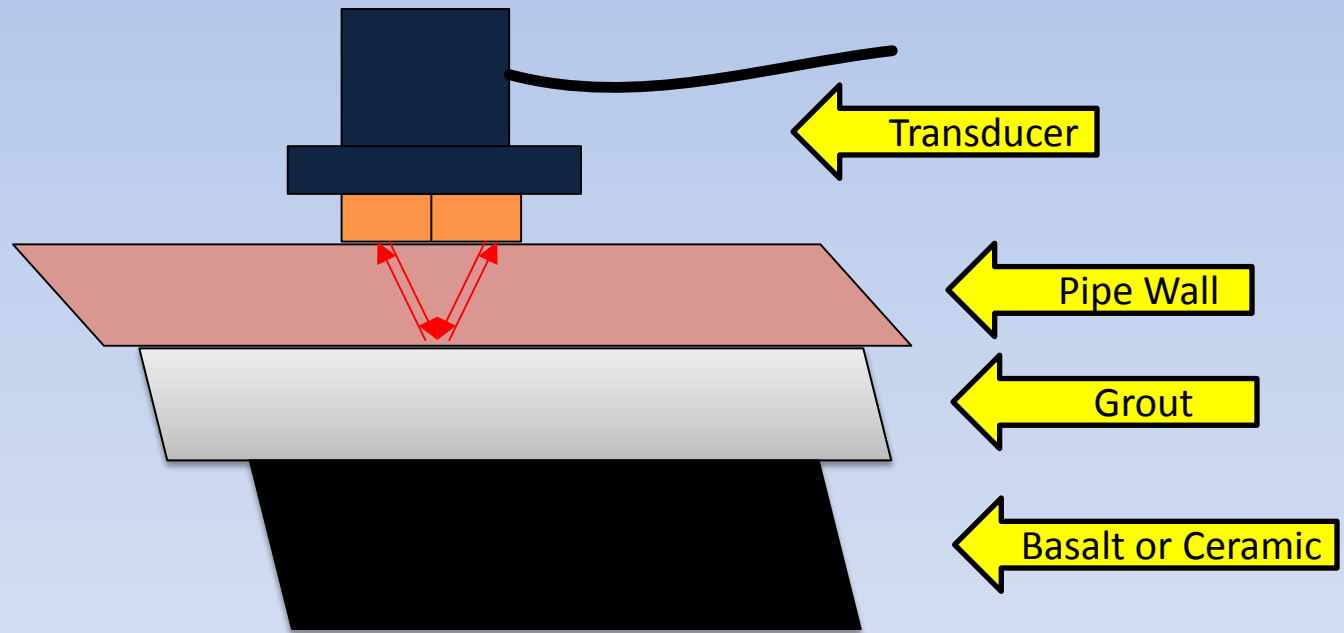
Test Mechanisms

- Ultrasonic Testing (UT)
 - Monolithic



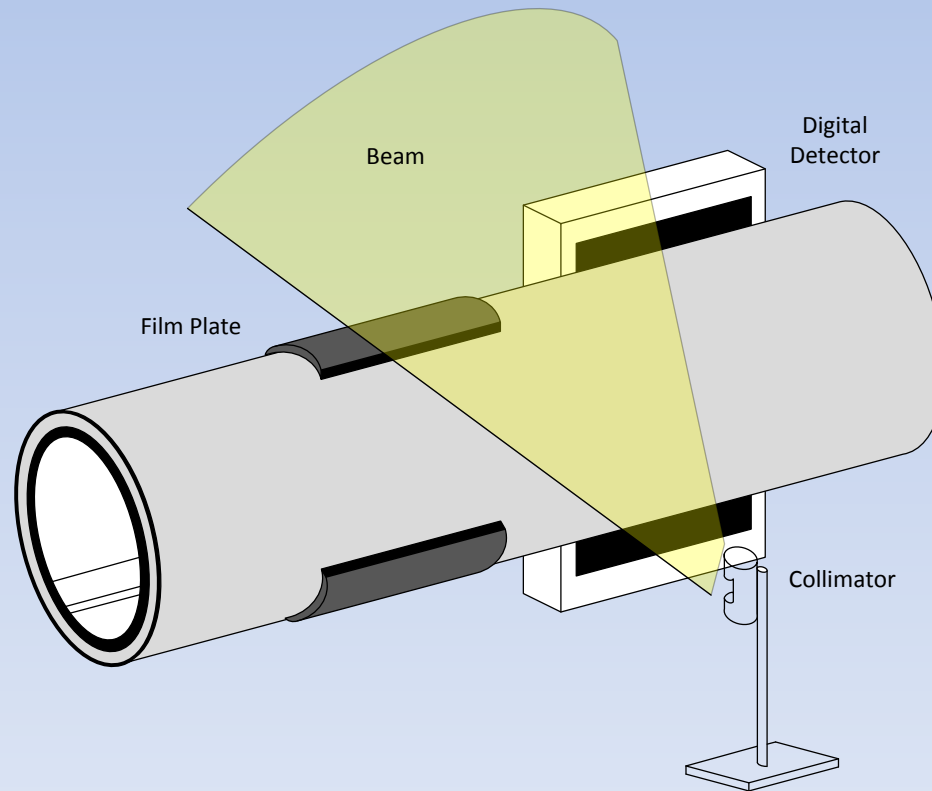
Test Mechanisms

- Ultrasonic Testing (UT)
 - Composite



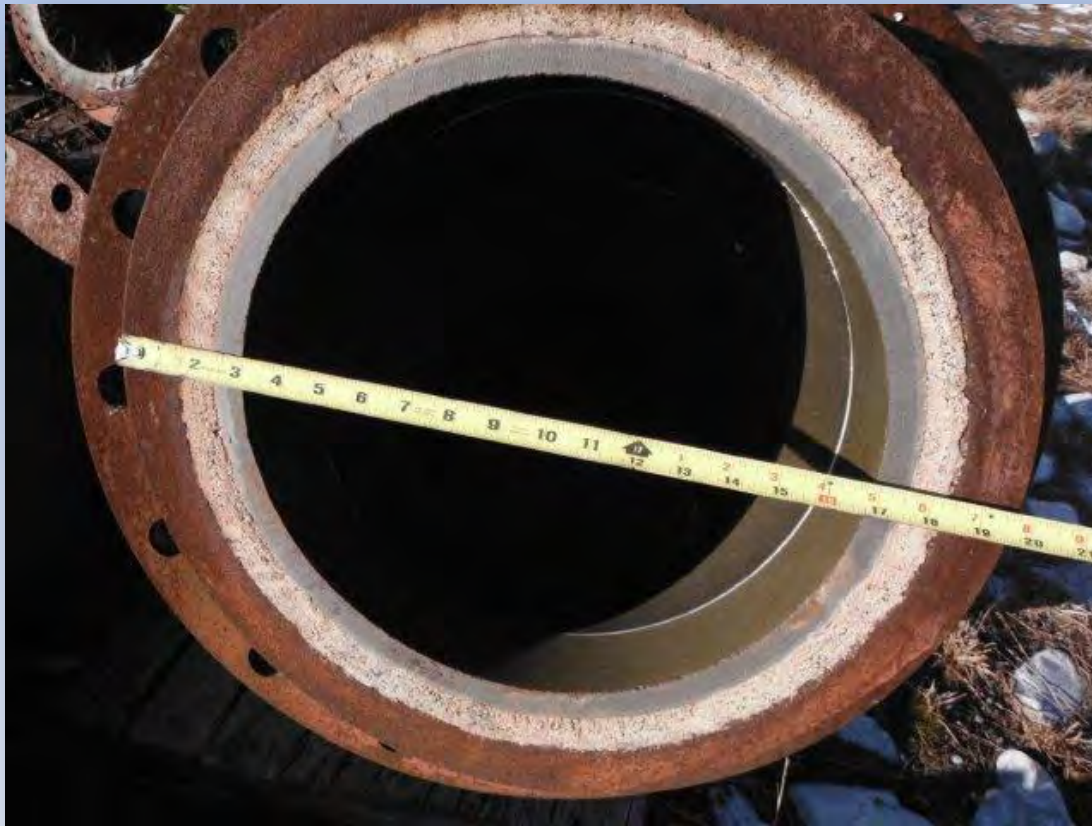
Test Mechanisms

- Radiographic Testing (RT)
 - Monolithic or Composite



Test Equipment

- Direct Measurement
