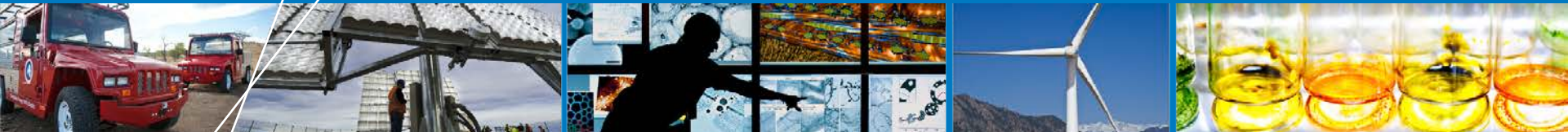


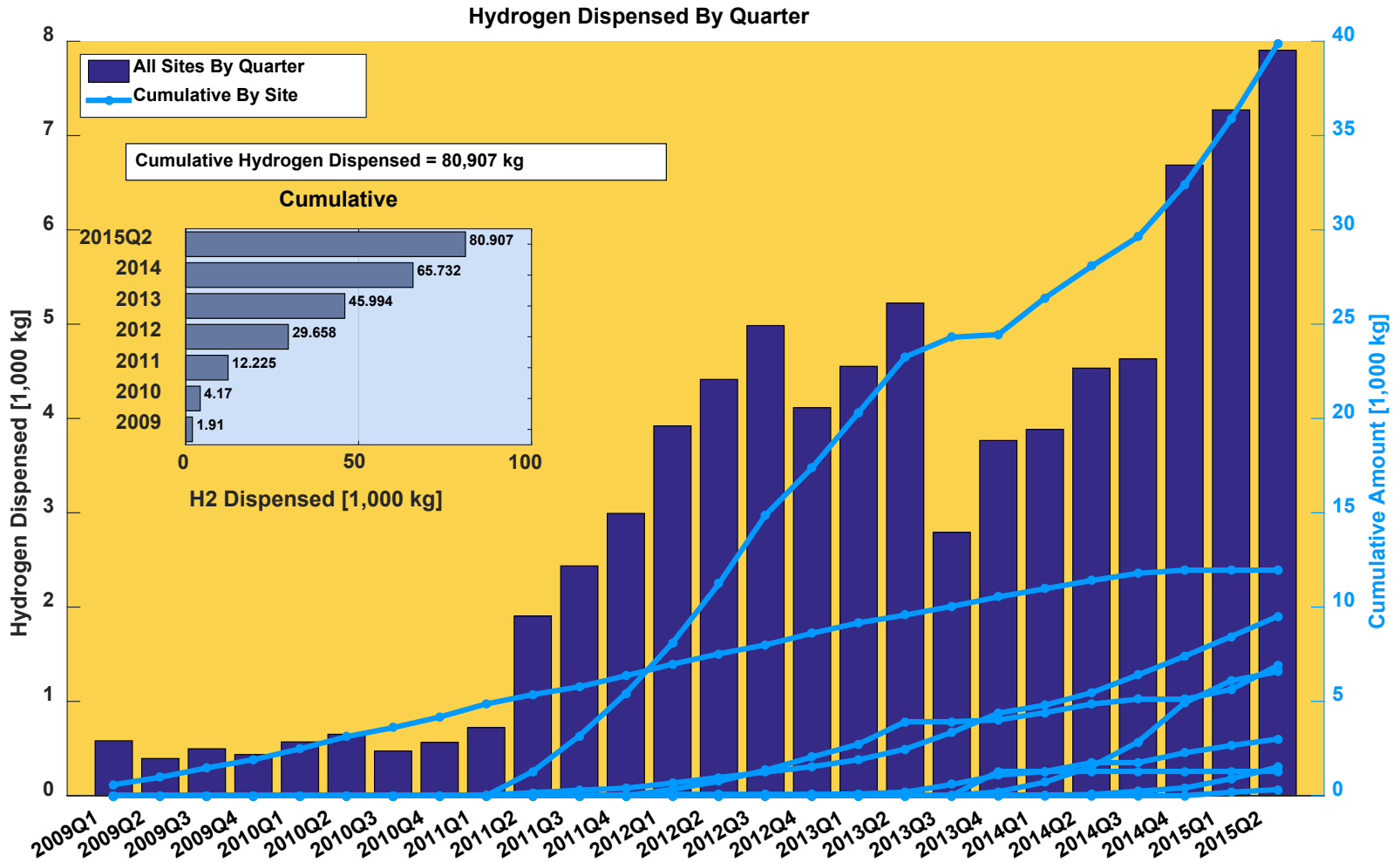
Next Generation Hydrogen Station Composite Data Products Data through Quarter 2 of 2015



