Drone Inspections of Air Cooled Condensers

ACC Users Group 2026

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Principal Technical Leader EPRI Program 223 Heat Rate and Flexibility

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Air Cooled Condenser Overview

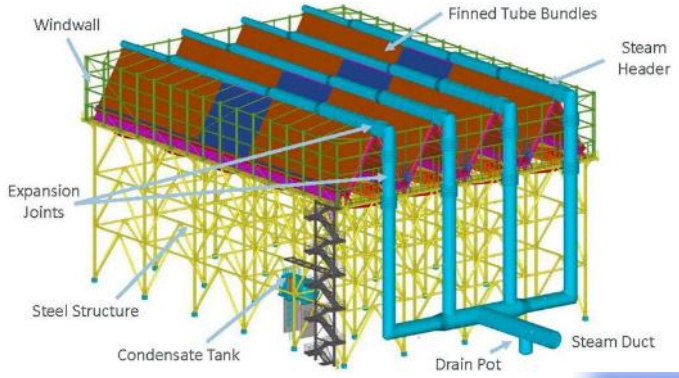
The steam exits the steam turbine into a duct that exhausts out to the air cooled condenser. At the air-cooled condenser this duct splits and rises up on top of the air cooled condenser and down a single duct that is referred to as a street. The streets have two heat transfer surfaces that exhaust down from them to the condensate header at the bottom. A middle section of each street contains the air removal section of the air cooled condenser. This is called the dephlegmator section. This section separates out the non-condensable gases, commonly referred to as air. These gases are pulled out by the steam jet air ejectors (SJAE) or Vacuum pumps.

Generic/typical Air Cooled Condenser Design

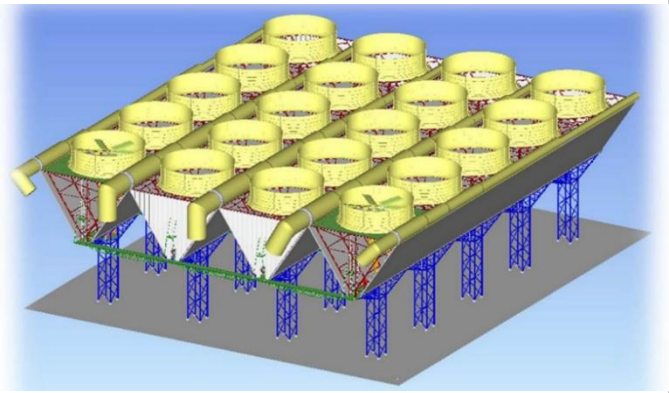
Not easily accessible

The photos at right show some of the difficulties accessing the upper steam duct or street, where all of the tubes connect into on a A style air cooled condenser.

