PROMETHEUS GROUP 17TH ANNUAL | USER CONFERENCE NORTH AMERICA

Next Generation Manufacturing Using Smart Data Analytics

April 23, 2024

LSB INDUSTRIES

Data Analytics Monitoring: Purpose

Enable resources to proactively take action upon real time information and insights to the plant's processes while continuously improving plant uptime and capacity.

- Protect What Matters
  - Looking across all areas all the time by utilizing a variety of models to identify changes in process and equipment health.
- Make It Better
  - Focus on identifying emerging issues, days, weeks or months in advance.
- Be One Team
  - Knowledge sharing and collaboration between LSB resources.
- Practice Integrity
  - Being humble in our conversations when talking about new potential issues.

Data Analytics Monitoring: Roadmap

Data Historian Infrastructure

- Build out data historian capabilities
- Organize Data in PI-AF to make easily available
- Aggregate all “Stranded Data” IE: PLC, Op Rounds Into PI
- Strategically add instruments for data resolution
- Optimize reporting and ops metrics
- Build out Screens (KPI’s)

Data Analytics (M&D)

- Build out APR models to prevent failures
- Integrate new information into our workflow, planning, maint, and operations
- Review “Top 25” Items in all areas at plant aggregate together and build models.
- FMEA’s (Included in Strikeforce)