**Sam Sprik, Jennifer Kurtz, Chris
Ainscough, Genevieve Saur, Mike
Peters, and Matthew Jeffers**

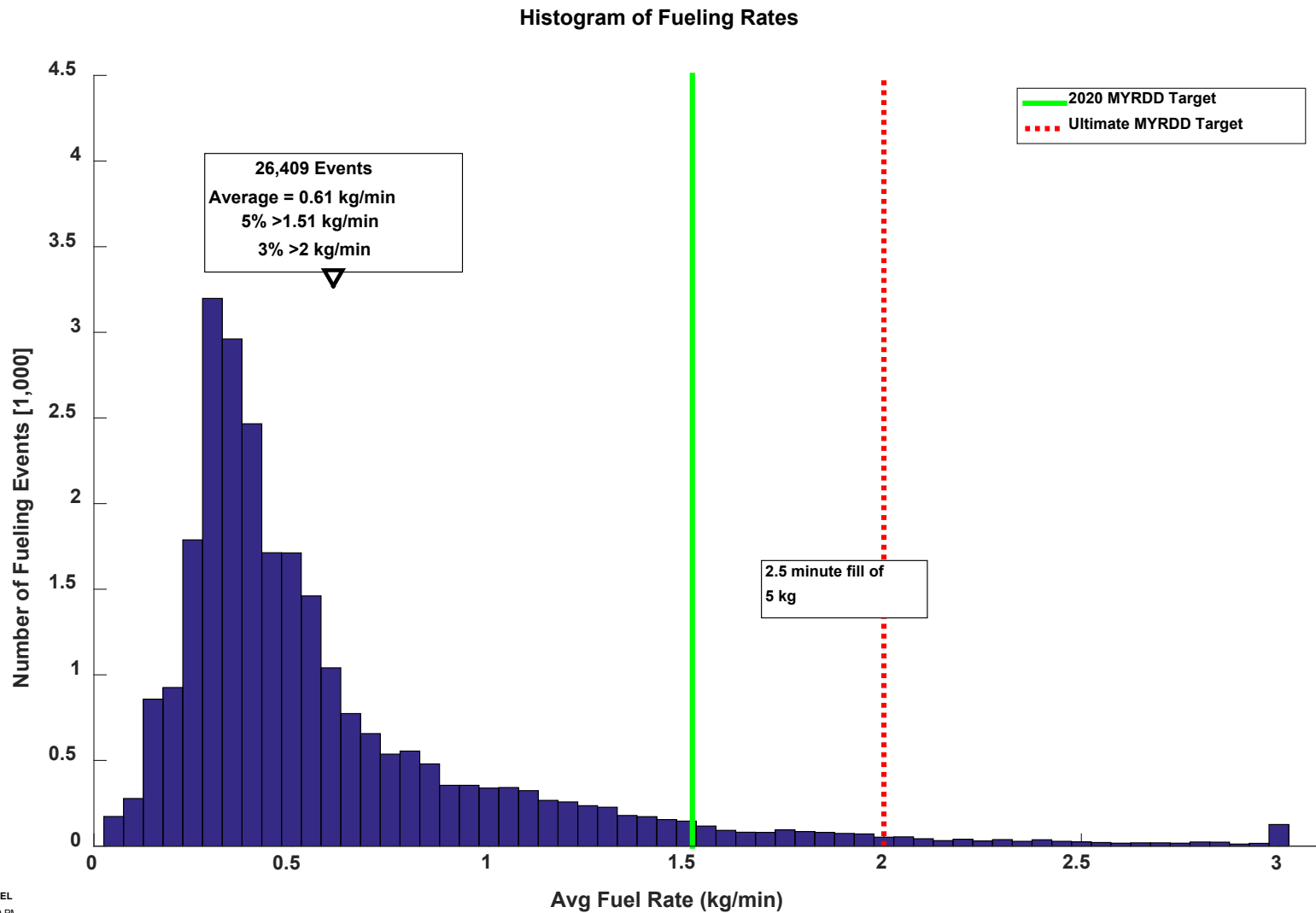
November 2015

Hydrogen Dispensed by Quarter

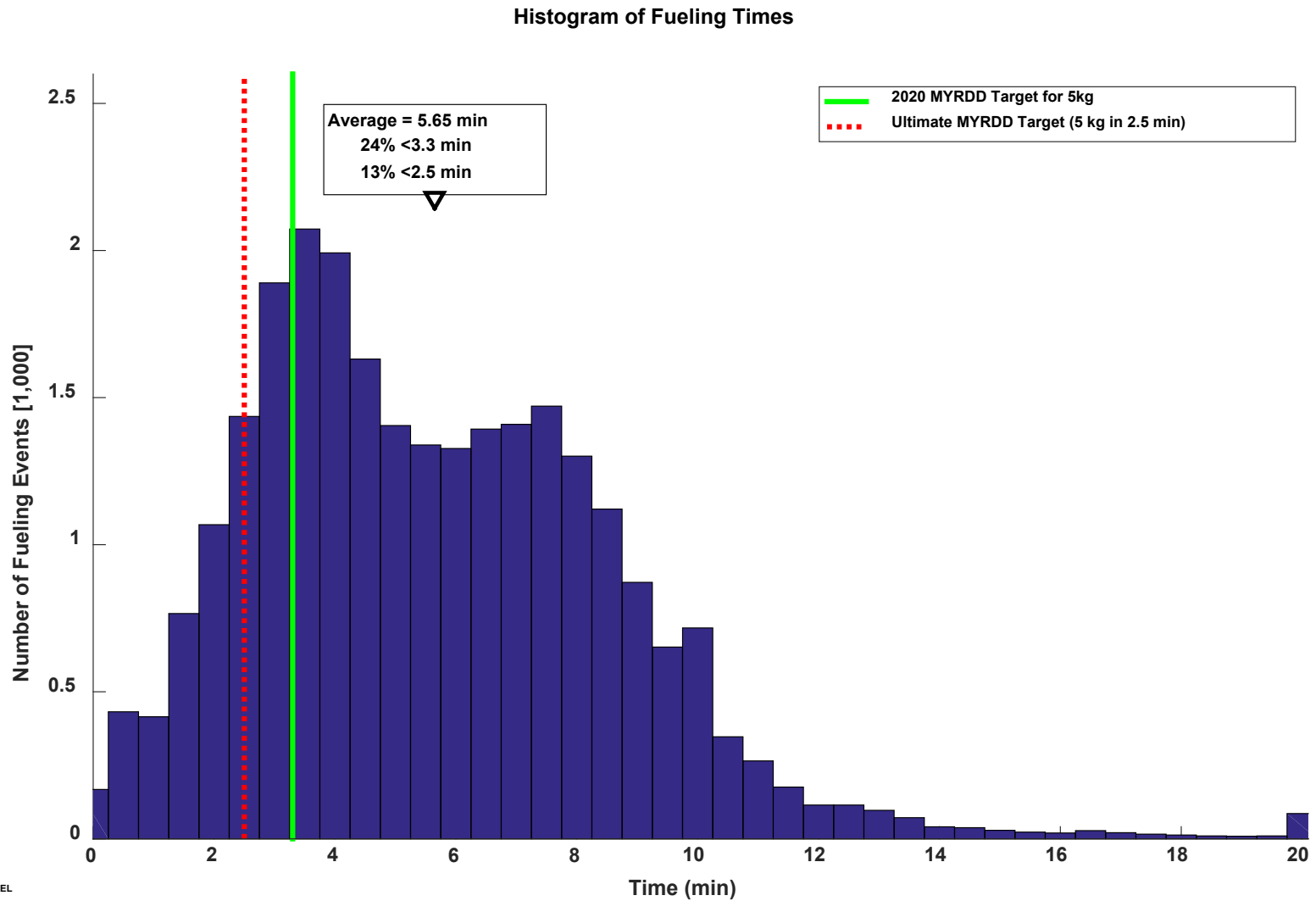


Created: Oct-19-15 4:00 PM

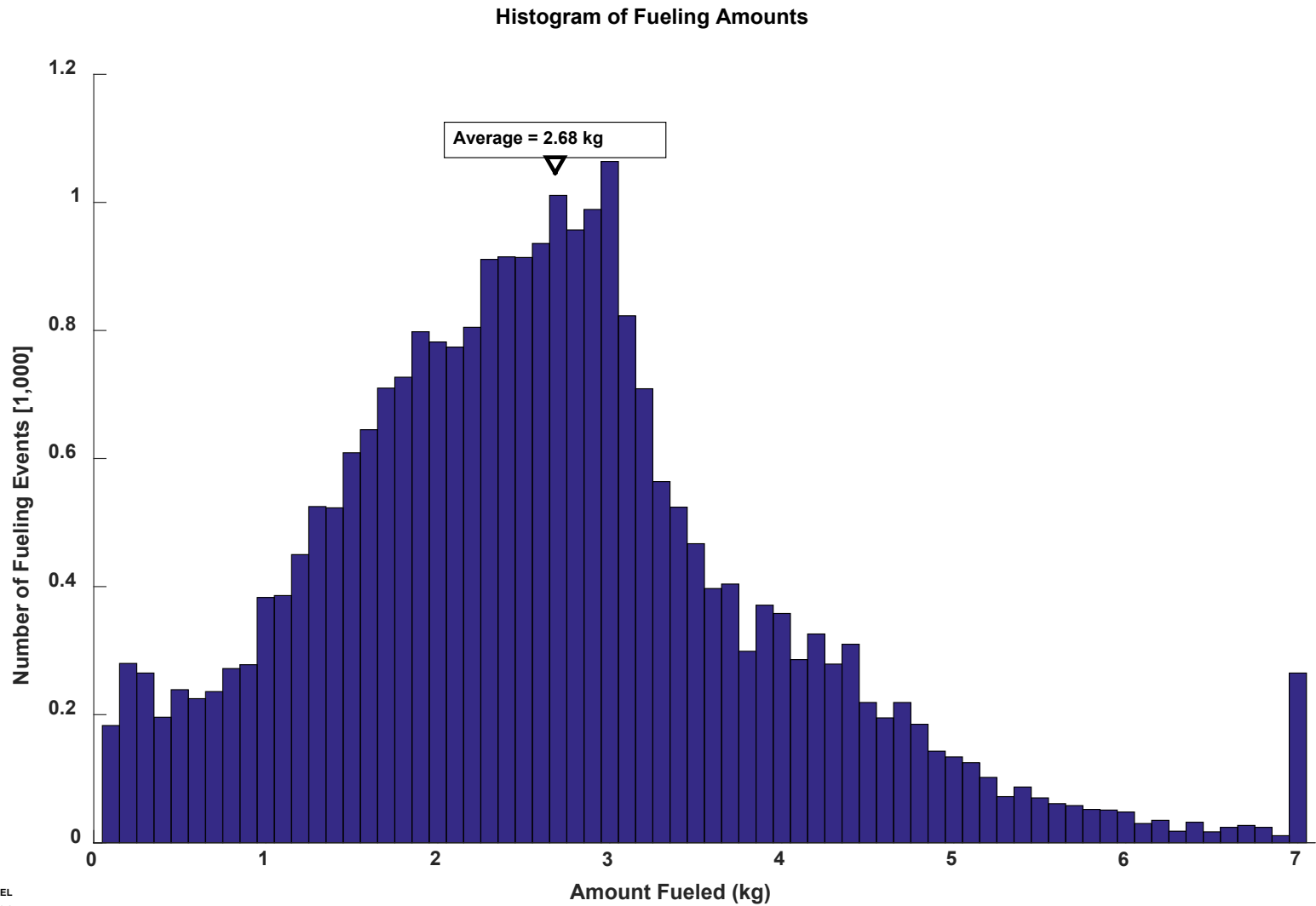
Histogram of Fueling Rates



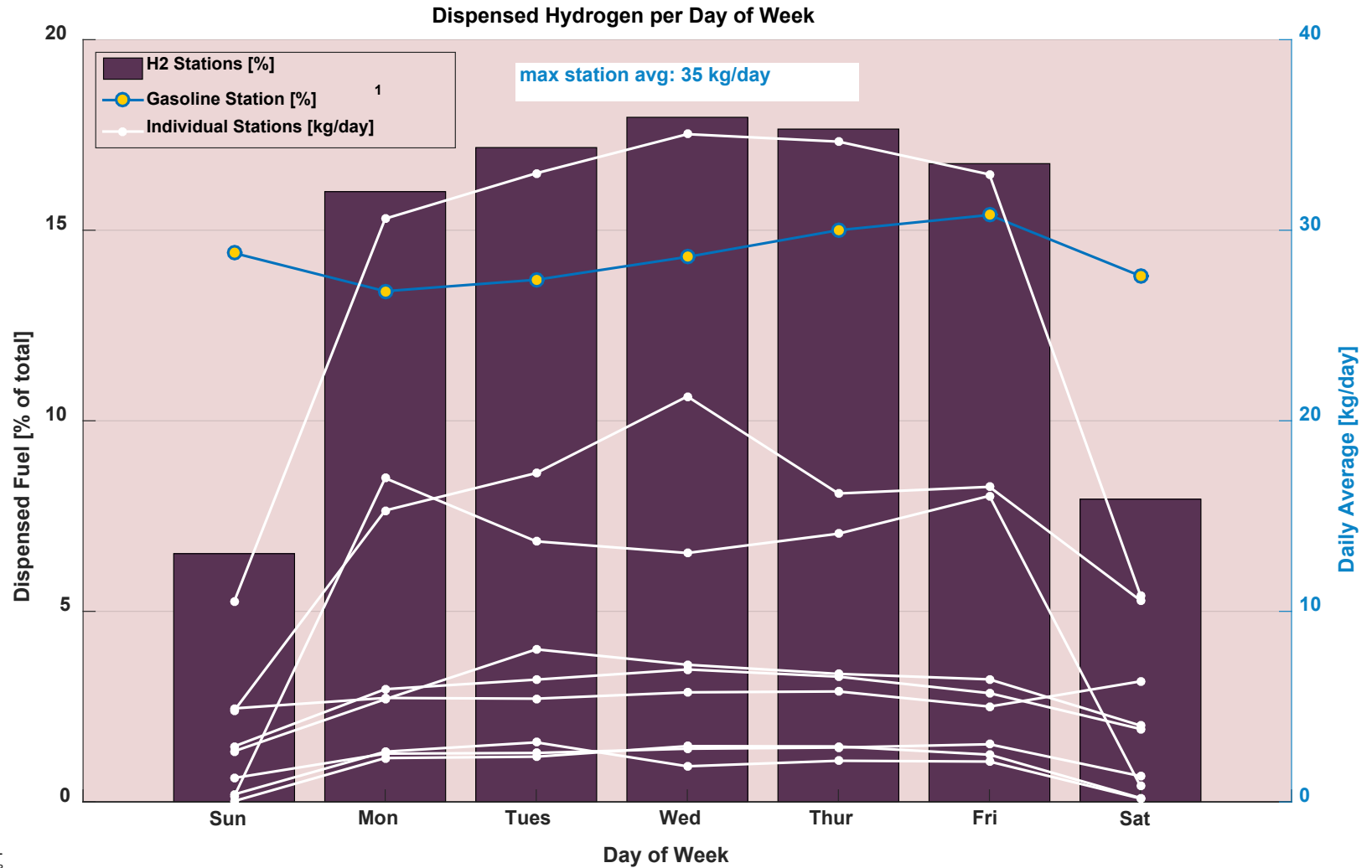
Histogram of Fueling Times



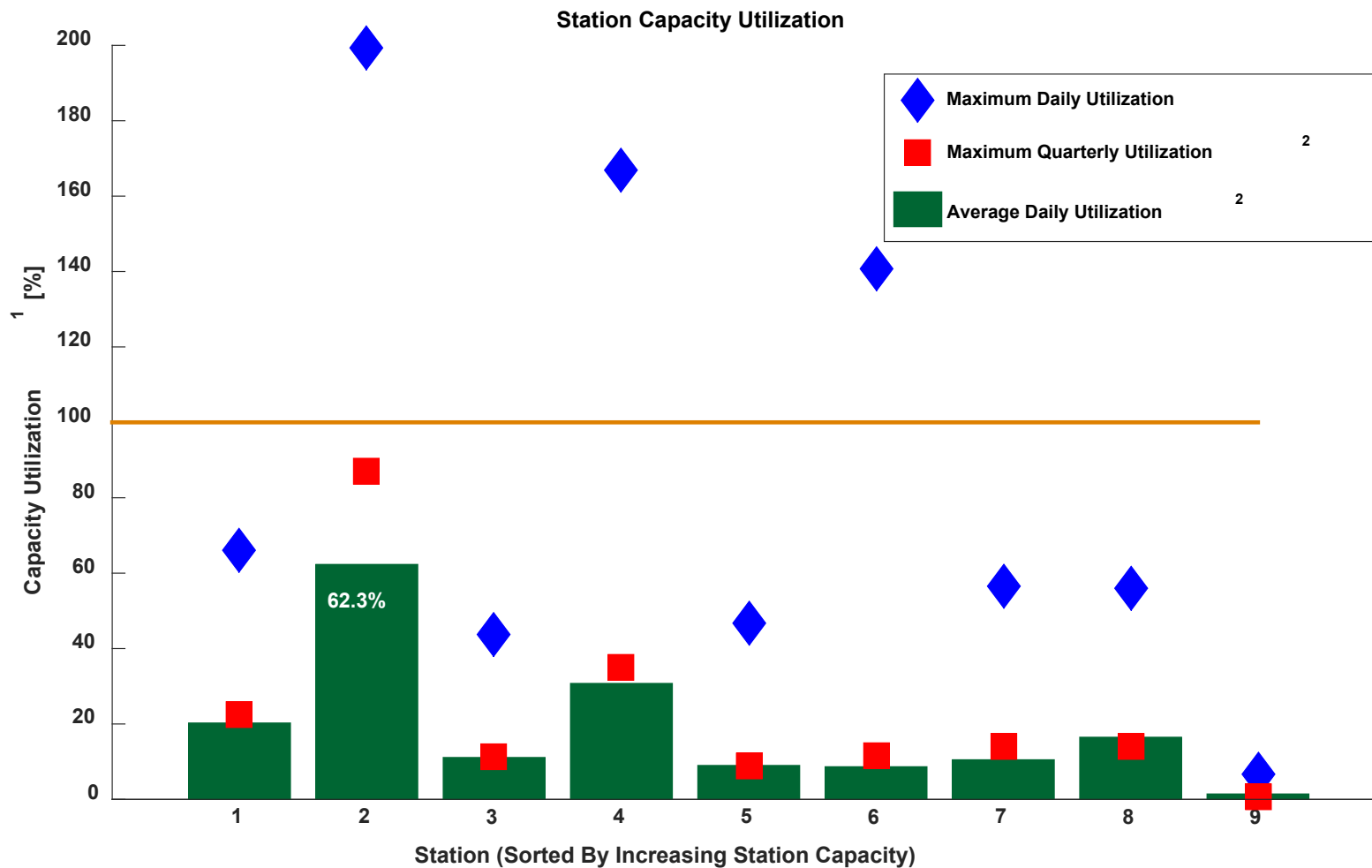
Histogram of Fueling Amounts



Dispensed Hydrogen per Day of Week

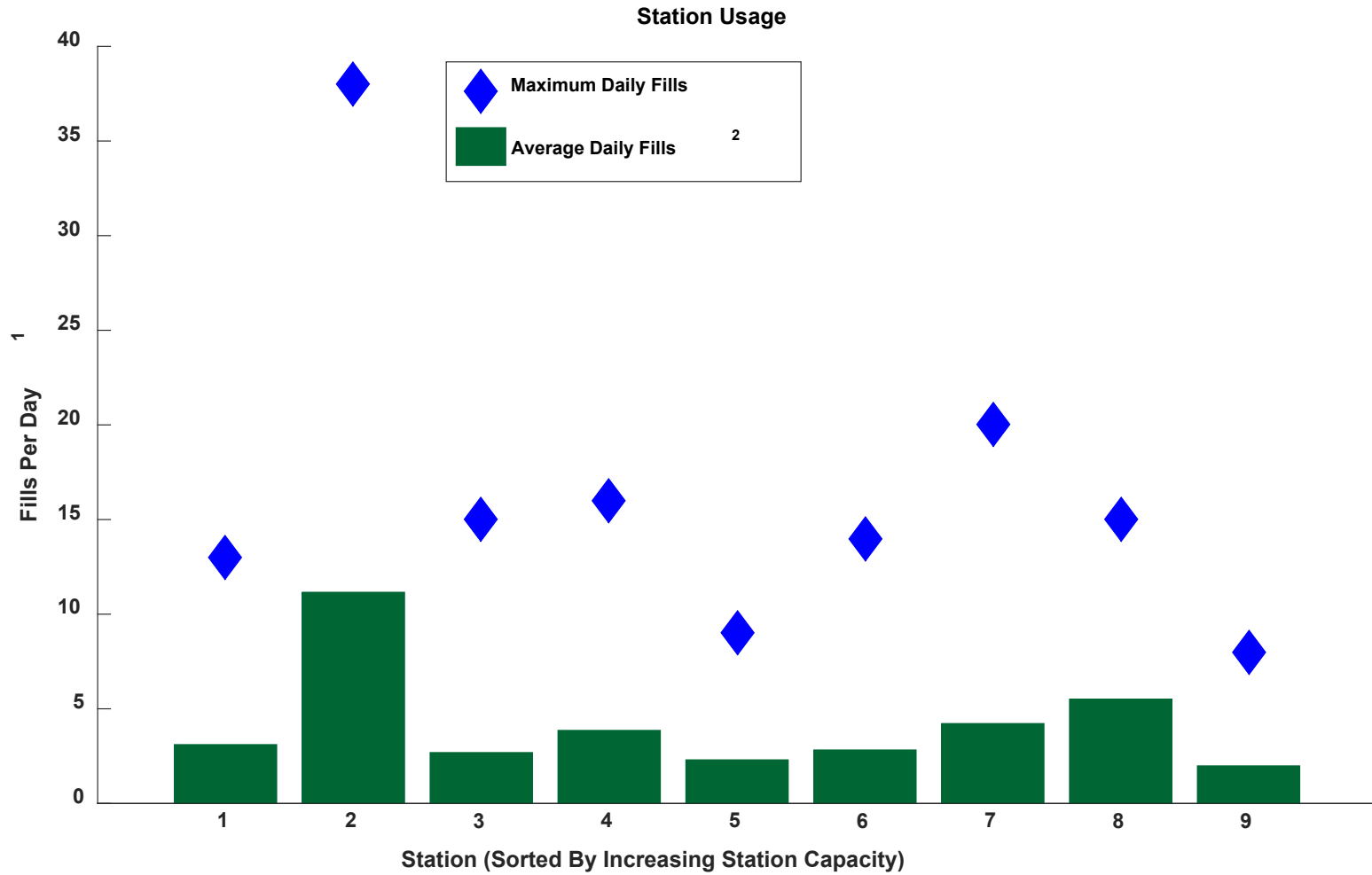


Station Capacity Utilization

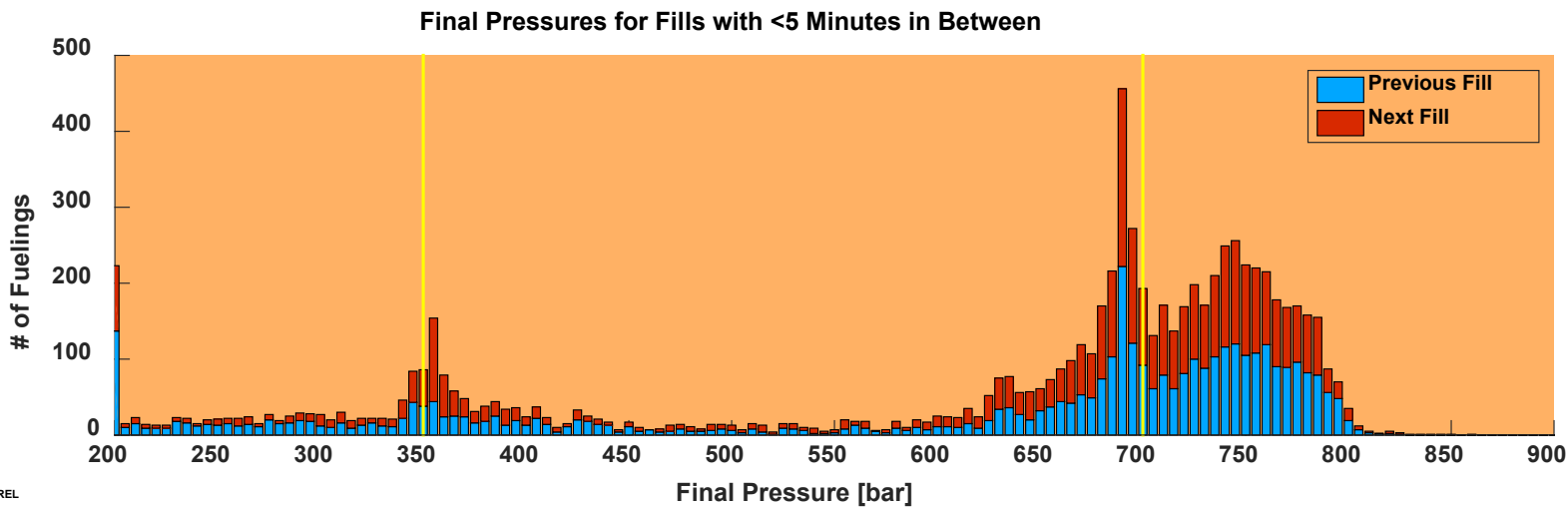
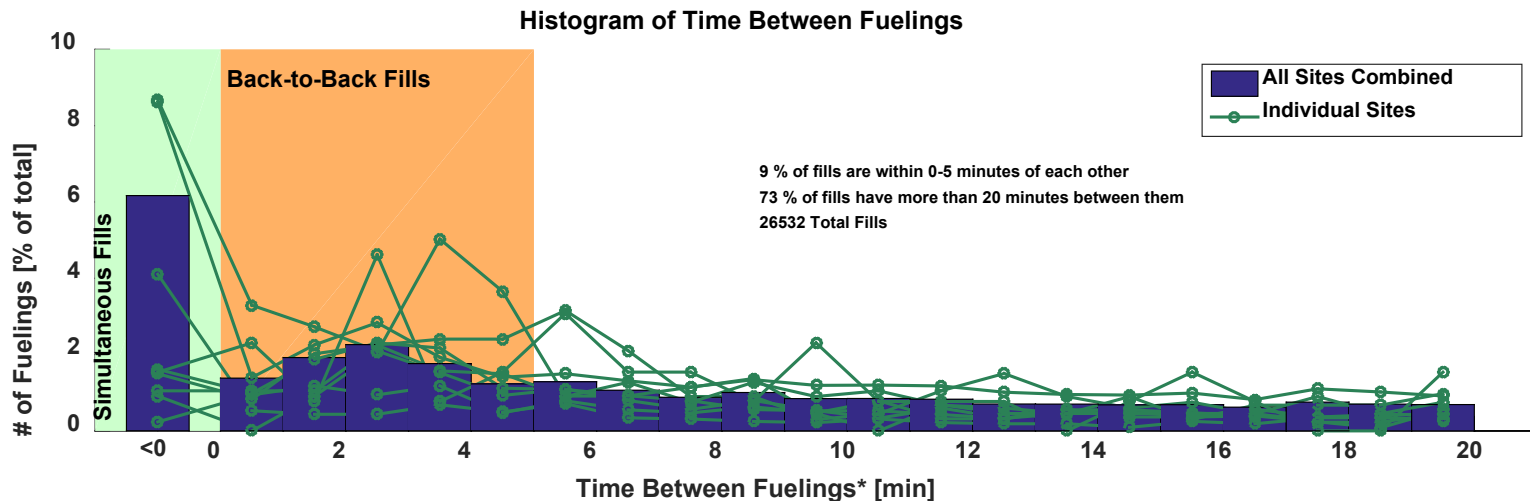