Below are diagrams of A-type and Inverted A frame style ACC's



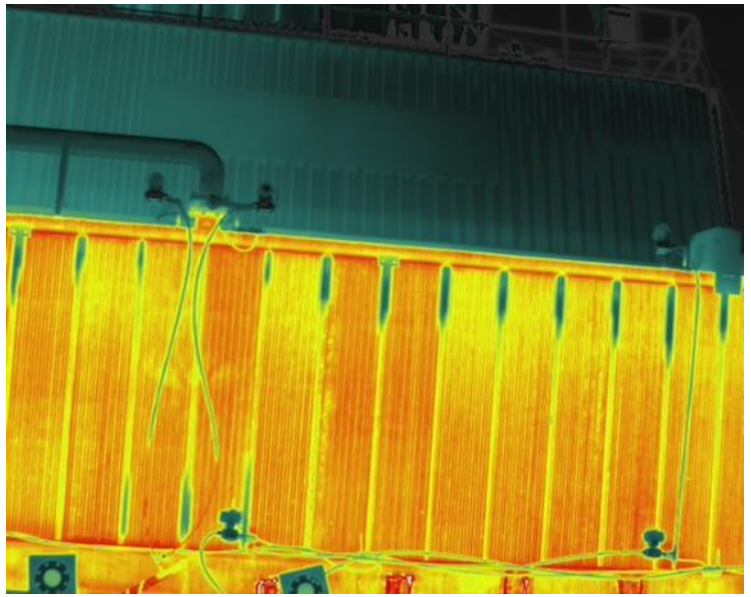
A-Type ACC

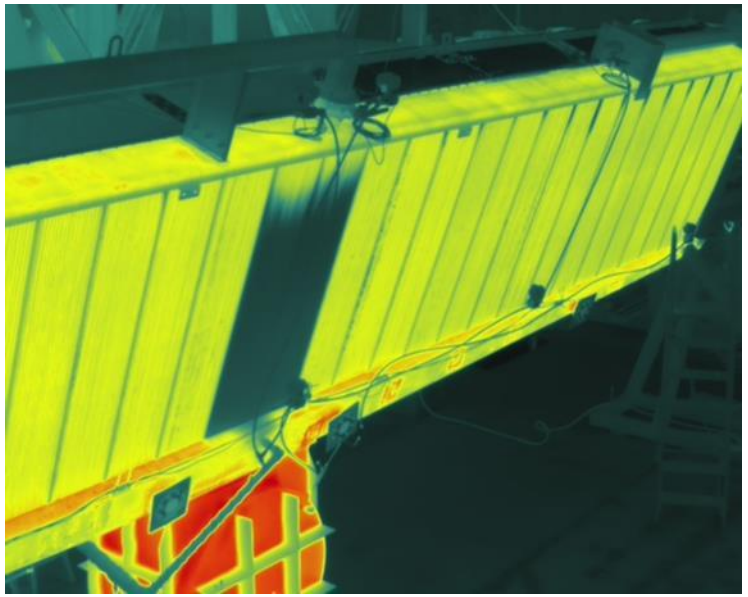


Inverted A-Type ACC

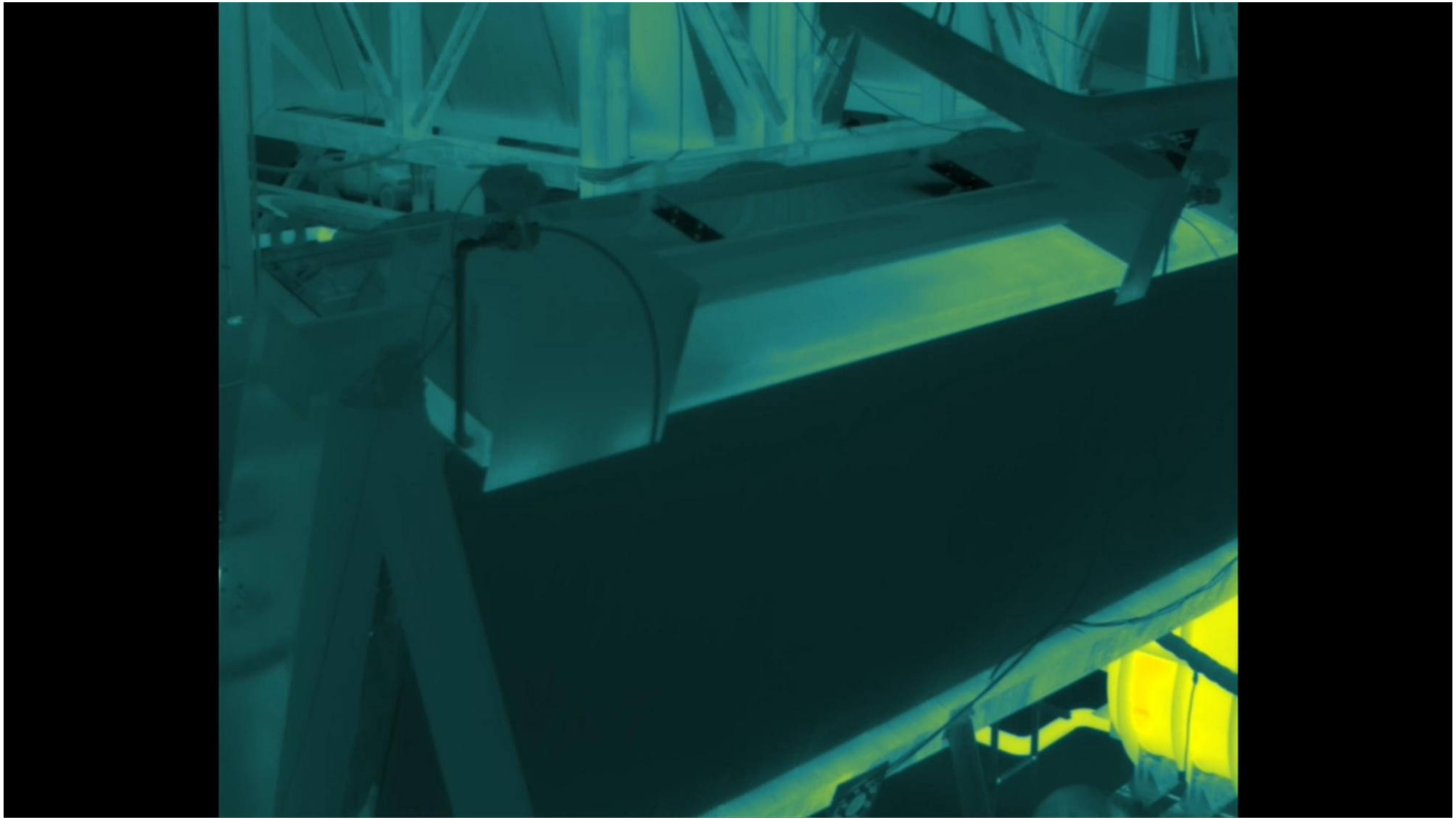
Calibration Runs

Prior to visiting a plant, we conducted what we referred to as calibration runs at the Evapco Test labs in Taneytown, Maryland. We ran the same drone, tested camera resolution and distances and tested air in-leakage with intentional air in-leakage. We thank Evapco for and their Advanced Technology laboratory for their support.





Calibration Run Video



Air in-leakage Challenge

Leak detection has been expressed as an interest of EPRI members. Based on our experiences at plants and our experience at Evapco's test laboratory, we cannot say that infrared inspections provide definitive leak detection services.

Acoustic Camera Potential

EPRI is developing a test methodology to utilize acoustic cameras mounted on a drone to inspect air cooled condensers. This methodology has been discussed with multiple members of EPRI who have experienced success with handheld acoustic cameras. Mounting the acoustic camera on a drone is new as far as we are aware. EPRI is continuing to develop this technology and hopes to apply it to multiple applications once it has been proven for air-cooled condenser air in-leakage detection.

EPRI Acoustic Drone Testing 2026

Air Cooled Condenser Assessment

Project Objective and Scope

Objectives and Scope

- Review the ACC with onsite visit
  - compare with industry equipment and practices
  - internal steam side inspection if requested
  - IR heat distribution inspection via drone if requested
- Provide report advising improvement opportunities

Key Developments and Updates

Value:

- Ensure equipment is suitable and activities are industry best-practices
  - Describe and advise improvements where feasible
- Discuss performance improvement opportunities

Air-Cooled Condensers have inherent performance deficiencies and operating optimally will minimize the effects on plant efficiency

Schedule and Upcoming Work

Details and Contact

Cost depends on specifics of plant location and scope of work requested.

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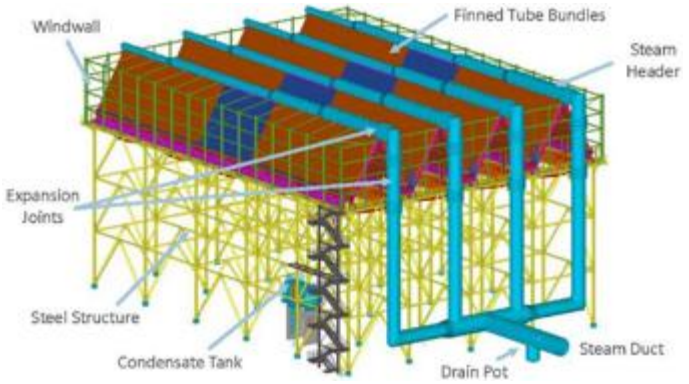
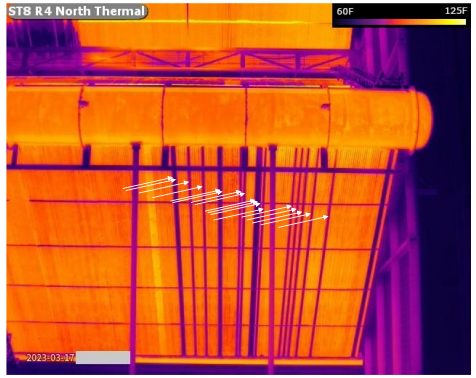
SPN Number: 3002017422