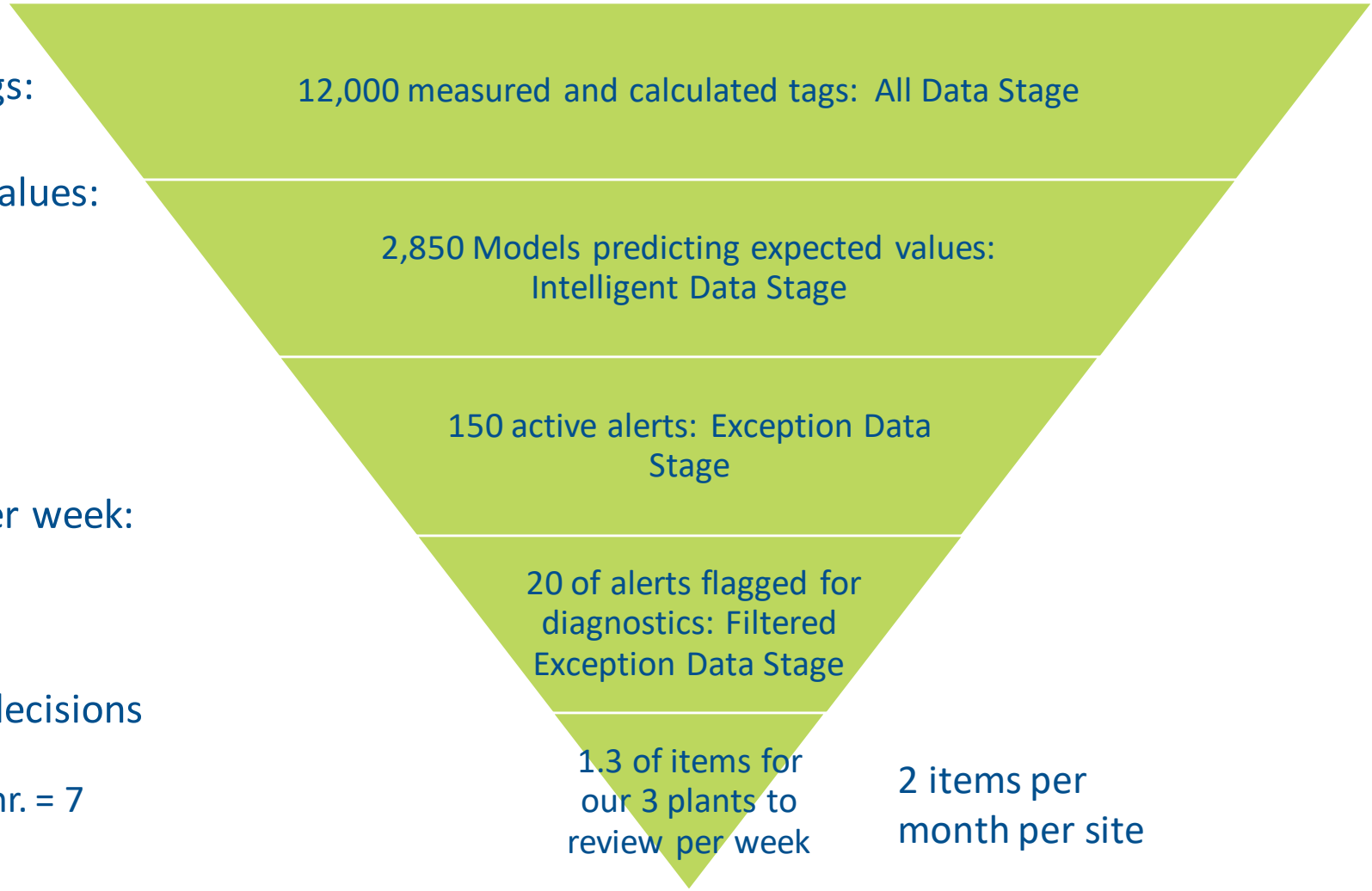
DCS/ Performance / APC

- Future state keep adding instruments to prevent failures and increase performance and output
- Develop APC controls to optimize closed loop control
- Aggregate model alerts for typical failure modes
- Build real time performance metrics and compare to actual

Data Analytics Monitoring: Why Smart Data

- 10,000's of measured and calculated tags:
  - All Data Stage
- 1,000's of Models predicting expected values:
  - Intelligent Data Stage
- 100's of active alerts:
  - Exception Data Stage
- 10's of alerts flagged for diagnostics:
  - Filtered Exception Data Stage
- 1's of items to for our plant to review per week:
  - Actionable Data Stage

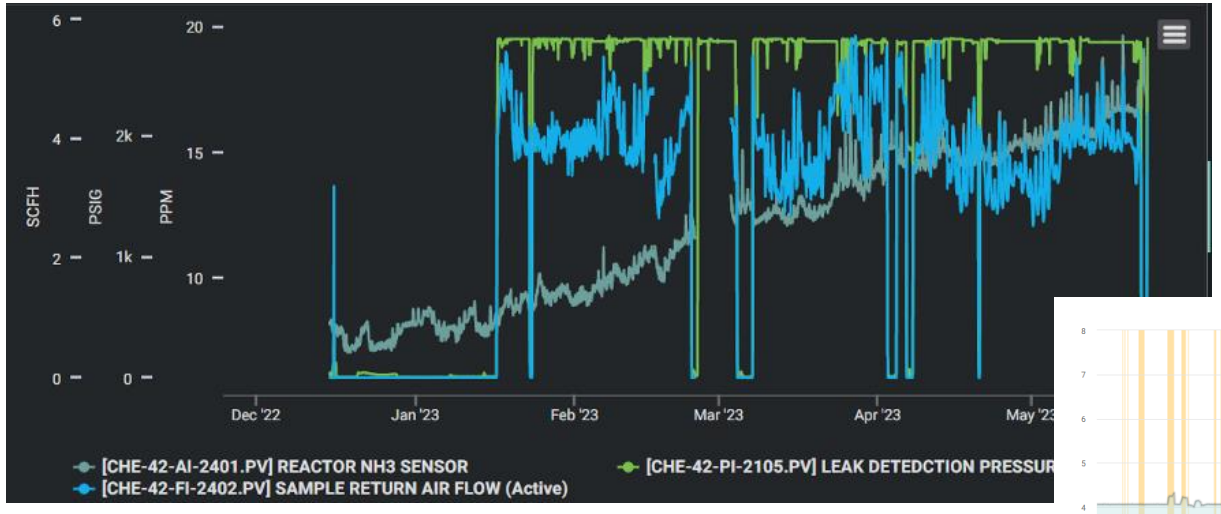
- Currently this is what we are asking our Operators / Engineers to review, make decisions on, and act on:
  - 10,000 points / Day = 416 Data points / hr. = 7 Data points / min