CDP-INFR-07

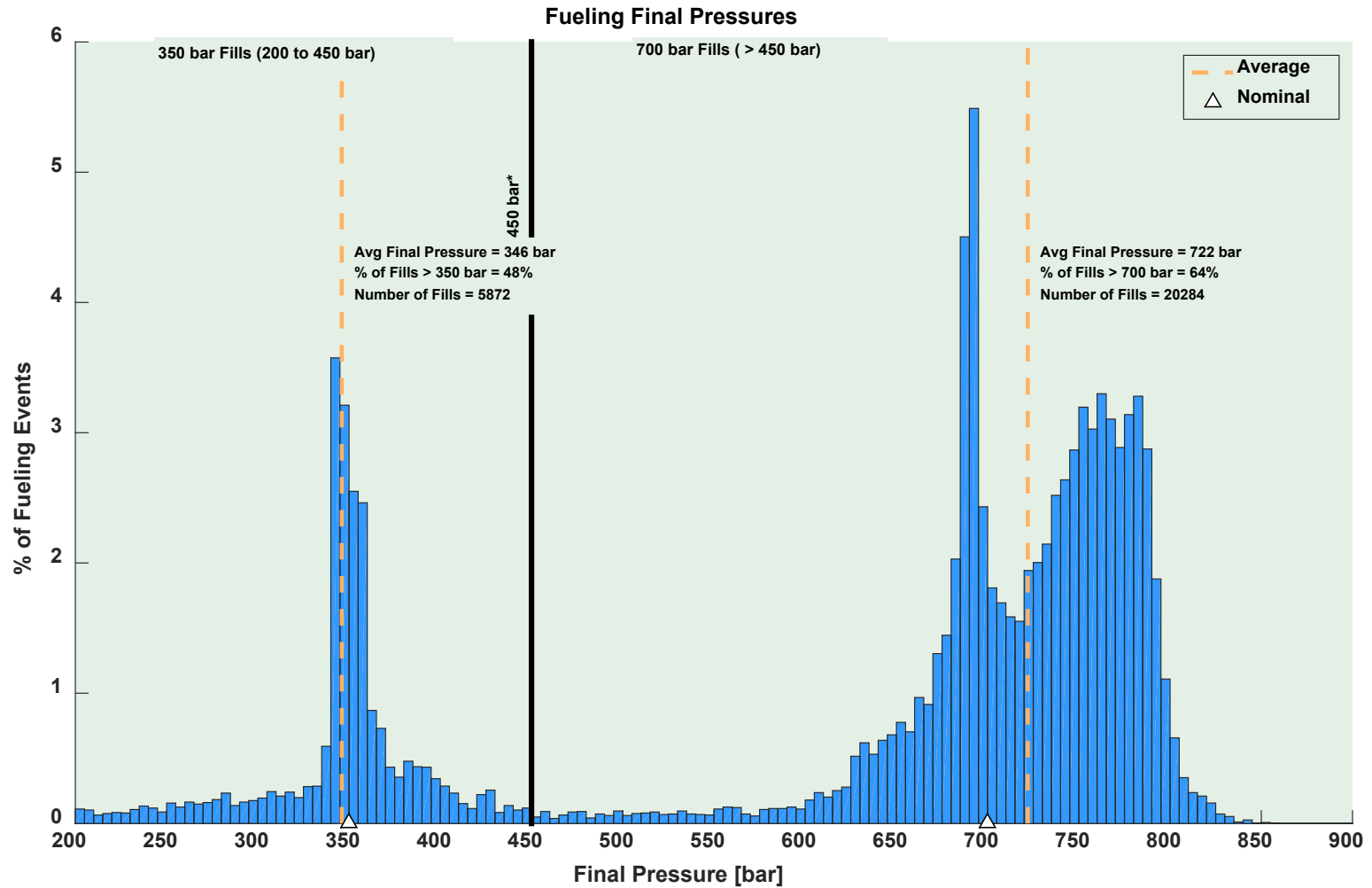
Station Usage



Time Between Fueling

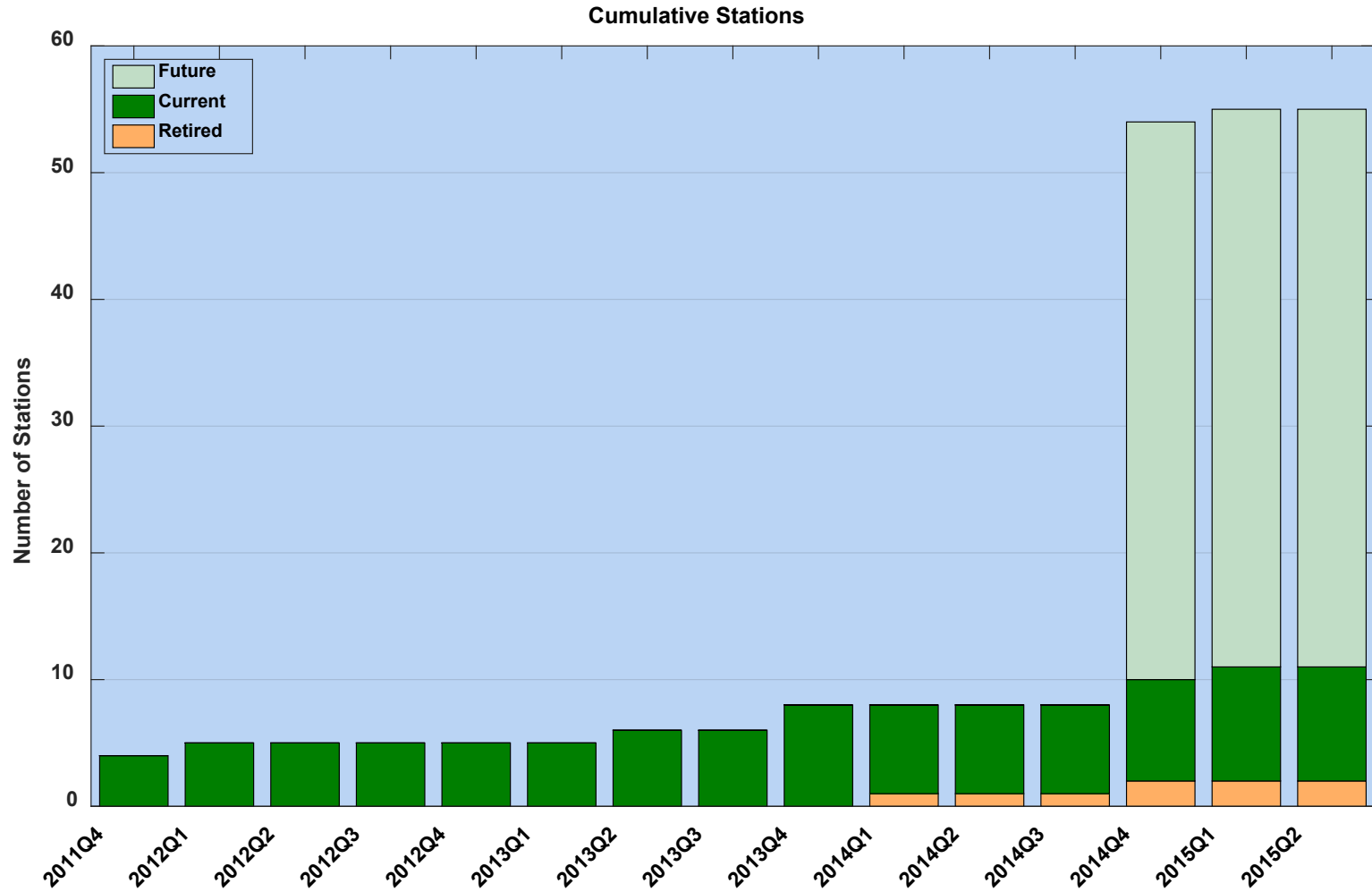


Fueling Final Pressures

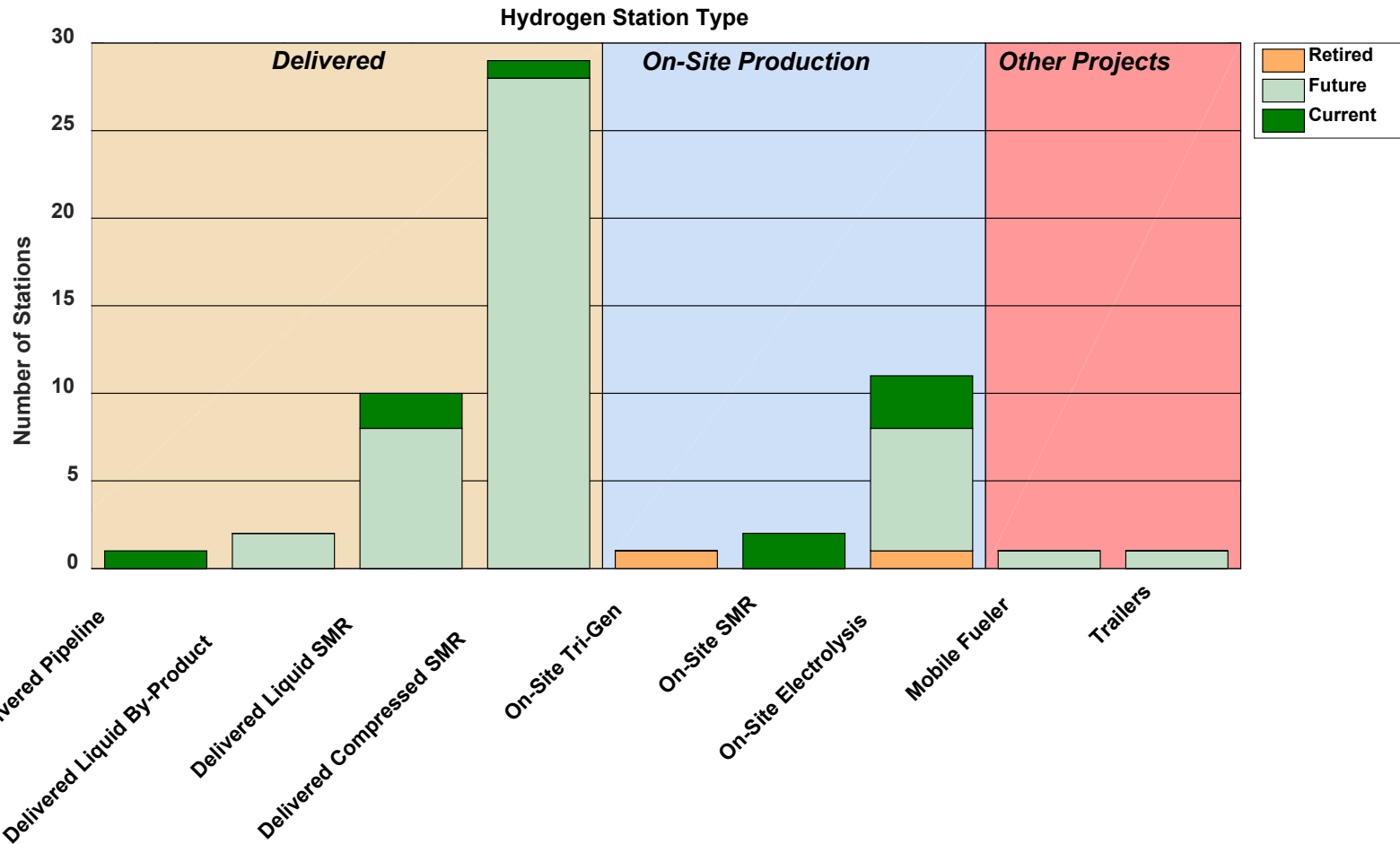


CDP-INFR-10

Cumulative Number of Stations



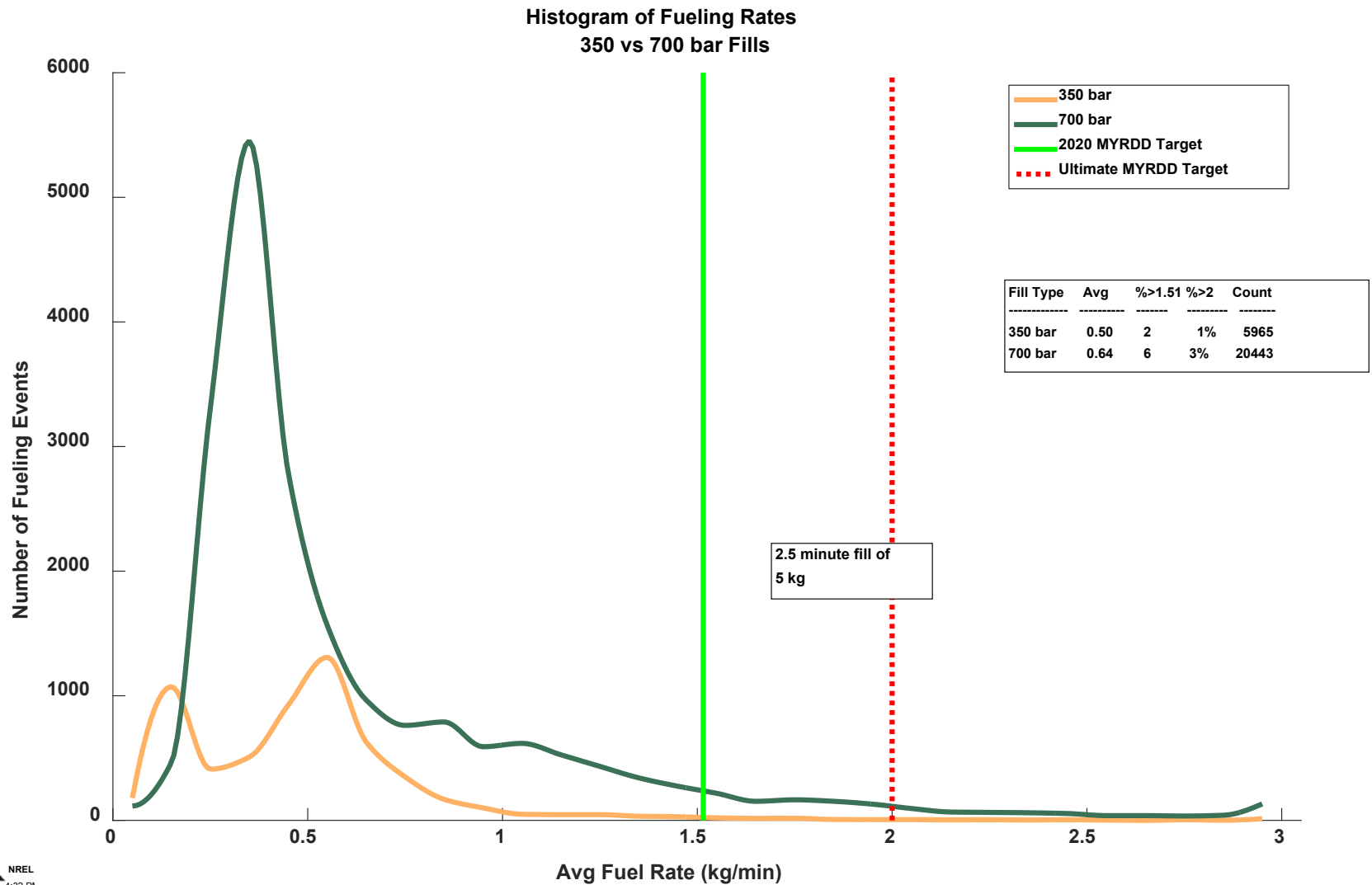
Hydrogen Stations by Type



Created: Sep, 2018 2:50 P

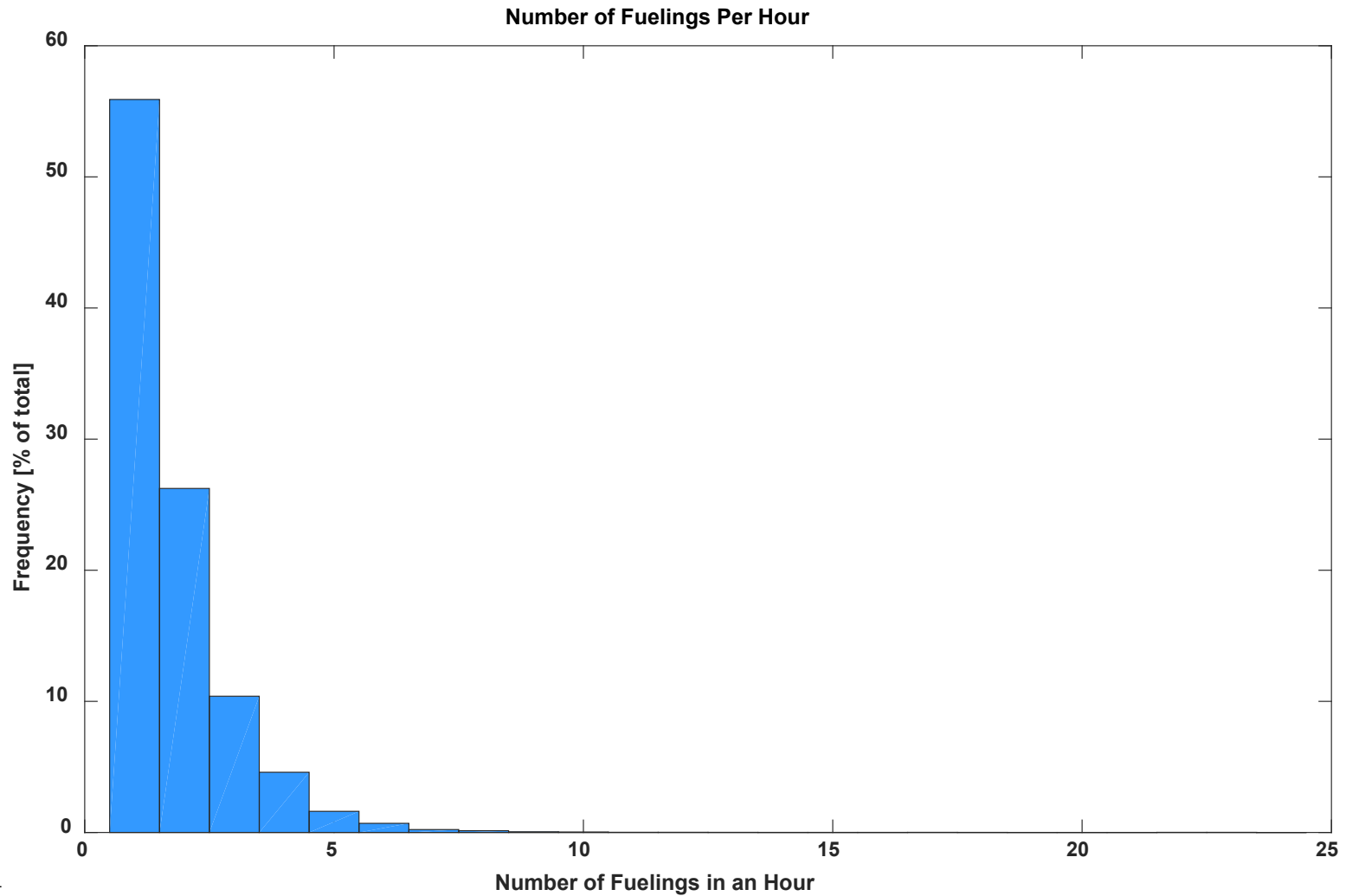
CDP-INFR-12

Fueling Rates 350 vs. 700 bar



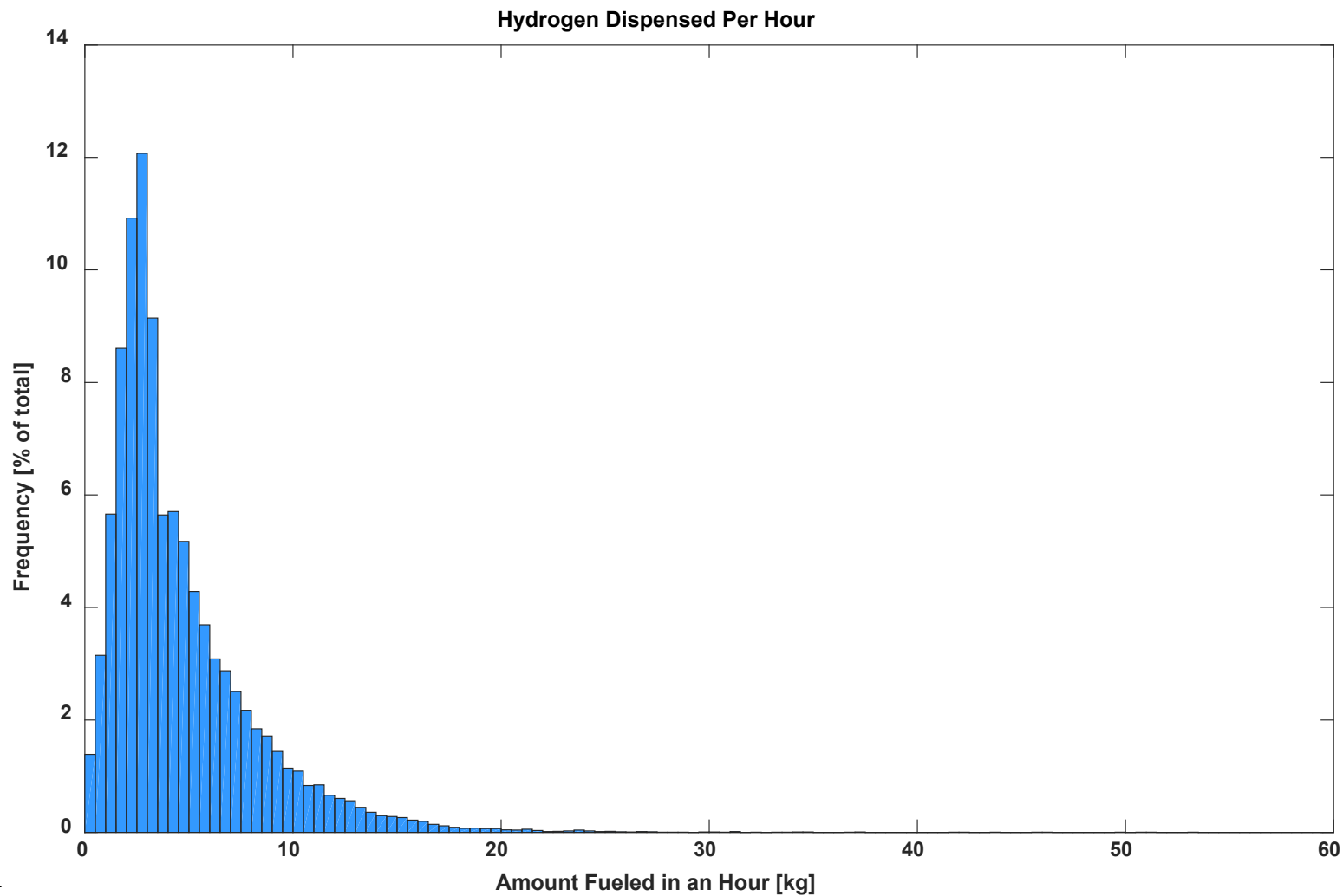
CDP-INFR-13

Number of Fueling Events per Hour



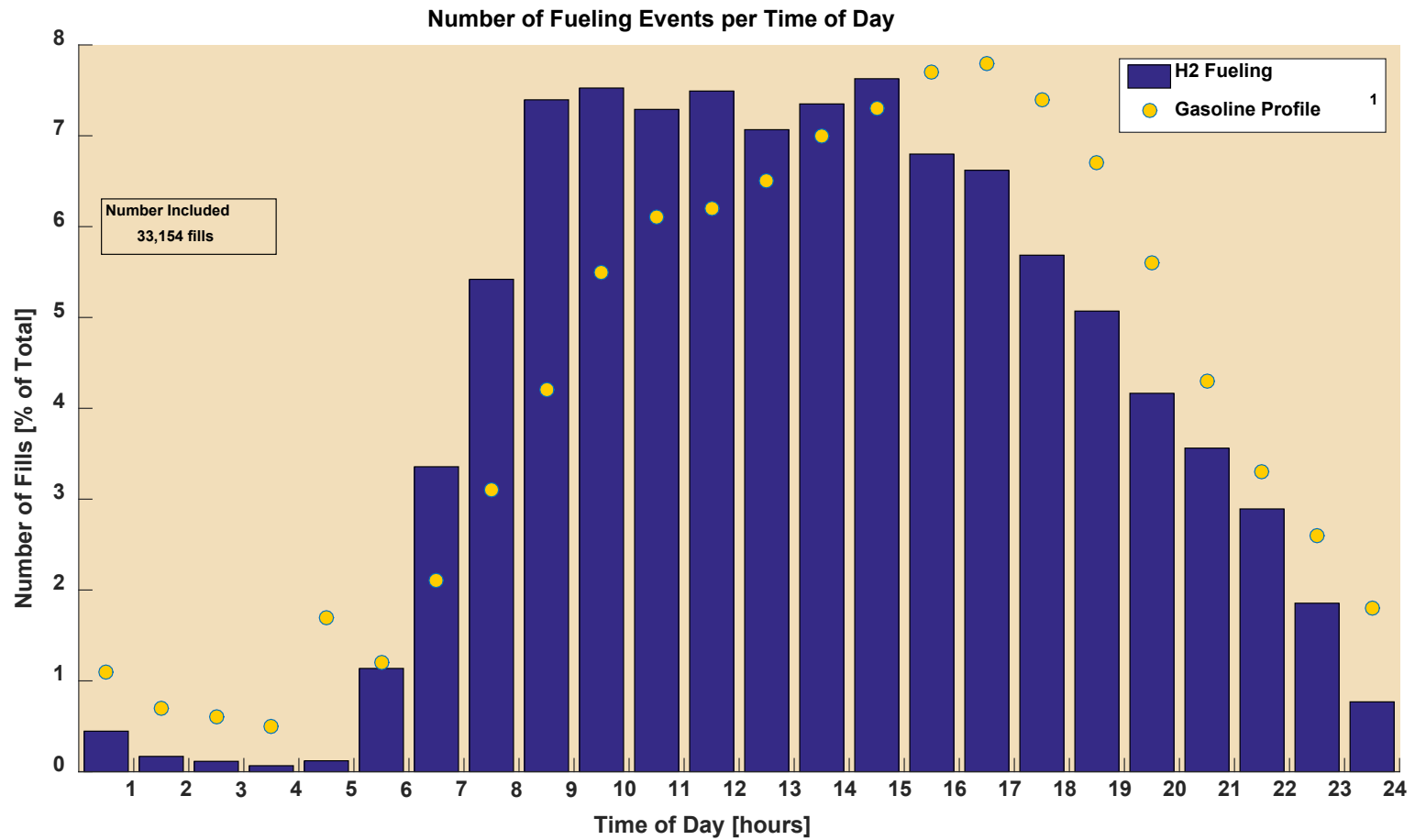
CDP-INFR-14

Hydrogen Dispensed per Hour

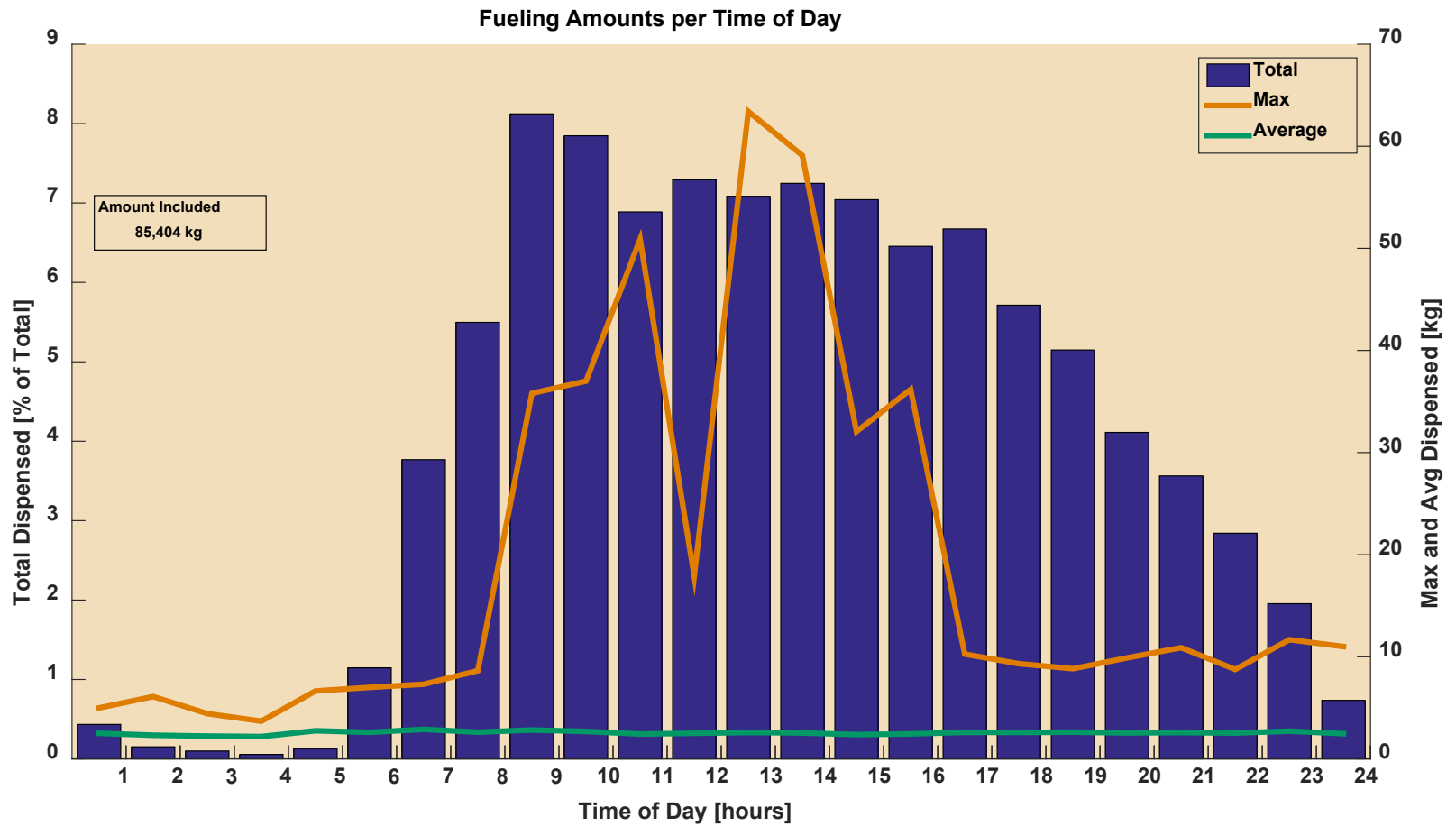


Created: Oct-19-15 4:37 PM

Number of Fills by Time of Day

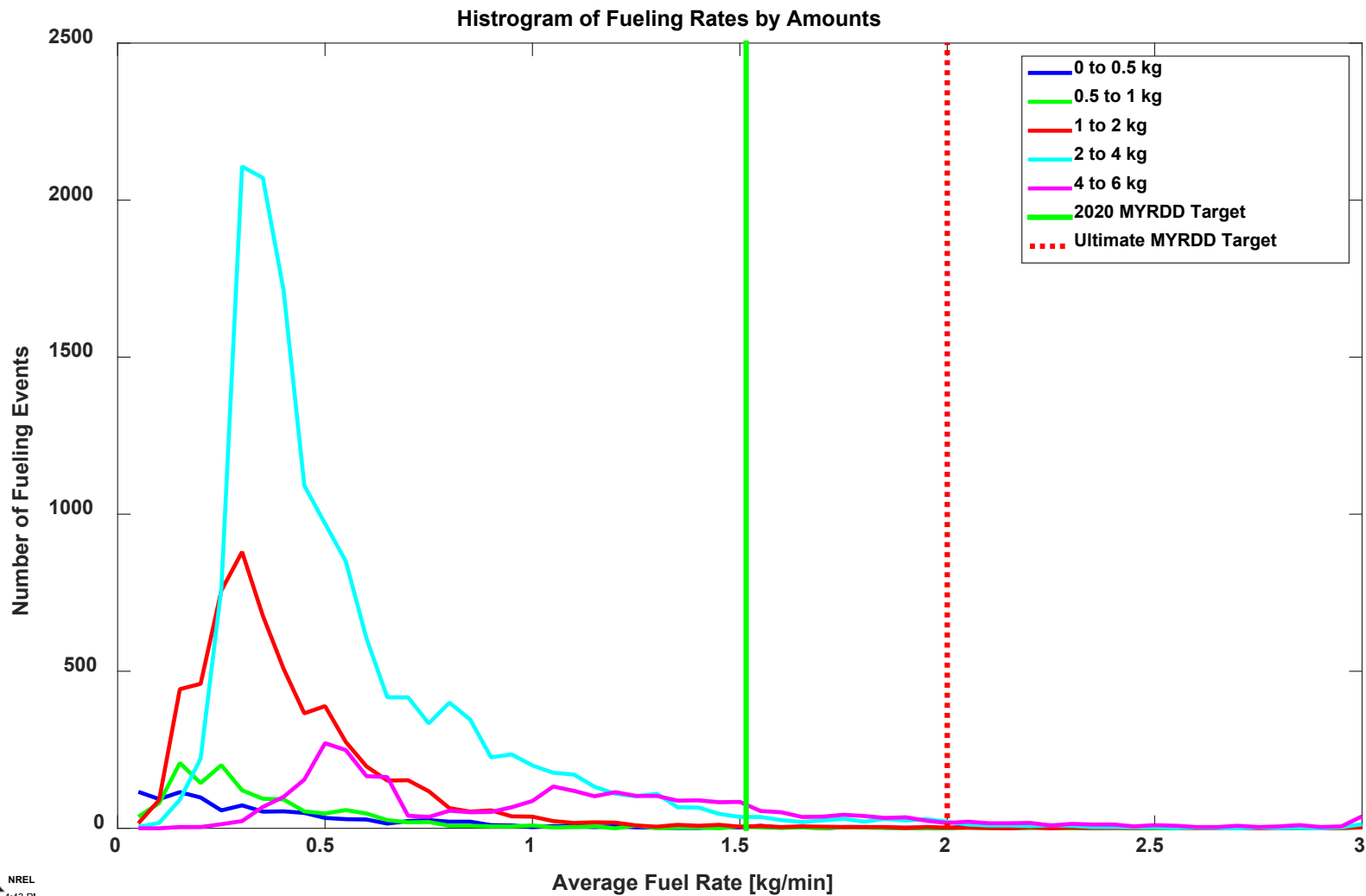


Fueling Amounts per Time of Day

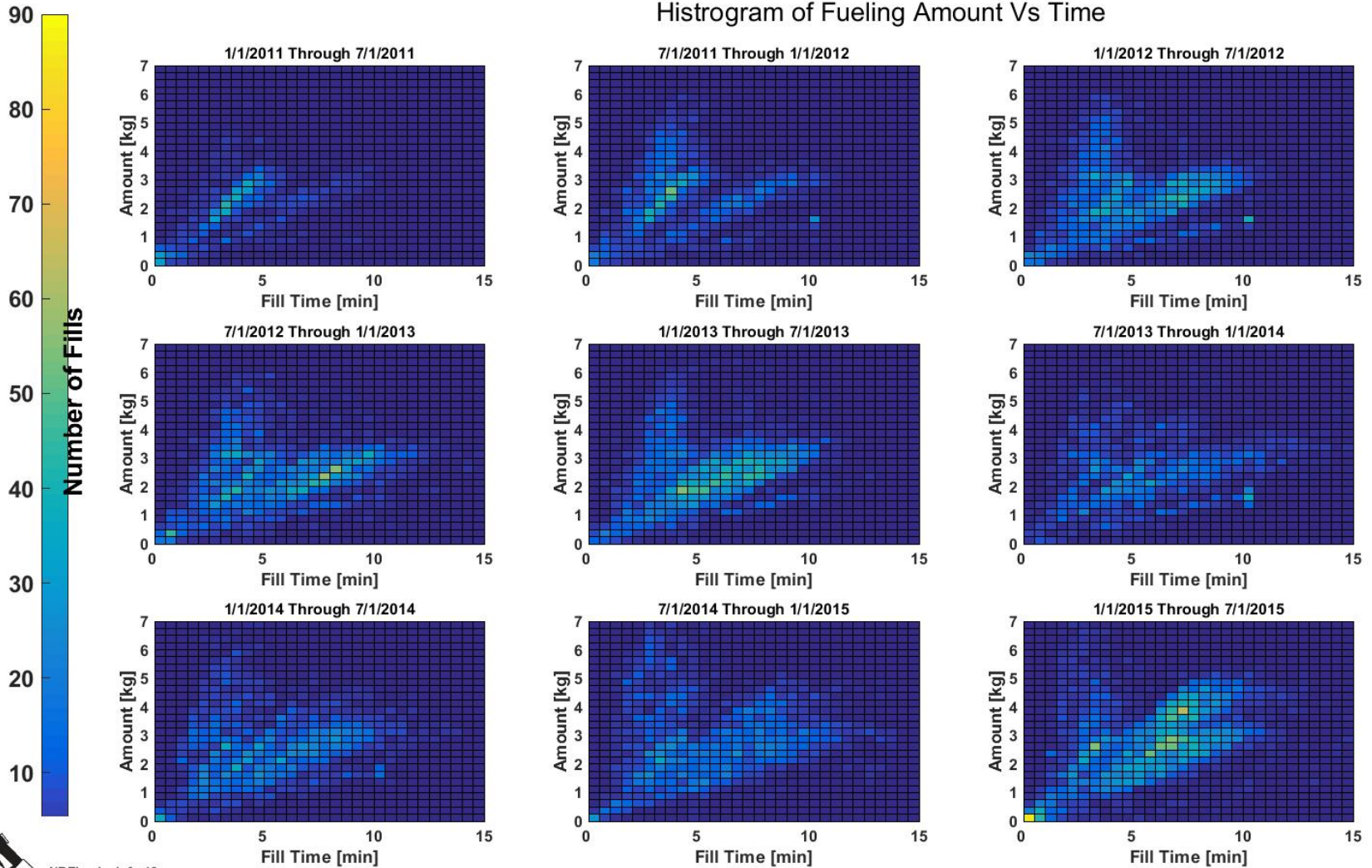


Created: Oct-19-15 4:42 PM

Fueling Rates by Amount Filled



Fueling Amount vs. Time to Fill

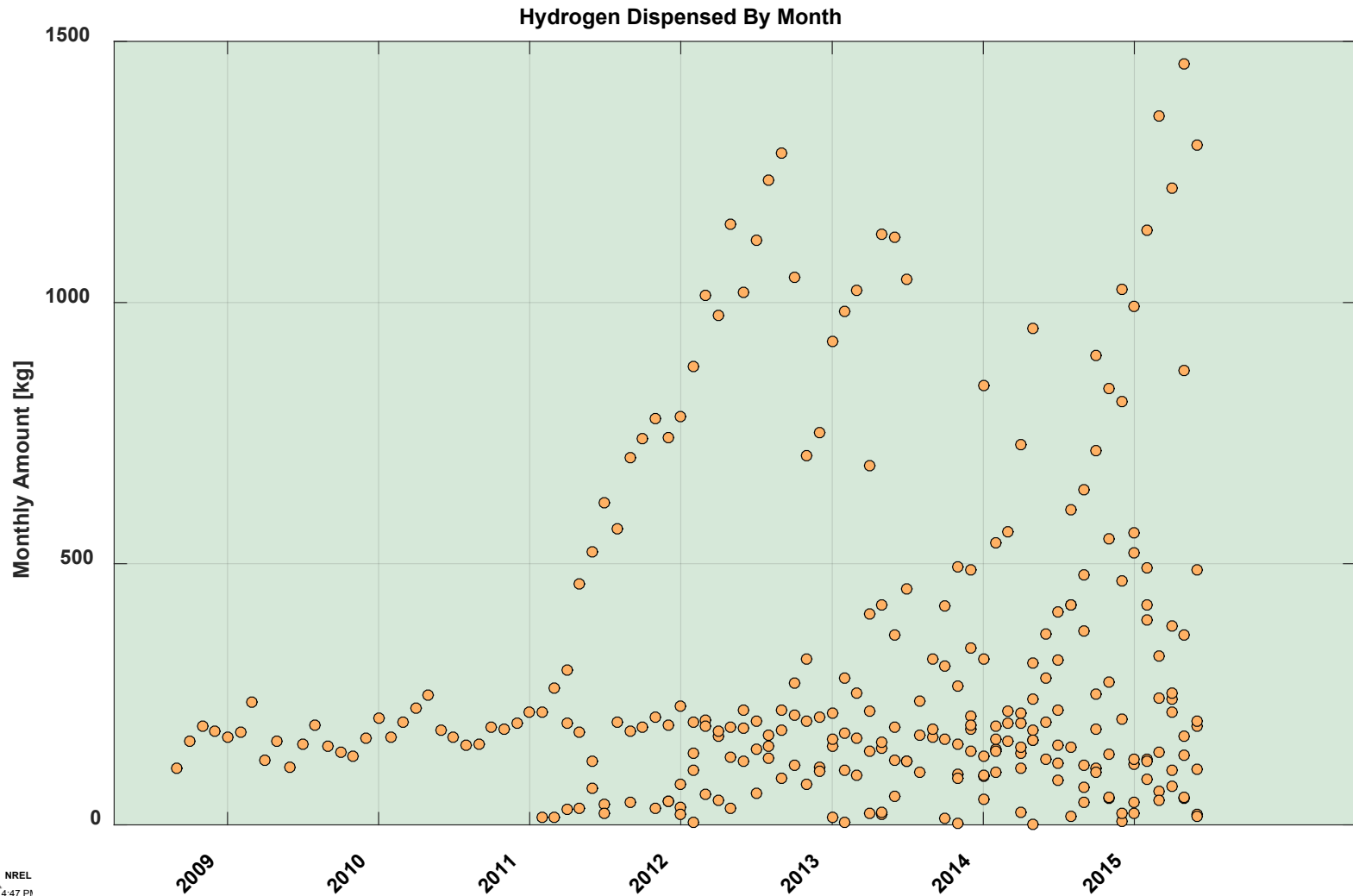


NREL cdp_infr_18

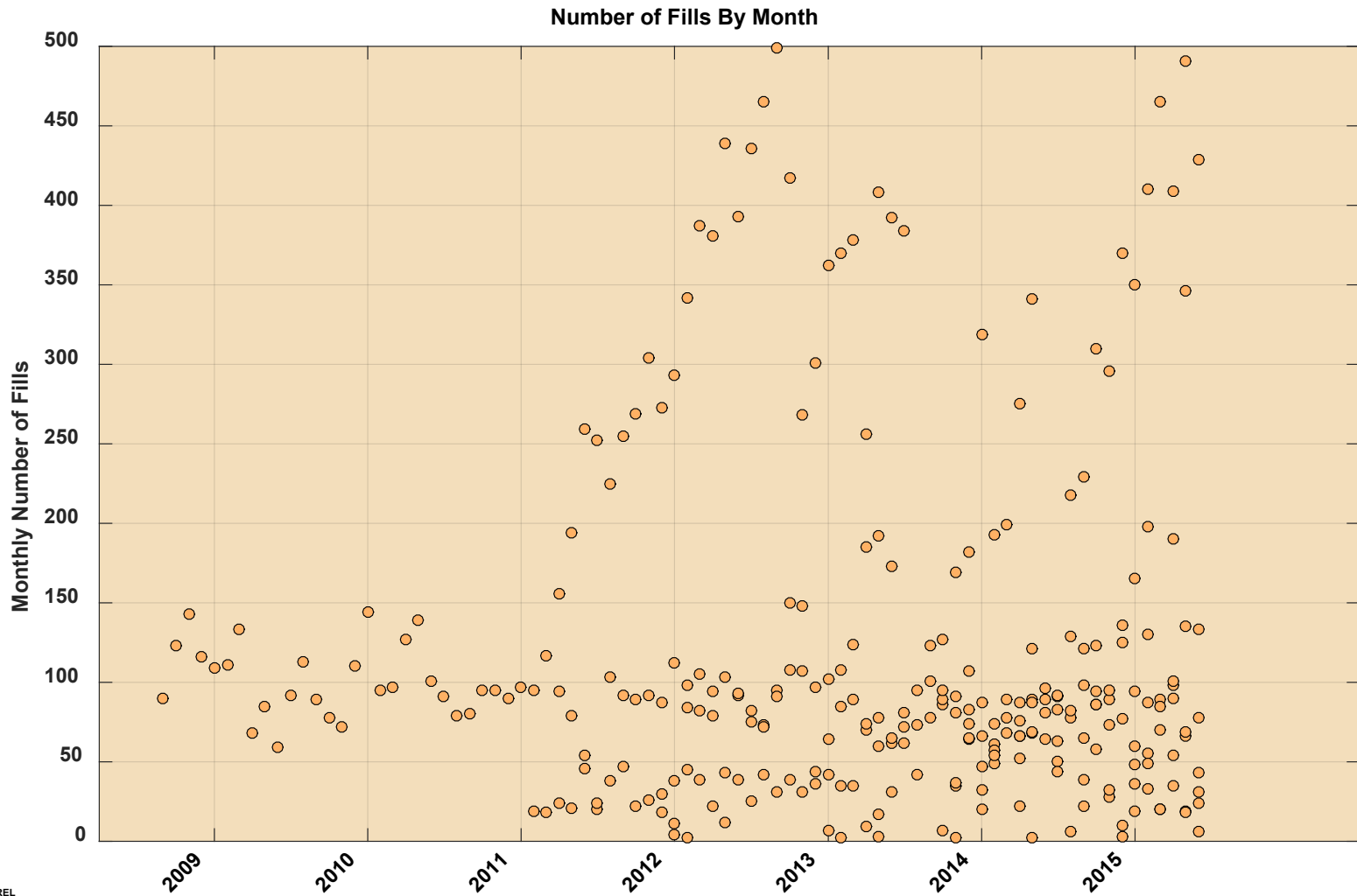
Created: Oct-19-15 4:45 PM | Data Range: 2008Q3-2015Q2