 - Access required
 - Original thickness must be known



Test Equipment

- Robotic
 - Access required
 - Limited to visual examination

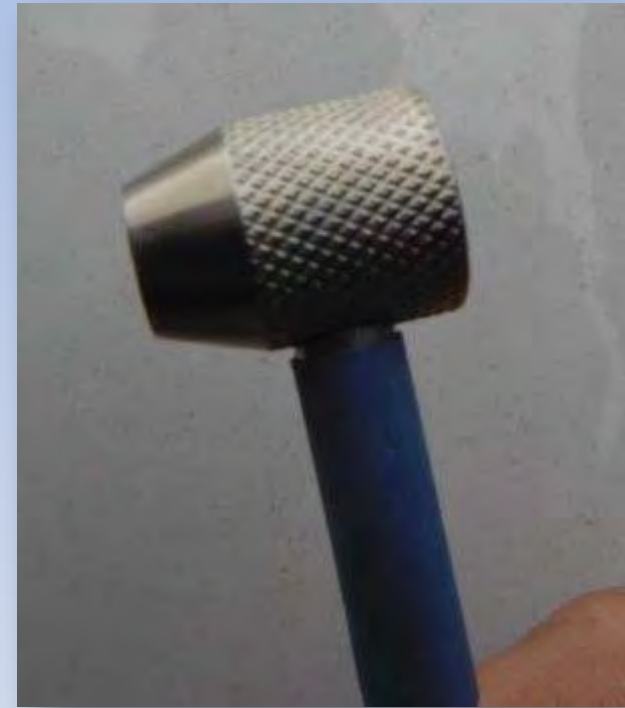


Test Equipment

- Ultrasonic Testing (UT)



Control Unit



Standard Transducer
for High Density
Materials

Test Equipment

- Ultrasonic Testing (UT)



