Diagnostic Techniques for Aging Nuclear Power Plants

NRC DOE Workshop on U.S. Nuclear Power Plant Life Extension R&D

February 19-21, 2008

Presented By:

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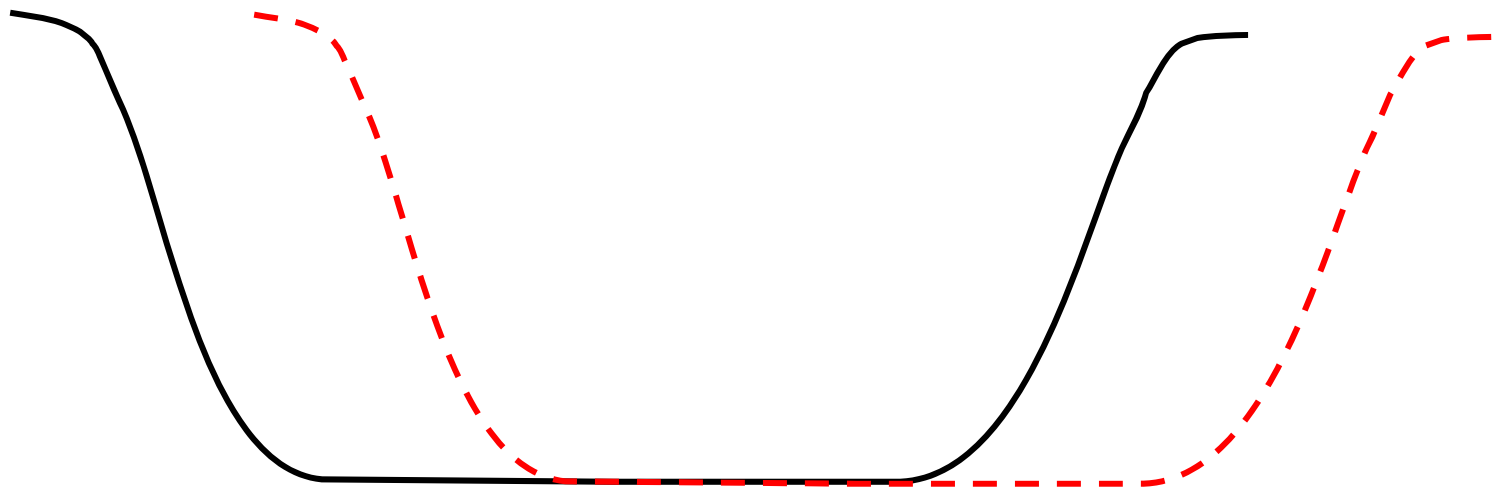
Probability of Failure Can Increase When Equipment is Replaced Prematurely



Bath Tub Curve

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Effect of Long Life on Critical Plant Equipment

- Effect on I&C
  - Sensors and Transmitters
  - Process-to-sensor interfaces
  - Cables & connectors
- Effect on reactor internals
  - Core barrel, thermal shield, and reactor vessel vibration monitoring
  - Reactor coolant pump vibration monitoring
  - Monitoring of thermal hydraulic anomalies
- Effect on other plant equipment