CDP-INFR-19

Hydrogen Dispensed by Month

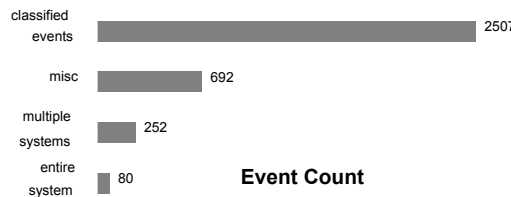
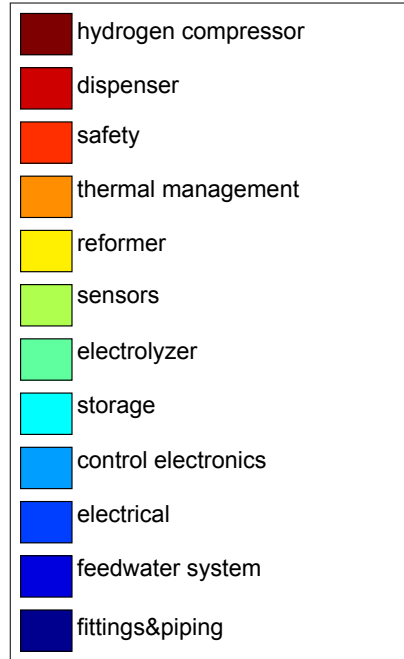
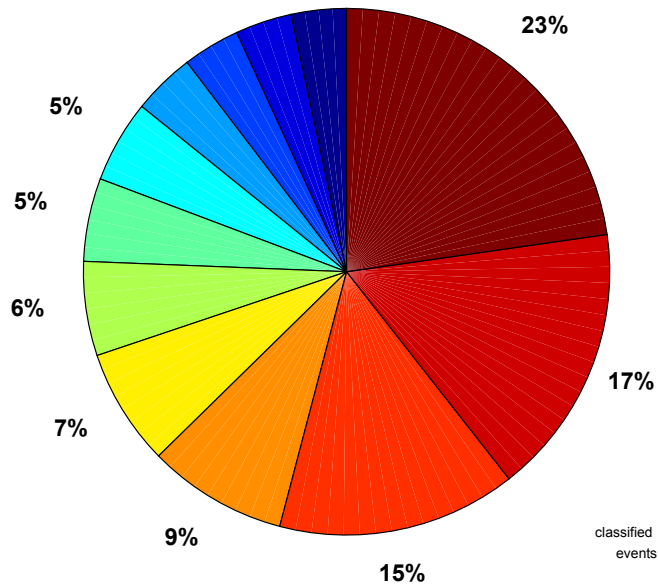


Number of Fills by Month

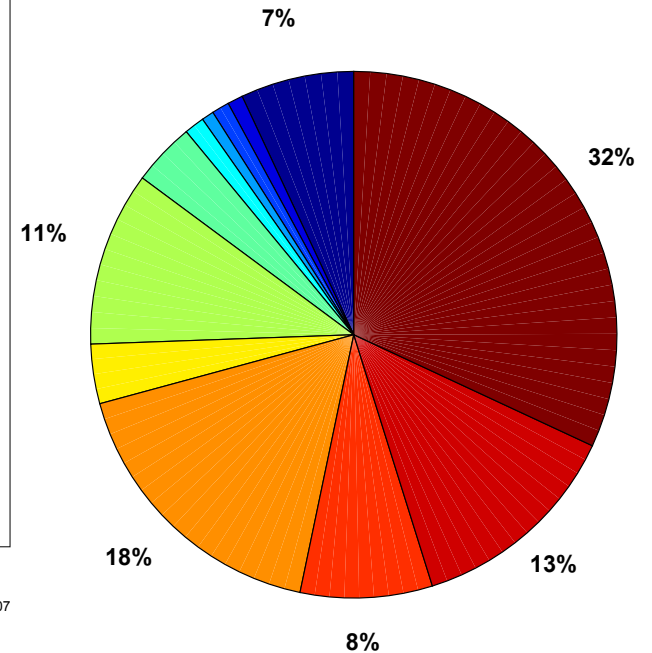


Maintenance by Equipment Type

Total Events ¹ = 3,531
37% unscheduled

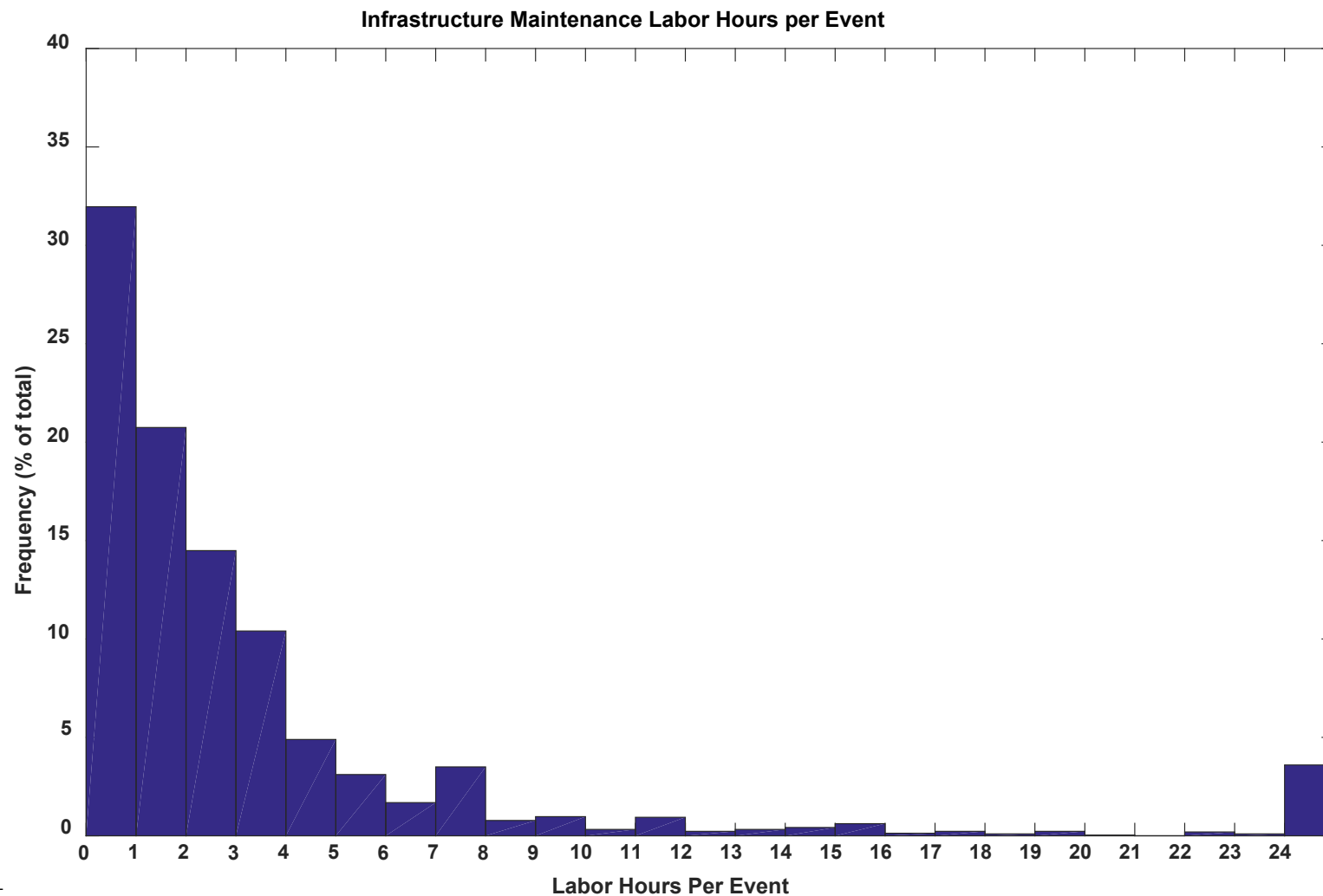


Total Hours ¹ = 24,304
17% unscheduled

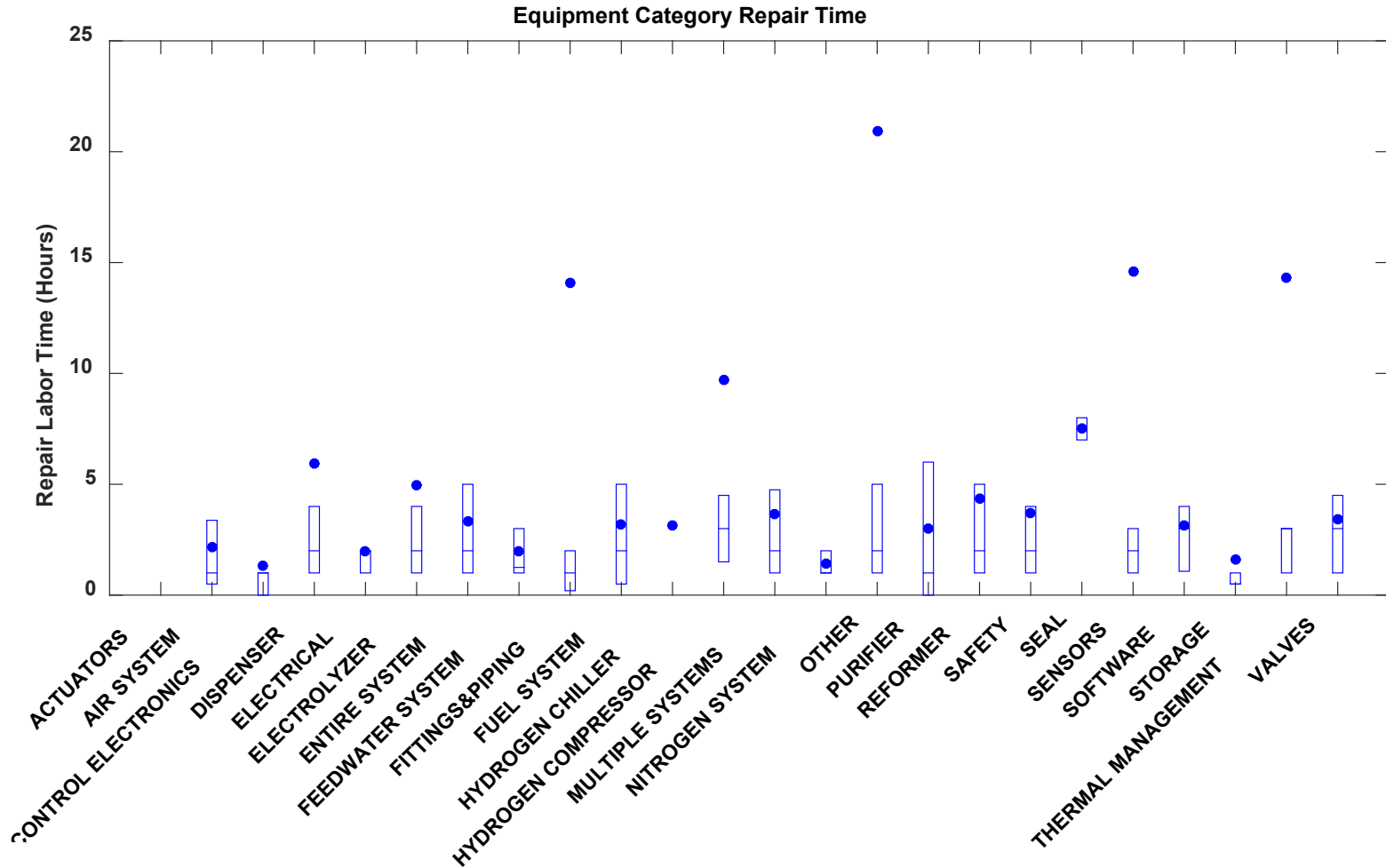


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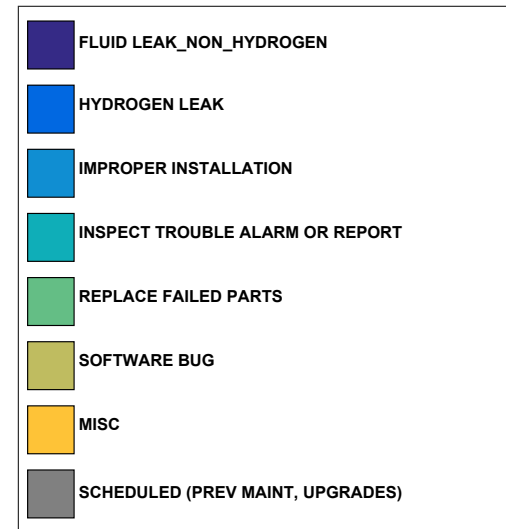
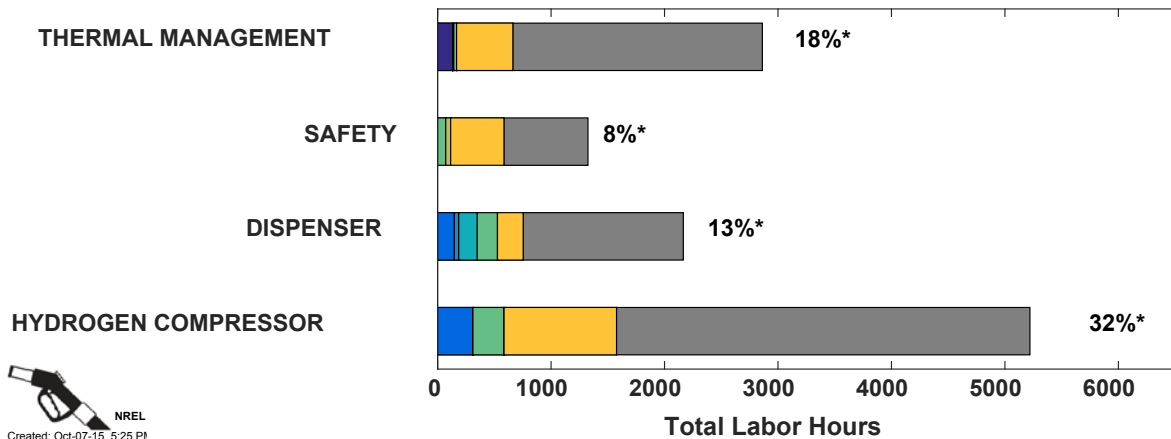
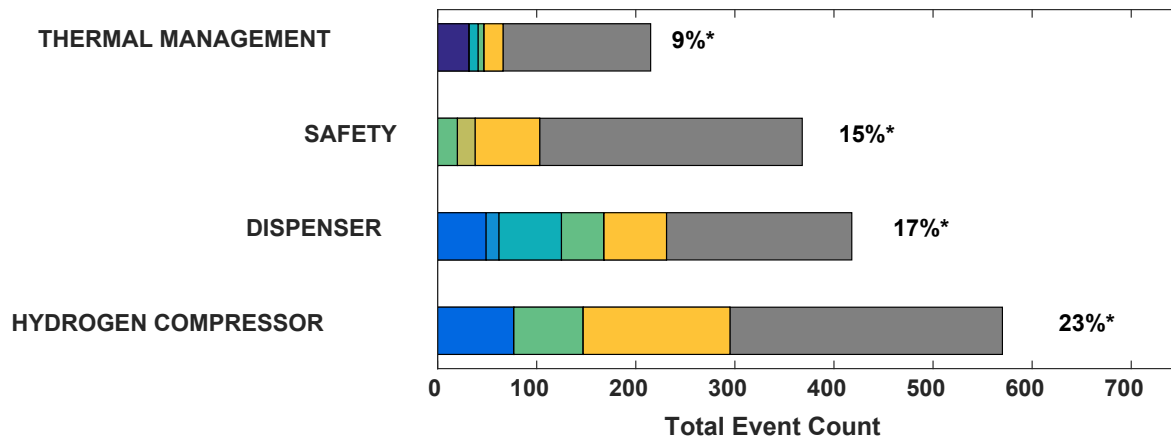
Maintenance Labor Hours per Event



Equipment Category Repair Time

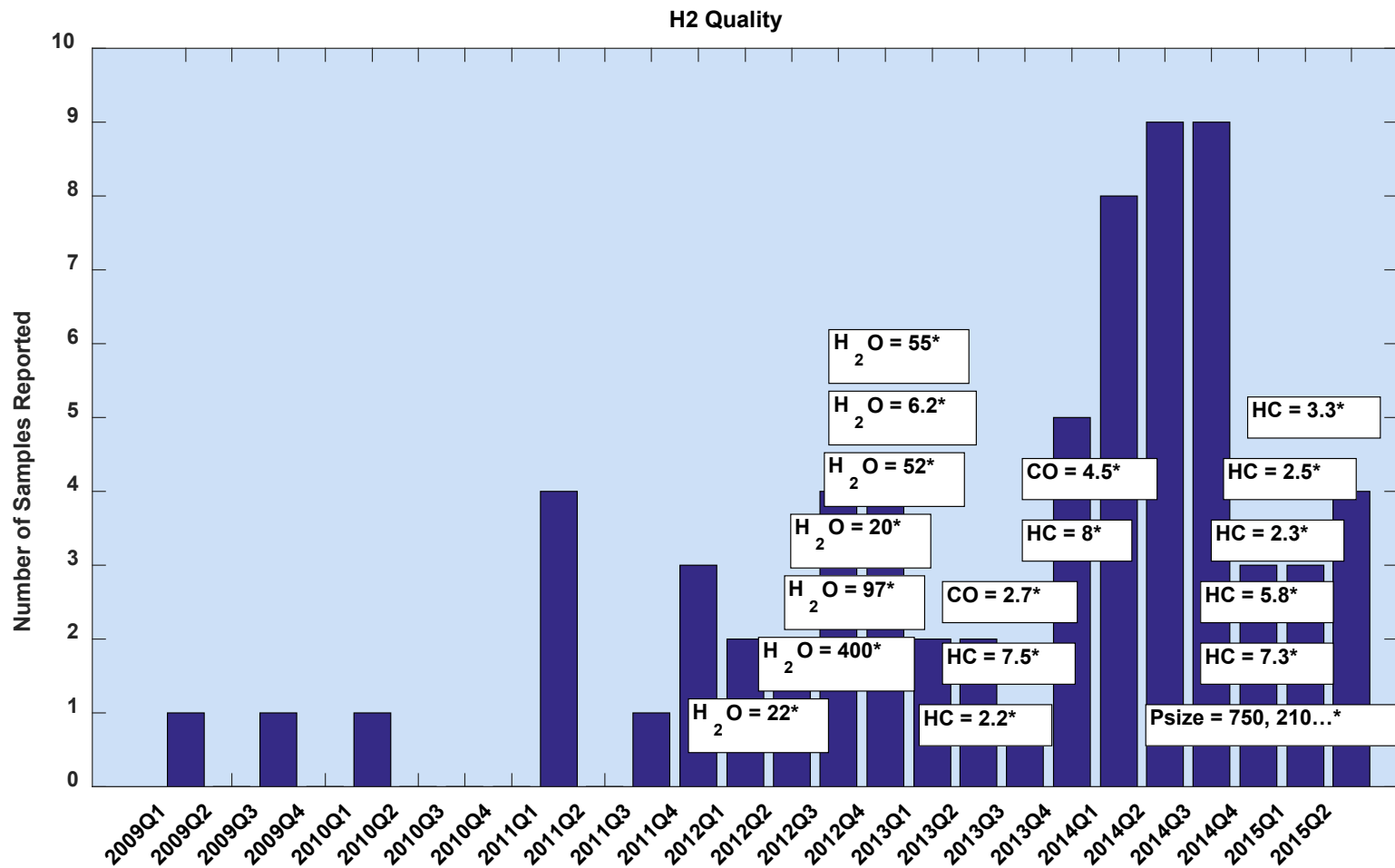


Failure Modes for Top Equipment Categories



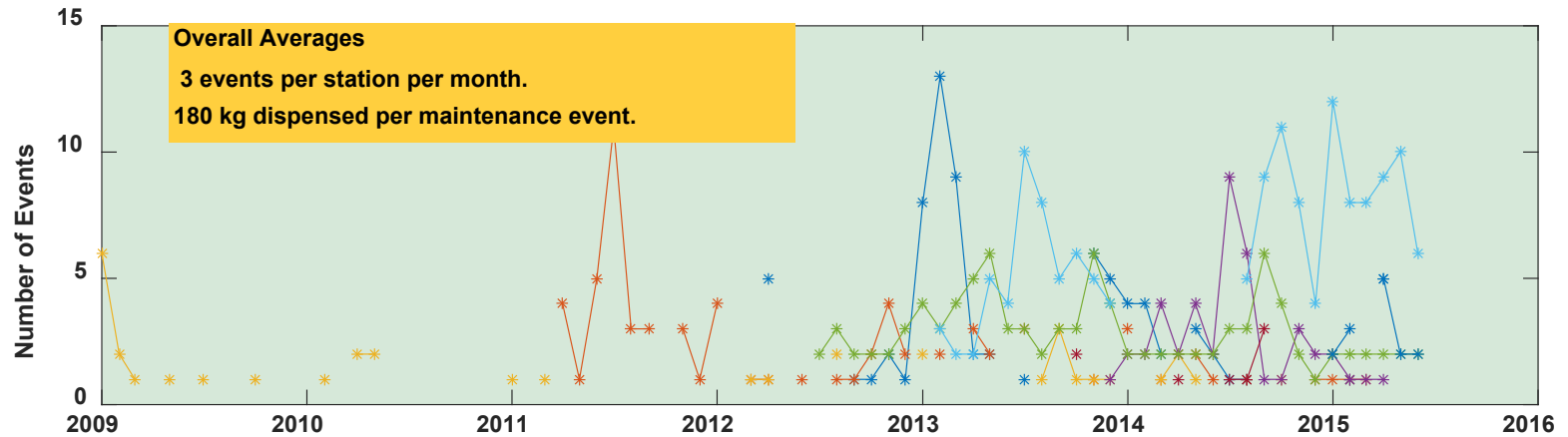
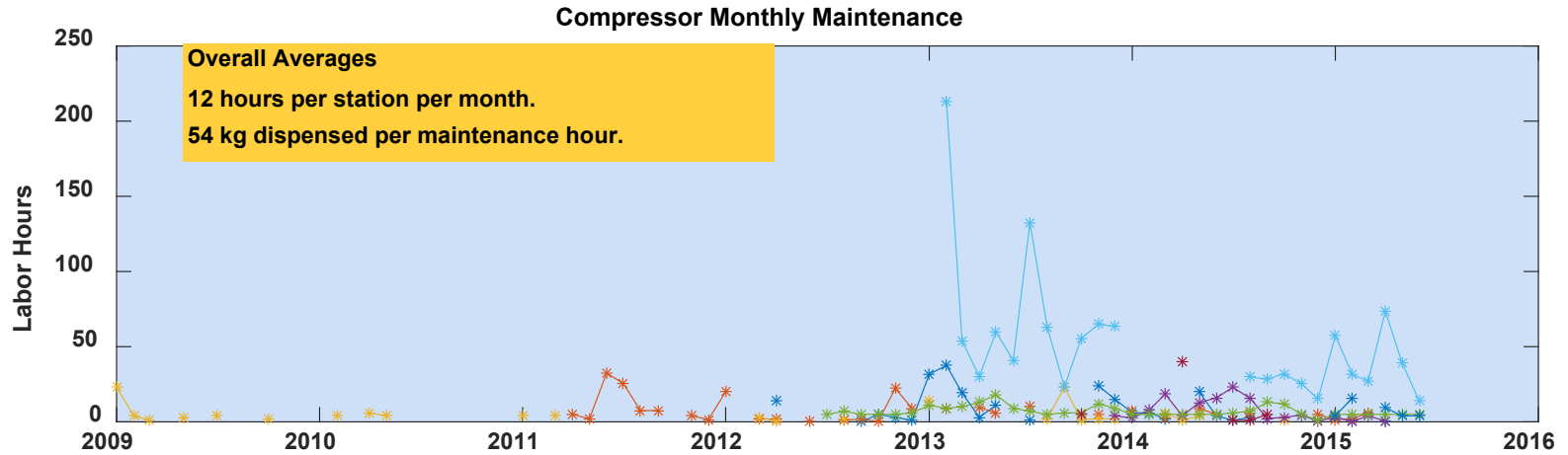
CDP-INFR-25