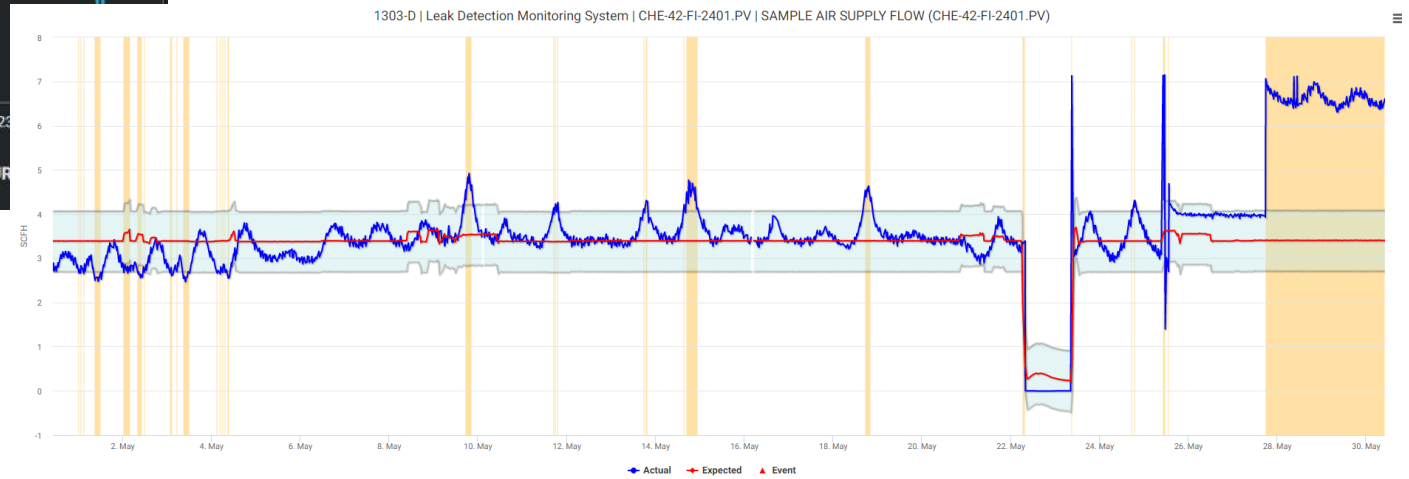


Site 3: BOP MCC Temperatures

- **Alert**: When building new models for MCC Temperatures after the Pryor finding, it was noted Cherokee had some elevated MCC Temperatures.

