



Wiley|Wilson®
Constant Progress

Tyler D. Morris, PE

Project Manager

434.455.3692

Michael J. Gehl, PE

Sr. Mechanical Engineer

434.947.1627



Redesign of Virginia Military Institute Central Heat Plant

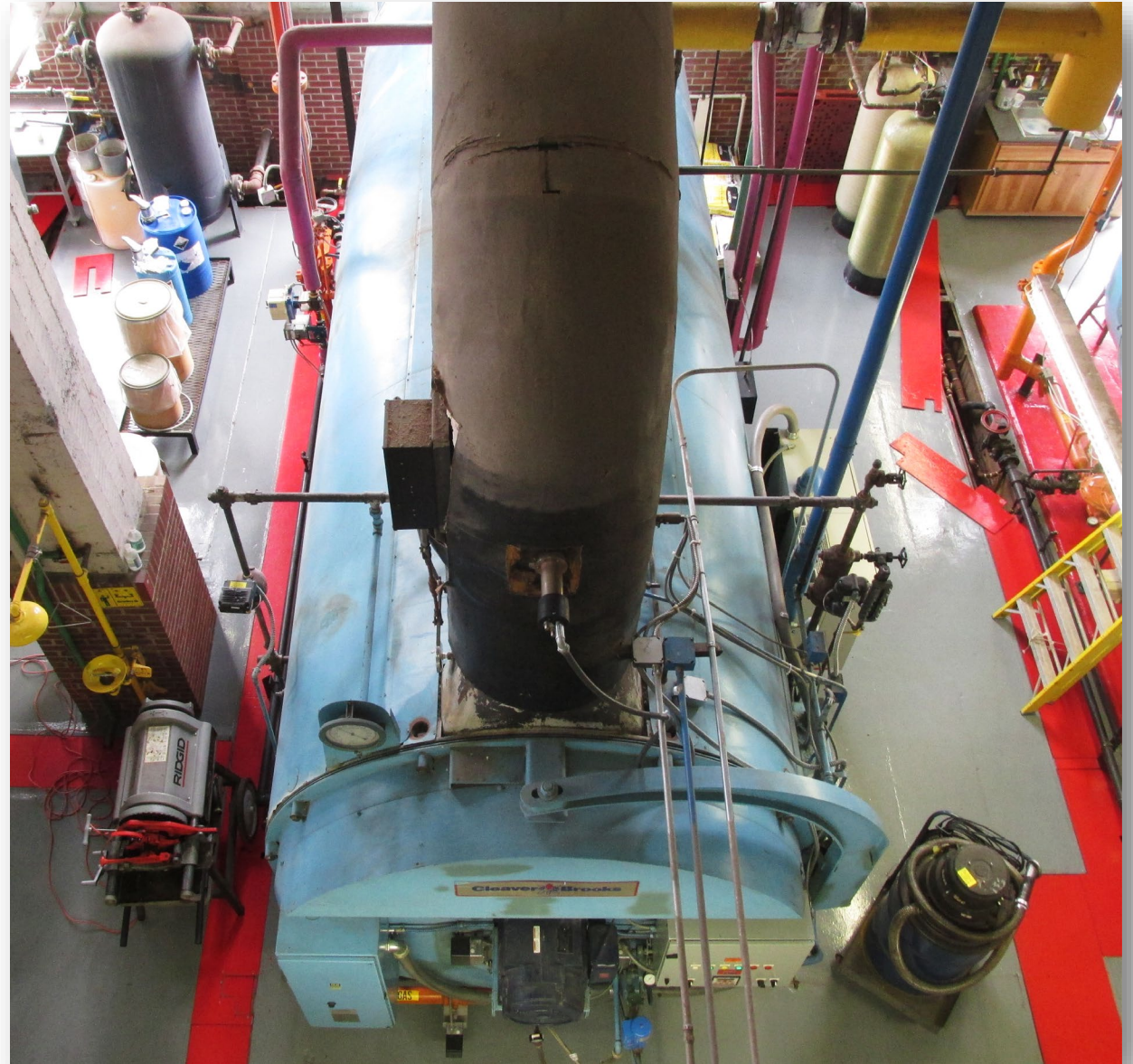
GOALS

Infrastructure

Resiliency

Efficiency

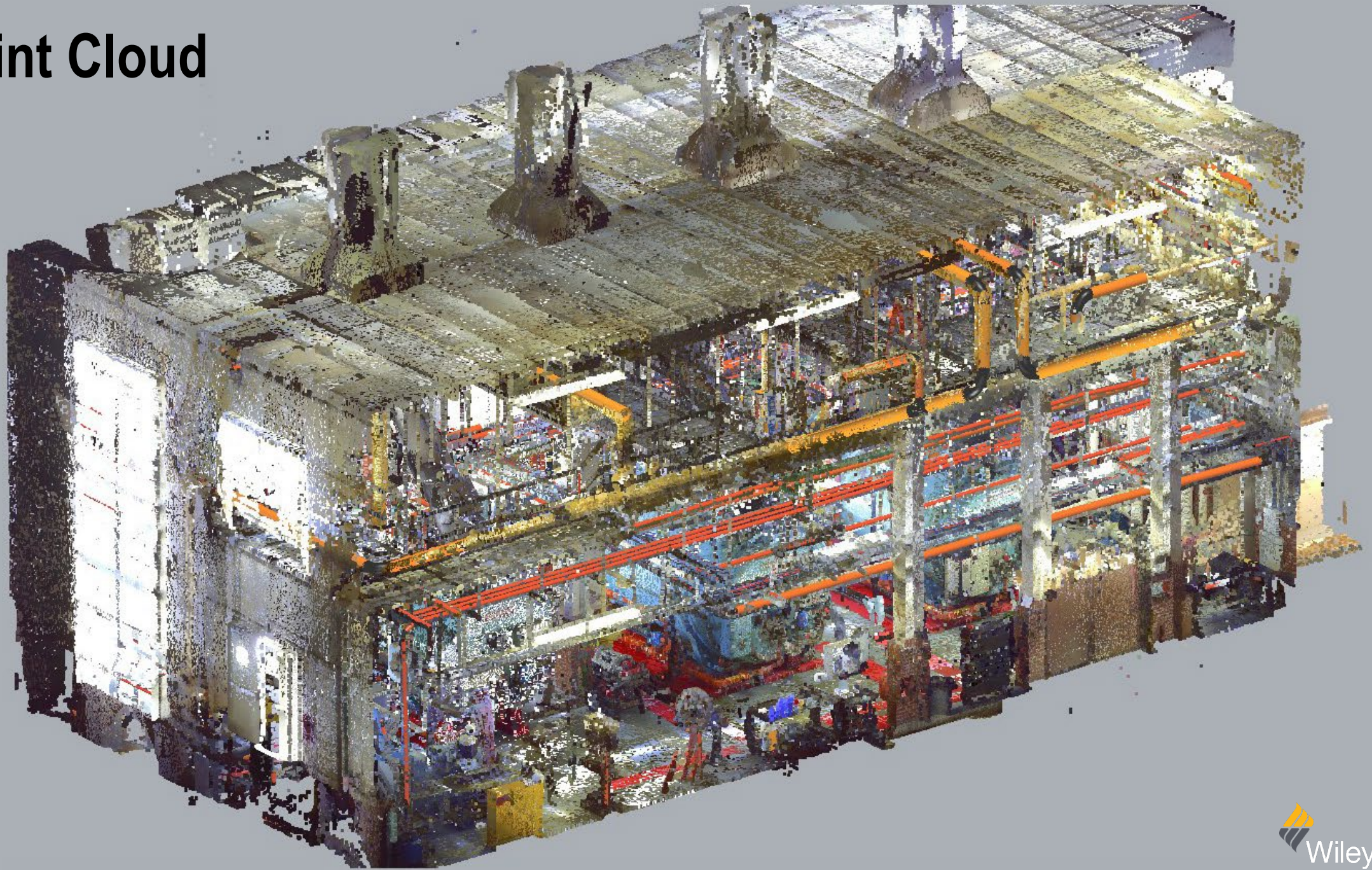
- 1905 historic structure
- Generated at 100 psig, distributed at 100 & 60 psig
 - Building heating
 - Domestic hot water
 - Laundry
- Firetube boilers
 - Boiler 1: 400 BHP (1994)
 - Boiler 2: 800 BHP (1994)
 - Boiler 3: 400 BHP (1986)