Hydrogen Quality

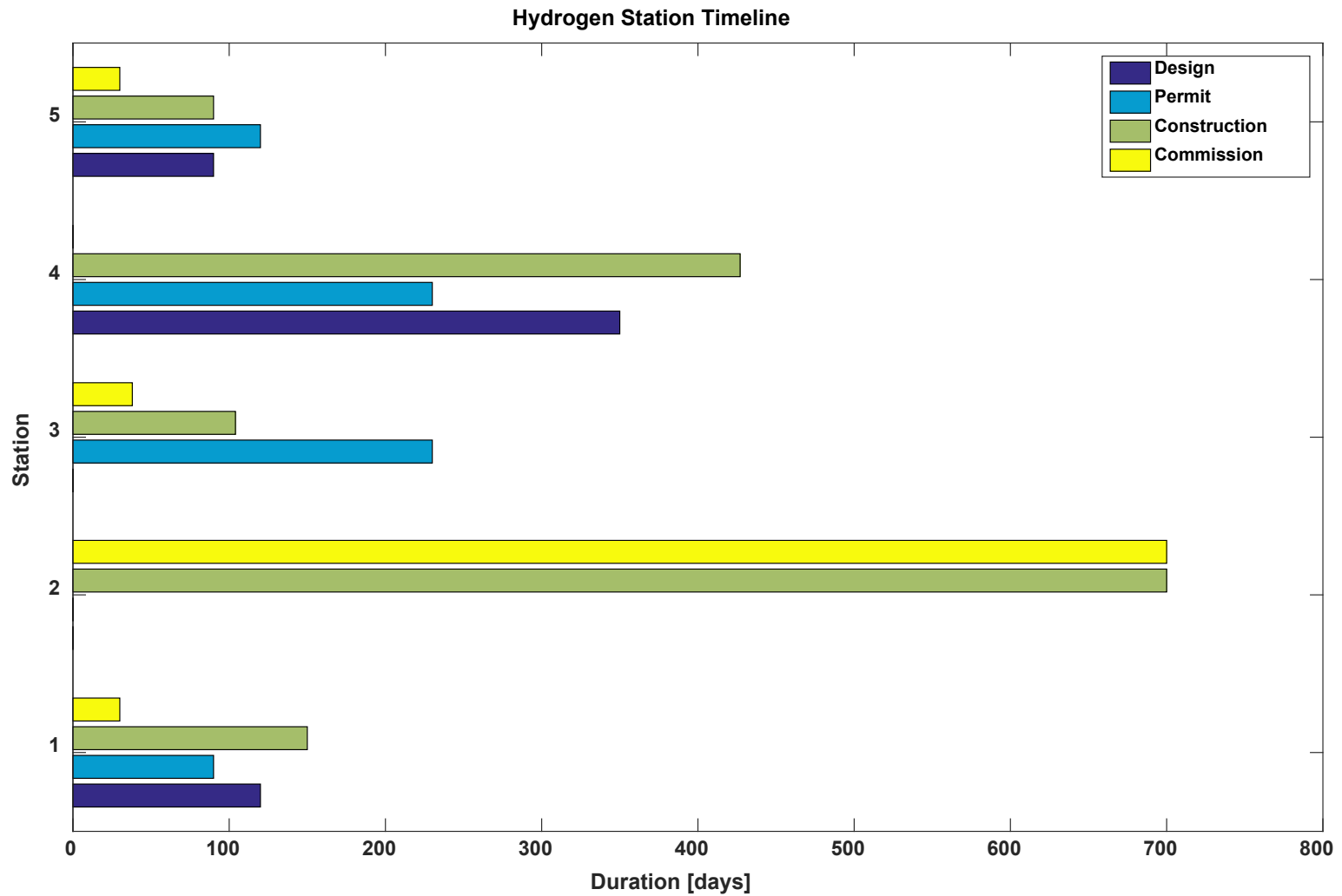


CDP-INFR-26

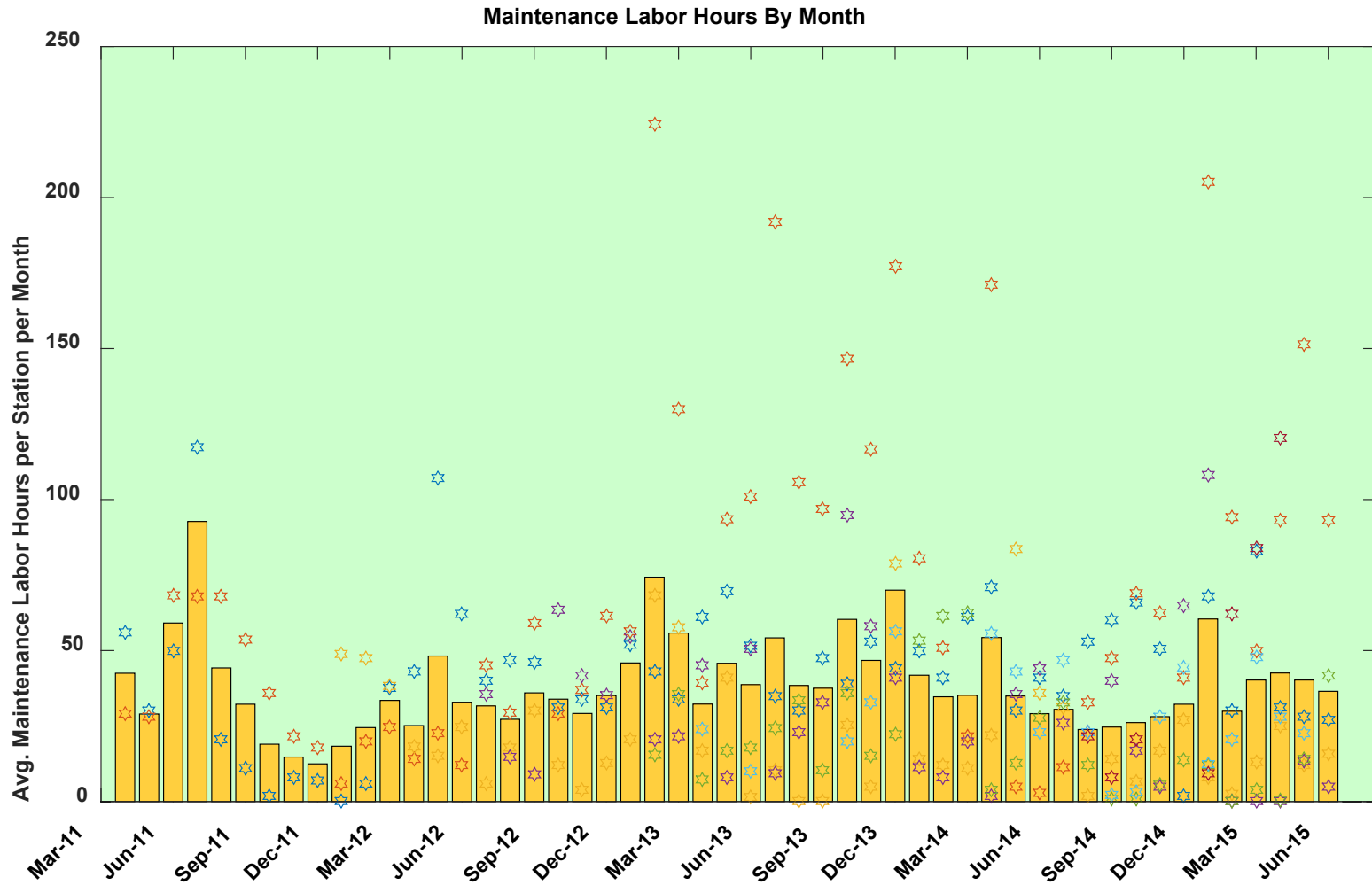
Compressor Monthly Maintenance



Hydrogen Station Timeline

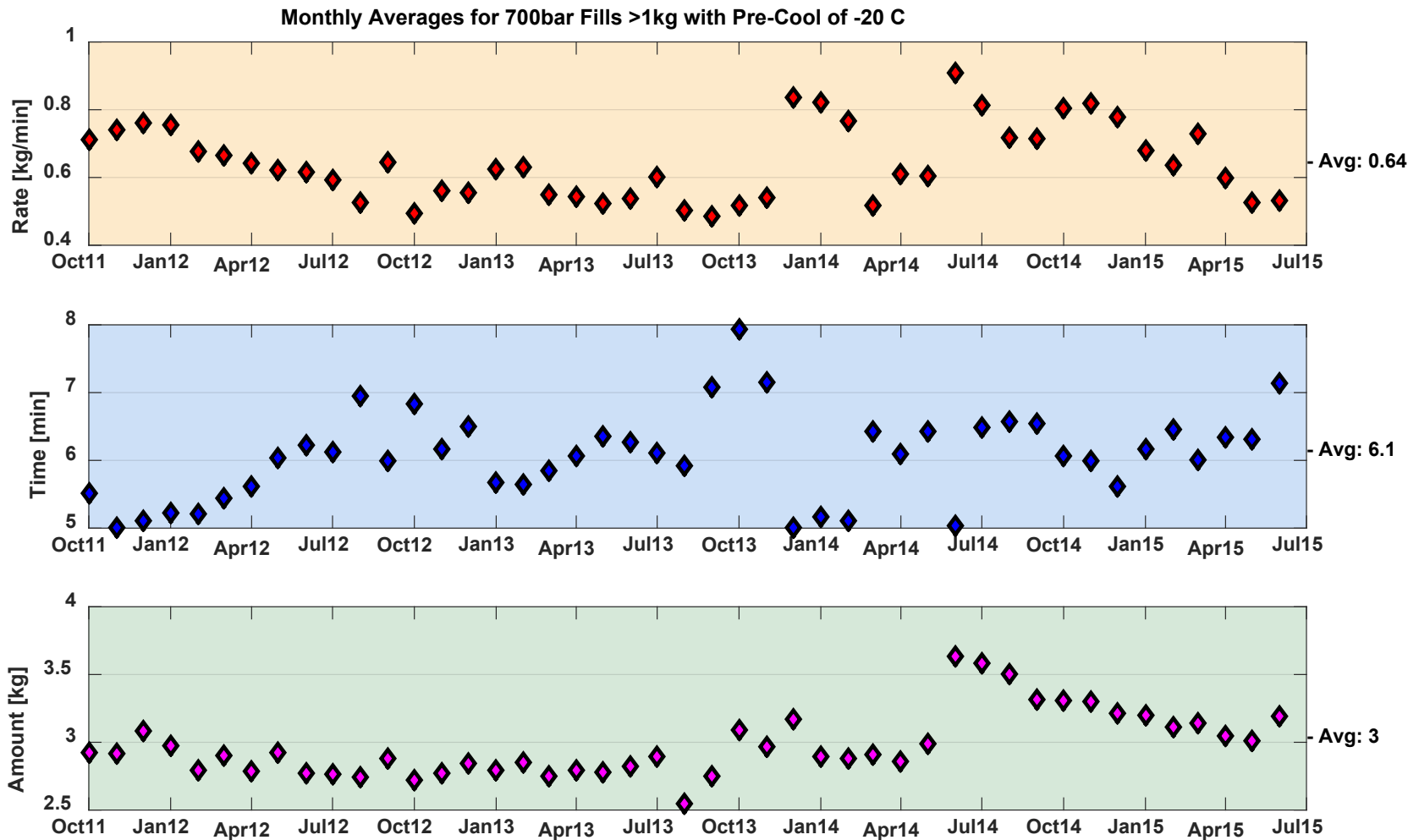


Maintenance Labor Hours by Month

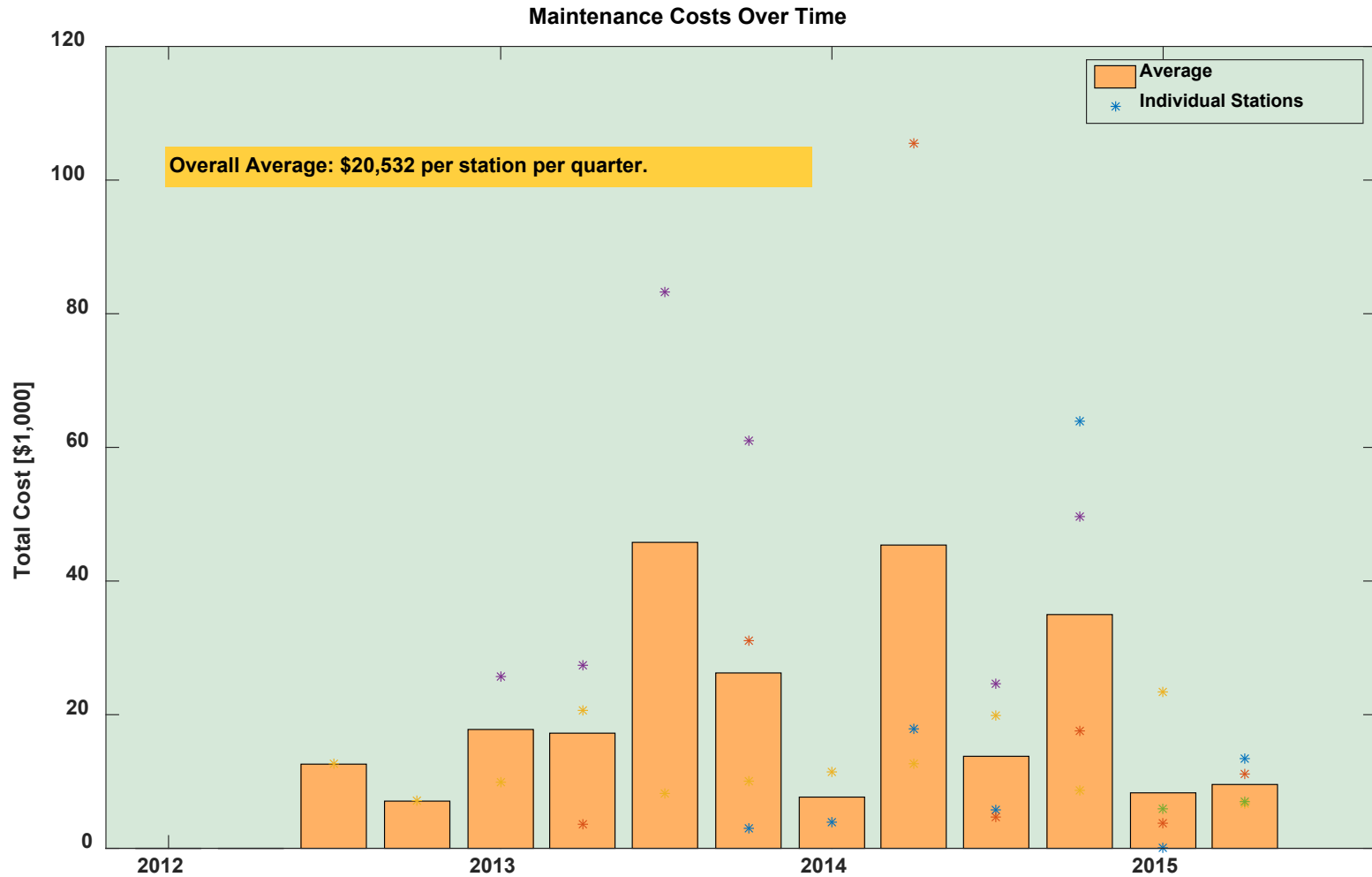


CDP-INFR-29

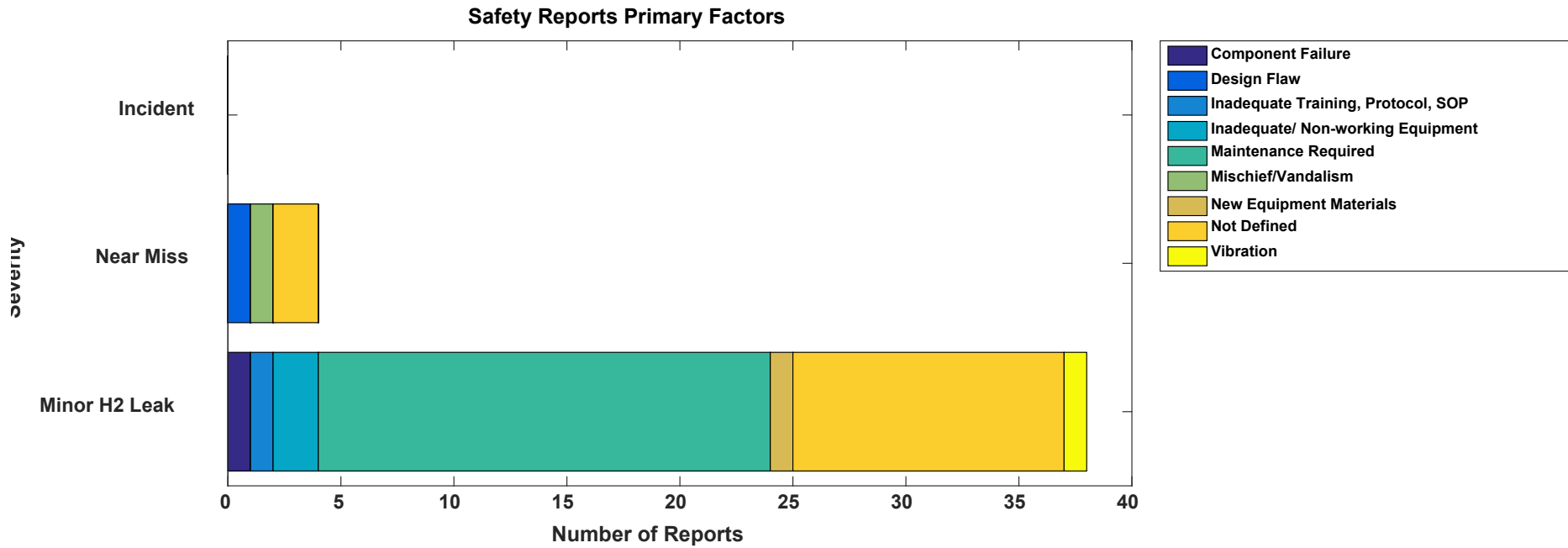
Monthly Averages for 700 bar Fills >1 kg with Pre-Cool of -20°C