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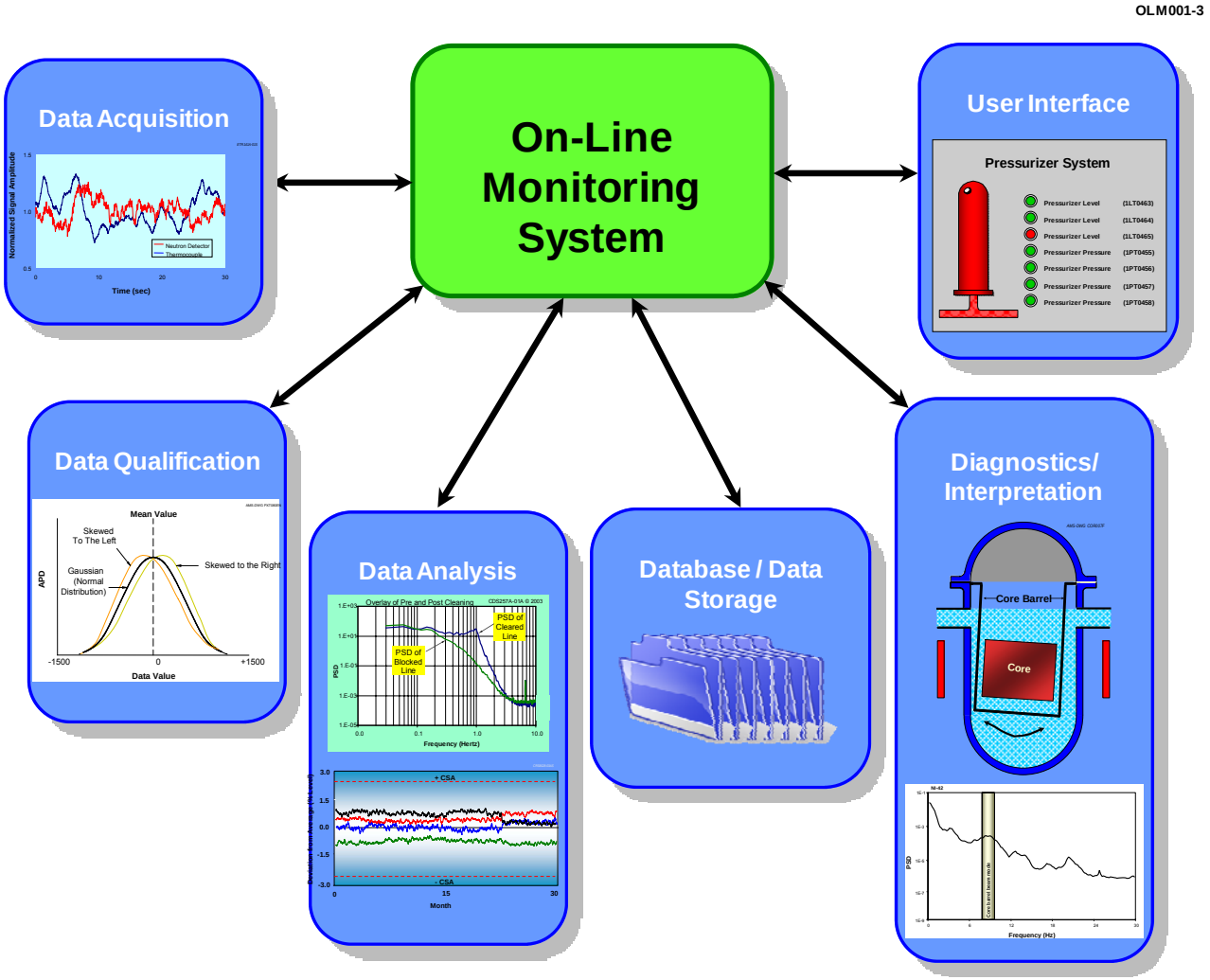
Parameters to Monitor for Management of Aging of Plant Equipment

Equipment	Vibration	Humidity	Ambient Temperature	Ambient Pressure	Acoustic Signal	Thermography	Motor Current	Insulation Resistance	Electrical Capacitance	Electrical Inductance
Pump	✓		✓	✓	✓	✓	✓	✓		
Valve		✓		✓	✓					
Motor	✓		✓		✓	✓	✓	✓		✓
Heat Exchangers	✓	✓	✓	✓						
Steam Turbine	✓	✓	✓	✓	✓					
Electrical & Electronic Equipment			✓			✓		✓	✓	✓
Cables and Connectors			✓			✓		✓	✓	✓
Pump Seal		✓		✓	✓			✓		
Piping/ Structures	✓				✓					
Compressor	✓				✓	✓	✓			