Drone Inspection Methodology for ACC Inspections



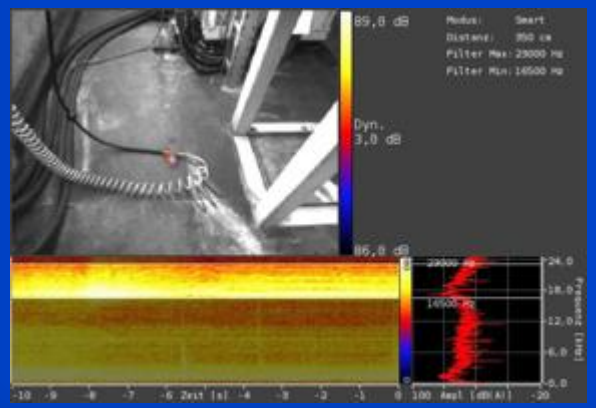
A-Type ACC

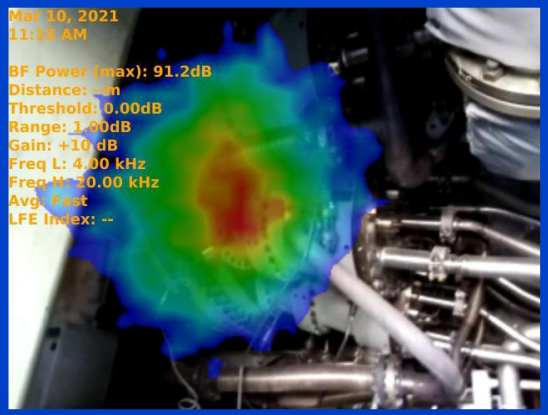


What's Next?

Acoustic Leak Detection from a flying drone:

- Preliminary feedback has been positive for detecting leaks of human detectible frequencies and above human detectible frequencies.
- Acquiring potential sensor now, will design mount for it and physically test it and fly with it. Then will need a plant to test it at.
- Technology can be further developed for applications on robots, specifically for conventional condensers.
- Additionally, drone mounted, and robot mounted may also be applicable for HRSG leak detection. Will be especially useful in areas under the HRSG that are risky to humans.





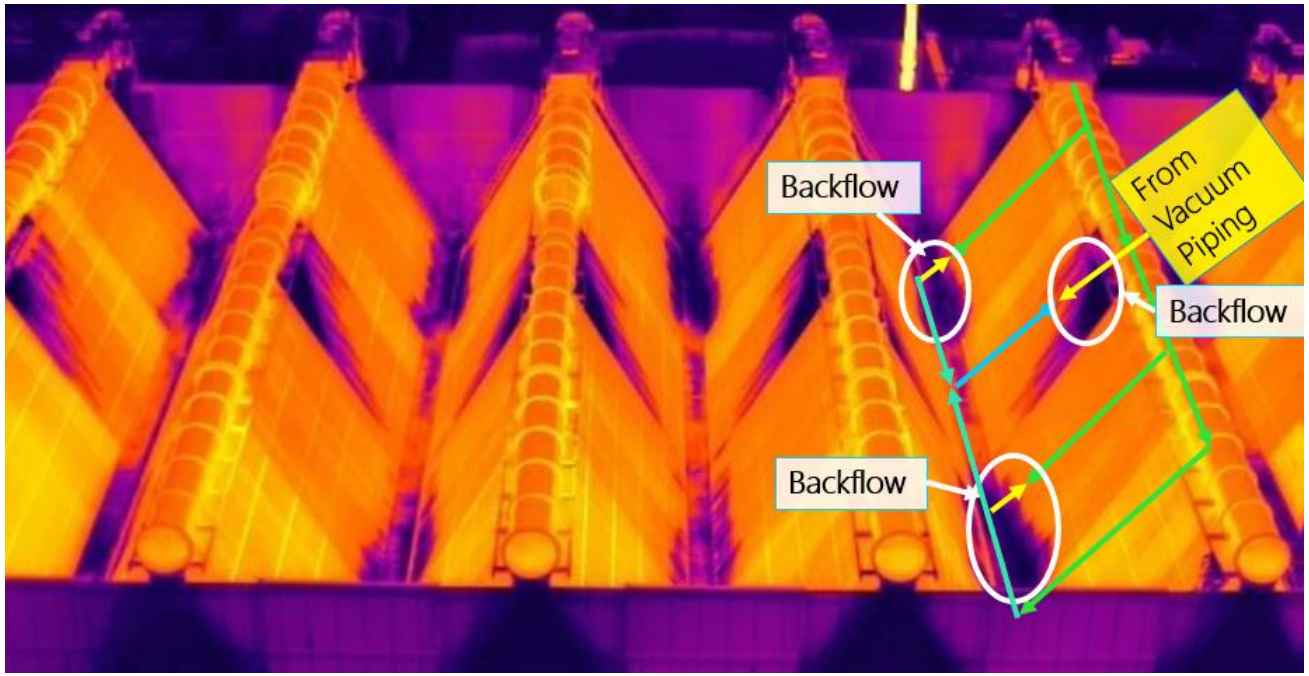
Airspace Issues

- The plant below is located 1300 feet from an airport Glidepath
- This plant is also within New York City Jurisdiction for the FAA, FBI, CIA, ATF, etc.
  - Probably the most difficult place to fly in America
  - Fortunately the plant had a FAA permit that we were able to fly under
  - Once we had the permit, the drones were registered, and we were properly permitted, if a dignitary decided to visit NYC, we would not be allowed to fly.