In-Line Transducer for
Low Density Materials



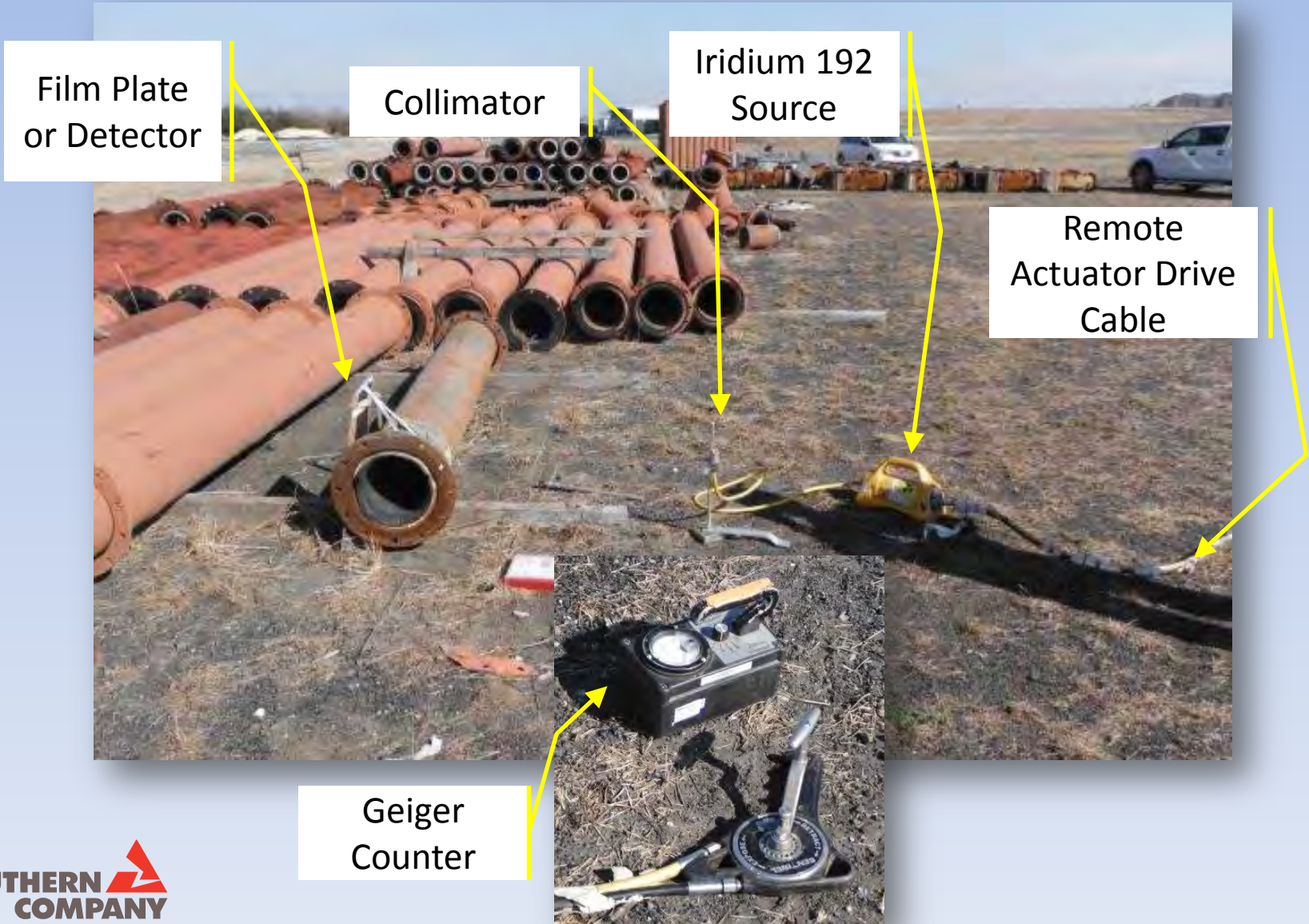
Phased Array
Transducer for Testing
against Obstructions

Test Equipment

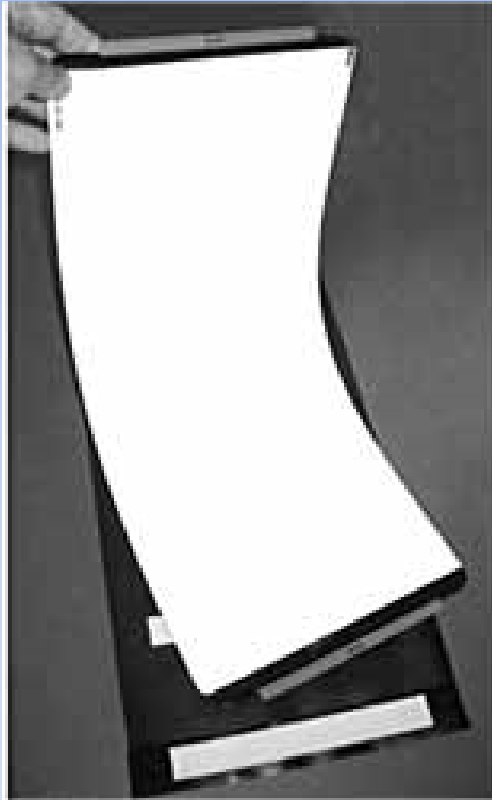
- Radiographic Testing (RT)
 - Not X-Ray
 - Uses a nuclear isotope such as Iridium, or cobalt
 - Two Types:
 - Computer Radiographic (CR)
 - Digital Radiographic (DR)



Typical Field Radiographic Setup



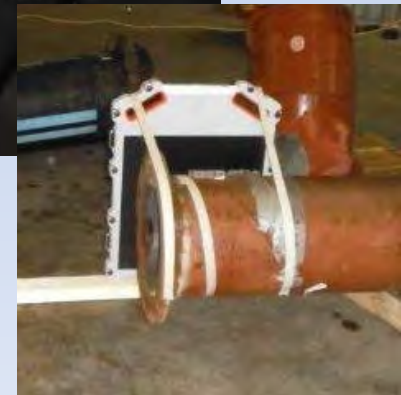
CR vs. DR Radiography



CR Uses Floppy Film Plate and can be wrapped around pipe, or boiler tube



DR Uses Rigid Detector and must be oriented as shown



CR vs. DR (Cont.)