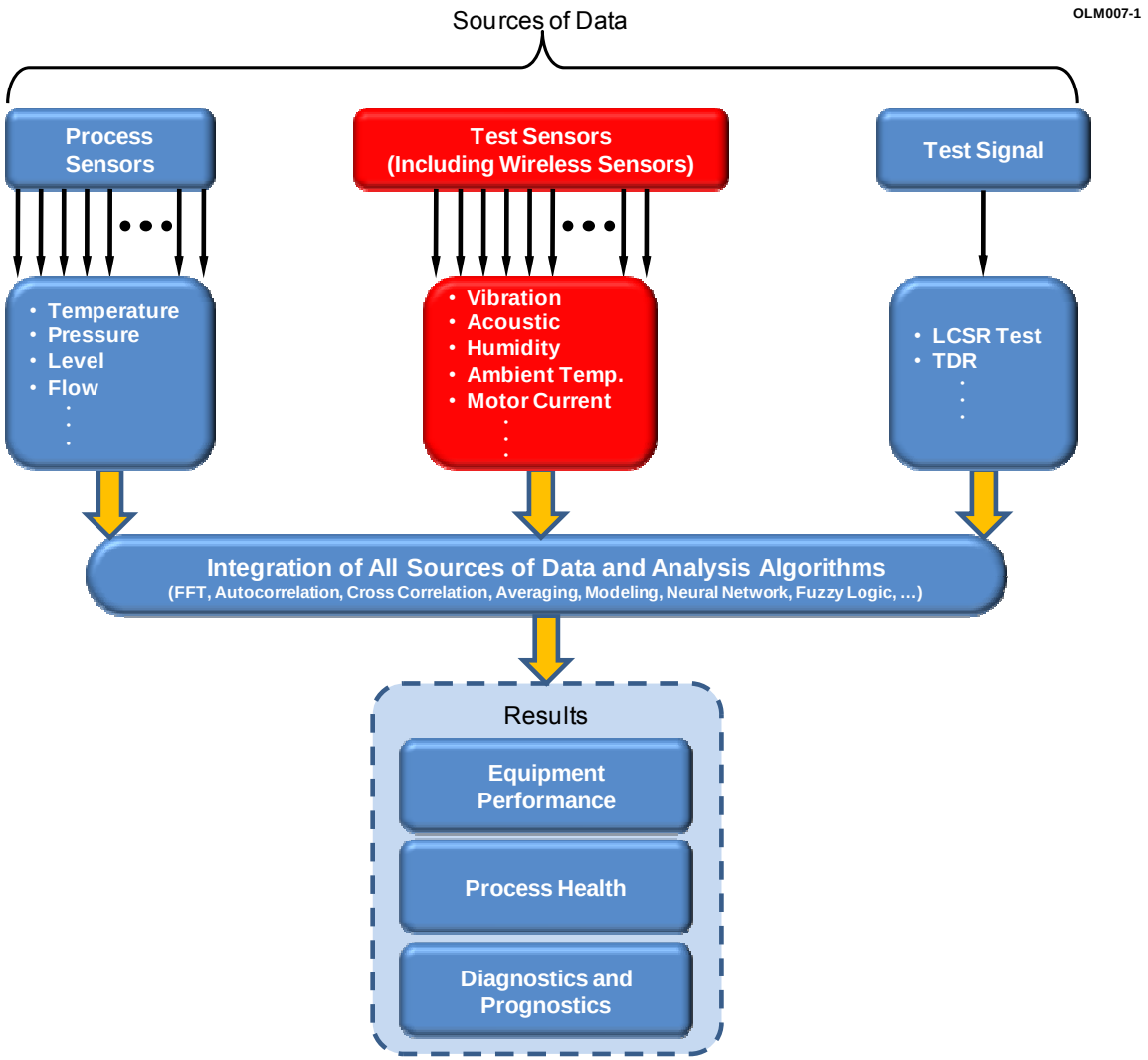
Phase II R&D Project Sponsored by DOE

(On-Line Condition Monitoring system for Nuclear Power Plants)