Identifying Non-Condensable Gas Pockets

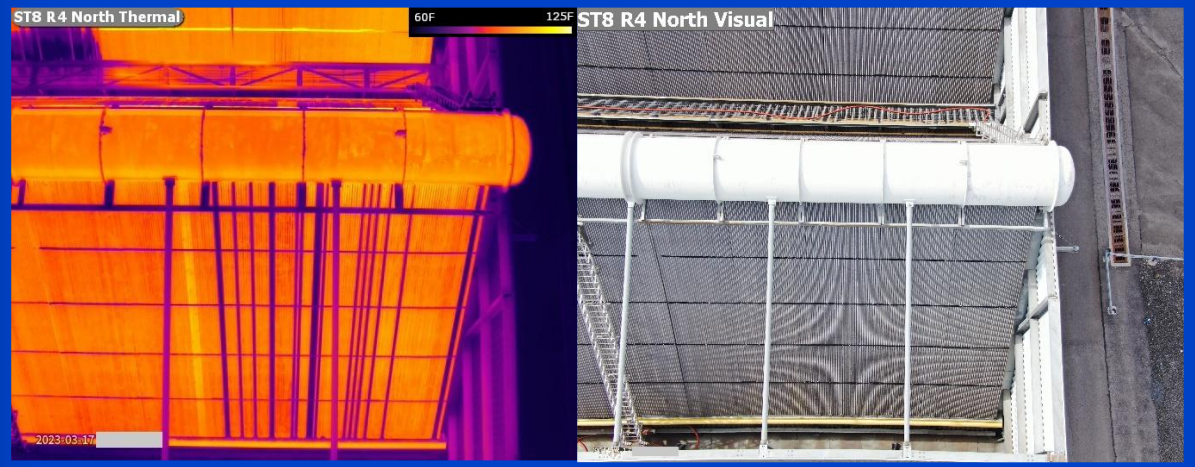
Items to consider

- IR cameras are influenced by emissivity
  - If the material is coated or corrodes, emissivity changes
- It is recommended that one walkdown the identified areas immediately upon conclusion of the inspection before conditions or configuration change in the ACC.
- In addition to air blanketed tubes, some changes in temperature are due to air leakage around and through the bundle. More to show in later slides.