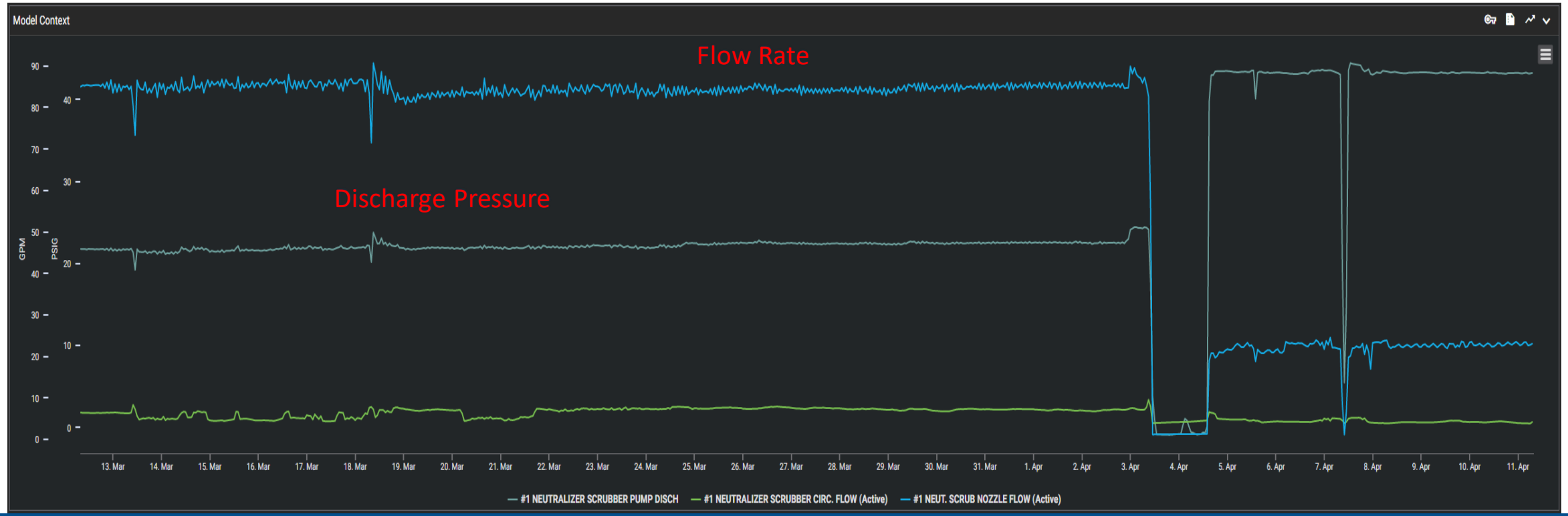
Resolution: It has been recommended to do an HVAC walkdown of the MCC temperatures to determine improvements to get below the recommended threshold of 80°F.