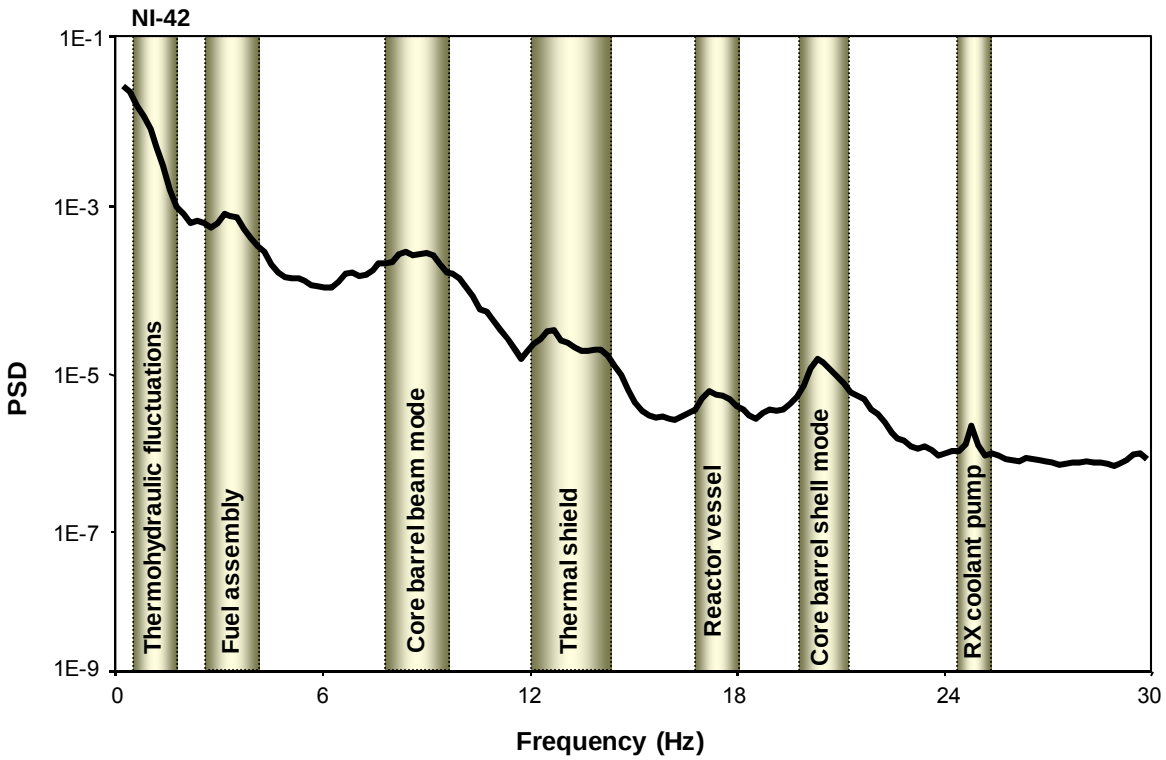


Phase I R&D Project Sponsored by DOE

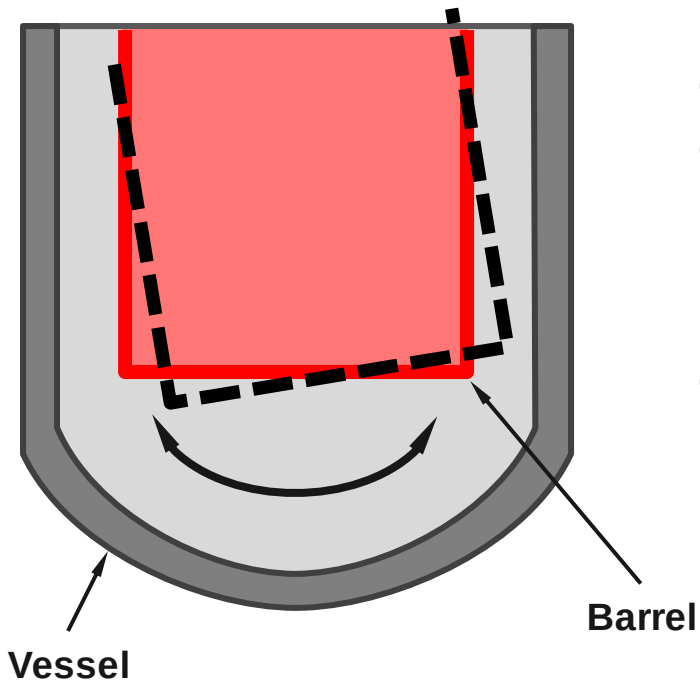
(Application of Wireless Sensors for Equipment Condition Monitoring)