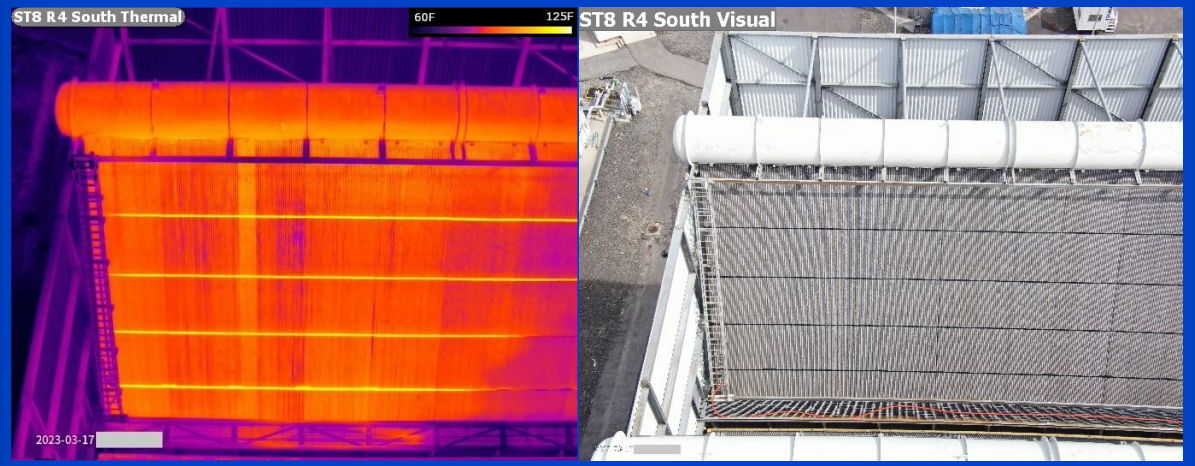


Problems identified

Street 8
Row 4 North



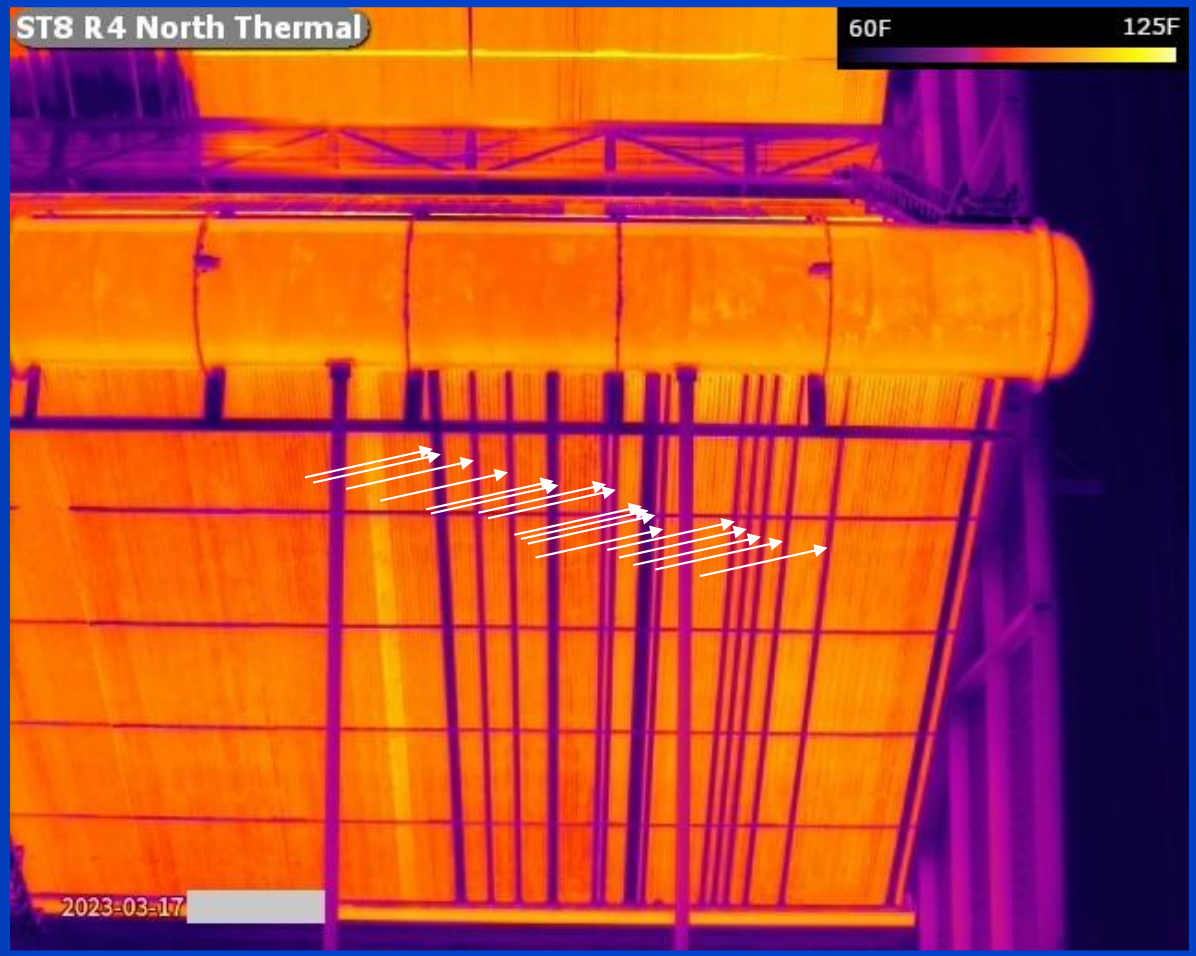
Street 8
Row 4 South



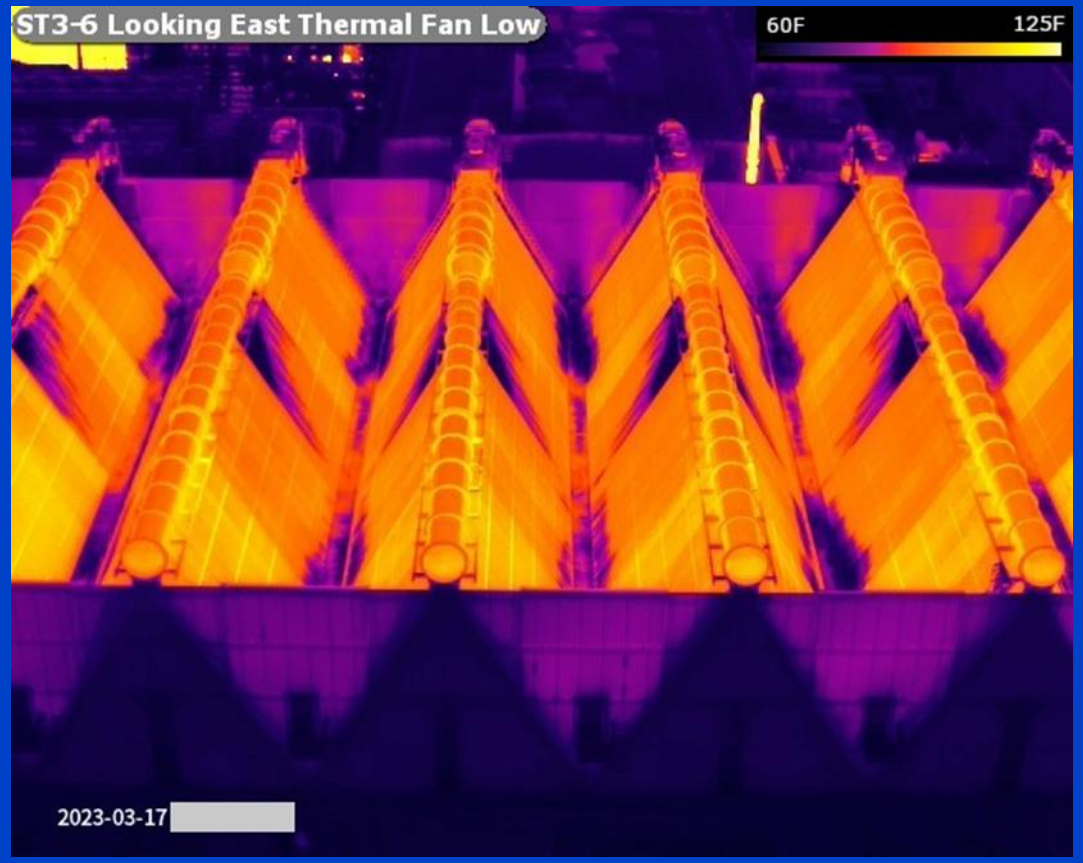
- The North Row is a separate heat exchanger from the South side, even though they are supplied with steam from the same Street, so they are distinct pieces of equipment.

Street 8 Row 4 North Detail

- The North side clearly has tubes that are cold, which means they are likely not full of condensing steam. Therefore, they are either air blanketed or are plugged as denoted by the white arrows in the image on the right. This reduces the capacity of the air-cooled condenser, and will increase condenser backpressure, decreasing steam turbine performance. Plugged tubes and the specific locations were confirmed on an internal inspection and the numbers of the plugs aligned with this image.