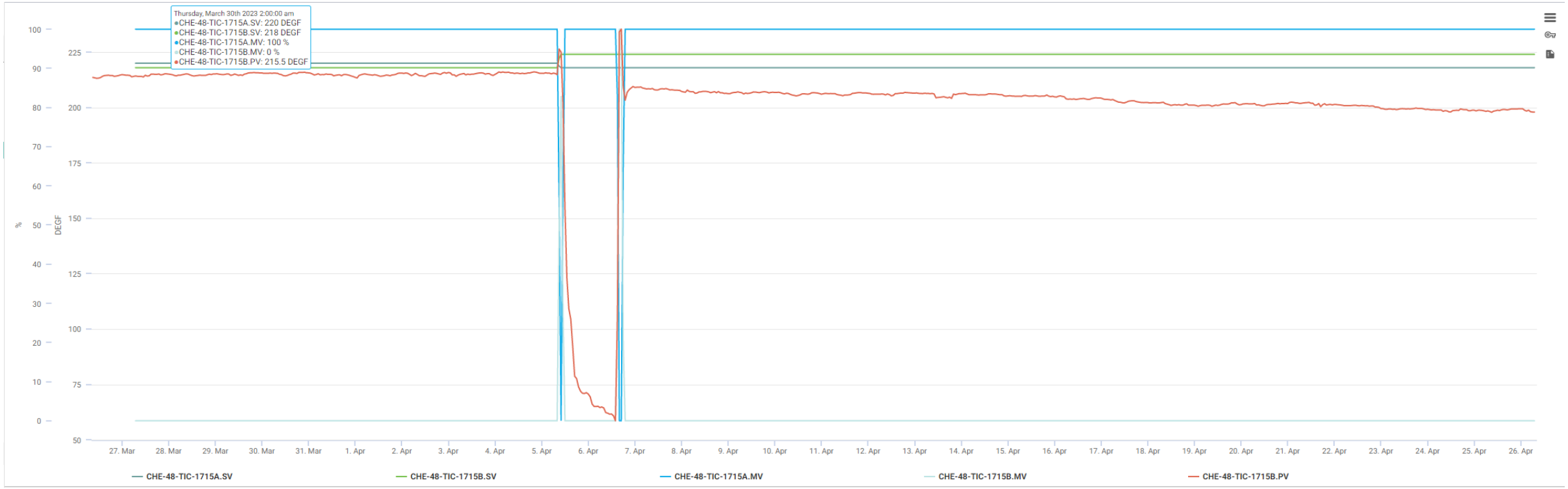
Site 3: AN Neutralizer Scrubber

- **Alert**: The scrubber pump was observed to have a reduced flow and an increased discharge pressure indicating a potential hydraulic issue.
- **Resolution:** The team was able to review the system and Identified a bad check valve that had come loose.
- **Key Notes:**
  - Though there are still several items to review, the state of this system is known, and resolution plans are in the works to return it back to normal operation



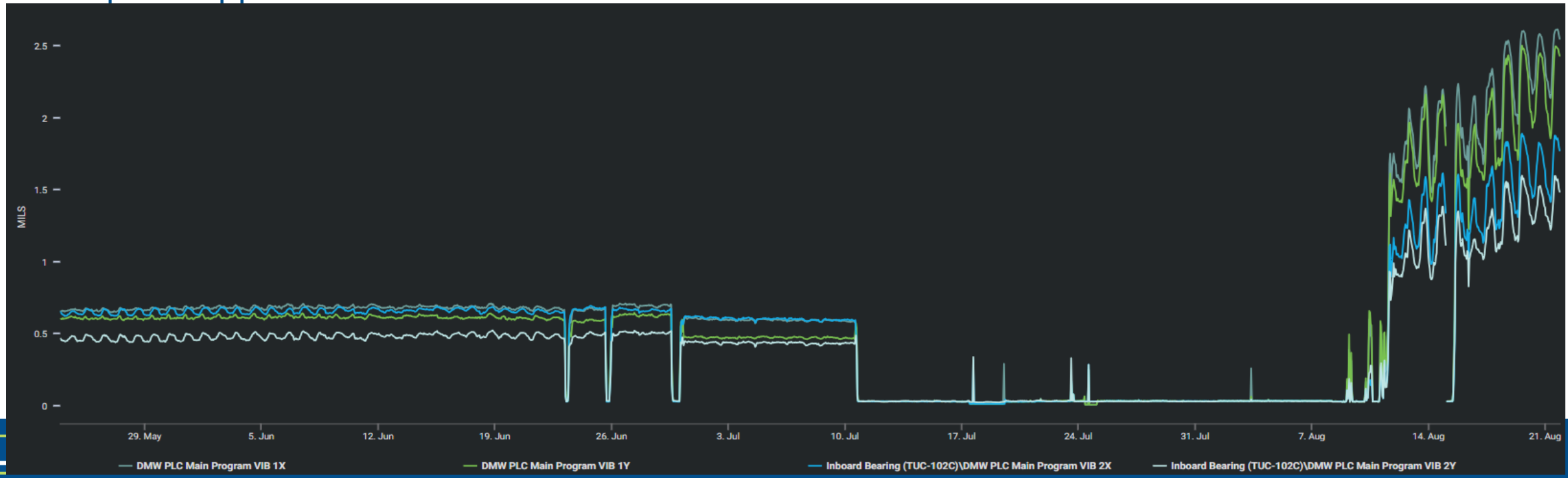
Site 3: Tank Heater

- Alert: The tank temperature for 83% was noticed to be on a consistent decreasing trend and the controller was observed to be 100%.
- Resolution: The team reviewed the system and identified that steam exchanger had a condensate return issue causing a loss of steam flow.
- Key Notes:
  - The team was able to correct an issue quickly and returned the system to a stable operation.