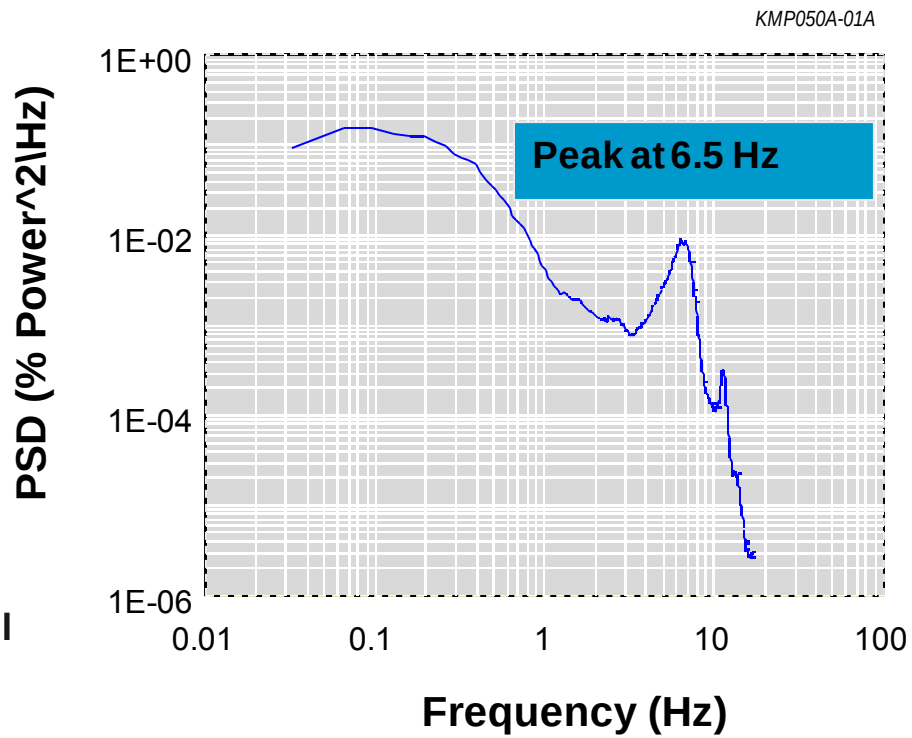


Results of Vibration Monitoring of Reactor Internals

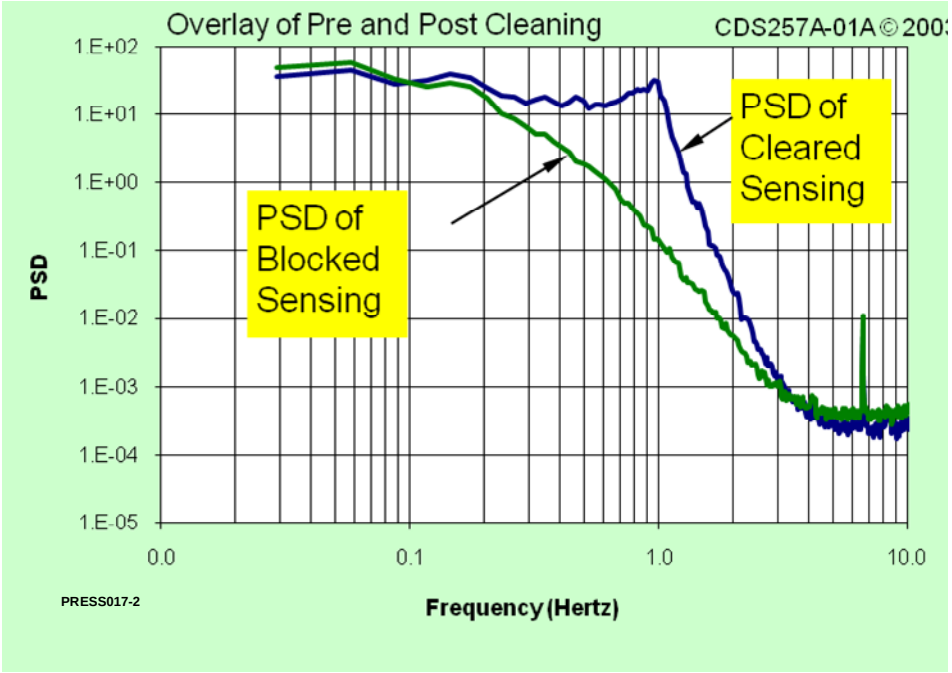


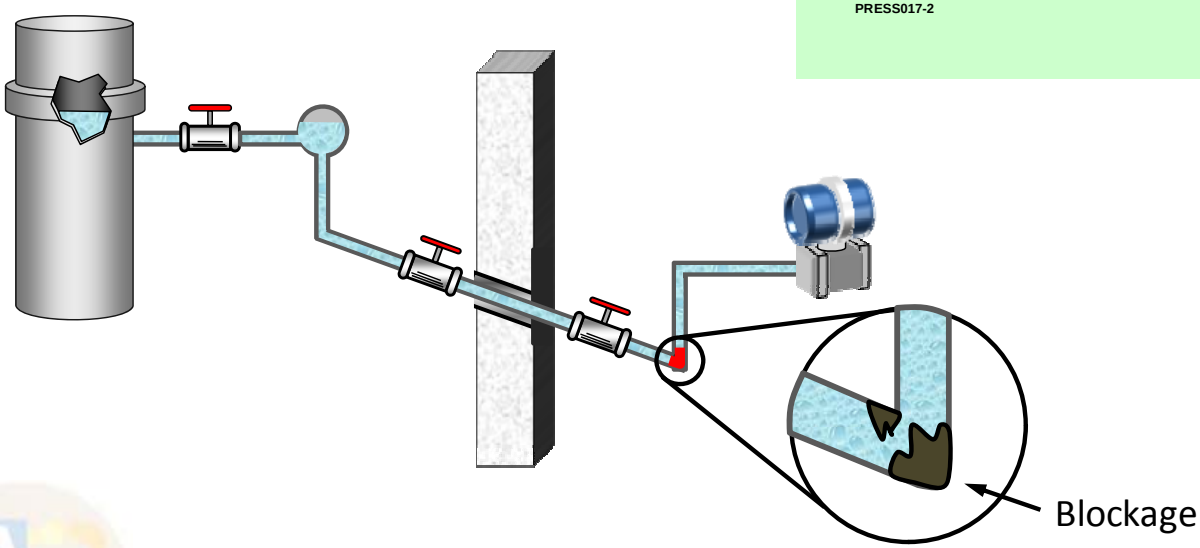
Core Barrel Vibration Signature