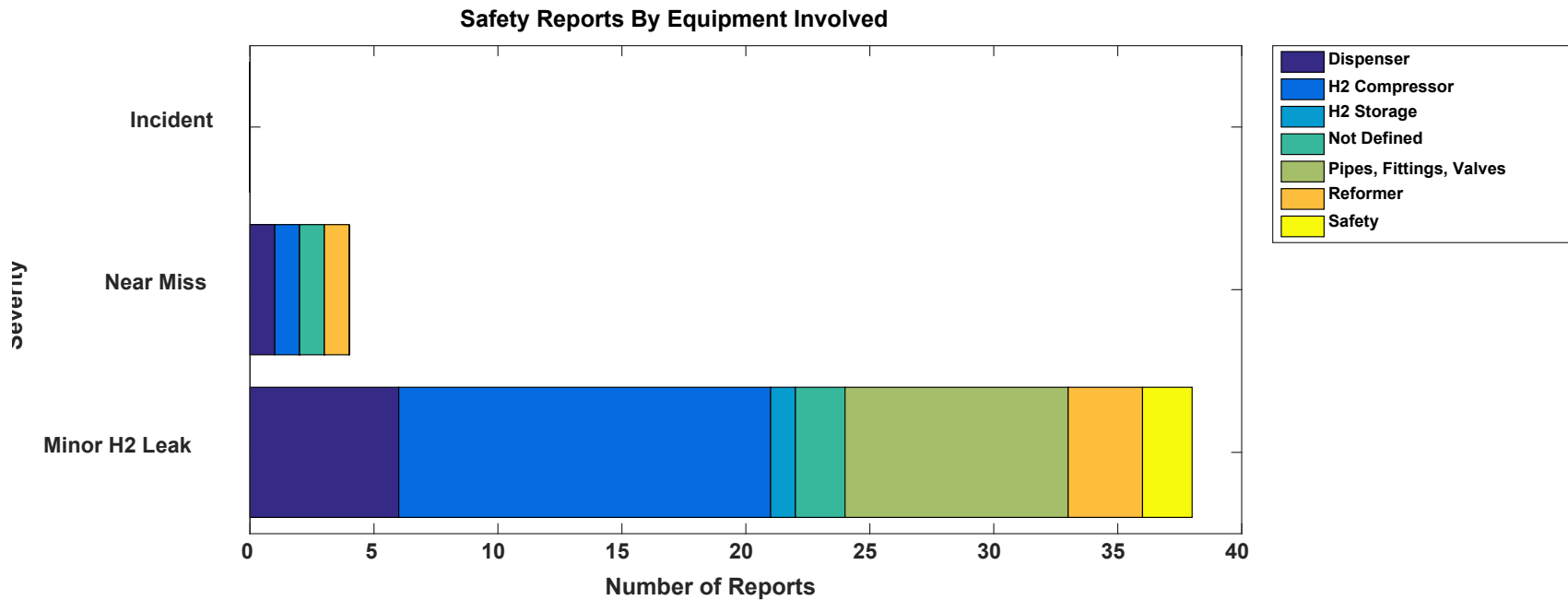
Maintenance Costs Over Time



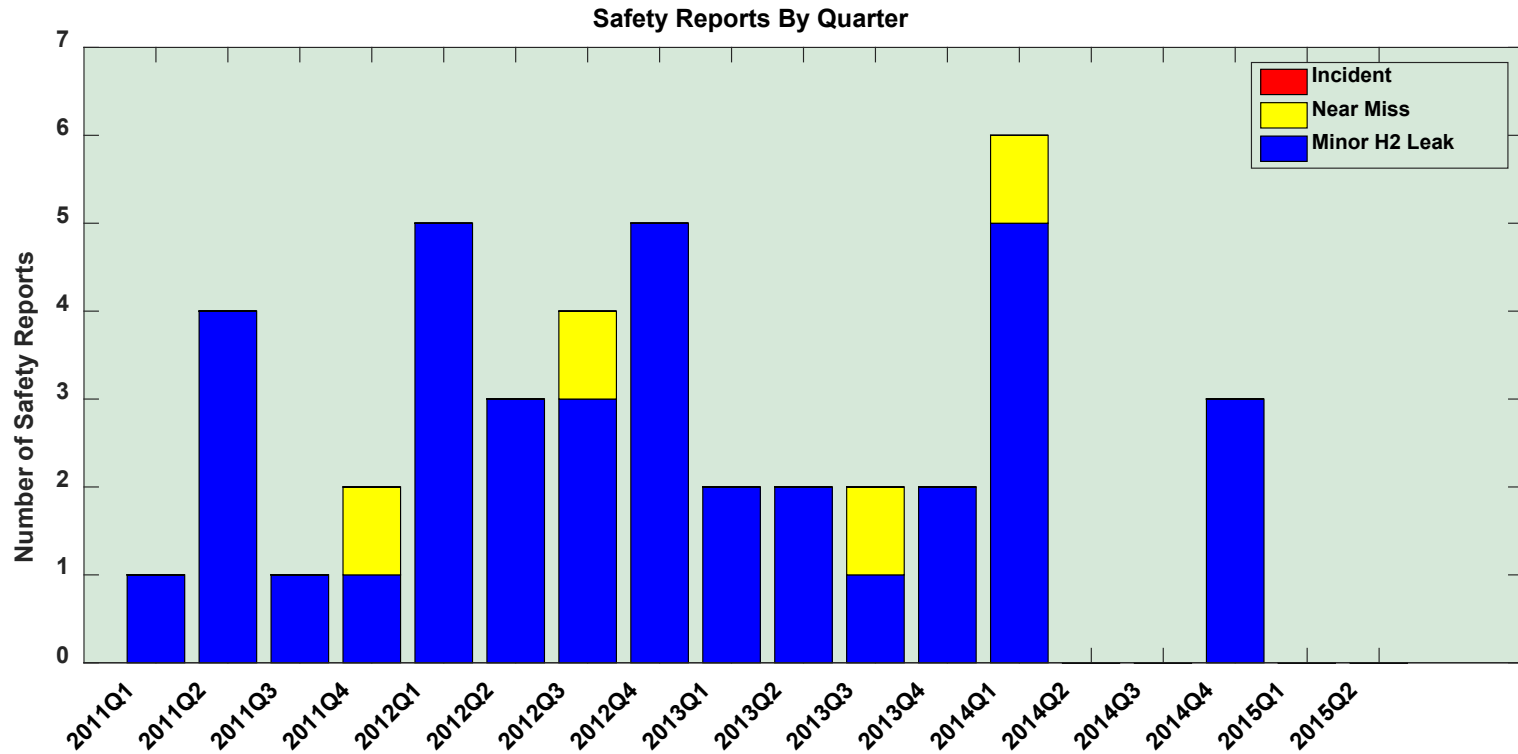
Safety Reports Primary Factors



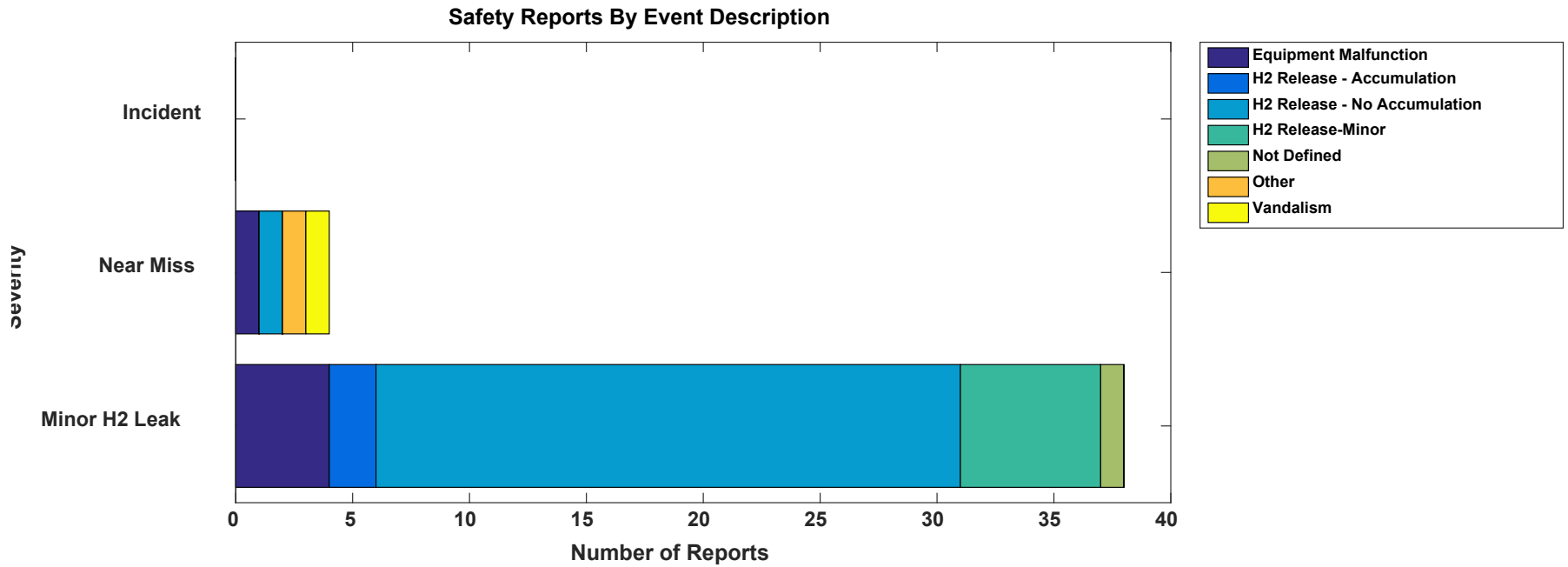
Safety Reports by Equipment Involved



Safety Reports by Quarter

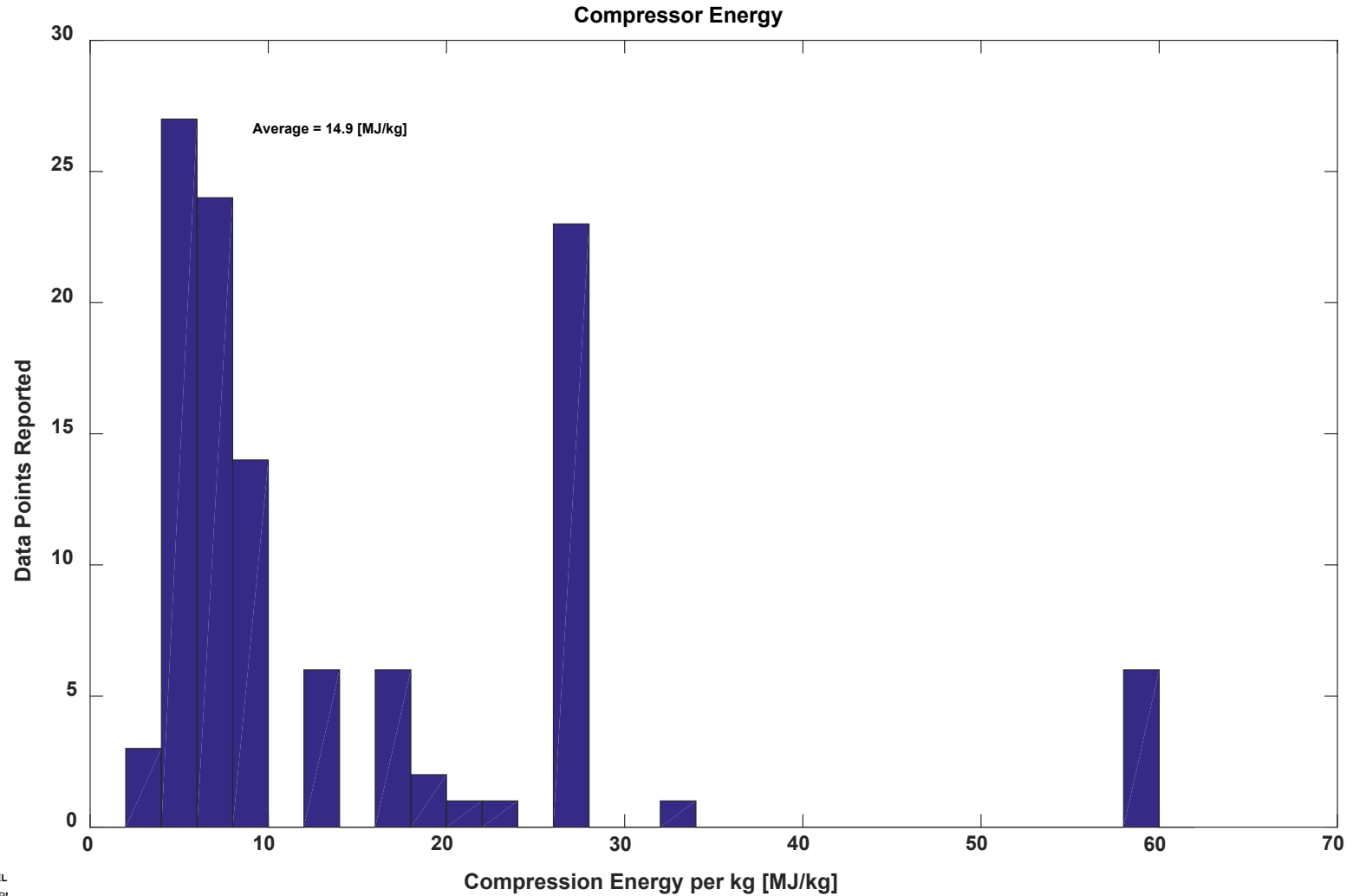


Safety Reports by Event Description



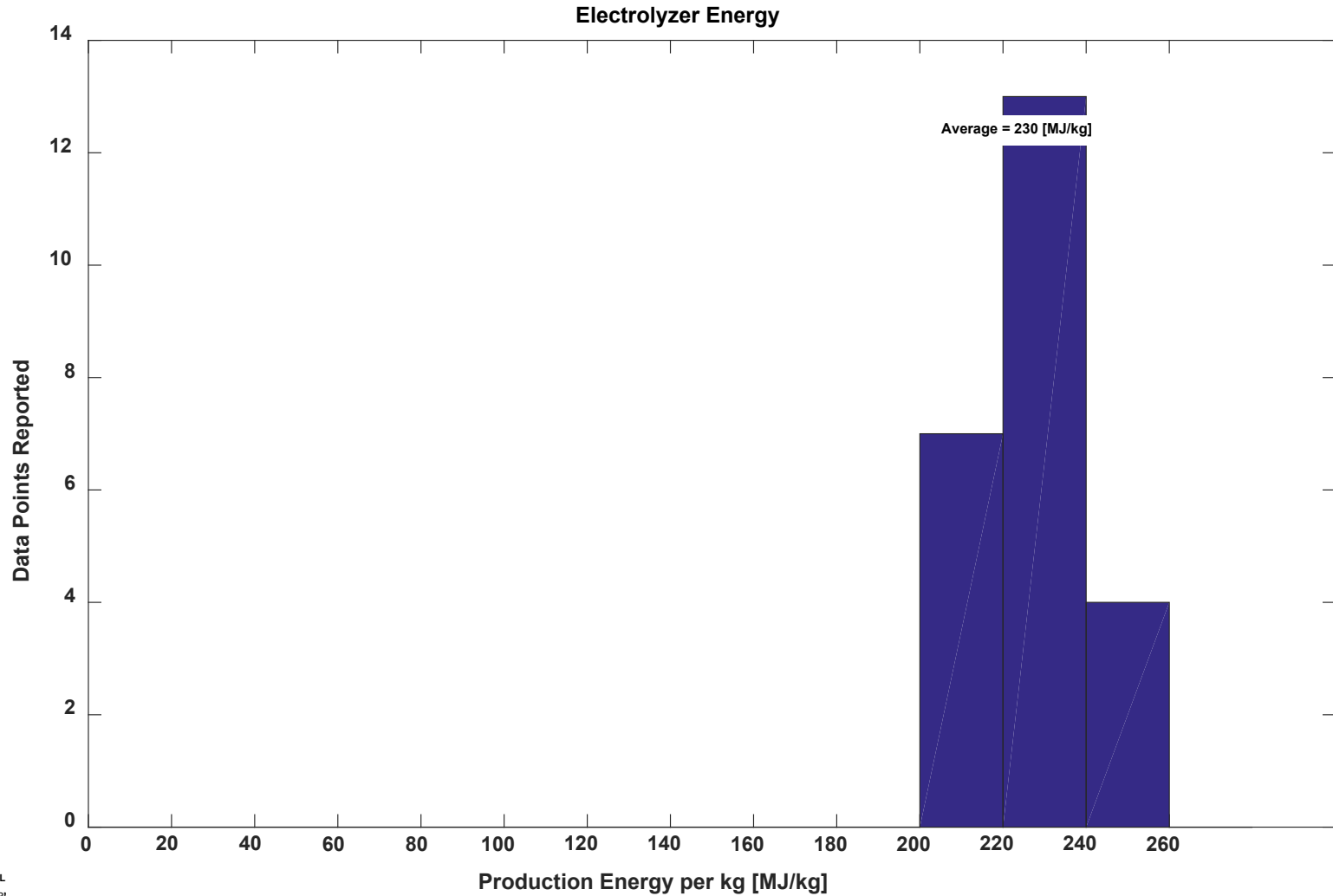
CDP-INFR-35

Compressor Energy



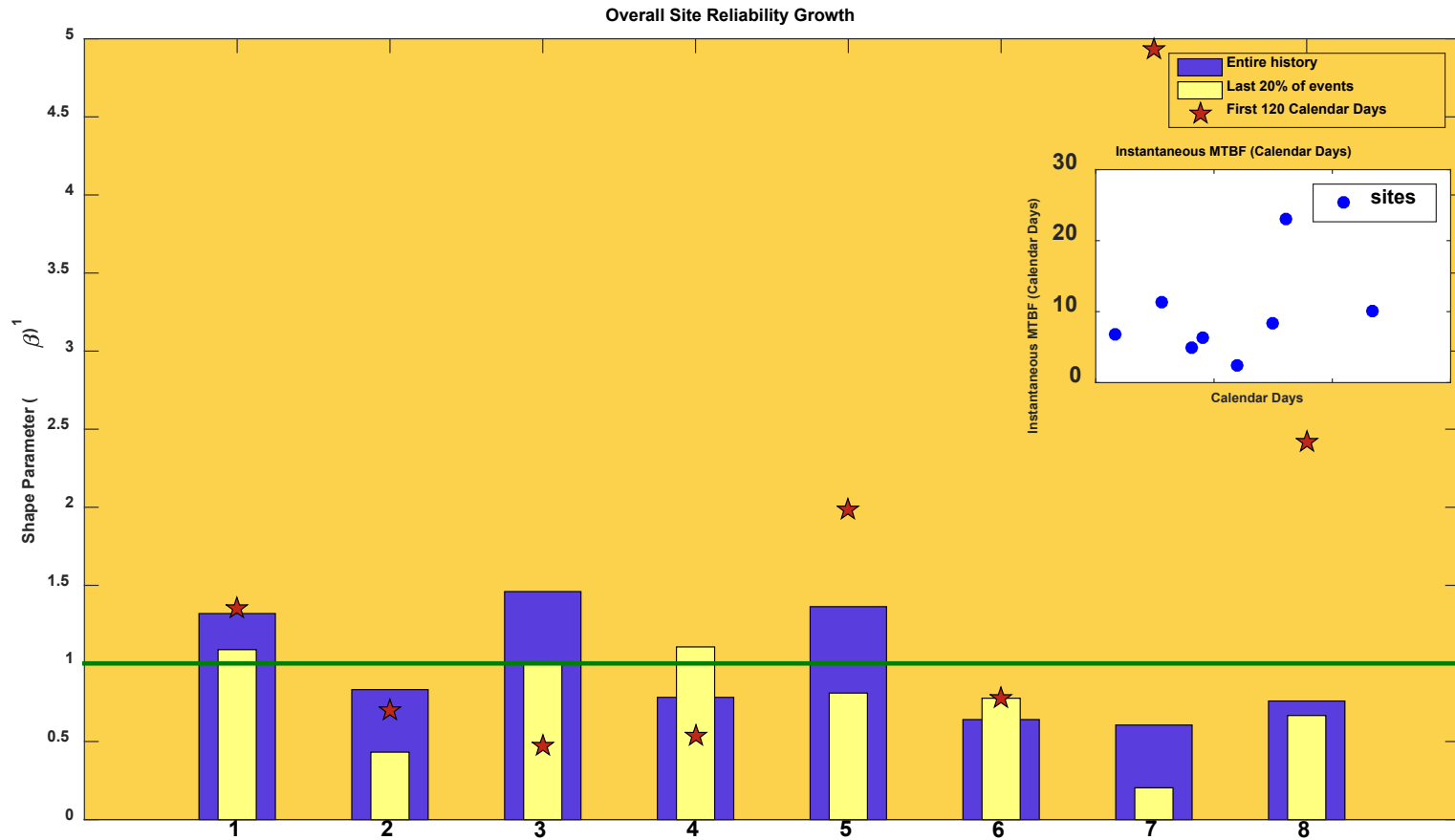
CDP-INFR-36

Electrolyzer Energy



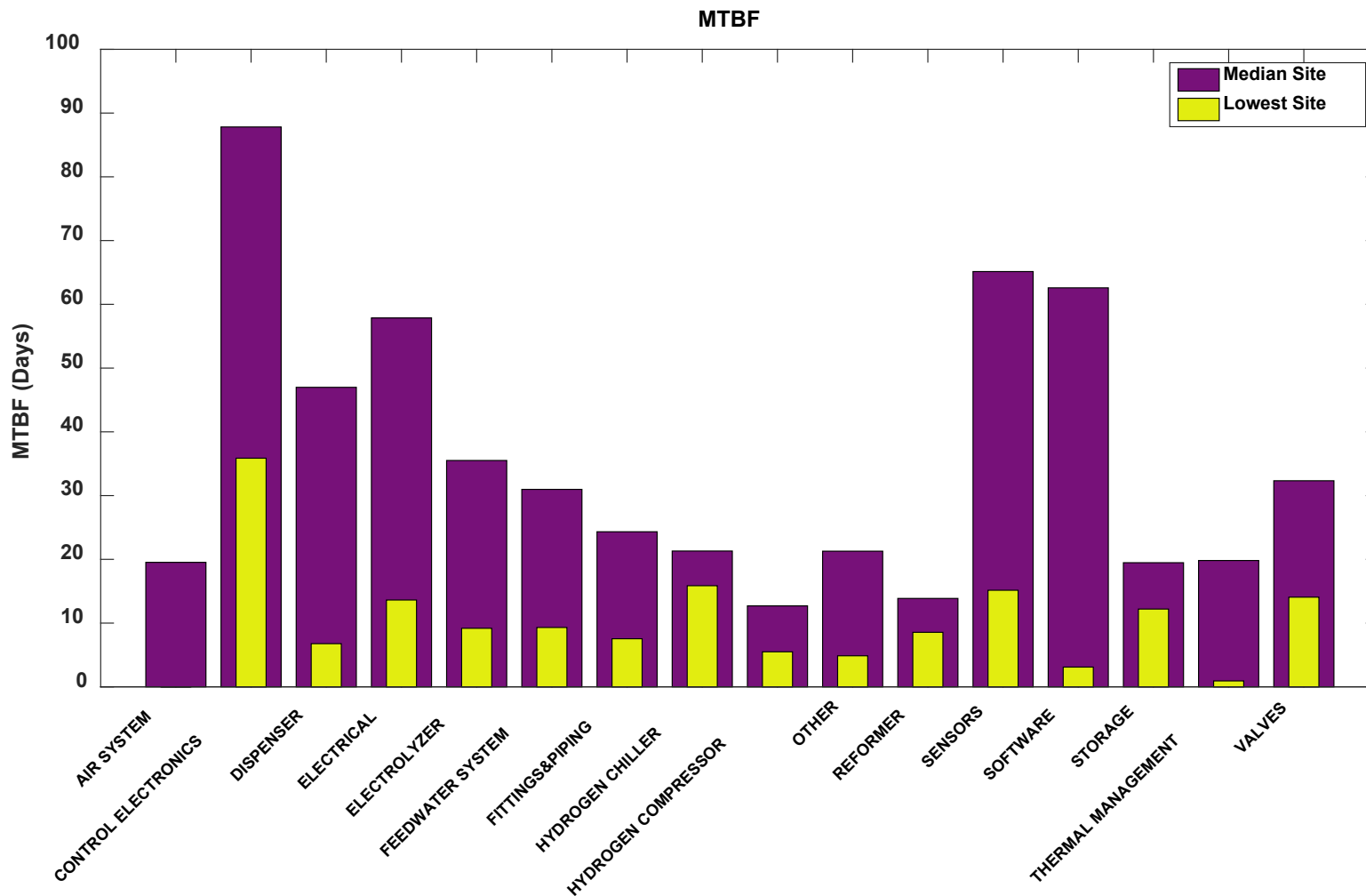
CDP-INFR-37

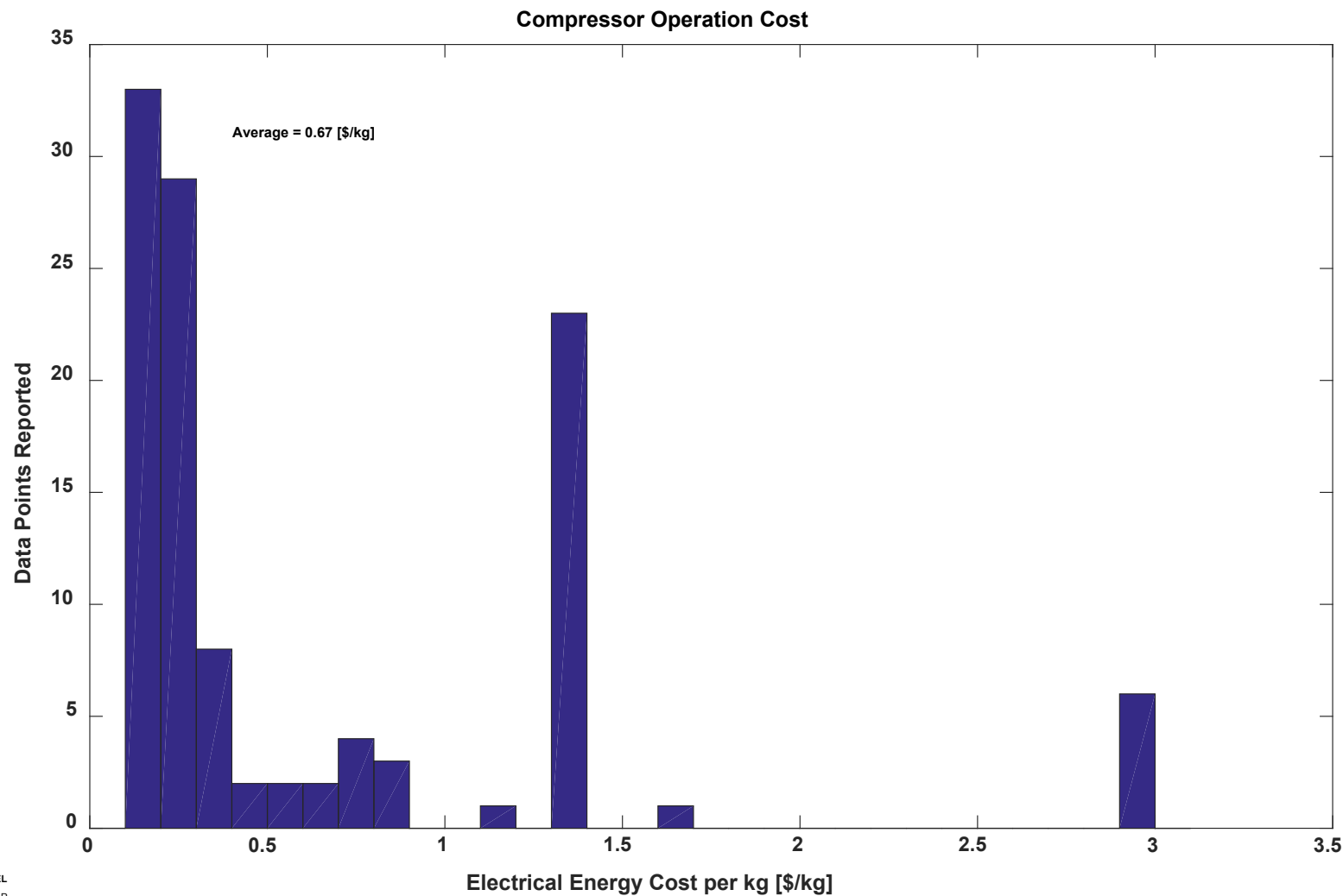
Reliability Growth



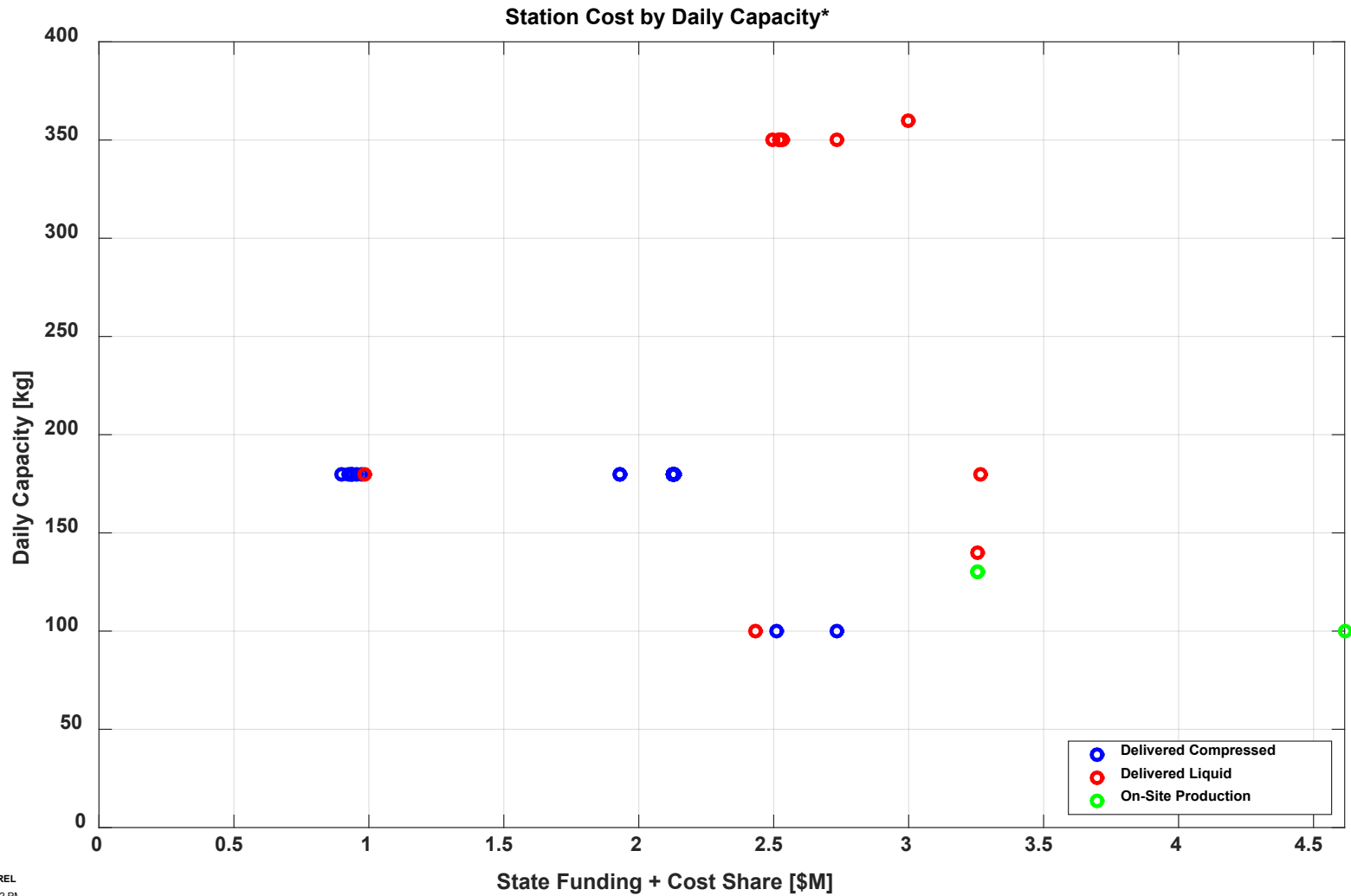
1. IEC 61164:2004(E), Reliability Growth - Statistical Test and Evaluation Methods, IEC. 2004.
2. % change in instantaneous mean Calendar Days between failures
3. Some sites are no longer active. Final results are shown for those sites.