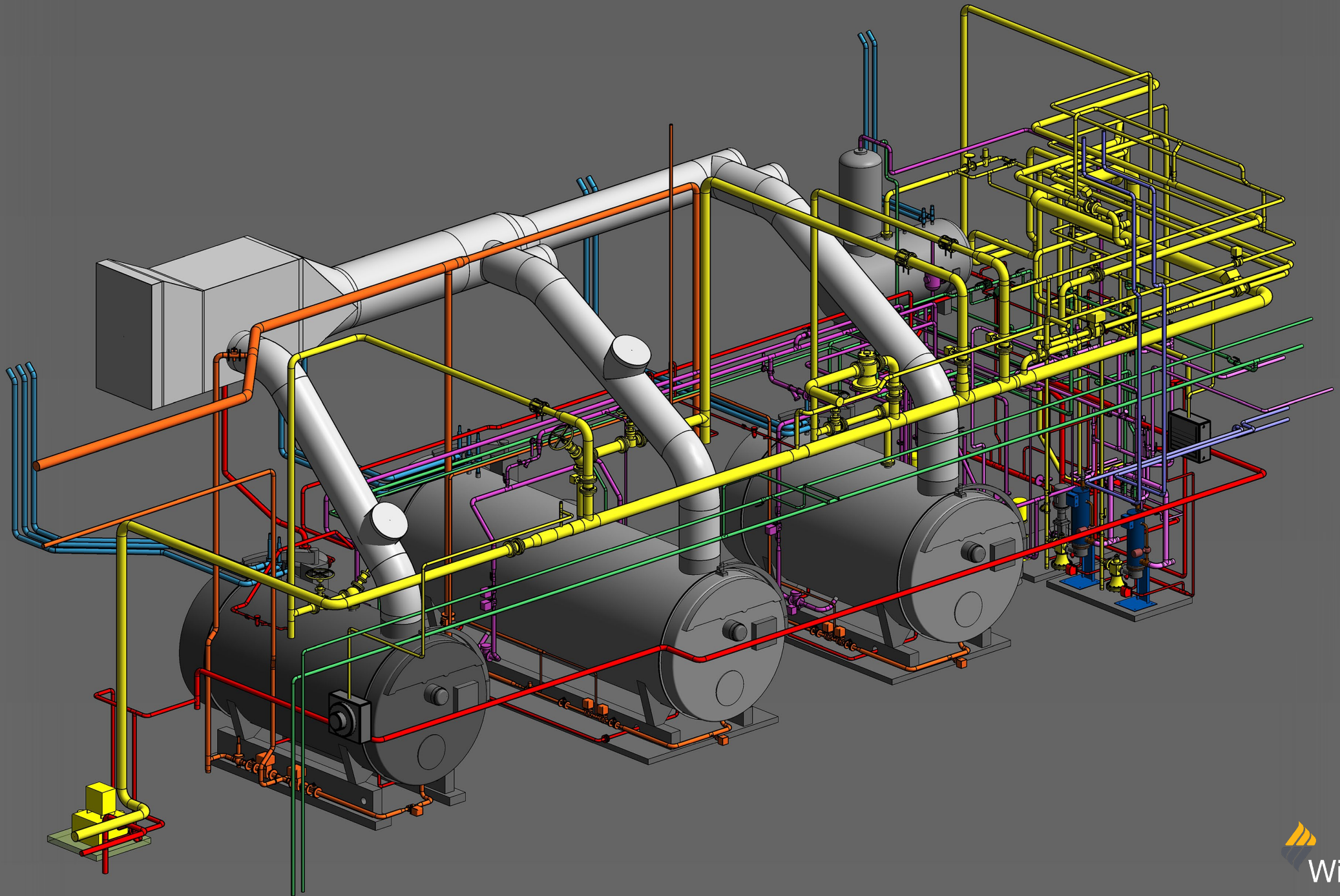


- Interviews with plant staff
- Load analysis
- 3D laser scanning
- Condition assessments
 - Boiler
 - Plant auxiliary systems