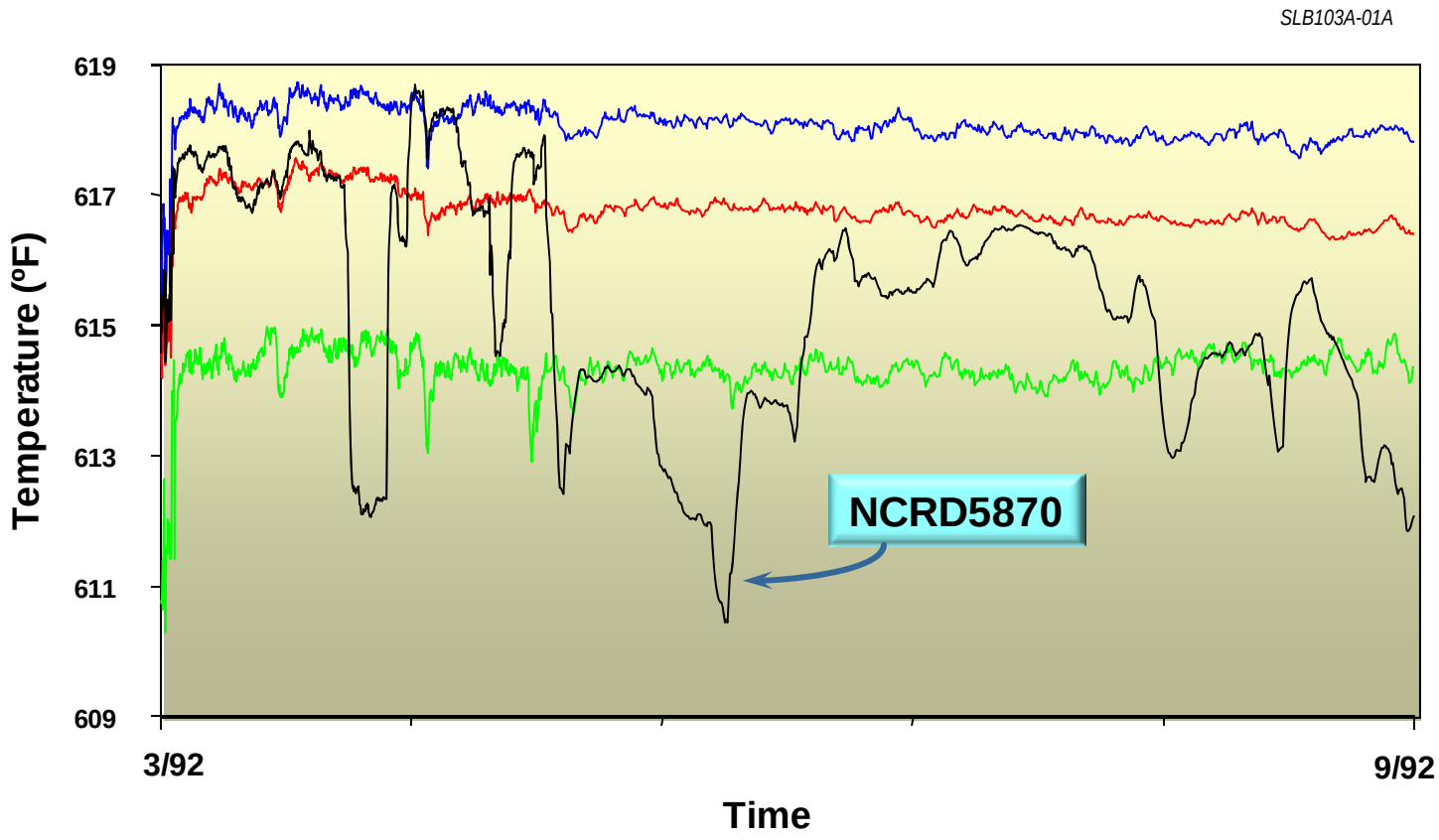


On-Line Detection of Sensing Line Blockages

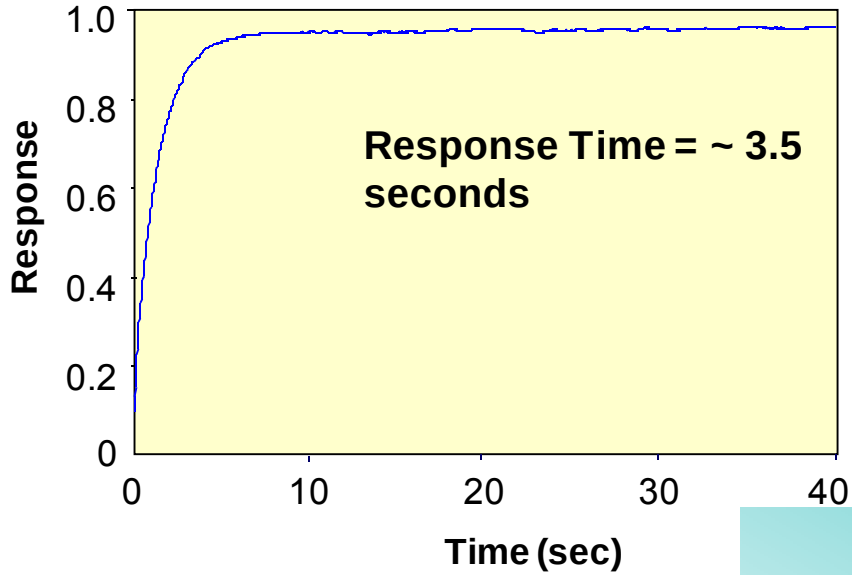




Incipient Failure Detection Raw Data