Maintenance Mean Time Between Failures (MTBF)



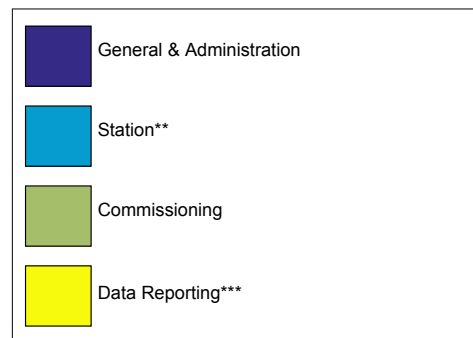
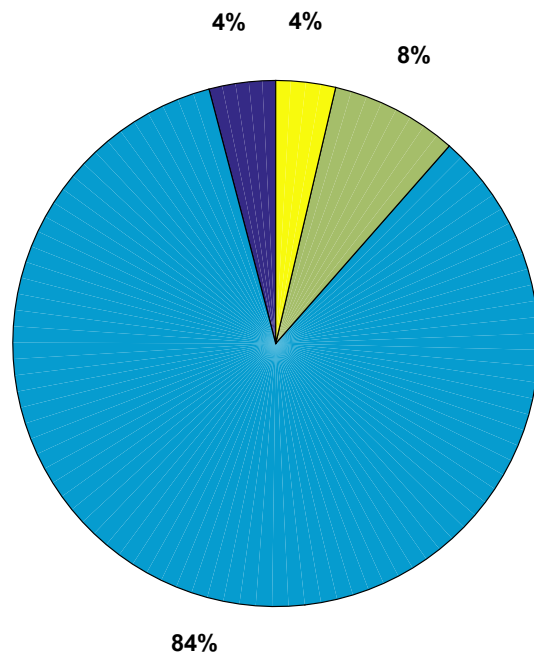


