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### HIGH-PRESSURE POWER BOILER LOG – Weekly

*(Post near boiler and initial when tested)*

**INSTRUCTIONS:**

- Continued safe operation of a boiler depends on regular maintenance and testing of the boiler and its operating and safety controls. The tests and checks outlined below are designed to determine whether or not the boiler and controls are in good operating condition.
- Should any check or test indicate that the device being tested or observed is not in good operating condition, it should be repaired or replaced immediately. Record repairs or replacements under "Remarks" so that a complete record will be available for review at any time.

**TESTING:**

**WATER COLUMN AND GAGE GLASS** (steam boiler) – Open drain valve quickly and flush water from glass and column. Water level should return quickly to normal operating level when valve is closed.

**LOW-WATER FUEL CUTOFF AND WATER LEVEL CONTROL** – Tests should be performed while burner is operating. For float-type LWCO, drain float chamber. For probe-type, drain the water column or use the test button on the device. These tests should interrupt the circuit, stop the firing equipment, and start feed pump. If controls are of probe or other type that require lowering of water level in boiler to test, **DO NOT** lower level to point below bottom of gage glass.

MANUFACTURER				BOILER NUMBER										LOCATION			WEEK BEGINNING		
DAY AND TIME	WATER							PRESSURE		TEMPERATURE			BURNER/STOKER OPERATIONS	FUEL SUPPLY	WATER TREATMENT	BOILER BLOW DOWN	FEED WATER MAKE-UP	OPERATOR ON DUTY	REMARKS
	Water Level	Low Water CutOff	Level Control	Column	Gage Glass	Feed Pump	Condensate Tank	Steam	Feed Pump	Feed Water	Steam	Condensate							
MON	A.M.																		
	P.M.																		
TUES	A.M.																		
	P.M.																		
WED	A.M.																		
	P.M.																		
THUR	A.M.																		
	P.M.																		

EST RECORD TWICE DAILY

# Remote Technology – Digital Log

May 2, 2022  
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1. Remote technology – current status
2. Problem definition
3. Technology solutions
4. Digital log examples
5. Initiate an industry conversation around IoT as a supplement to inspections

# Remote Technology – Current Status



Getty Images

- Asset management is driving remote visual inspection technology.
- Code cases and code changes for remote visual.
- Primarily to address safety.
  - COVID access issues,
  - permit required confined space entry
  - Side benefit - cost savings
- Large applications
  - Large utility, large PV,
  - vessels needing scaffolding or containing hazardous materials.

# What about Main Street? IoT – Digital Log



- Needs for inservice are different than asset management or shop inspections
- IS inspections
  - Visual external and internal
  - Witness control testing
  - Logbook review
- Smaller equipment
  - Shorter visits
  - Time savings and risk avoidance a lot harder to justify
- Remote visual – not an easy solution for main street
- IoT as a digital log has potential

# Elements of an IoT Solution



- Infrastructure
  - Gateway
  - Servers
- Sensors
  - temperature
  - thermal switch
  - pressure
  - water
  - vibration
  - etc.
- Back End (Home Office)
  - Algorithms
  - Automatic Alerts
  - Reporting (i.e. Logs)
- Technology will become less expensive

# What Can be Monitored Now? What Could be Monitored? What Should be Monitored?

- Testing of Safety Devices
  - **LWCO (non-probe type)**
  - Relief Valve
  - Other?
- Key operational
  - **Blowdown**
  - **On/off – cycles**
  - **Temperature differential**
  - Other?
- Boiler Control Tie-in?
  - Alarm log
  - Operating parameters
- Related
  - **Water presence**
  - **Humidity (ambient)**
  - **Temperature (ambient)**
  - **Historical temperature (weather data)**
  - **Sound levels**
  - **Vibration**
  - Amps

**Current**   Possible Future

# Potential Issues / Concerns



- Customer acceptance
- Cyber security
- Responsibility / liability
- Invasiveness
- Standards for boiler manufacturers and vendors



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# Case Studies – Heating Boilers and HP Steam Boiler