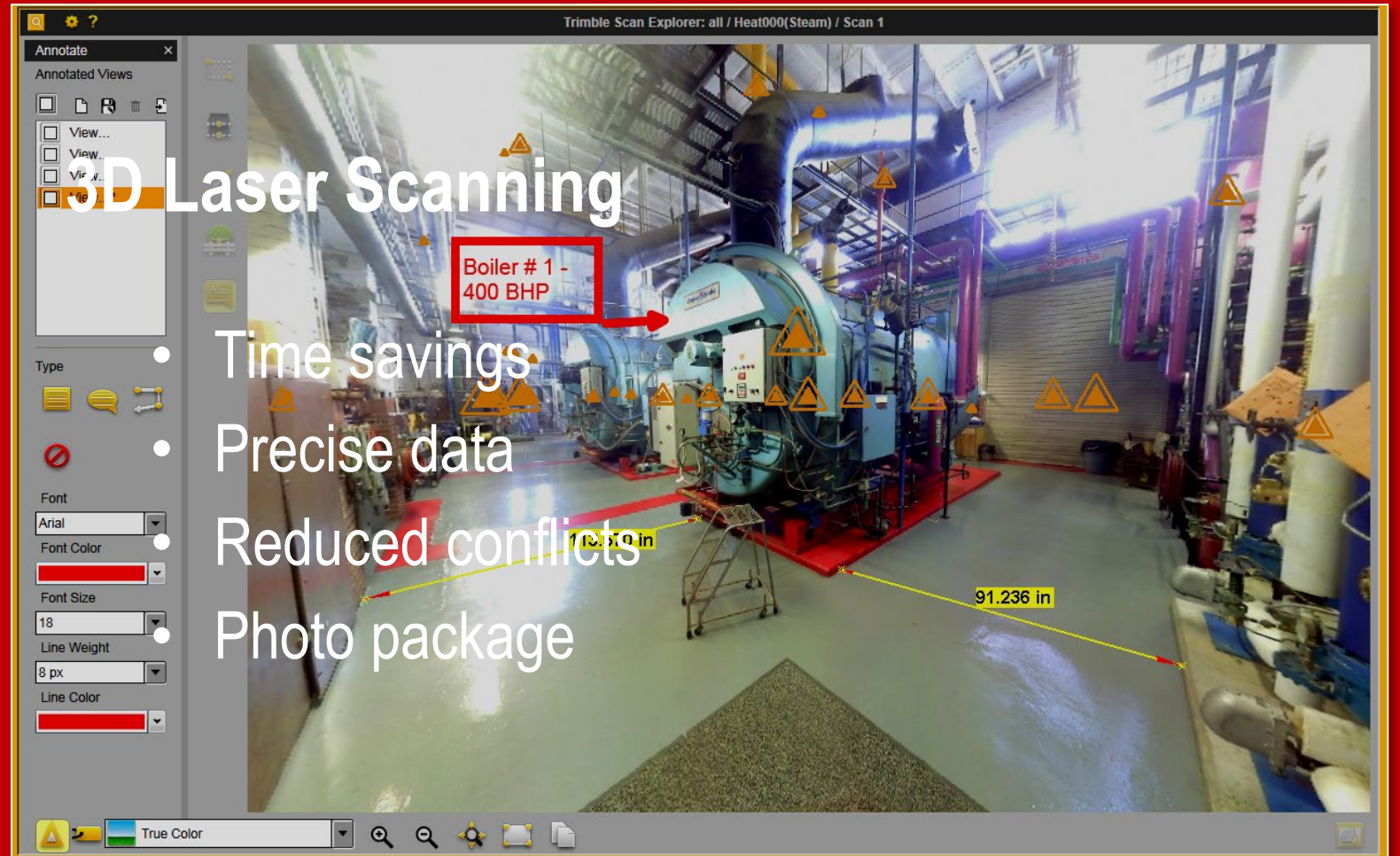
Point Cloud



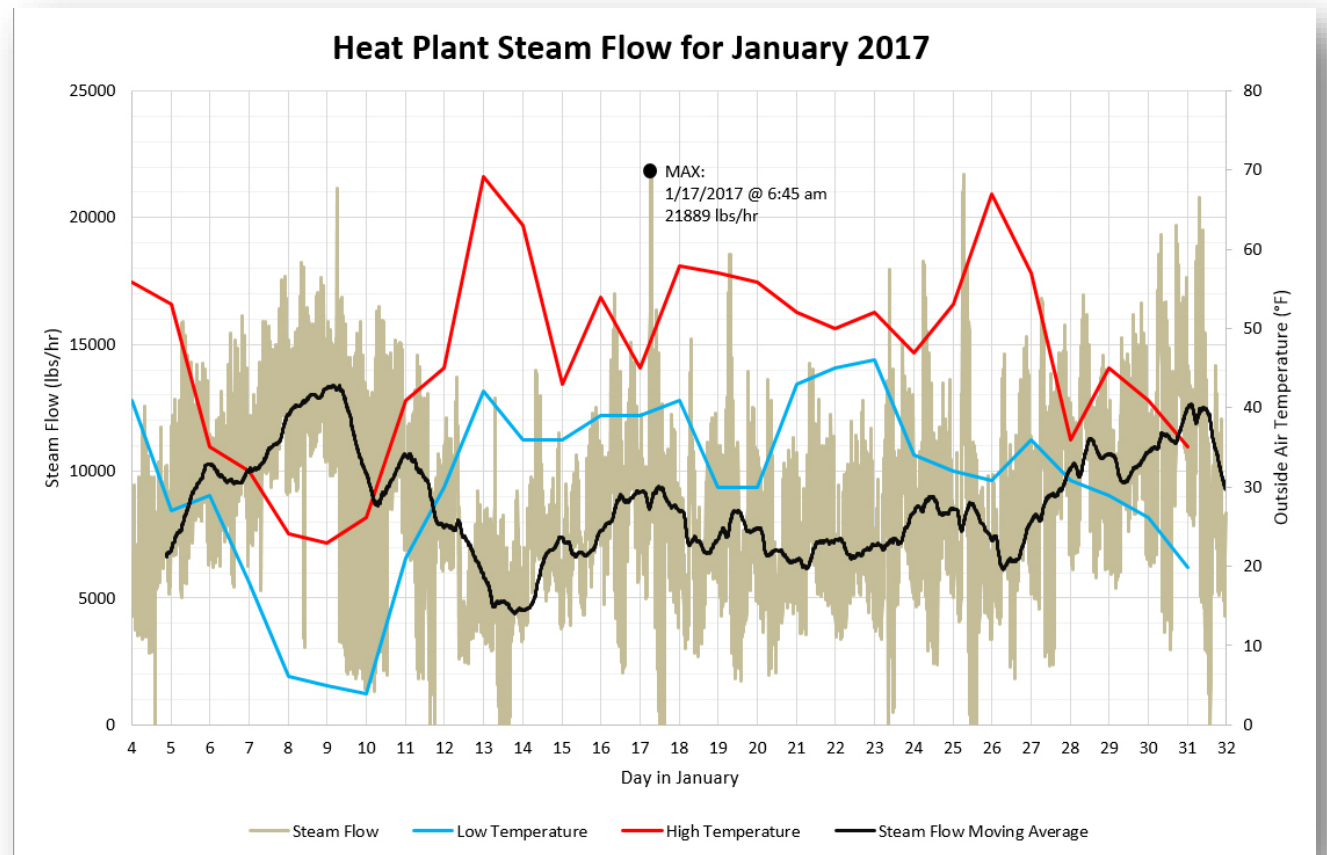


3D Laser Scanning

- Time savings
- Precise data
- Reduced conflicts
- Photo package



- Limited trending data
- Calculated vs nameplate steam loads
- Boiler 2 de-rated to 700 BHP
- Capacity
 - 1,500 BHP total (51,750 lbs/hr)
 - 800 BHP firm (27,600 lbs/hr)
- Design
 - 1,000 BHP firm (34,500 lbs/hr)



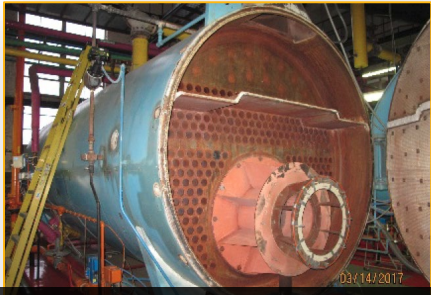