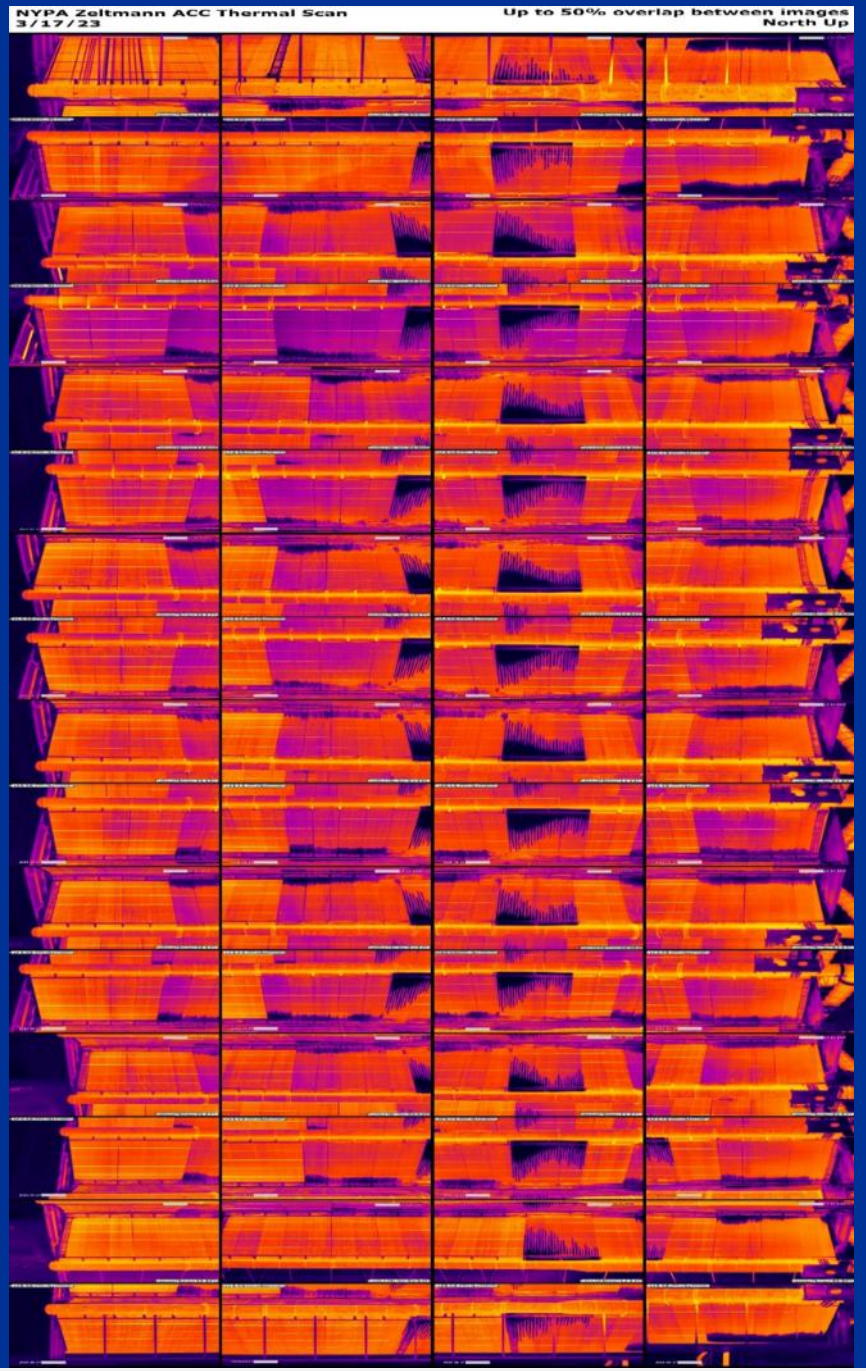


General Image

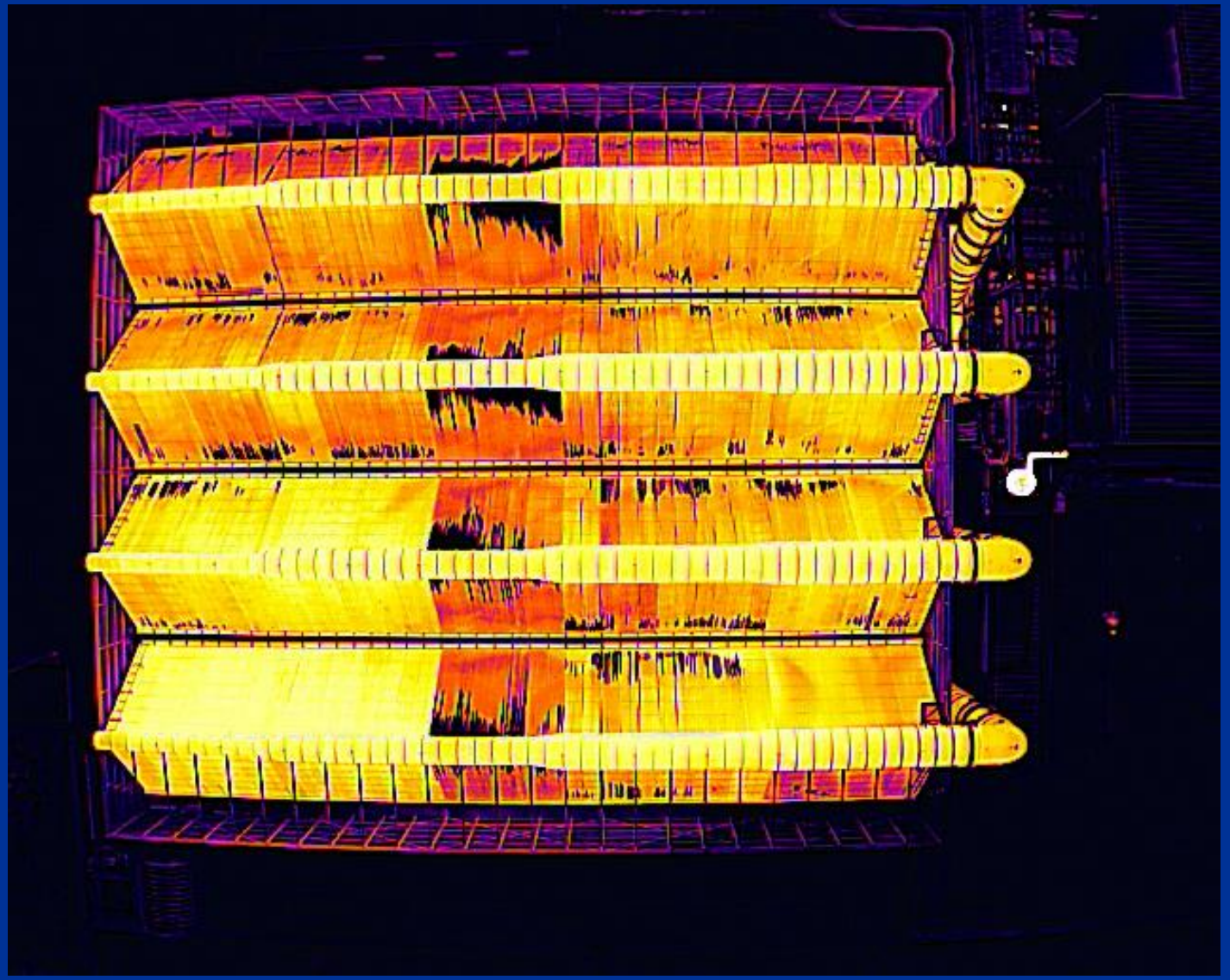


- This image shows multiple streets in their entirety from further away.