CR Processing Lab



Film
Processor

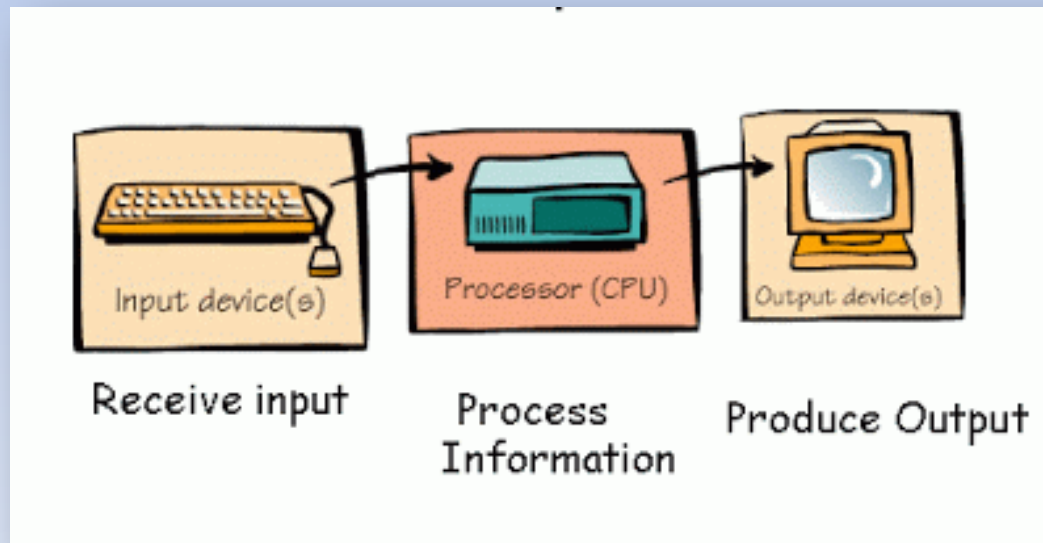
High
Resolution
Monitor

DR Processing Lab

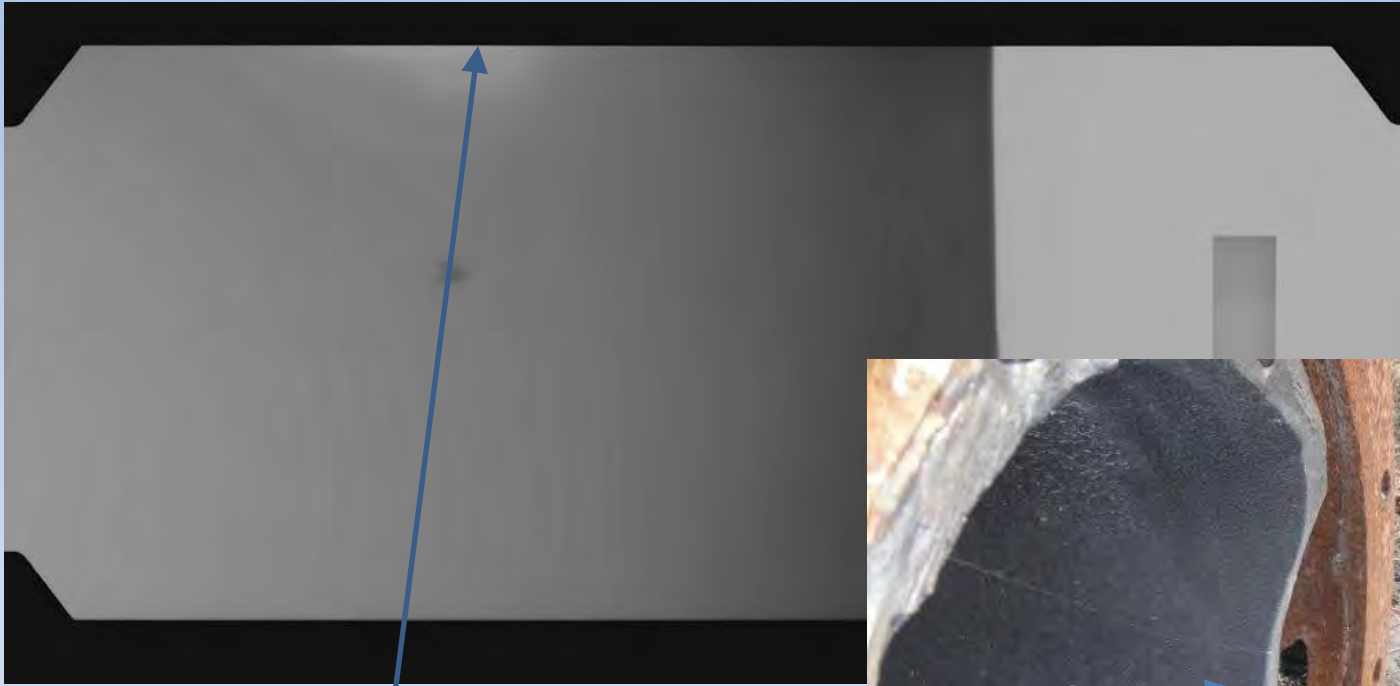


DR Does not require film processing as
Detector communicates directly with PC