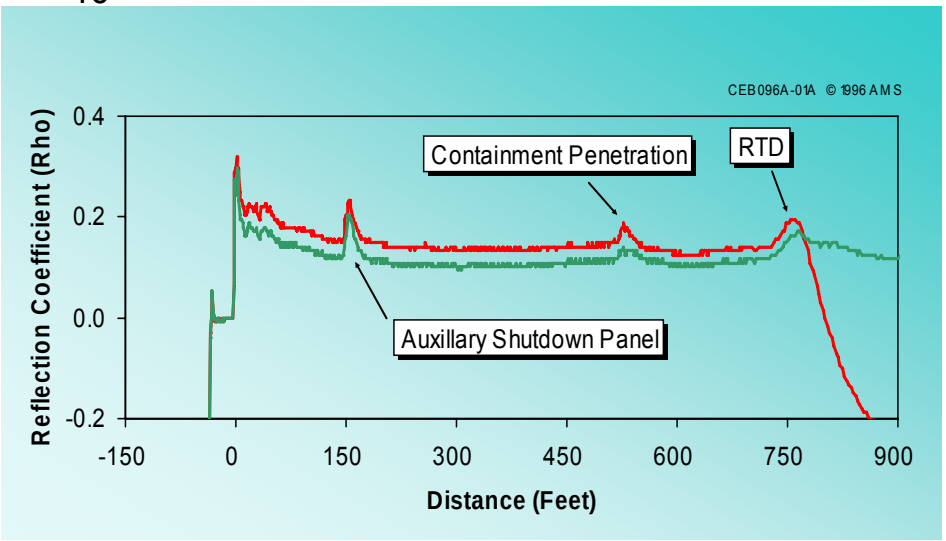


Active Testing Techniques



LCSR Test of RTDs and Thermocouples

In-situ Testing of Cables and Connectors



Thank You.

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