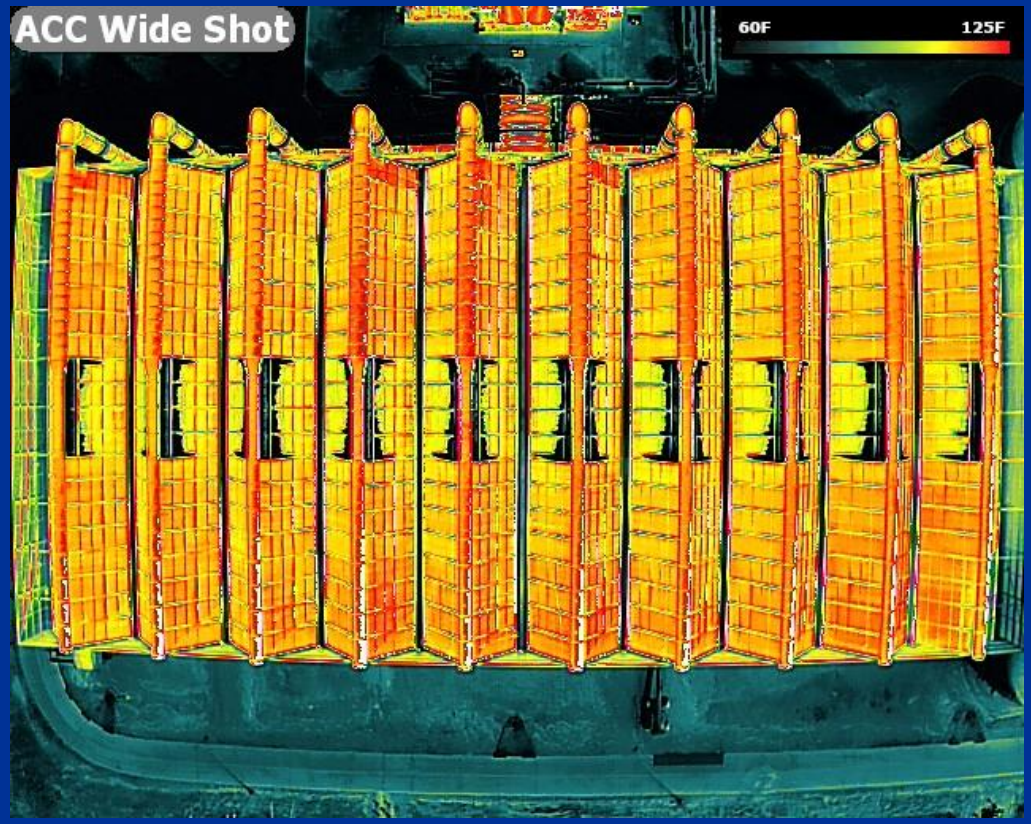
IR Images of entire ACC stitched together



Top Down IR Drone photo of an ACC

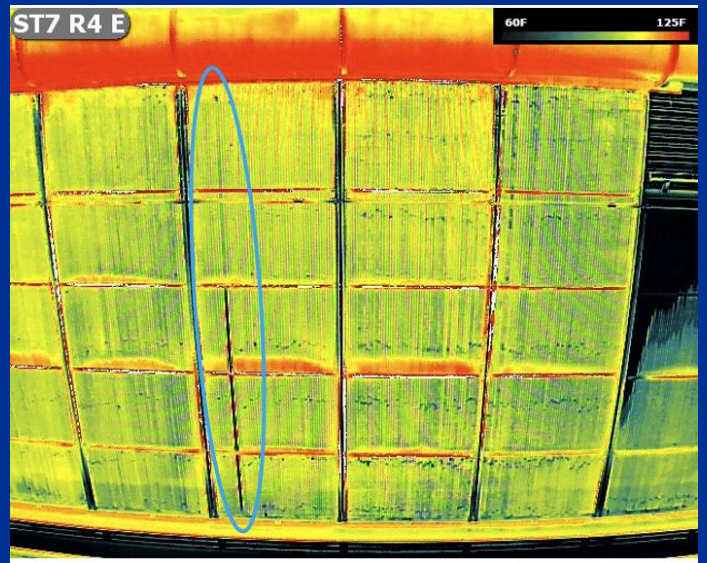


Top Down IR Drone Photo of an ACC



Cold Tube

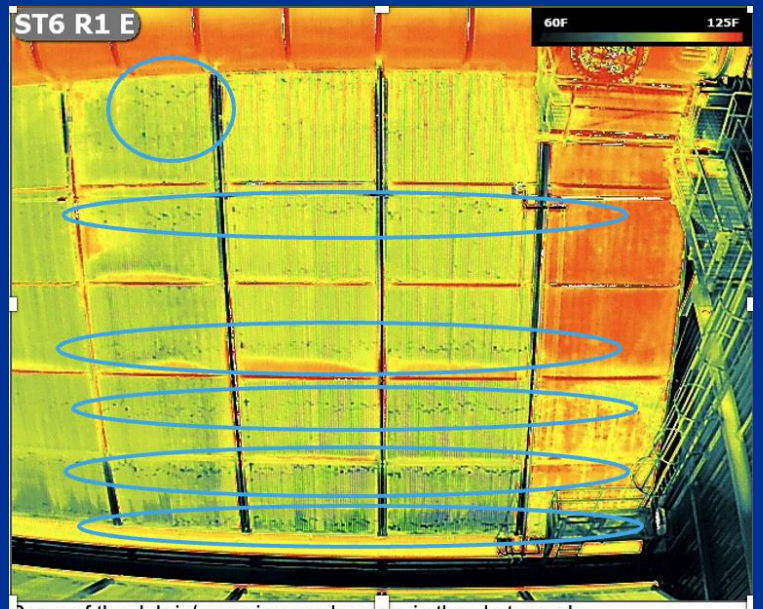
Tube was cold in person, further investigation will be required to see if tube is plugged or what the problem is.