Radiographic Output Images

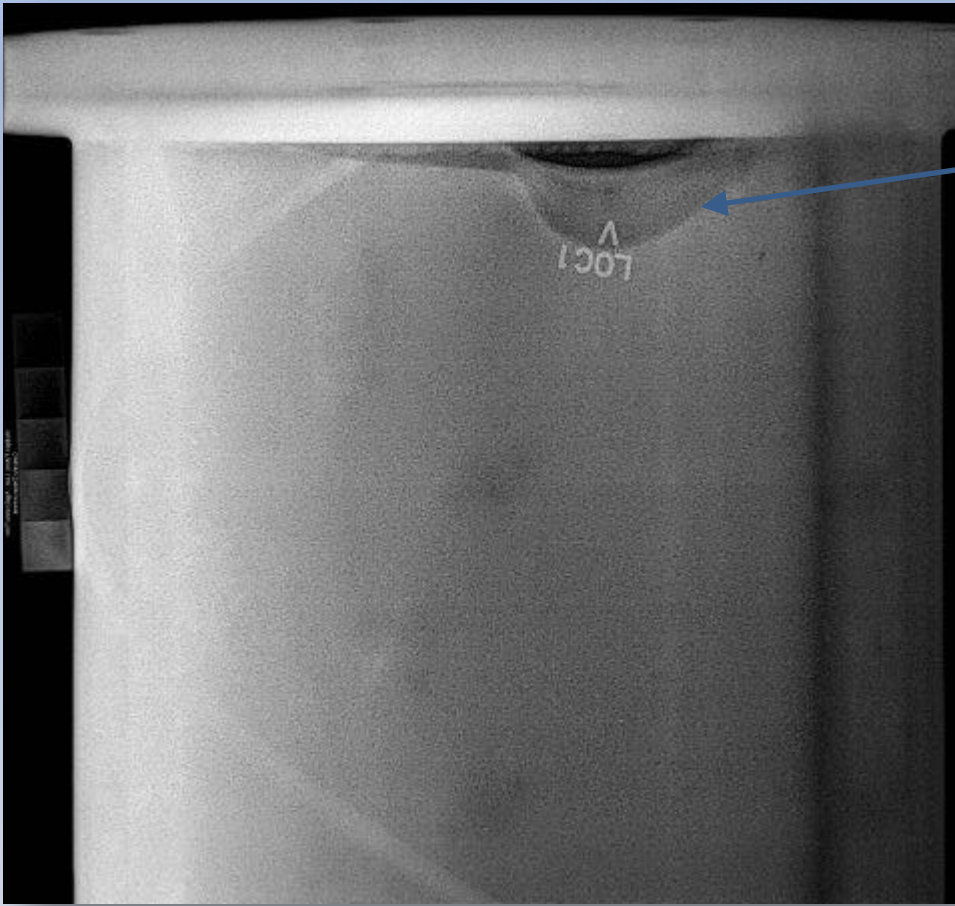


Computer Radiographic (CR) Representation of Flaw (Hole) in Basalt



Hole in
Basalt

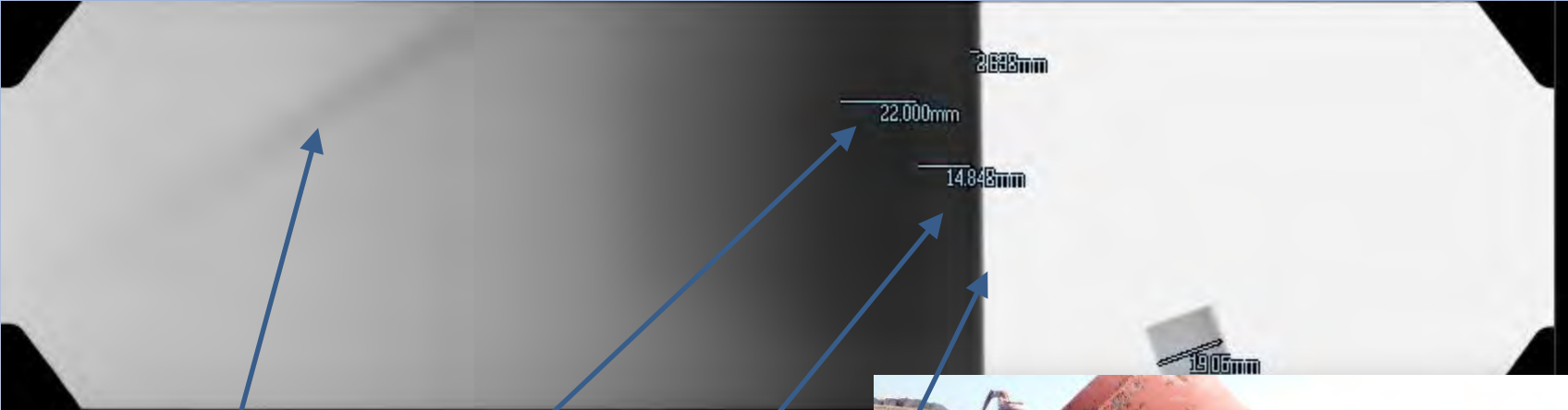
Digital Radiographic (DR) Representation of Flaw (Hole) in Basalt