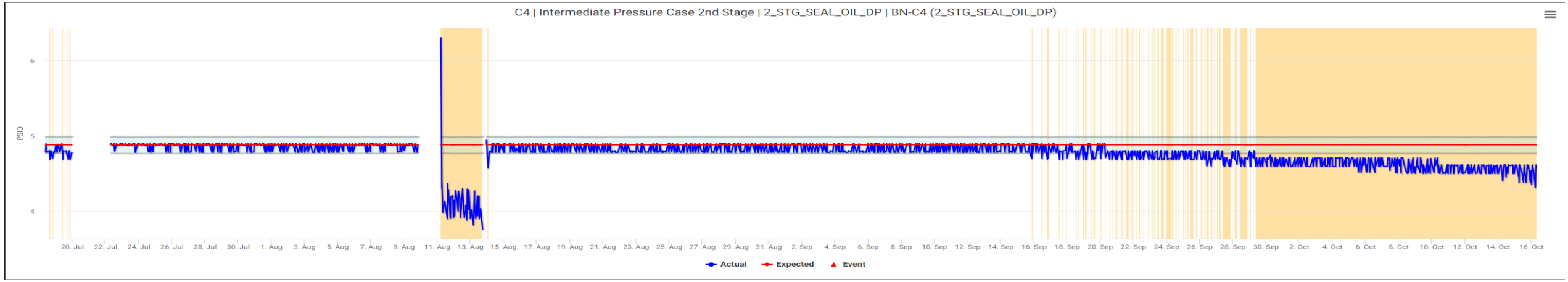
Site 1: Acid 1 – Steam Turbine Bearing Vibration

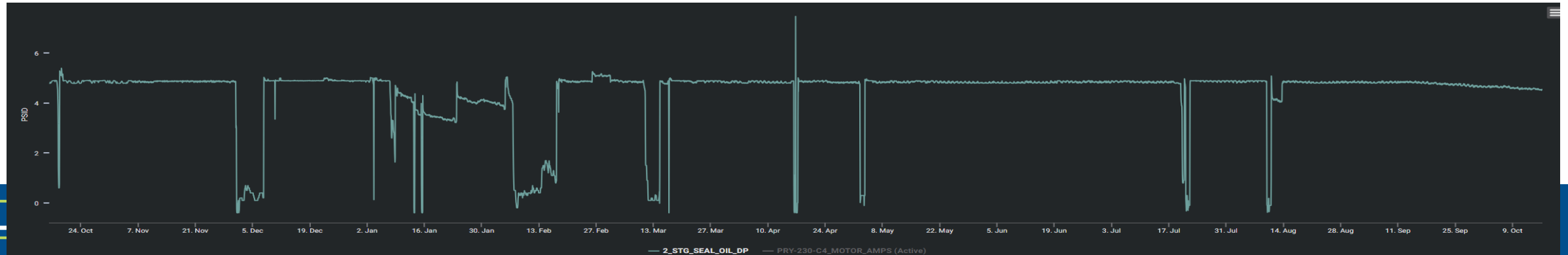
- **Alert:** Starting with the August restart of Acid 1; Bearing #1 and #2 vibrations were higher than before the outage.
- **Resolution:** Unit was shut down on August 23rd to inspect turbine and coupling. Coupling was machined during the outage and reinstalled.
- **Key Notes:**
  - Cause map indicated that when the coupling was installed in 2020 alignment growth was set up the opposite of how it should have been.