Station Costs by Daily Capacity



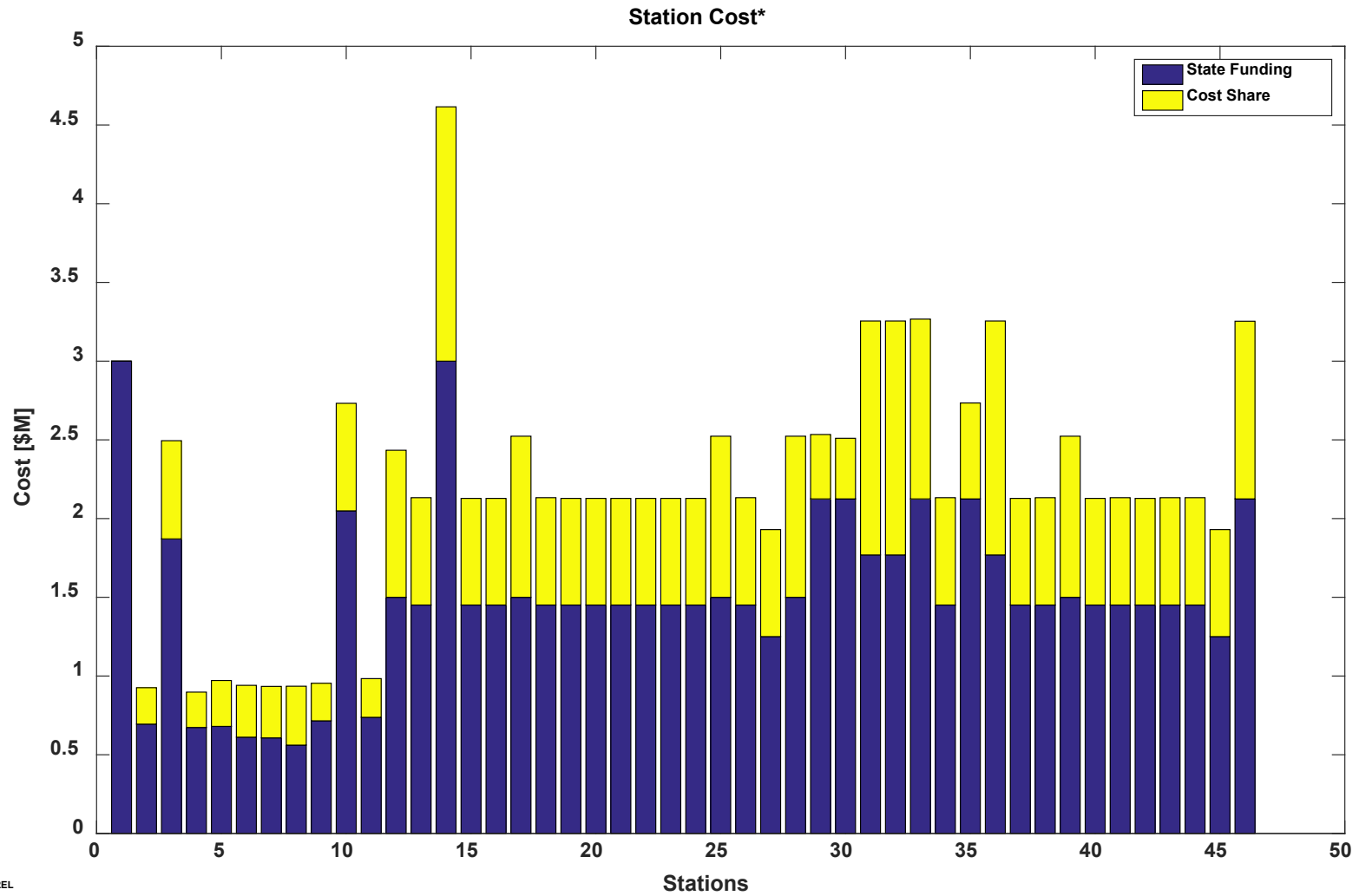
Average Station Cost by Category

Budget Amounts* (Avg Total = \$2.2M), 46 Stations



CDP-INFR-42

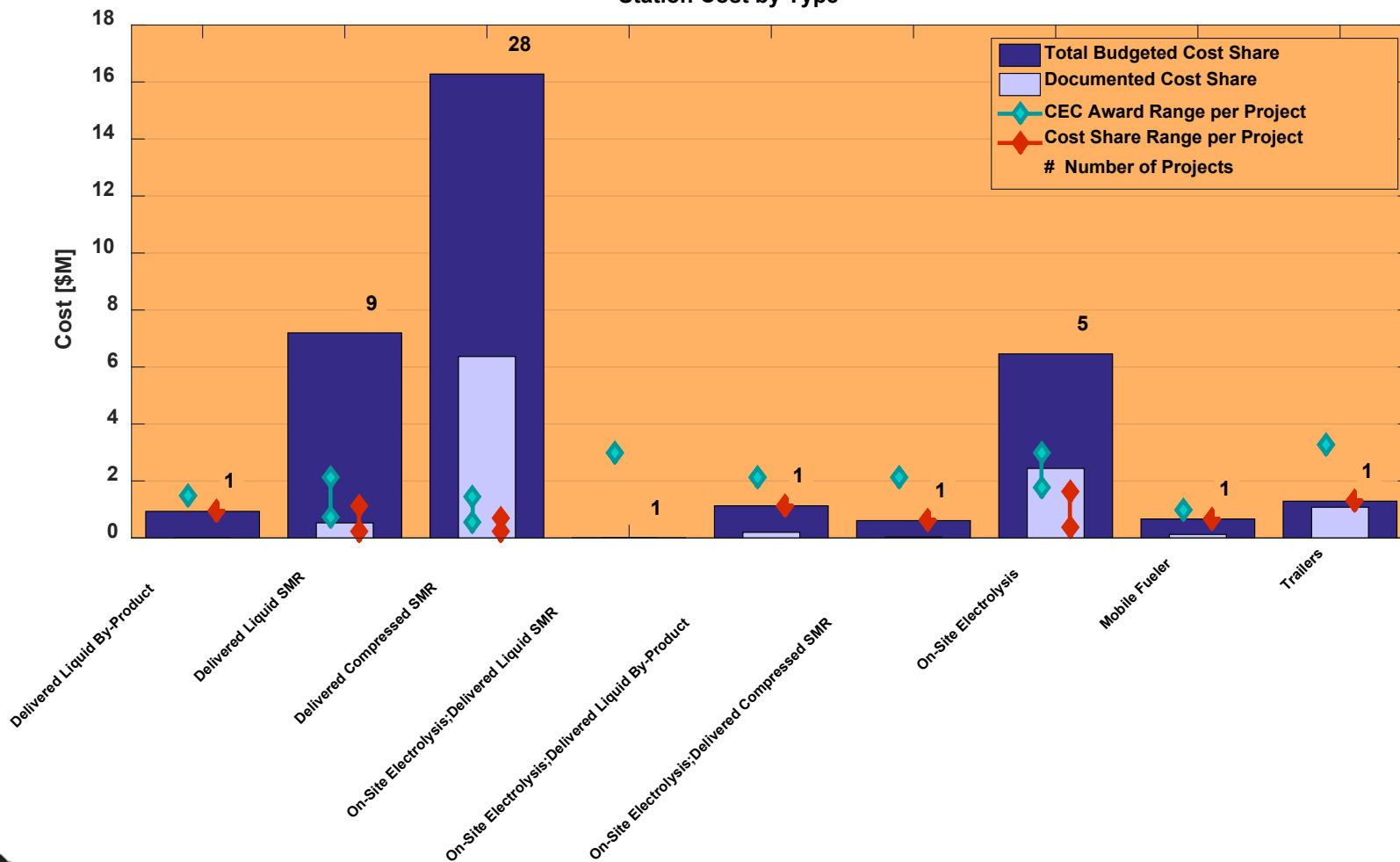
Station Costs



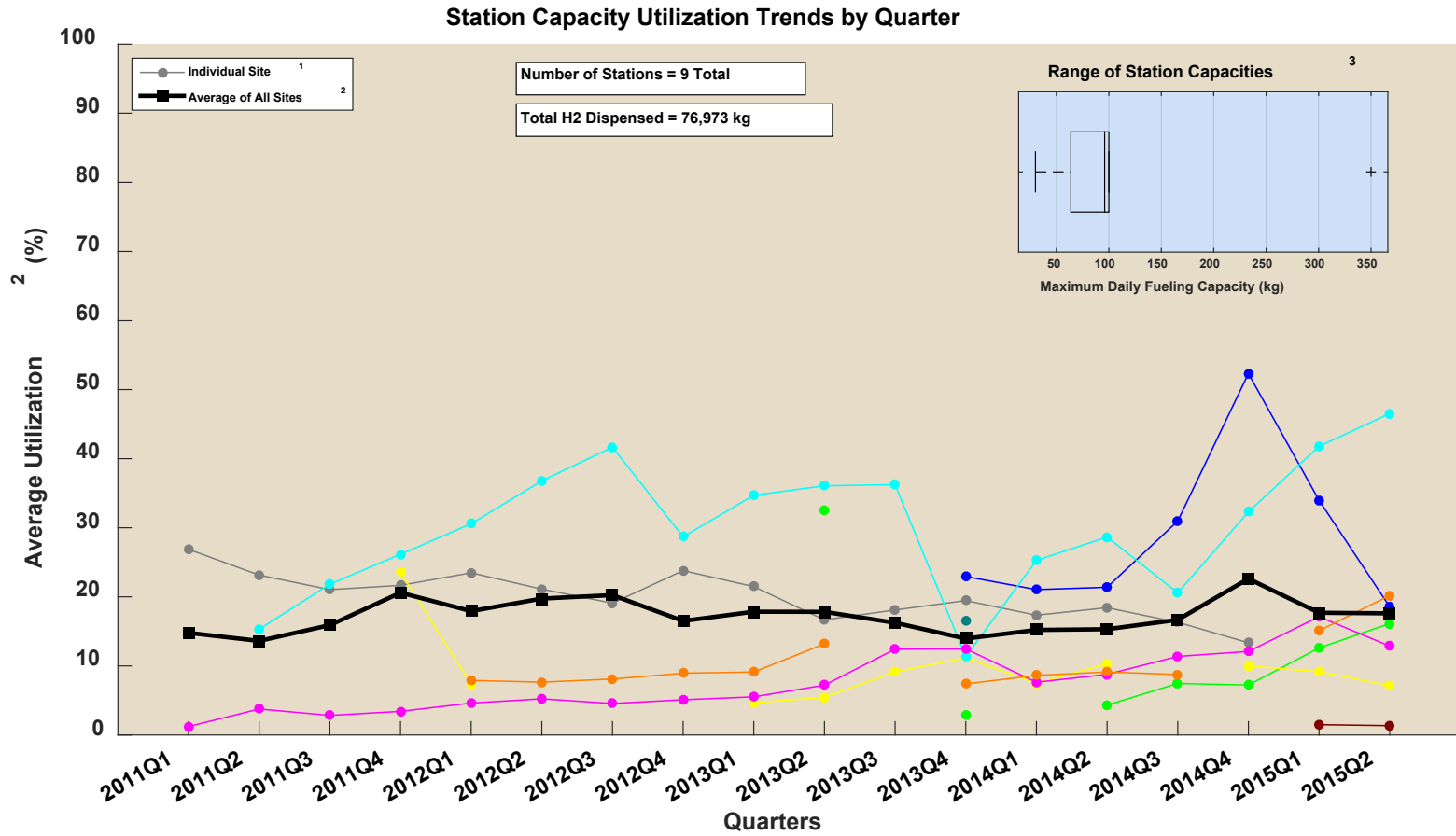
CDP-INFR-43

Station Cost by Type

Station Cost by Type*

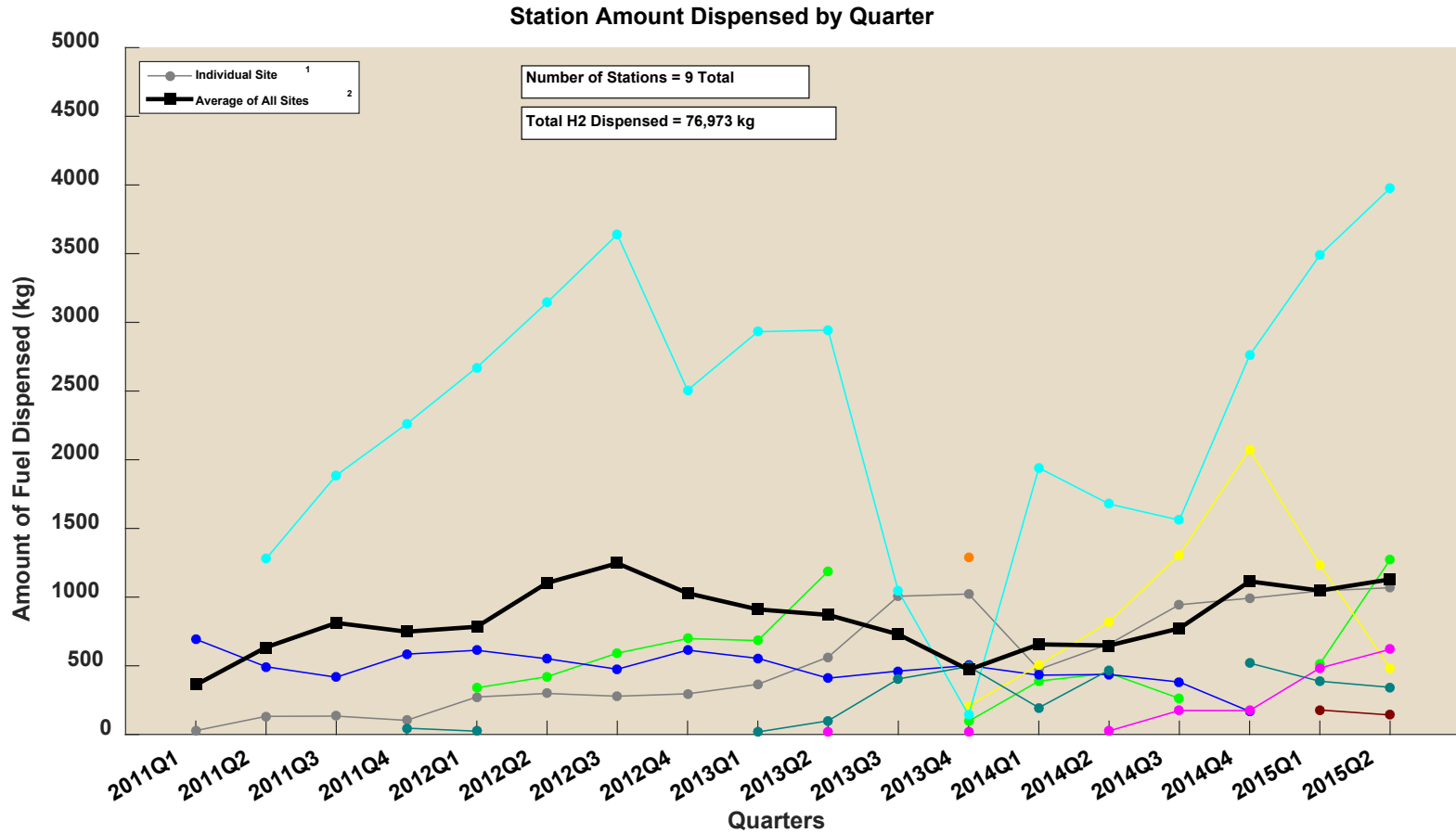


Station Capacity Utilization Trends by Quarter



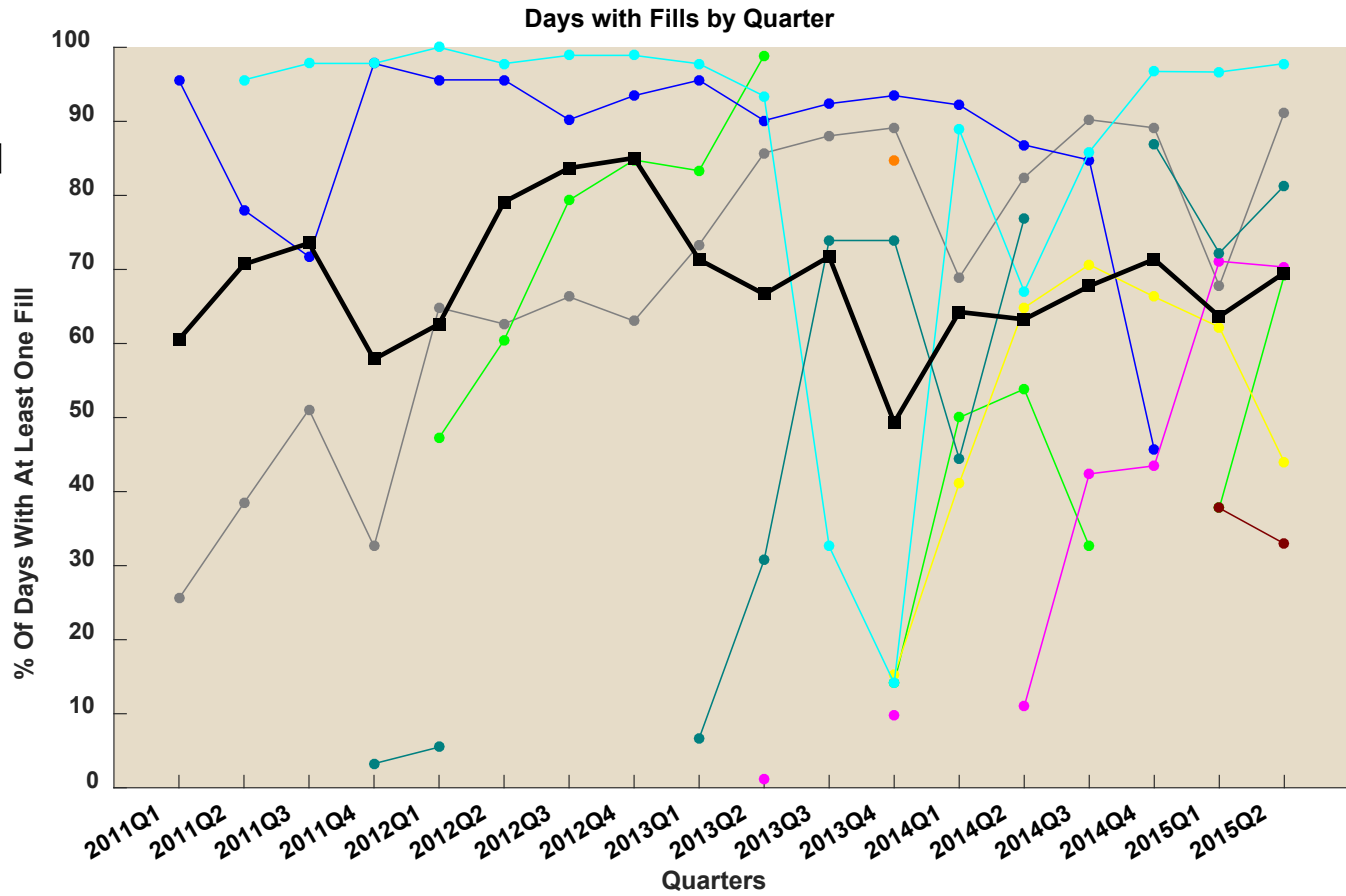
CDP-INFR-45

Station Amount Dispensed by Quarter



CDP-INFR-46

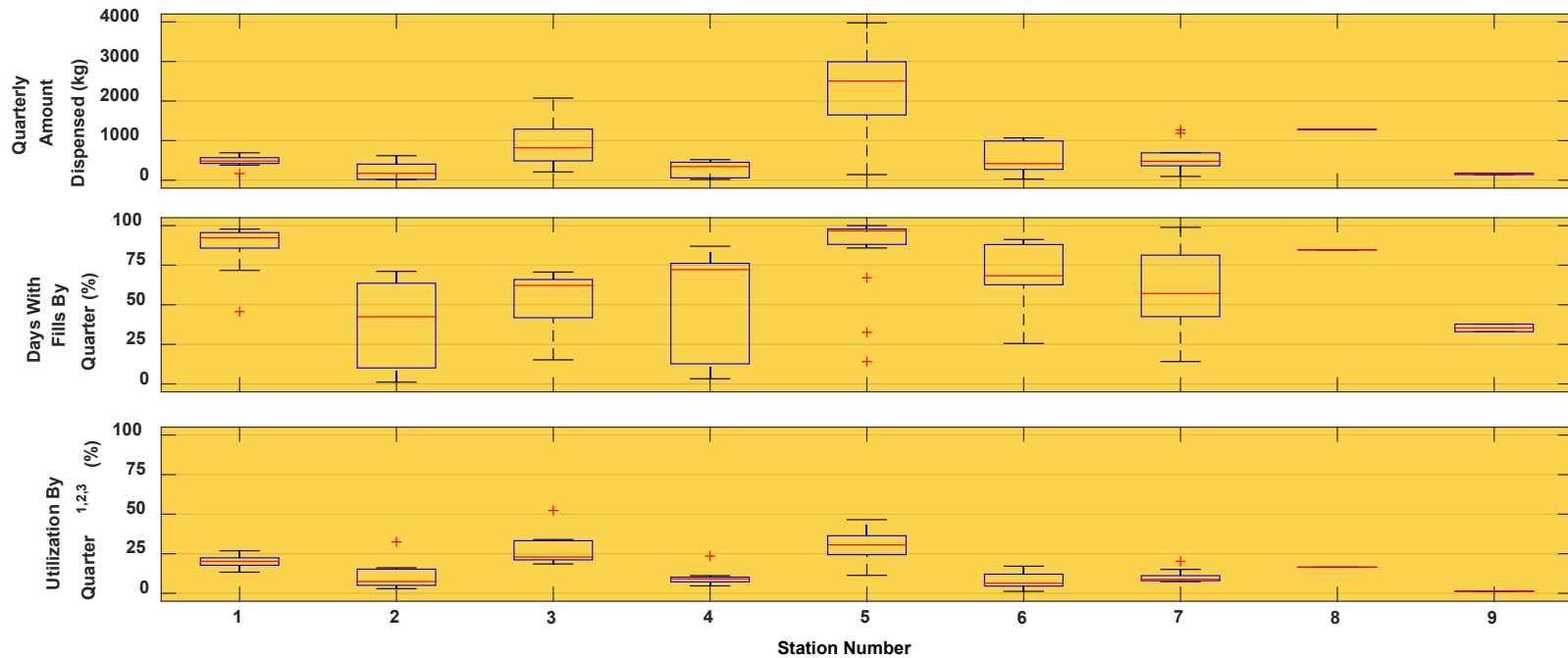
Days with Fills by Quarter



Summary of Station Usage Statistics

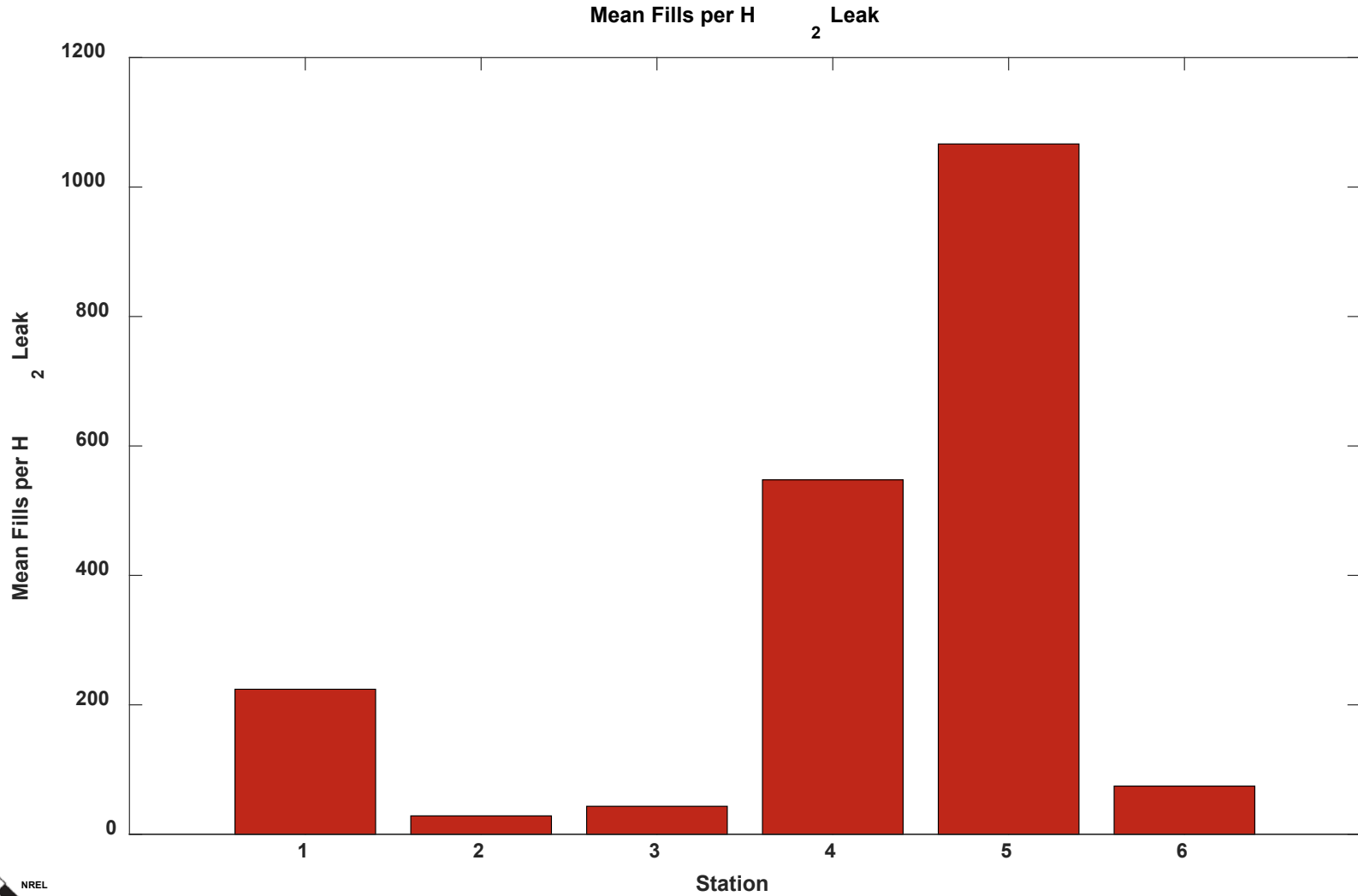
Summary of Station Usage Statistics

4

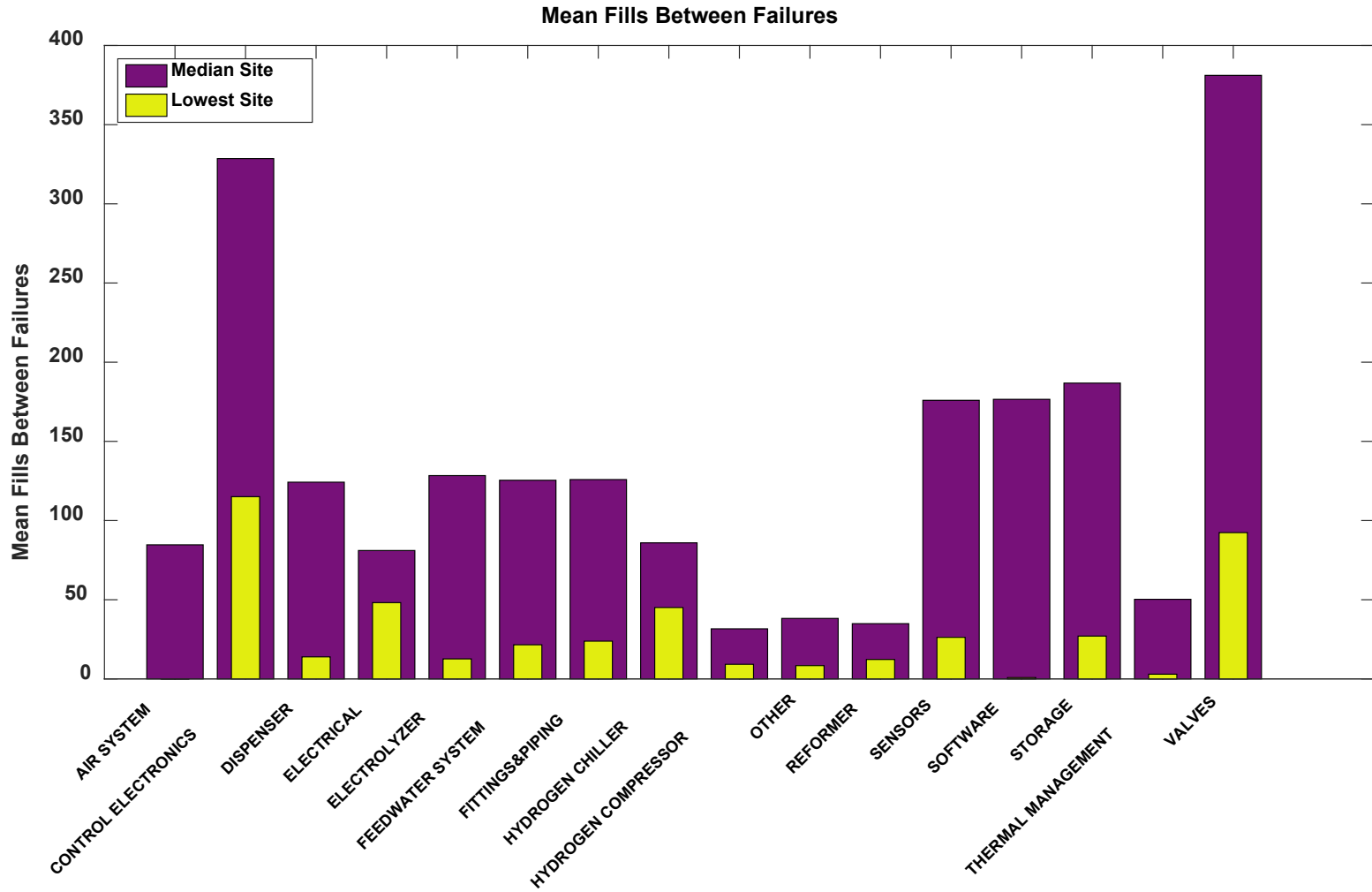


CDP-INFR-48

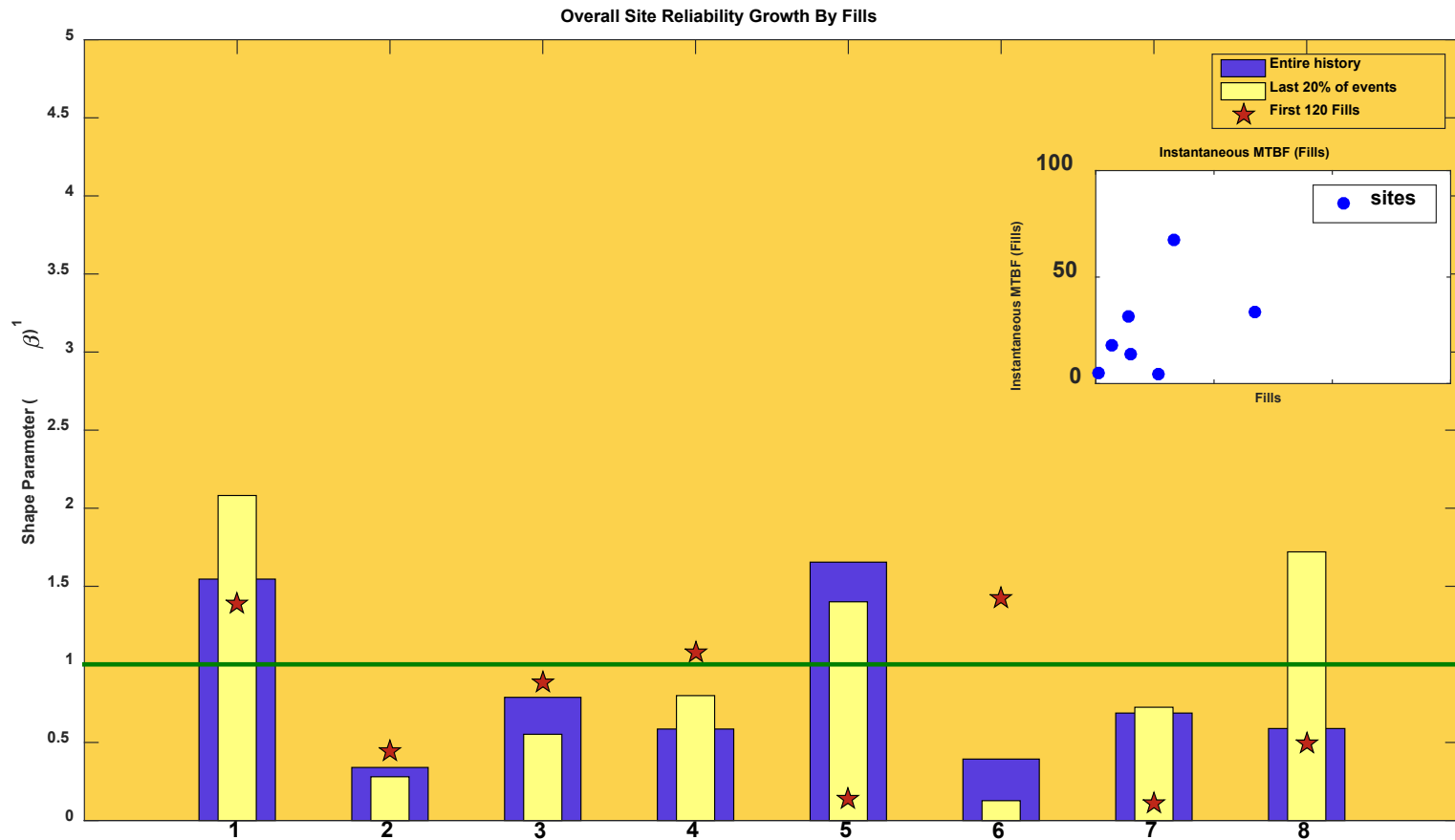
Mean Fills per Hydrogen Leak



Mean Fills Between Failures

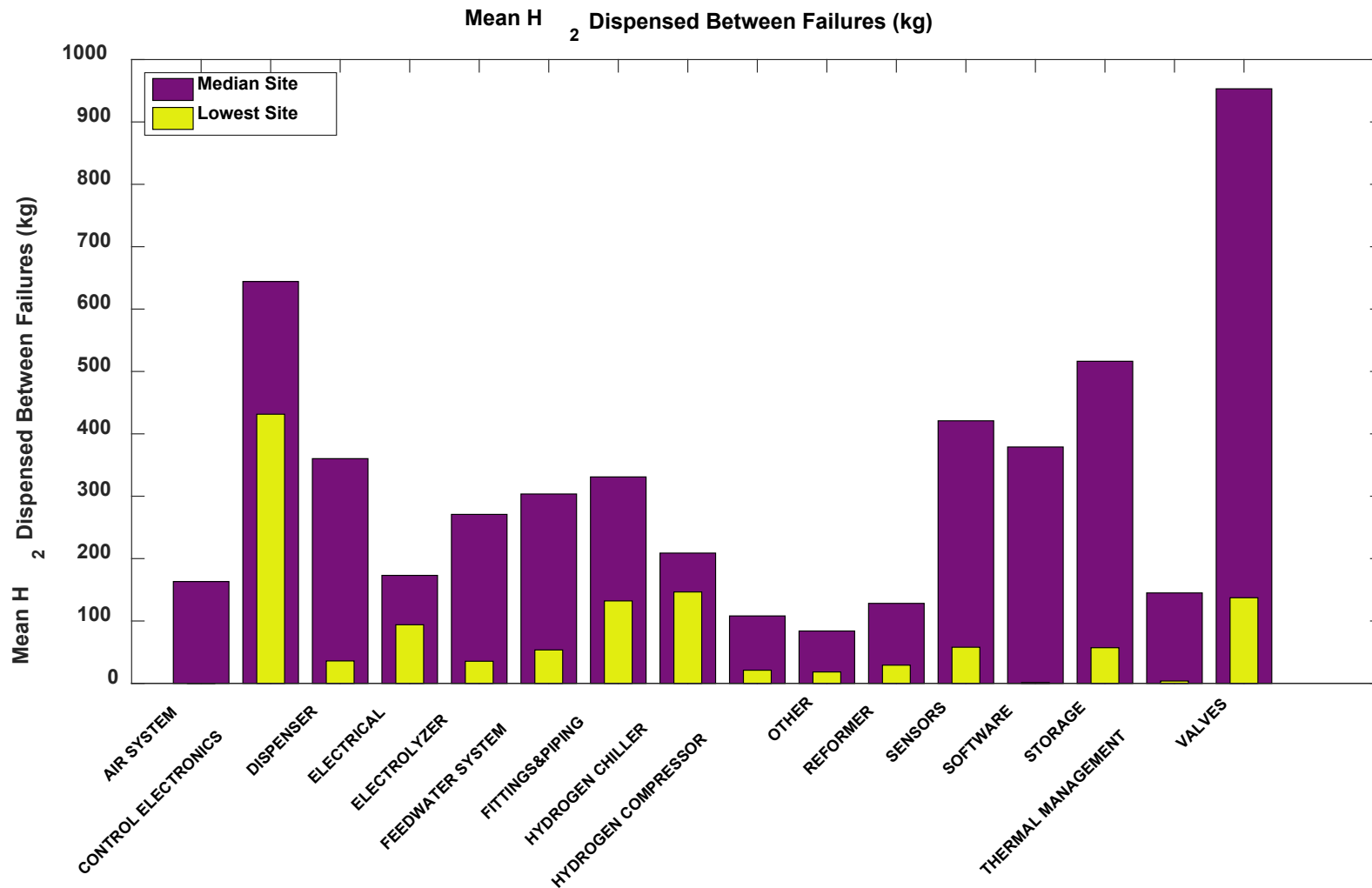


Reliability Growth by Fills

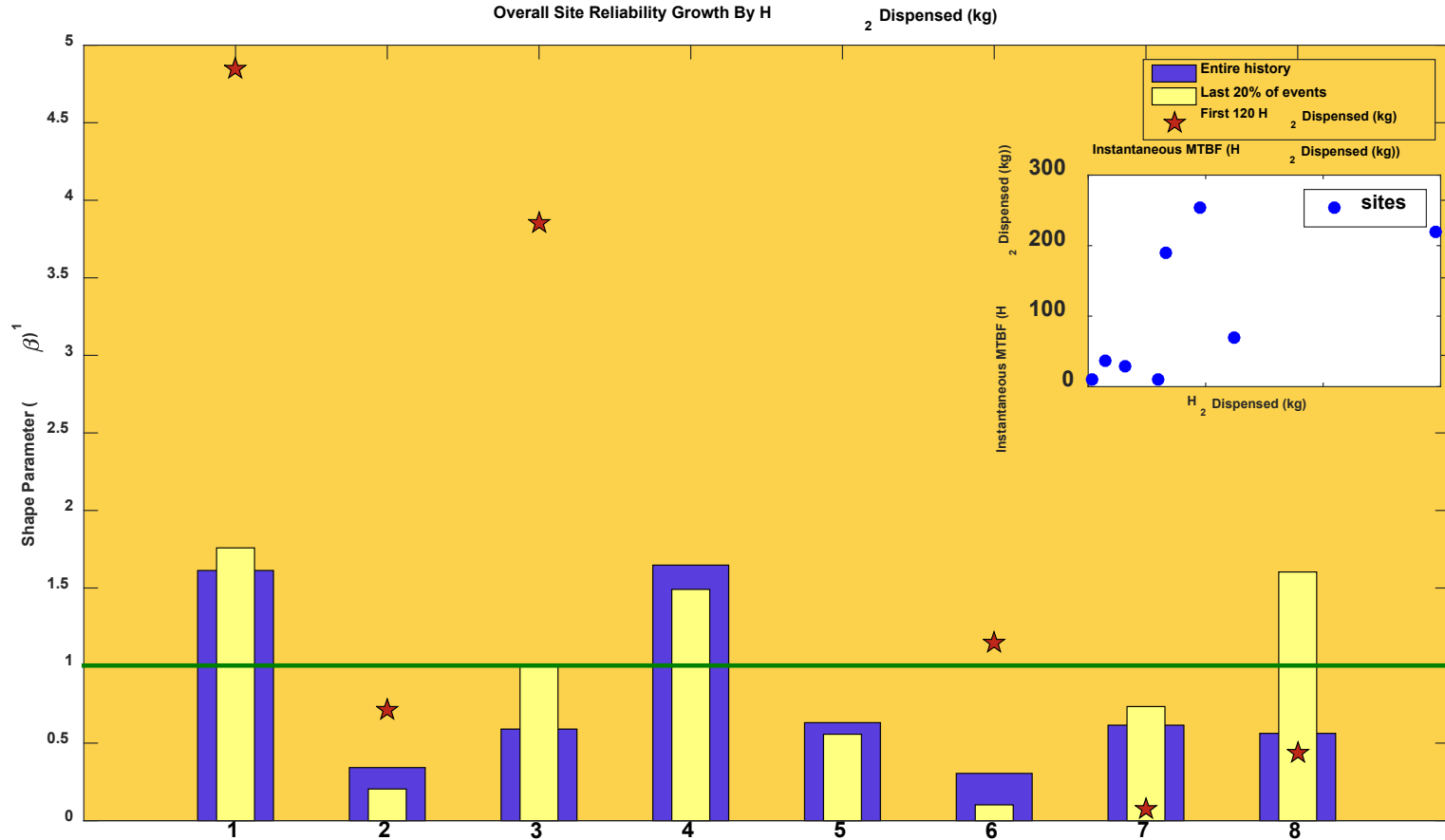


1. IEC 61164:2004(E), Reliability Growth - Statistical Test and Evaluation Methods, IEC. 2004.
2. % change in instantaneous mean Fills between failures
3. Some sites are no longer active. Final results are shown for those sites.

Mean Amount Dispensed Between Failures

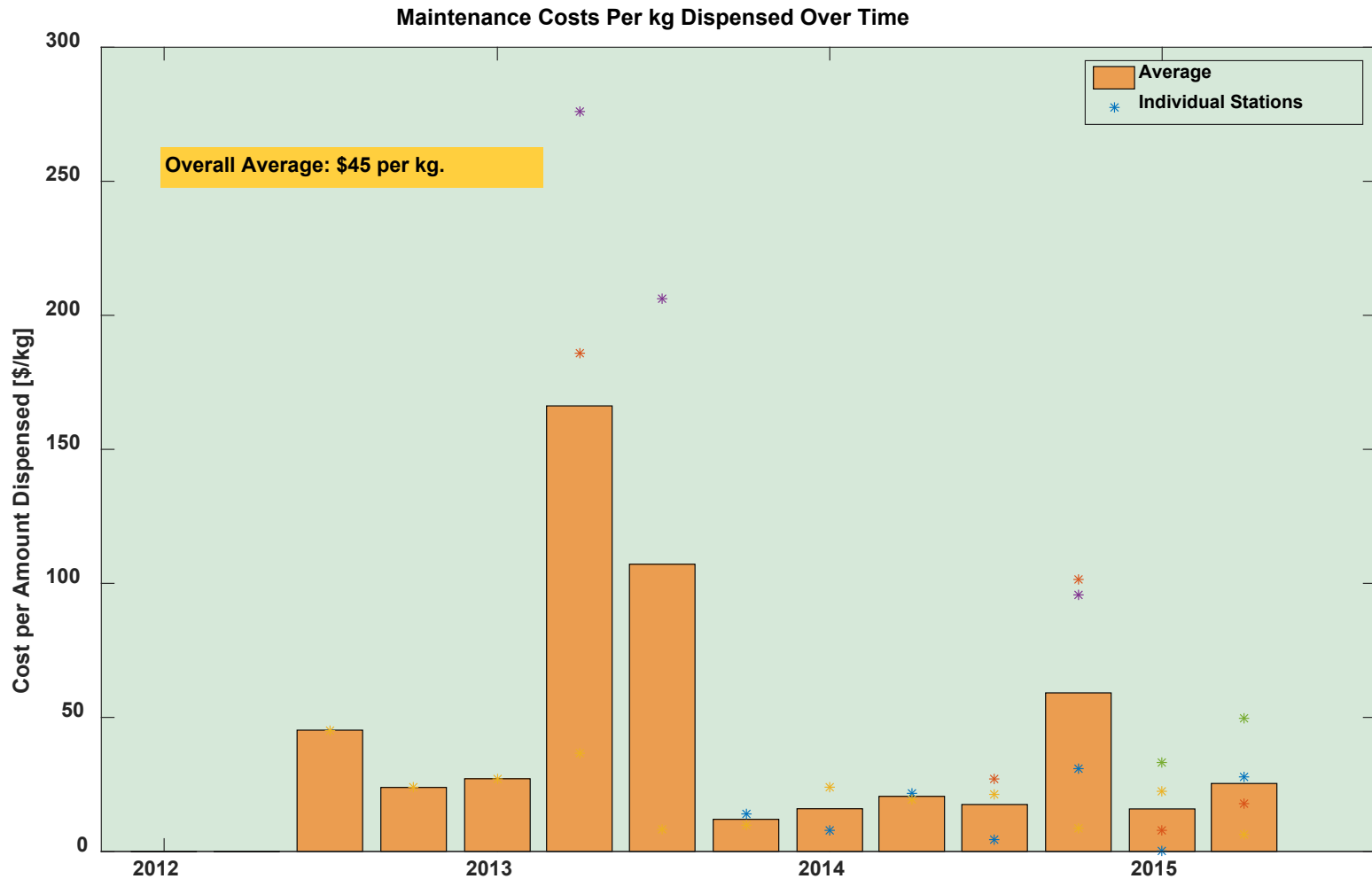


Reliability Growth by Amount Dispensed

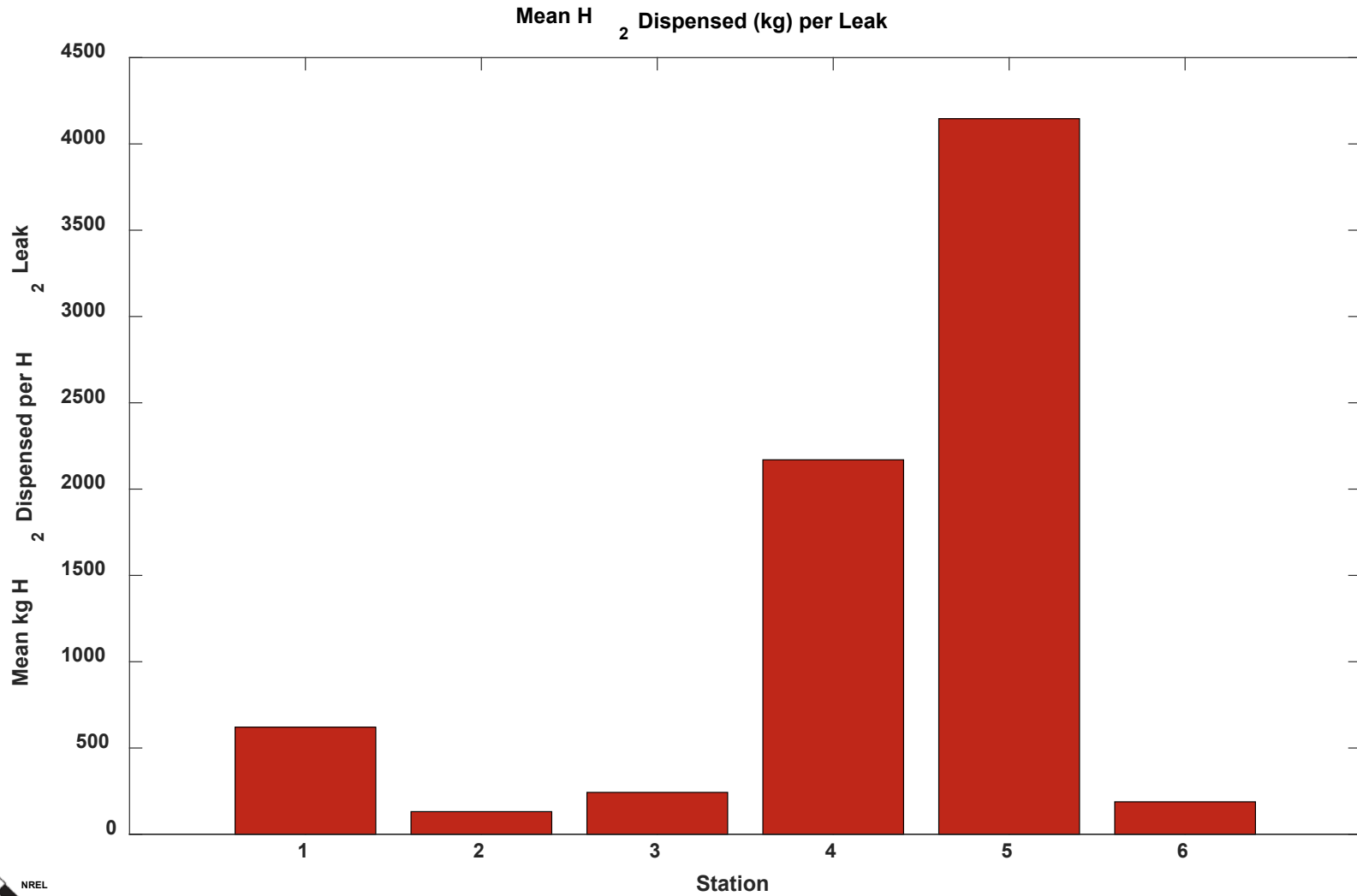


1. IEC 61164:2004(E), Reliability Growth - Statistical Test and Evaluation Methods, IEC, 2004.
2. % change in instantaneous mean H Dispensed (kg) between failures
3. Some sites are no longer active. Final results are shown for those sites.

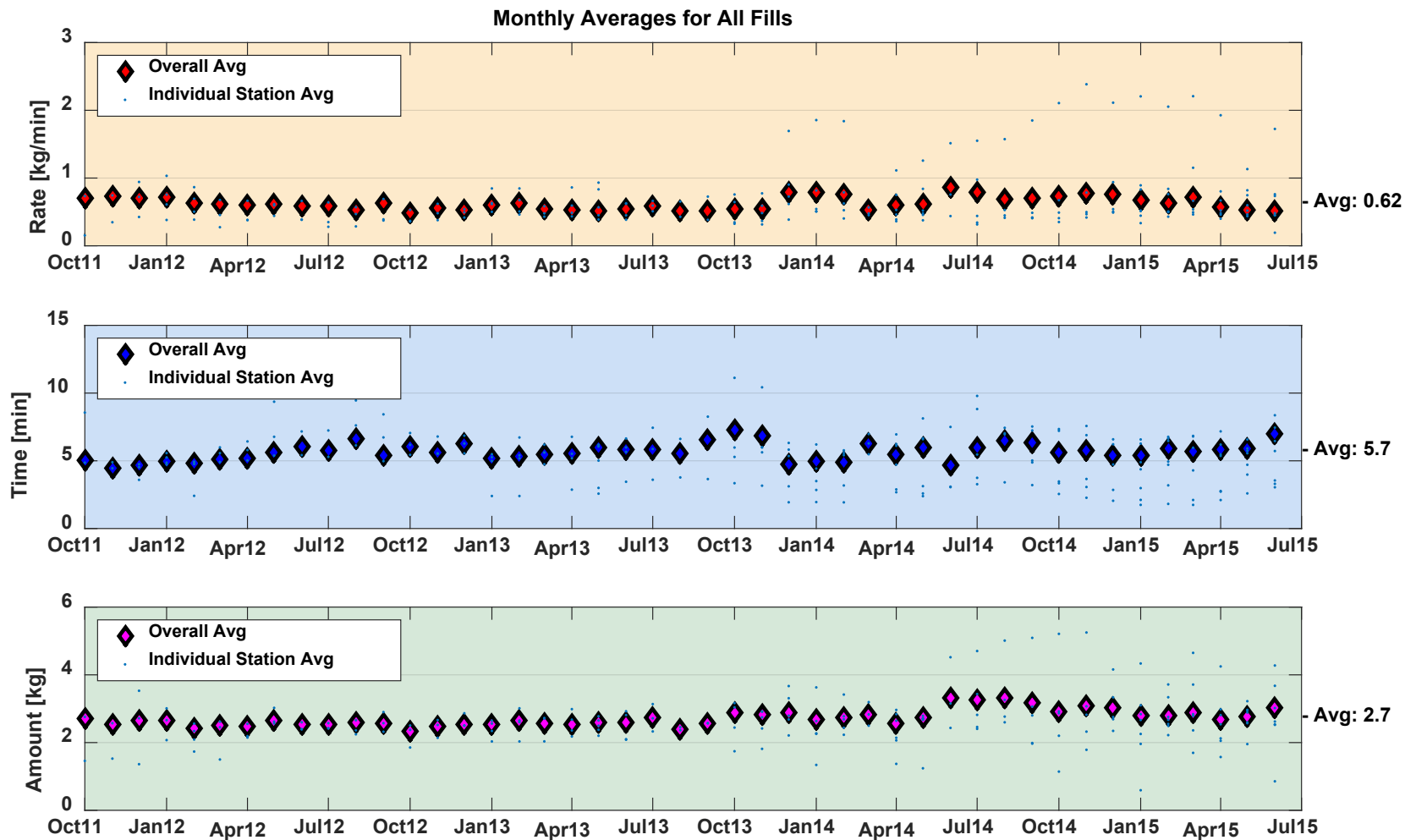
Maintenance Cost per Kilogram of Hydrogen Dispensed



Mean Hydrogen Dispensed per Hydrogen Leak



Monthly Averages for All Fills



Histogram of Fueling Rates by Year

Histogram of Fueling Rates
By Year