Hole in
Basalt



Ceramic-Lined Elbow Shot with CR



Weld
Seam

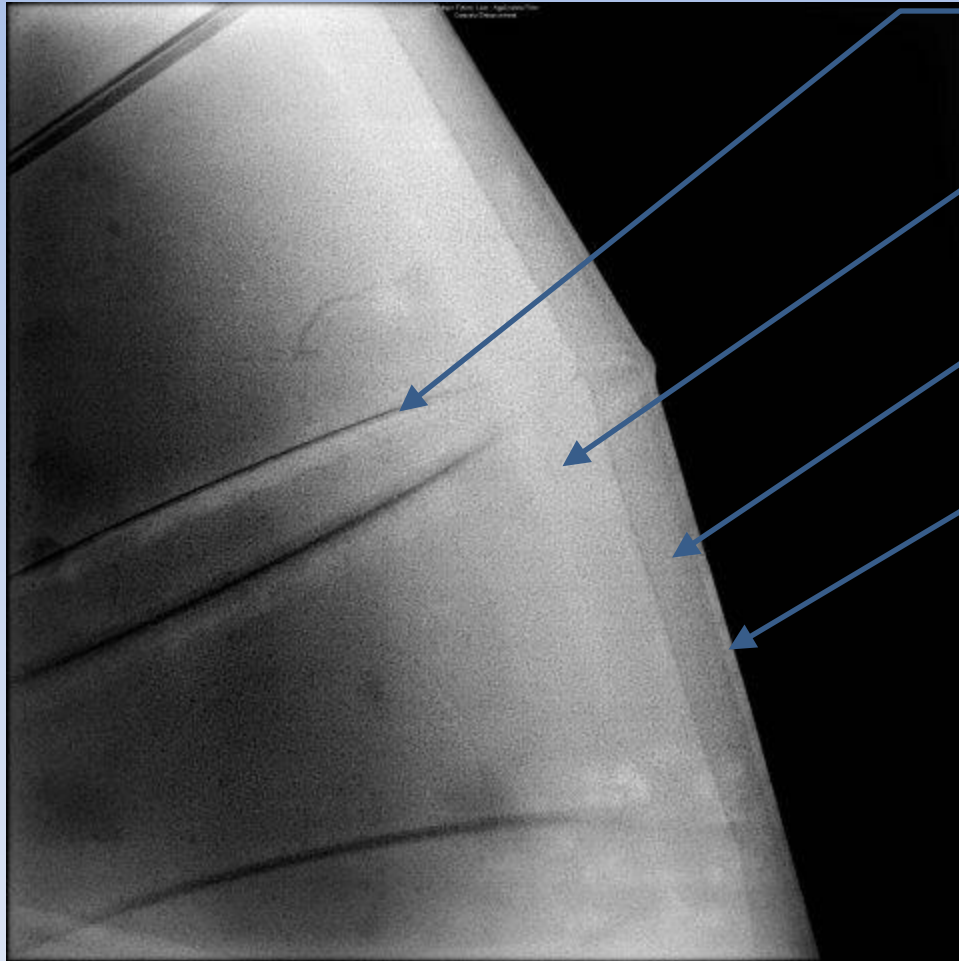
Basalt

Grout

Casing



Ceramic-Lined Elbow Shot with DR



Casing Welds
and Tile Seams