Steam Load due to:	Peak Steam Load
Building Heat	12,000 lbs/hr
Scott-Shipp Future Estimated Load	1,000 lbs/hr
Laundry (Richardson)	6,000 lbs/hr
Showering (Domestic hot water)	13,000 lbs/hr
Total Calculated Peak Steam Load	32,000 lbs/hr
Maximum Recorded Steam Load	21,889 lbs/hr



External stay
welds tested



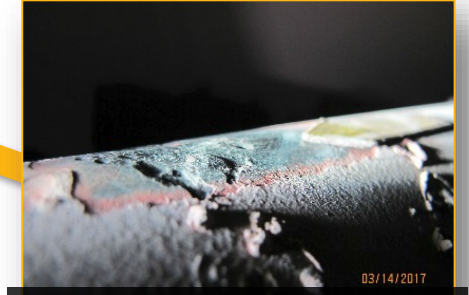
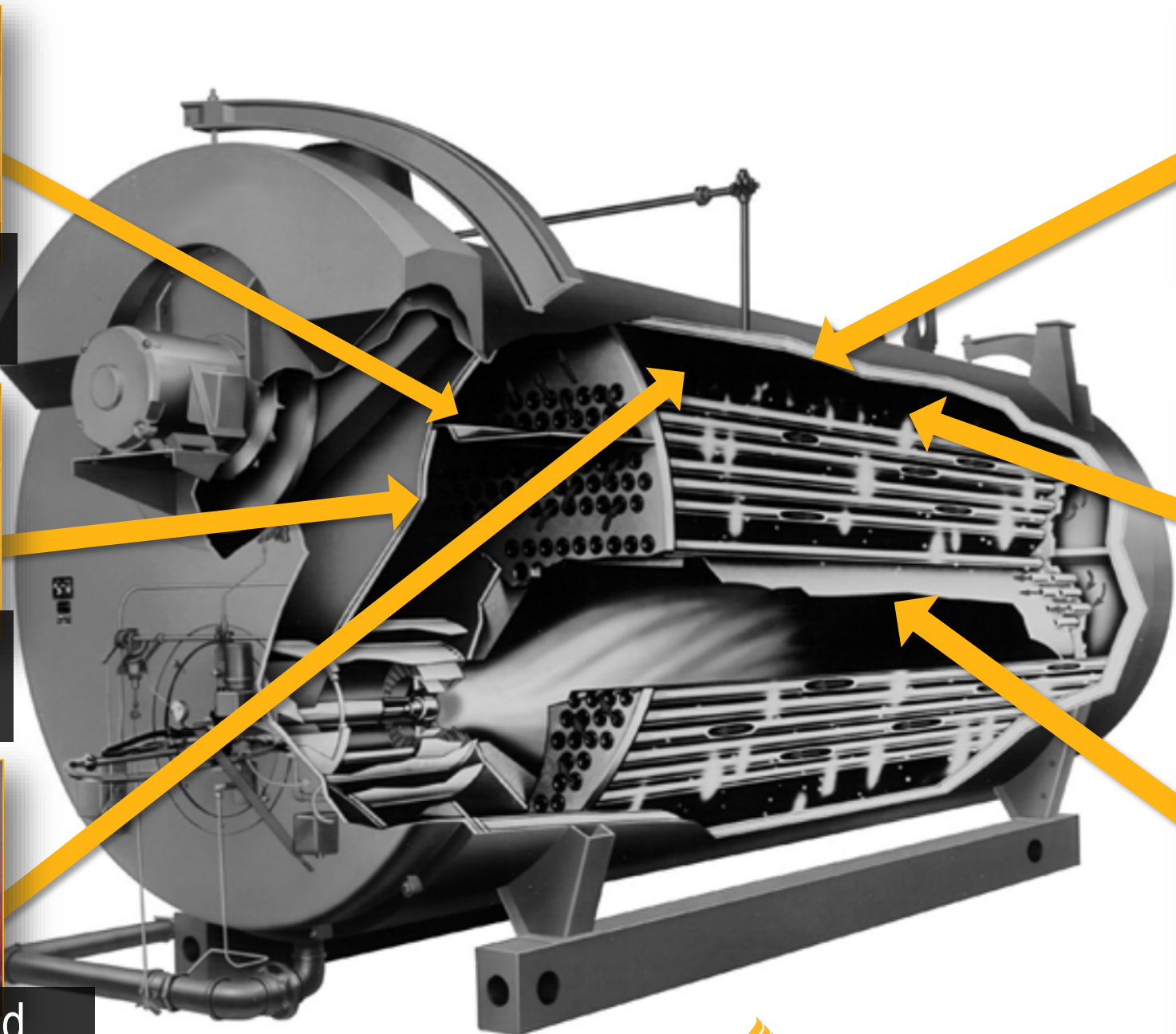
Critical welds
tested - OK