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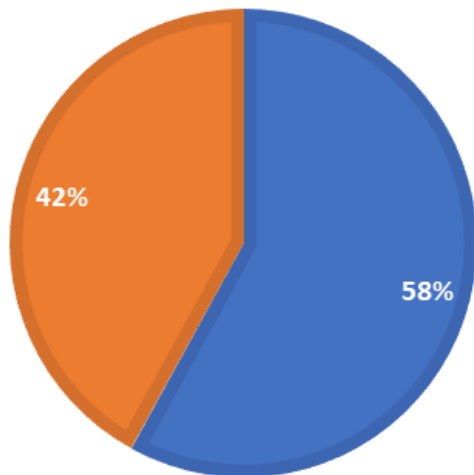


# Space Heating – Steam and Hot Water

## Predominantly cast-iron boilers

### LOSS (GROSS)

■ Hot Water Boiler ■ Steam Boiler



- Steam boiler losses
  - LWCO Failure
  - 32% of events represent 68% of losses
  - Lower freq – higher severity
- Hot water heating boiler losses
  - Over 95% of losses were cracks
  - Significantly dominates loss history
  - Higher frequency – lower severity

# First Step – Key loss event

## Steam Boilers – LWCO failure



Internal HSB Report

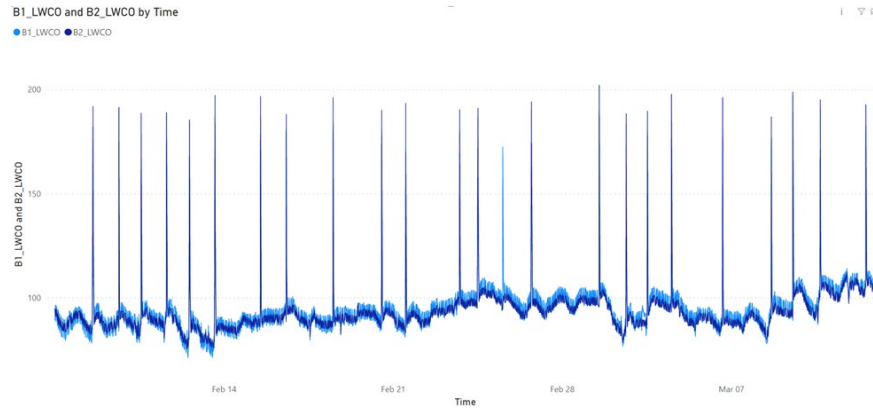
- Cast Iron Boiler
  - A total loss
  - Potential for property damage/personnel injury
- Large FTSM – Low water events
  - Lower frequency, higher severity
  - Potential for property damage/personnel injury