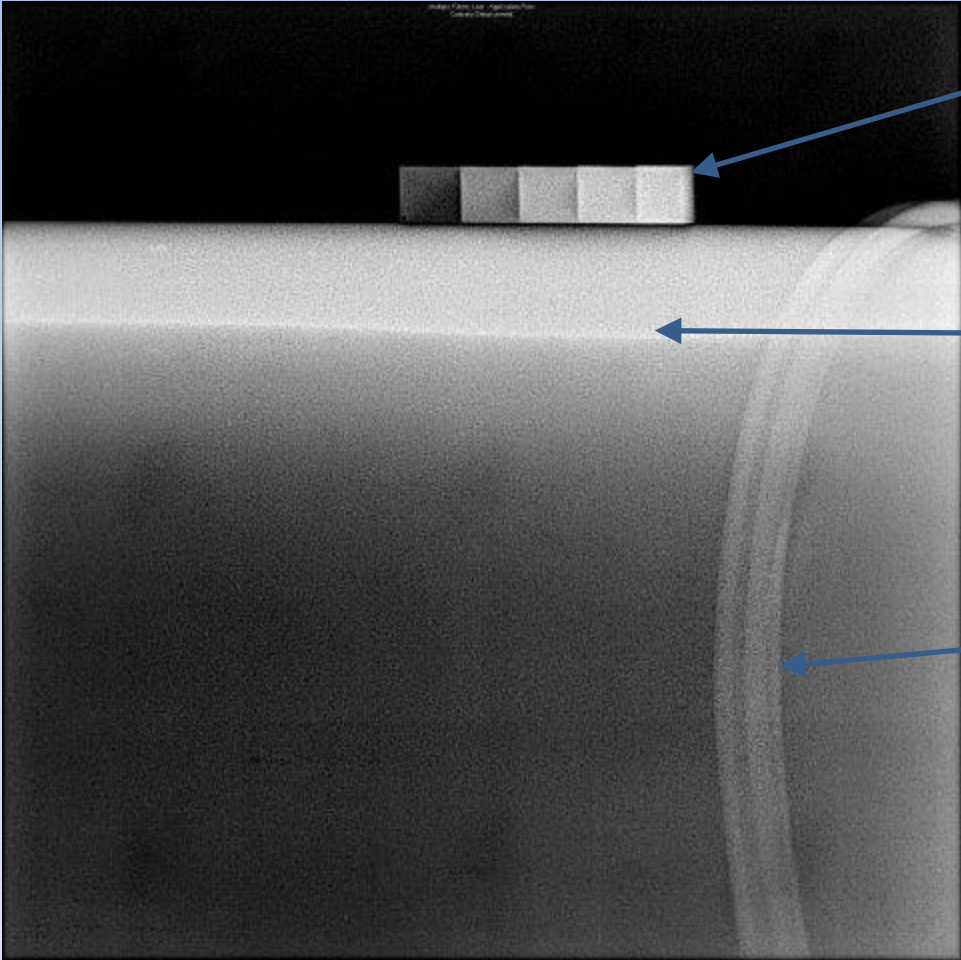
Basalt

Grout

Casing



Digital Radiography (DR) of HDPE Pipe

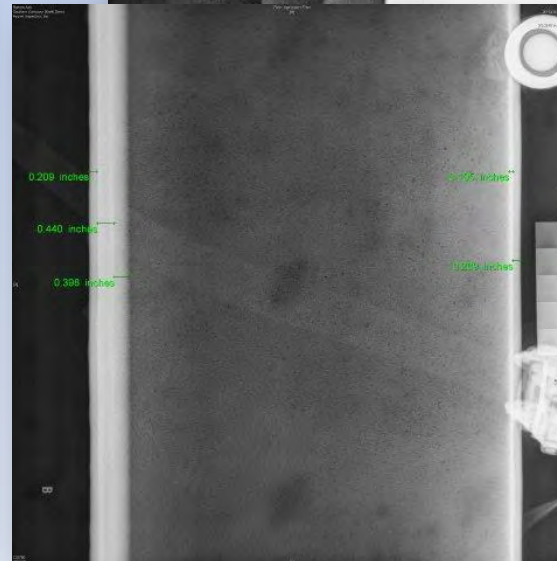
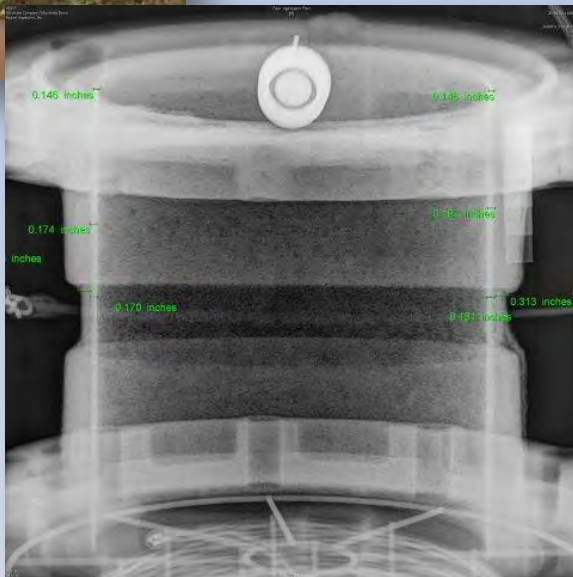
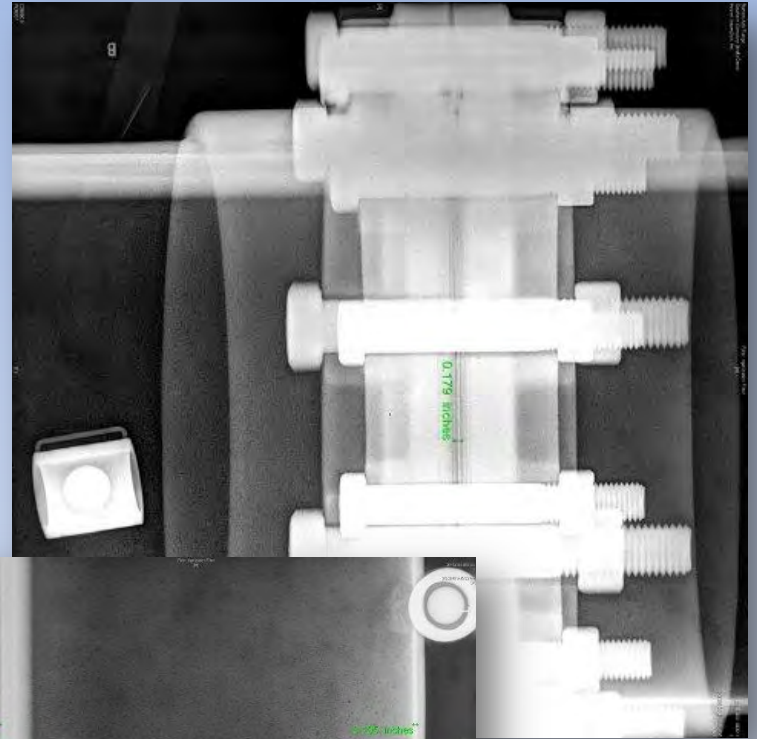