General view
(front) Boiler #2



No wastage or weld
cracks on diagonal stays



Isolated pitting
on boiler tubes



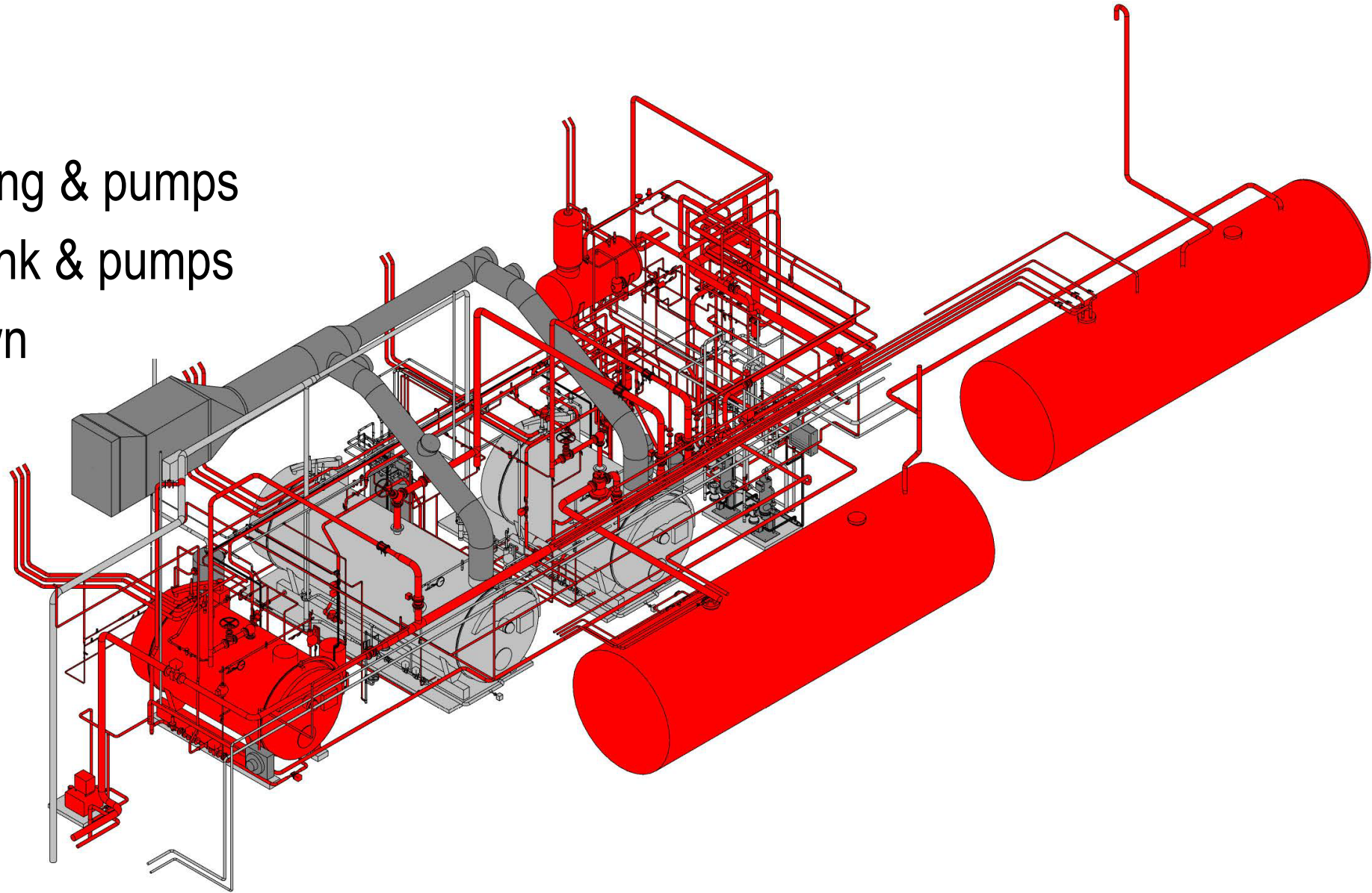
Furnace tube
welds MT - OK



Boiler Inspection Results

- Excellent condition for age, result of diligent water treatment
- 10+ years of remaining useful life
- Risk of sporadic tube failure

- Auxiliary systems
 - Deaerator
 - Feedwater piping & pumps
 - Condensate tank & pumps
 - Boiler blowdown
 - Controls