The photograph image looks normal

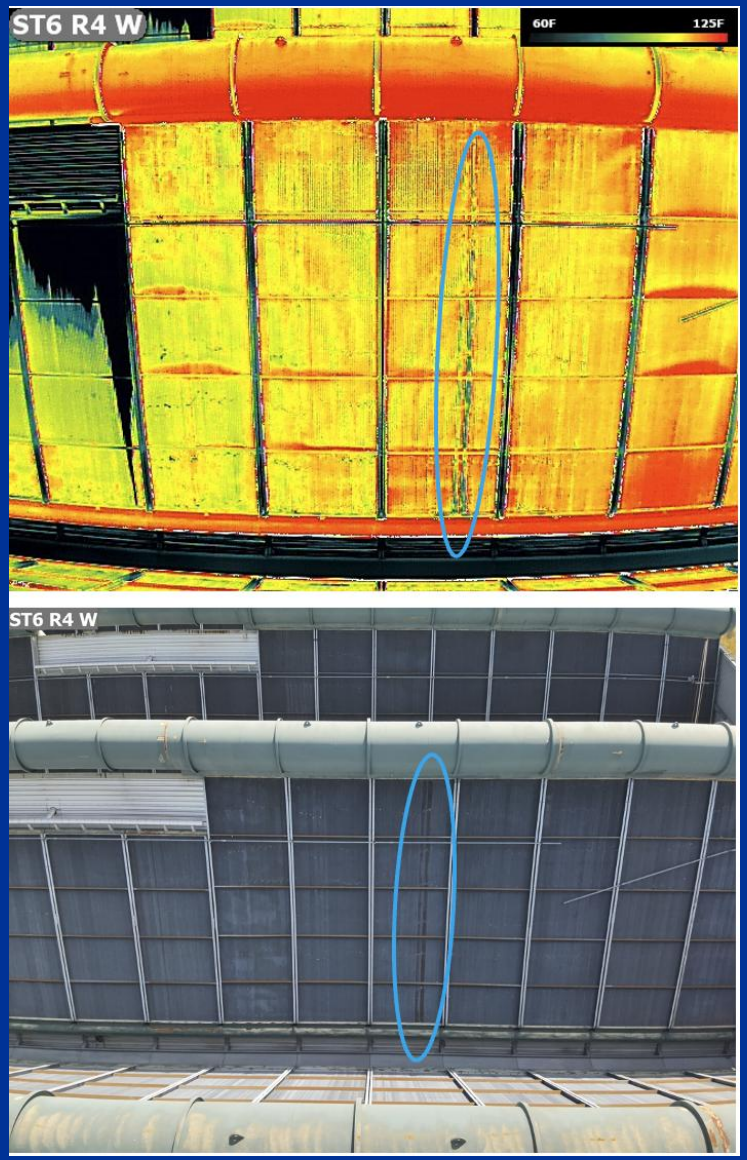
Freezing Damage

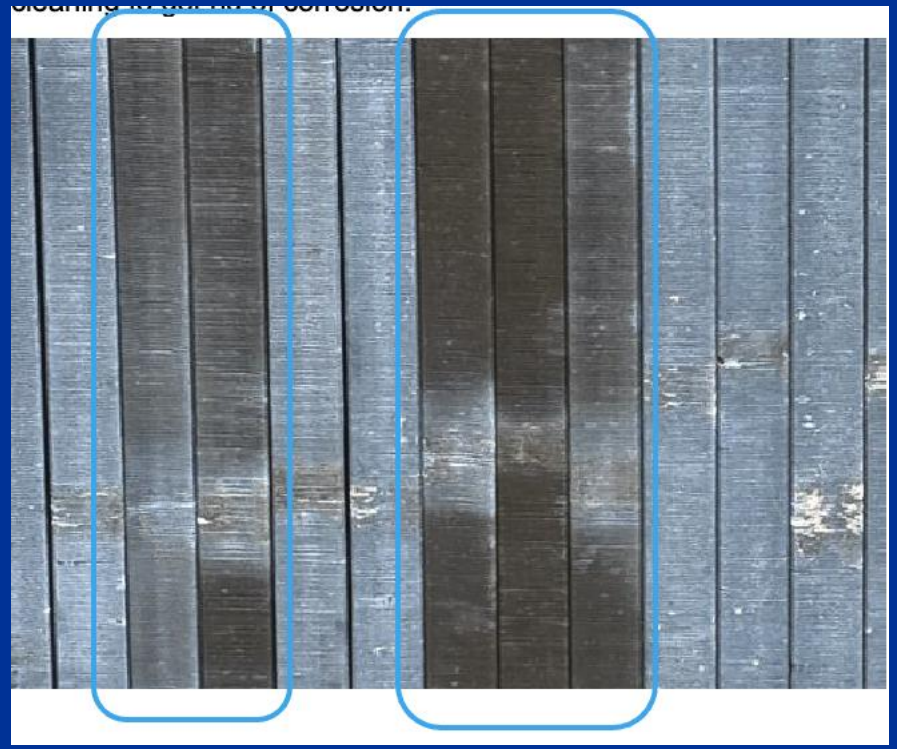
Cleaning Recommended



Some of the debris/corrosion can be seen in the photograph:

Cleaning Needed





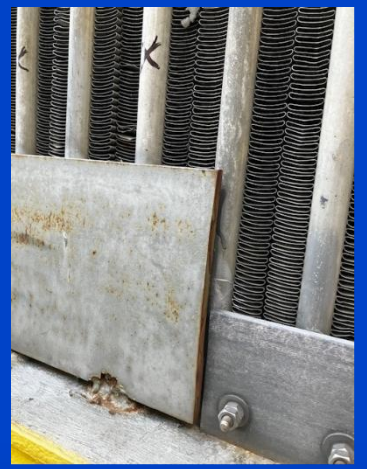
Cleaning recommended to get rid of corrosion, tubes were not cold in person.

Tube Coating Failure

- Not an IR Drone image, but of interest nonetheless.

Follow-on

- Multiple tubes identified as cold in where we saw them with the drone, confirming drone IR inspection results. The drone results allowed the plant to focus on this section.
- Some may be plugged. Inspection, verification, and possibly repair may occur in the upcoming outage.



Internal Riser Inspections

- Who does internal riser inspections?
  - How often do you do them?
  - How do you do them?
- Caged Drone Inspections
  - Video if it works at ACCUG…hopefully.

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