Thickness Gauge

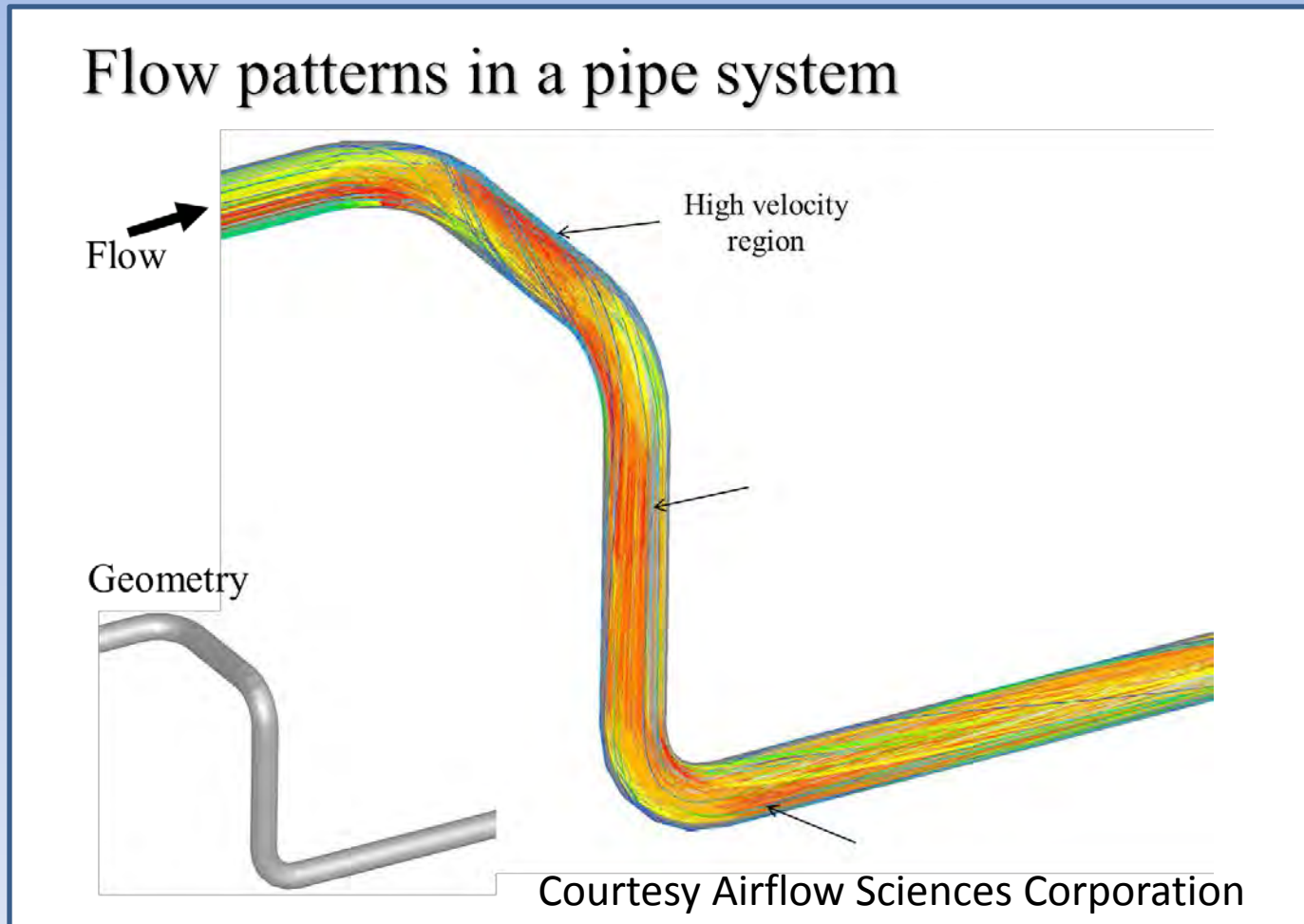
Variable Thickness Wall

Butt Weld

Digital Radiography (DR) Ceramic-Lined FRP

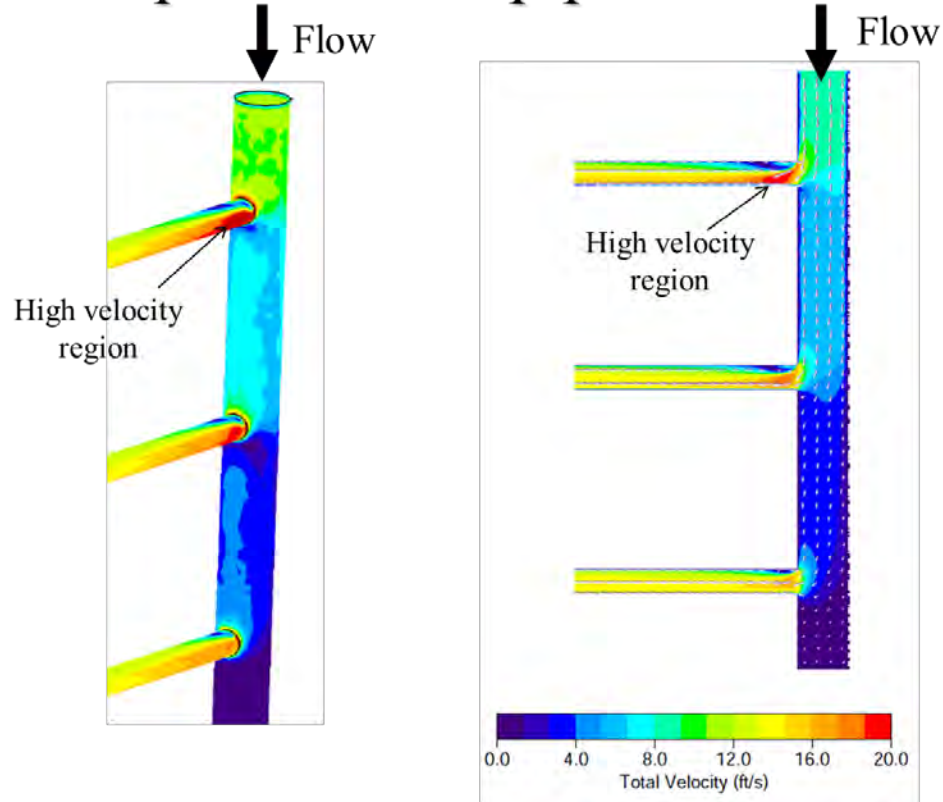


CFD Modeling of Pipe Flow



CFD Modeling of Pipe Flow

Flow patterns in a pipe manifold



Courtesy Airflow Sciences Corporation

Conclusions

- For Testing Monolithic Pipe:
 - Ultrasonic is fastest and the most convenient.
 - However, some application knowledge is necessary to test at representative locations.
 - If uncertainty exists, RT can be used as a second check.
 - UT not affected by water inside pipe.

Conclusions (Cont.)

- For Testing Composite Pipe:
 - Computer Radiography is the fastest and the most convenient of the RT methods.
 - However, detailed image resolution is limited to the laboratory work station.
 - Digital Radiography produces higher resolution imagery, but comes at a higher cost and requires more sophisticated equipment, necessitating higher operator skill levels.
 - RT is affected by water in pipe.

Thank You – Questions?