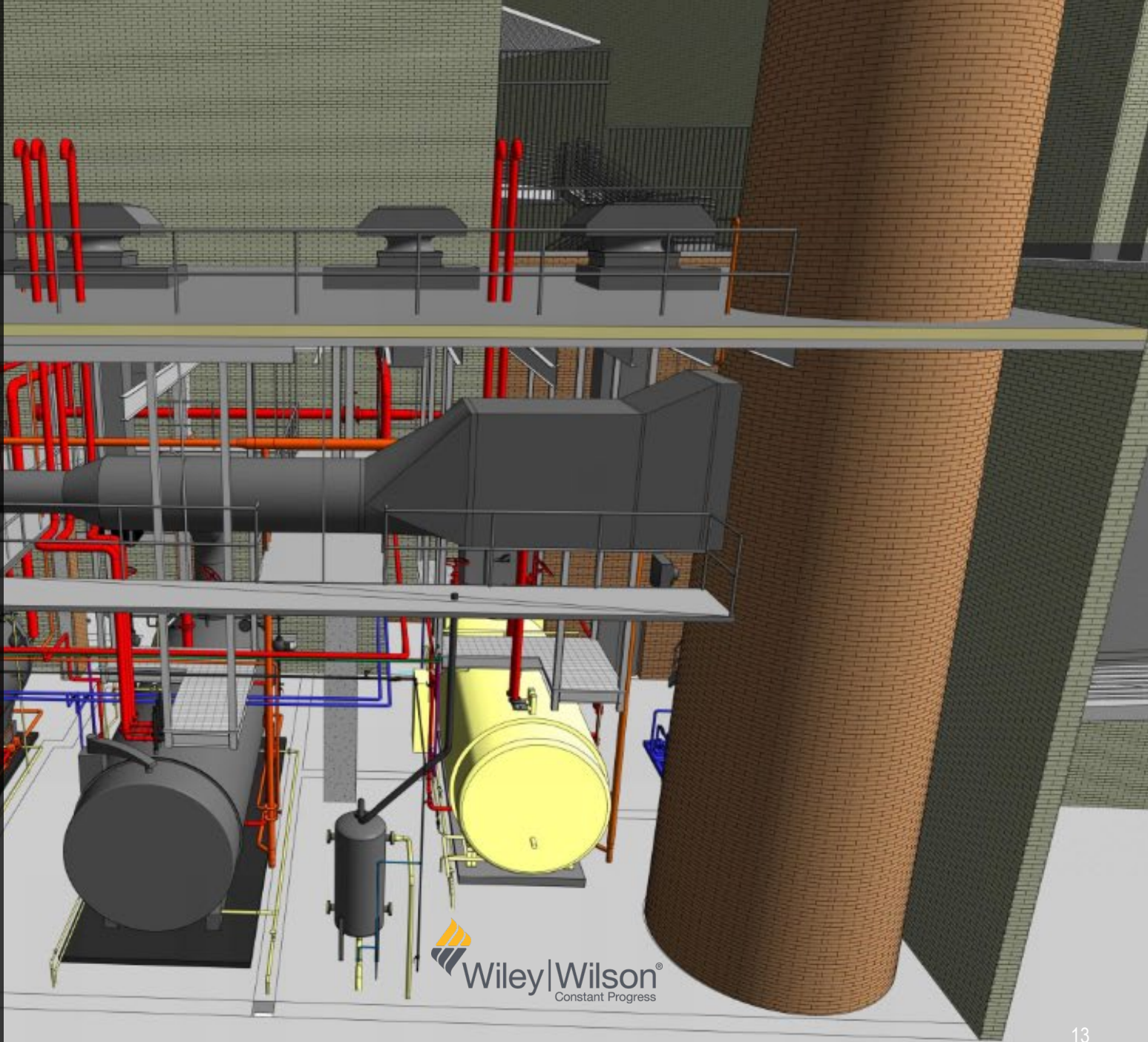


- Redundant PRV stations
- Interruptible NG without secondary fuel
- Steam flow meters
- Electrical system

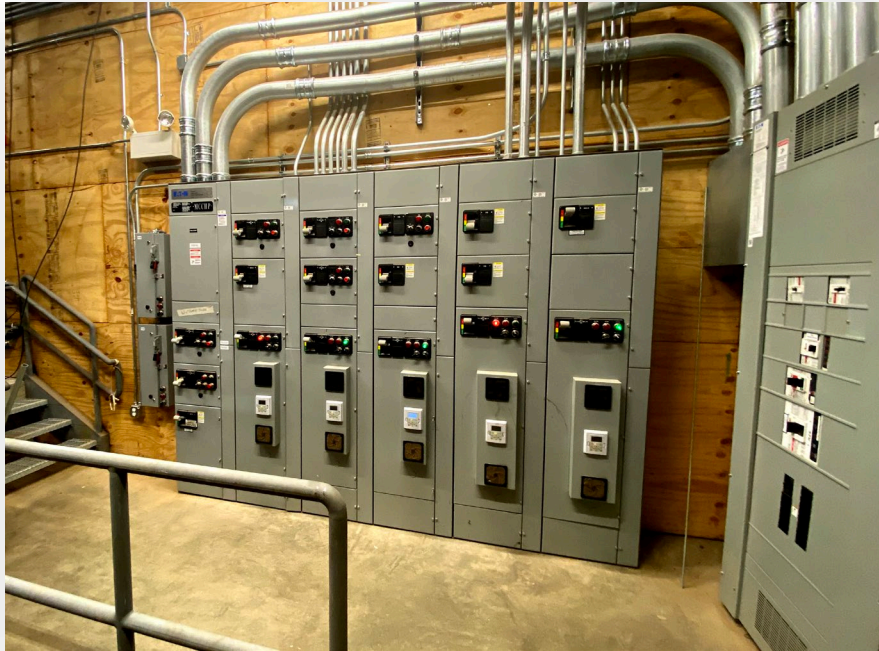


Solutions

- Boilers
 - Increase firm capacity to 1,000 BHP
 - Replace Boiler 3
 - 600 BHP
 - 4-pass, dry-back
 - 83.5% eff. NG
 - 86.8% eff. FO
 - Re-tube Boilers 1 & 2
 - Re-rate Boiler 2
 - 800 BHP (from 700 BHP)
- New auxiliary equipment