Site 2: NH3 C-4 2nd Stage Seal Oil dP

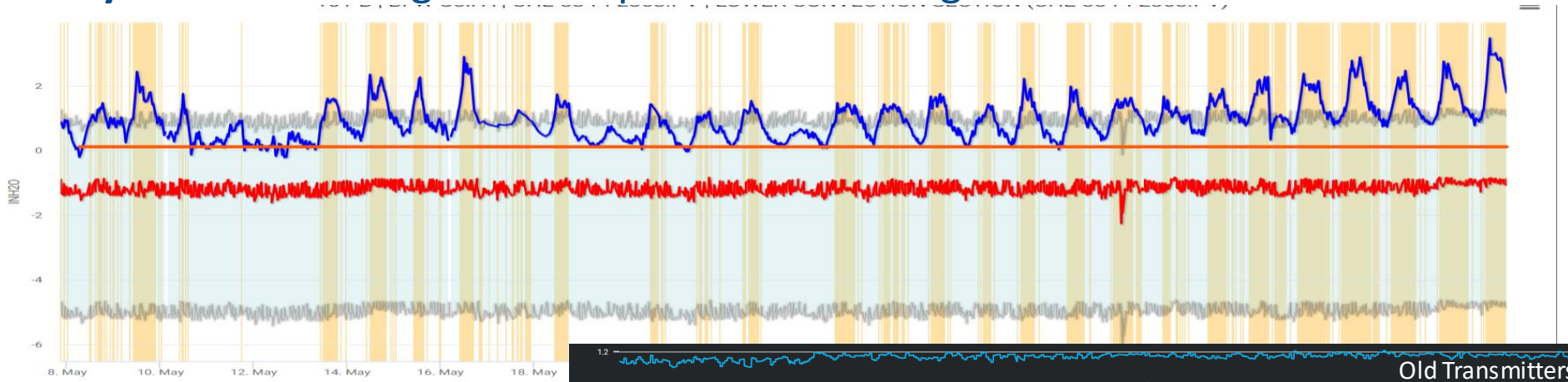
- **Alert**: Early October the Seal Oil dP started to decline at a slow rate.
- **Resolution:** This issue is still being investigated, but there was quick action by the team to review the system and assess the risk. It is speculated that the Lube oil temperature is the cause and the temperature indication is being repaired.
- **Key Notes**: The design dP of the system is 5 psid.