**REGULAR TESTING of LWCO is KEY to minimize losses.**

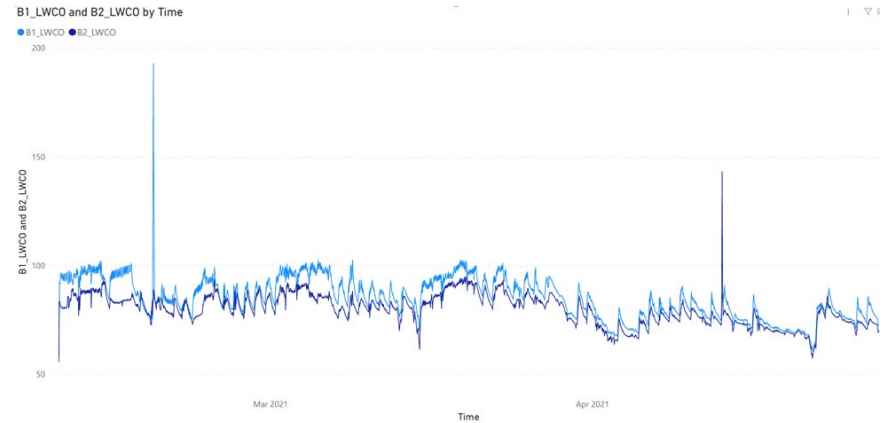
# Digital Log – LWCO

## Steam Heating Boiler

### Regular Testing of LWCO



### Irregular Testing of LWCO



HSB Report Data

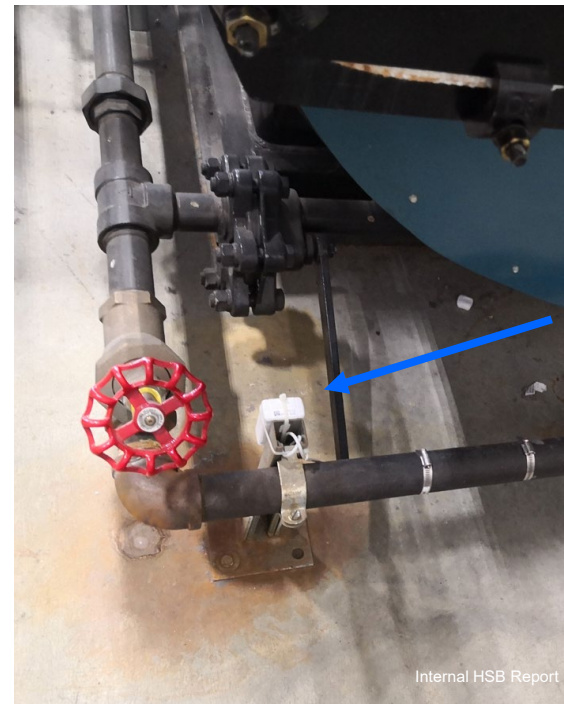
# Dry Cleaner Installation



150 HP FTSM



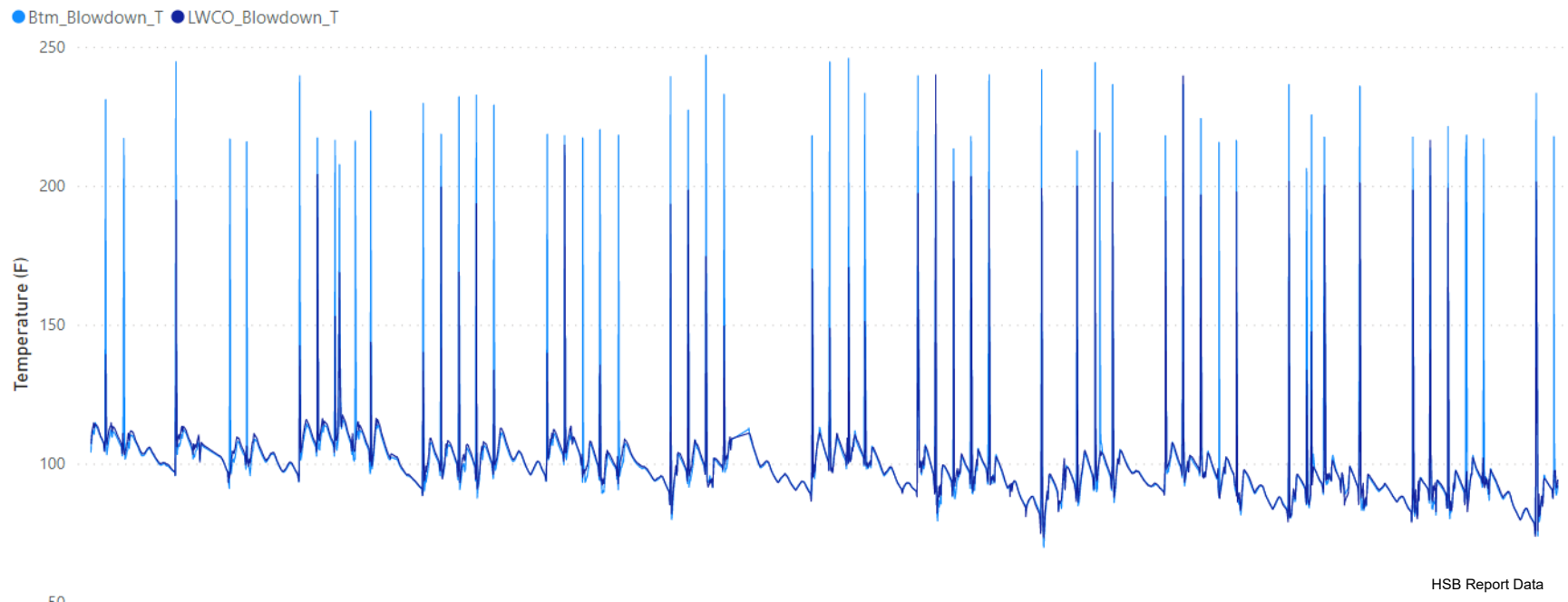
LWCO



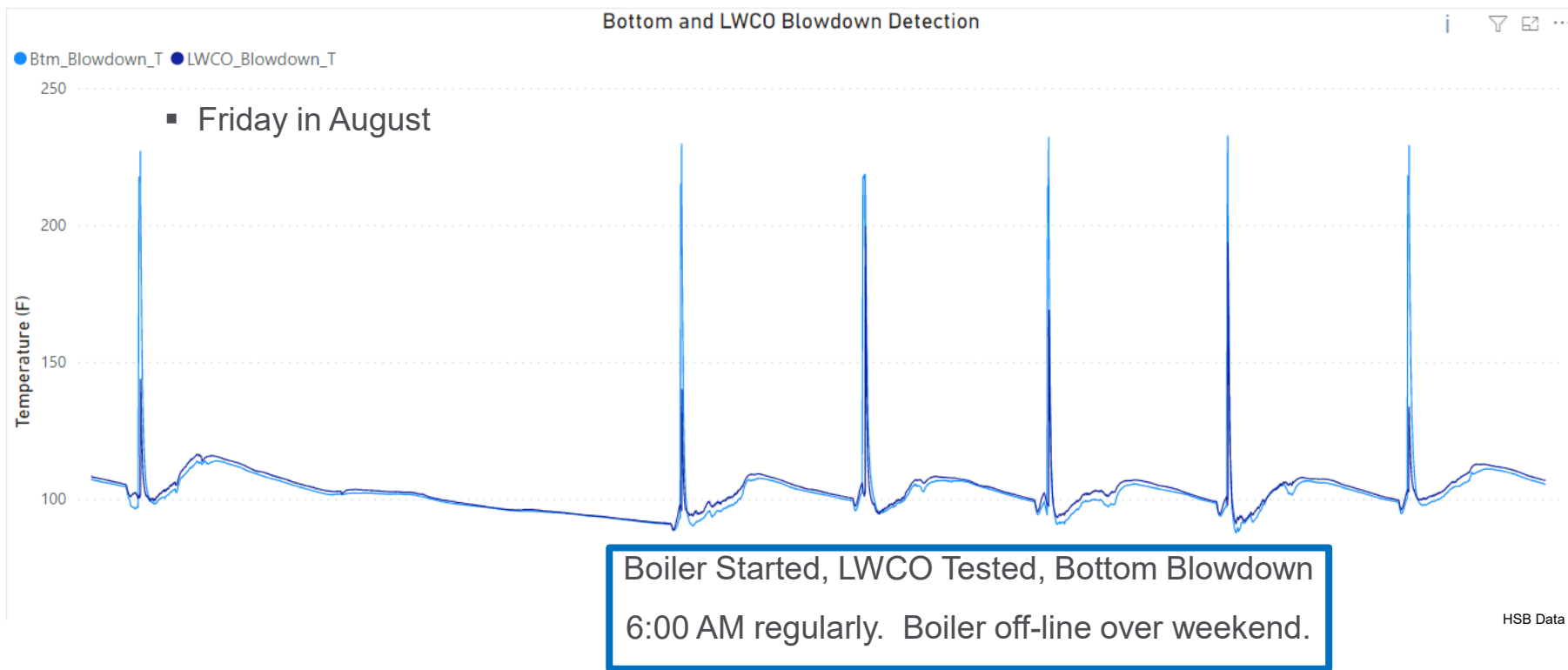
Blowdown