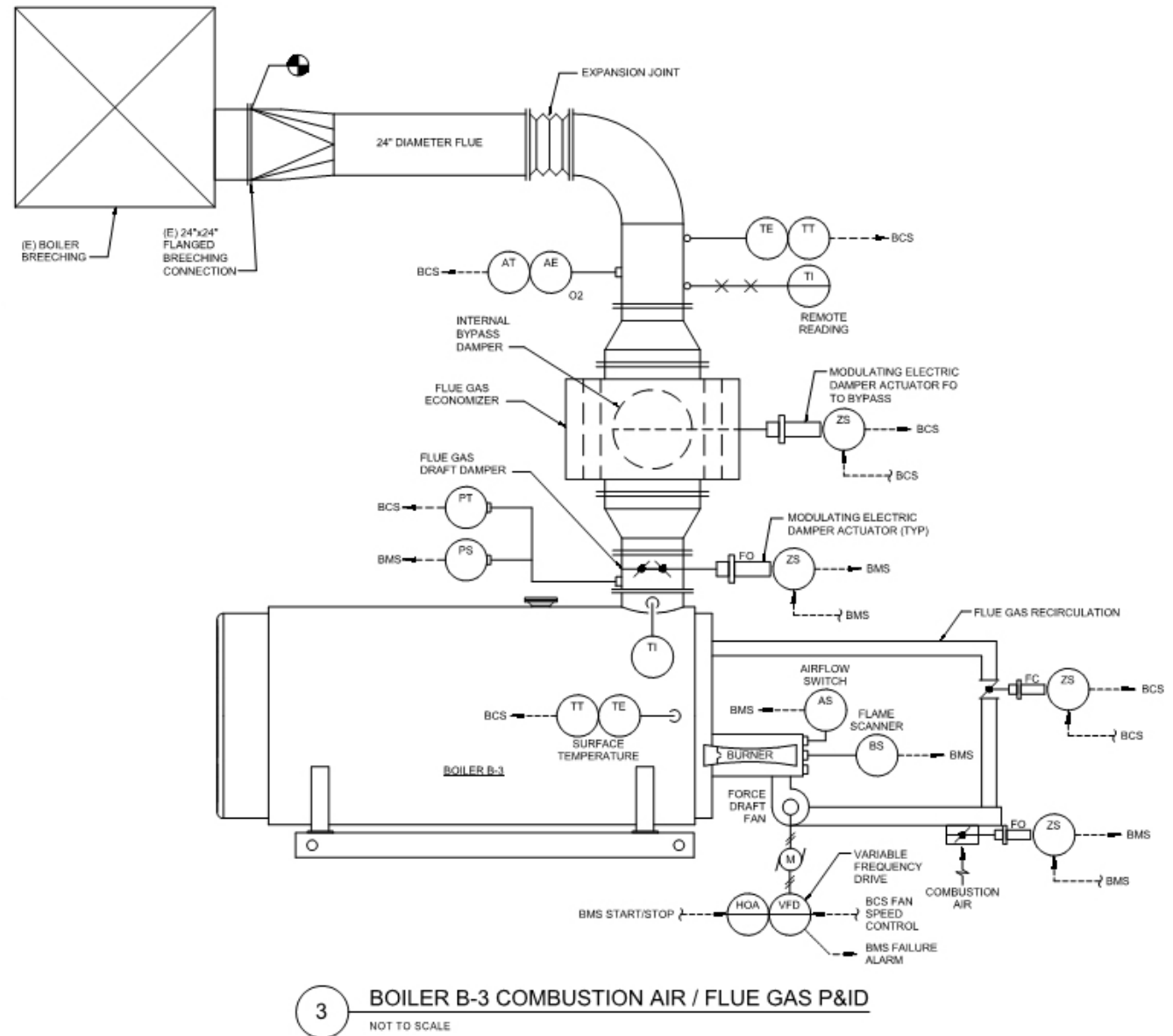


- Tray style DA tank
- Feedwater pumps, header arrangement
- Condensate tank & pumps in plant
- PRV stations
- New electrical equipment



Controls

- Auxiliary systems controlled by DDC
- PLC based control system for boilers
- All controls integrated with Post-wide BAS



Energy Improvements

BOILERS

- Draft control
- O₂ trim
- Control improvements

VFDs

- Boiler draft fan
- Feedwater pumps
- Condensate pumps

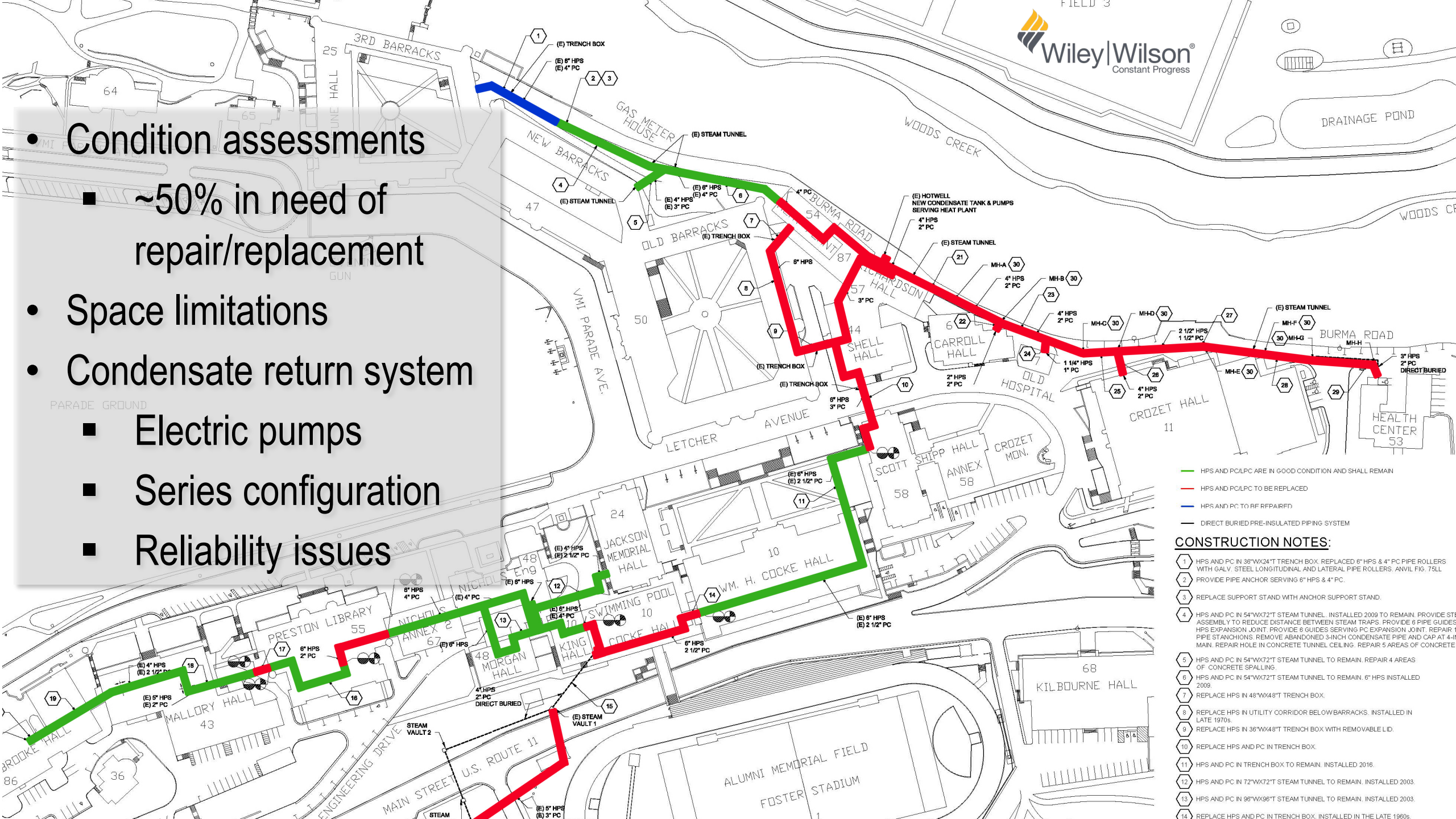
FEEDWATER PUMPS

- Dedicated summer load pump
- Feedwater recirculation based on steam flow (vs. fixed recirc flow)