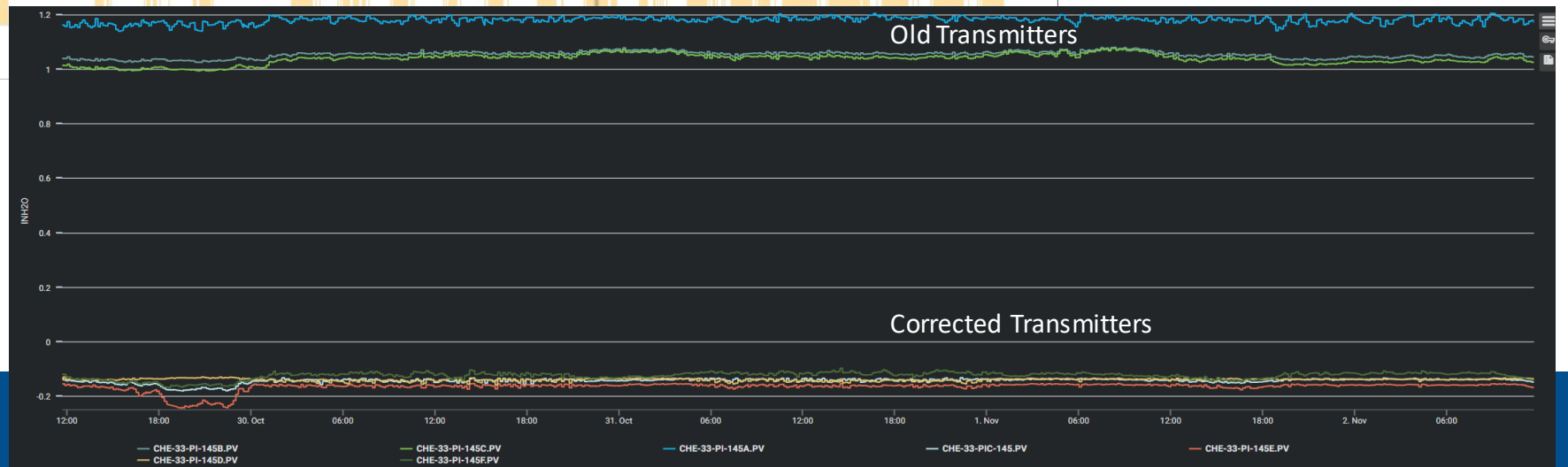


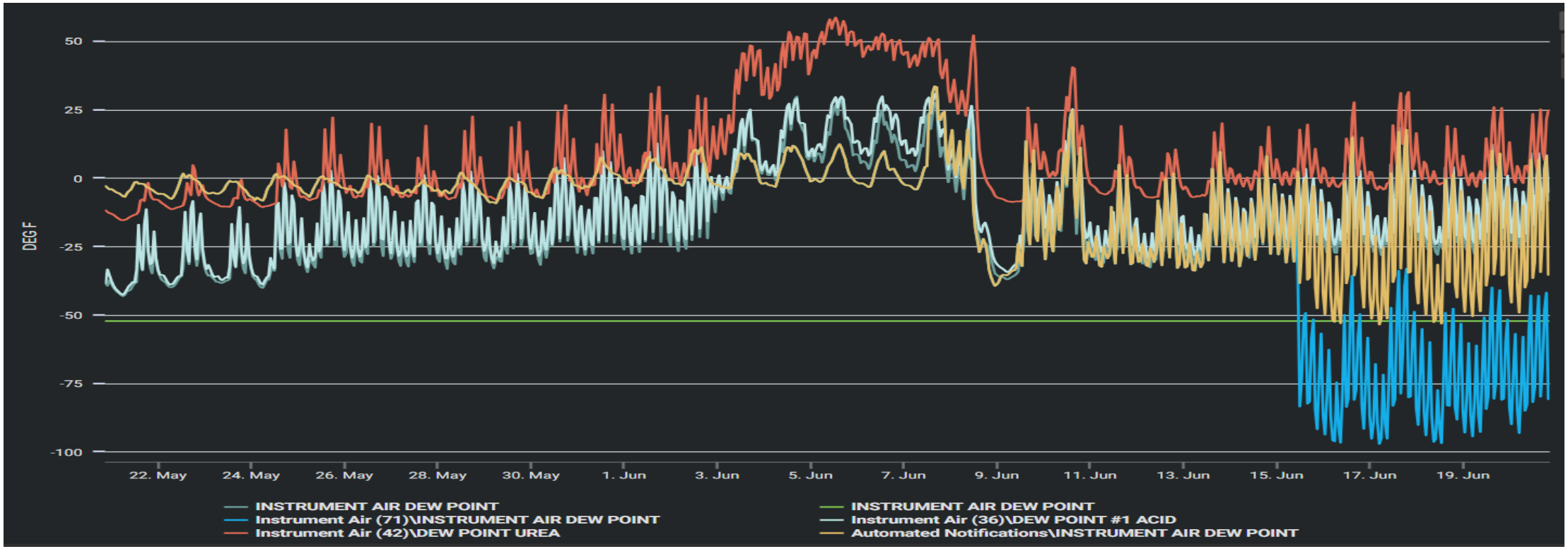


Site 3: NH3 Reformer Draft Instrumentation

- **Alert**: In June 2023, it was identified that the heater draft indications were often reading positive.
- **Resolution**: The instruments were moved so that they were above the taps and stopped collecting moisture. The team will be working to remove the no longer used transmitters.
- **Key Note**: This is a good example of overcoming normalization deviation.





Site 3: BOP Instrument Air Dew Points

- **Alert**: It was discovered in June that the instrument air system had dew points at times > 0 degF
- **Resolution**: The systems were walked down and drained knock outs, and kick off of a larger project for overall system performance.
- **Key Notes**: This is an ongoing issue and is currently at a step of getting an engineering review.