# Digital Log

## Dry Cleaner Boiler – (LWCO and Bottom Blowdown)



# Dry Cleaner Boiler – 1 Week



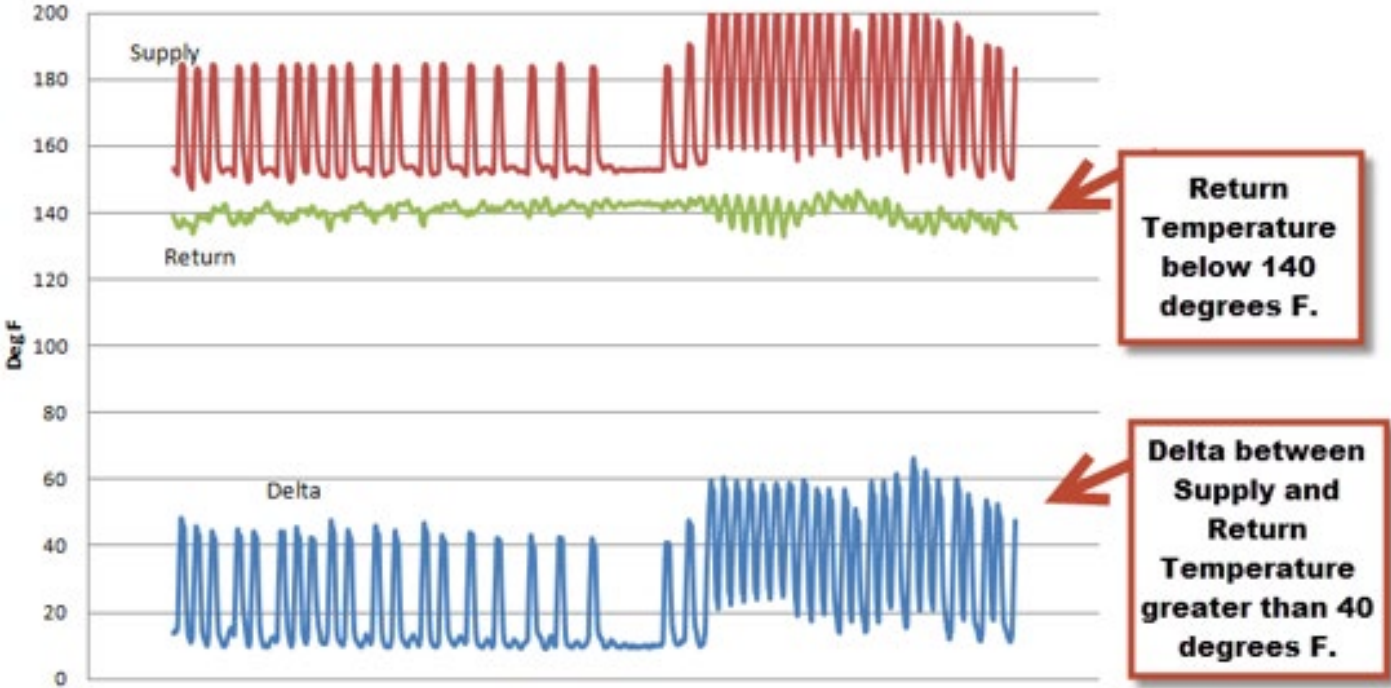
# First Steps – Key Loss Event

## Cast Iron Boilers Sectional Cracking



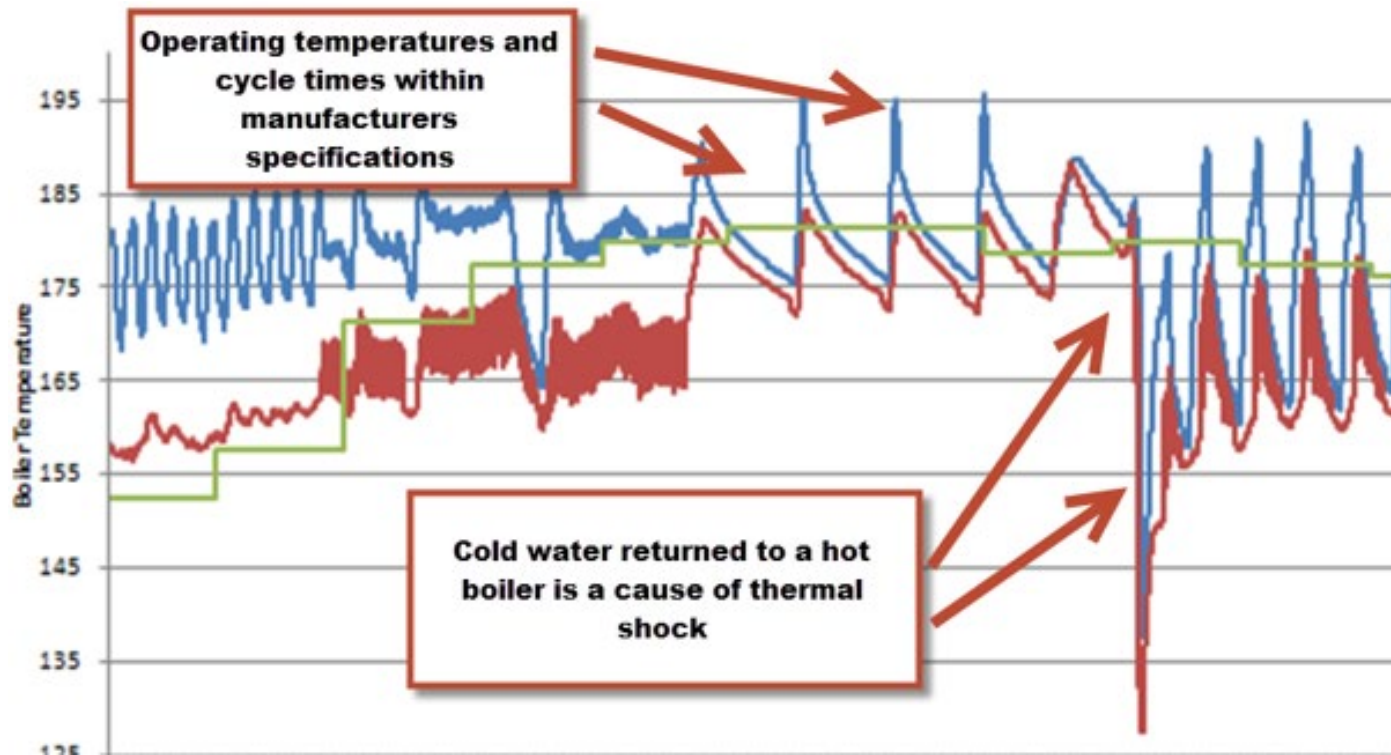
- Cast Iron Boilers – Cracked sections
  - High frequency, lower severity events
  - Disruptive – Most common during coldest month of the year.
- Contributing Factors
  - High temp differential
  - Cold water shocks
  - Frequent cycling
  - Low water outlet temps

# Example Data





# Example Data



# Summary

- Remote visual and remote NDE will continue to grow their roles for large equipment inspections
  - Asset management
  - Shop inspections
  - Limited jurisdictional
- Most jurisdictional inspections are performed at main street businesses.
- Remote visual has challenges in main street businesses
- Currently – IoT is being used for loss prevention services

# Let the Discussion Begin



- Can IoT be used as a supplement for external inspections?
  - Replace ?
  - Extend time intervals?
- What other technologies are needed / in flight?
- Vendors? Standard set of data output
- Must overcome concerns raised and get buy-in from all parties
- Not a replacement for trained inspectors nor operators



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The Hartford Steam Boiler Inspection and Insurance Co.

# Thank you

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