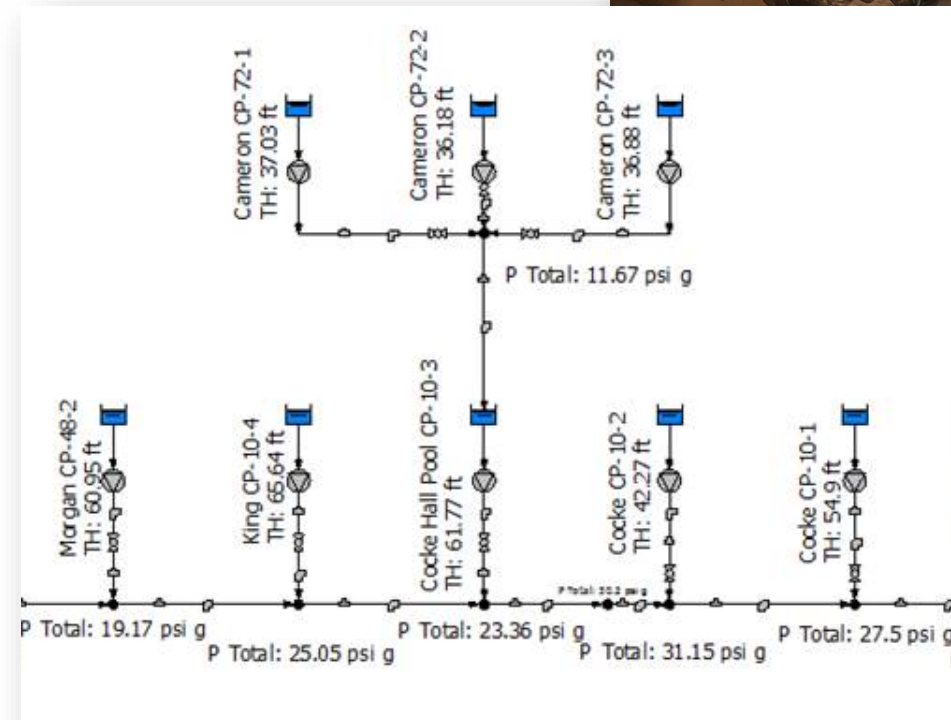
- Removable curtain wall for boiler tube pull
- New fuel oil tank
- Generator serving entire plant

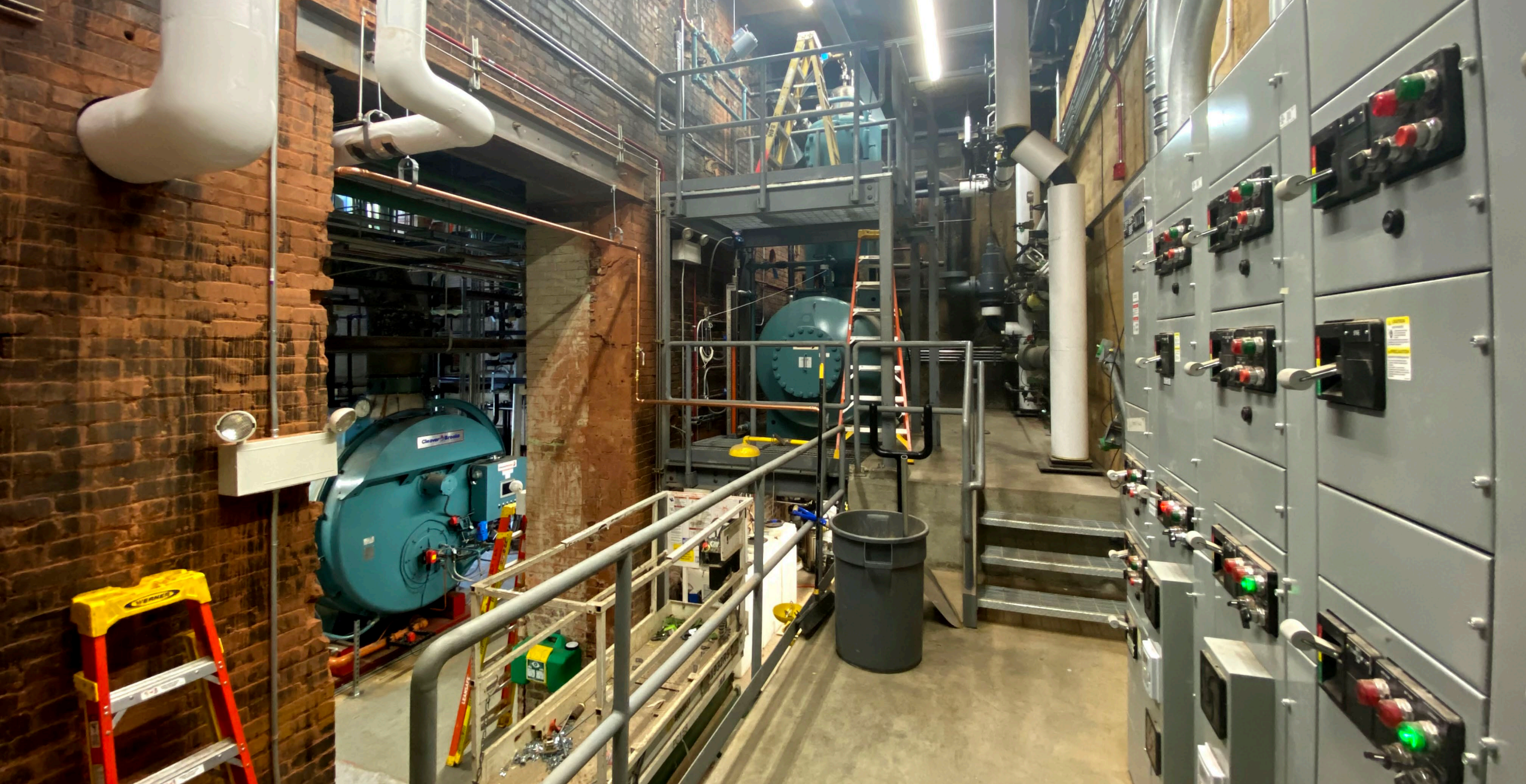


- Condition assessments
 - ~50% in need of repair/replacement
- Space limitations
- Condensate return system
 - Electric pumps
 - Series configuration
 - Reliability issues




- Replace steam & condensate piping
 - Tunnels, trench boxes, buildings, direct buried
 - Expansion joints, anchors, supports
- Condensate system
 - Convert buildings in series to parallel
 - Replace electric pumps with steam pressure powered pumps
 - Level switches & temperature transmitters connected to BAS





Lessons Learned

- 
- Challenges with integrating boiler control systems
 - Review coordination drawings with Owner & Contractor



Questions?



Wiley|Wilson®
Constant Progress

Tyler D. Morris, PE

Project Manager

434.455.3692

Michael J. Gehl, PE

Sr. Mechanical Engineer

434.947.1627

Thank You



CampusEnergy2020
THE POWER TO CHANGE
FEBRUARY 10-14 • SHERATON DENVER DOWNTOWN • DENVER, CO

**Redesign of
Virginia Military Institute Central Heat Plant**