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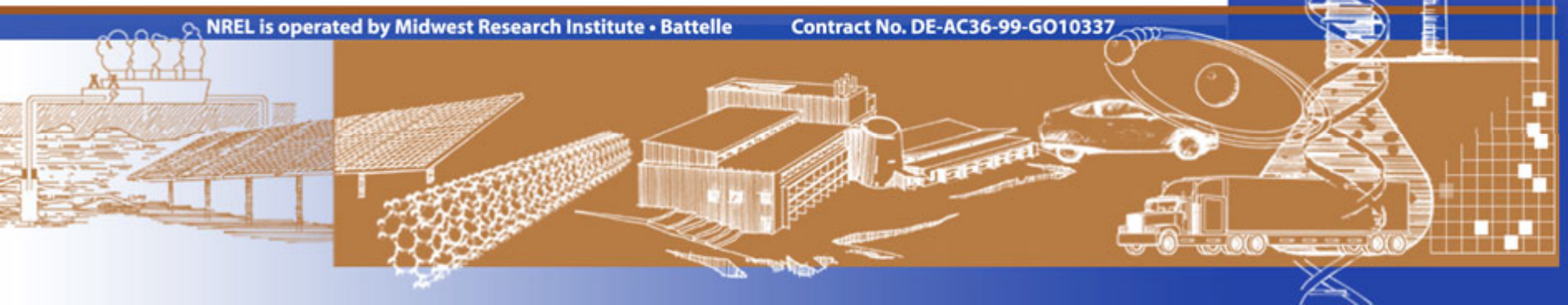
Completed Learning Demonstration Composite Data Products as of December 1, 2006

Keith Wipke

Technical Report
NREL/TP-560-41090
February 2007



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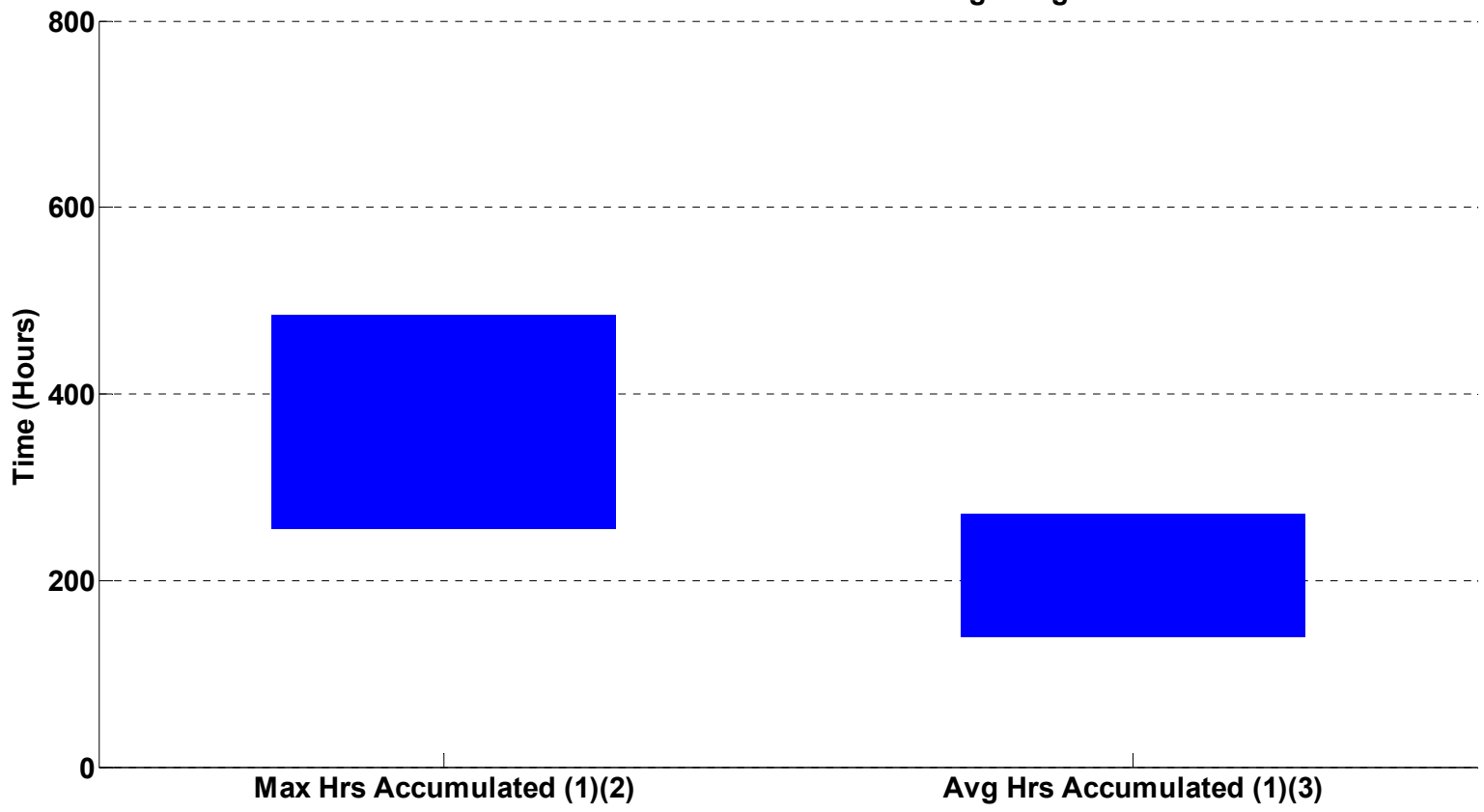
Completed Learning Demonstration Composite Data Products as of 12/01/06

Prepared under Task No. H270.8100

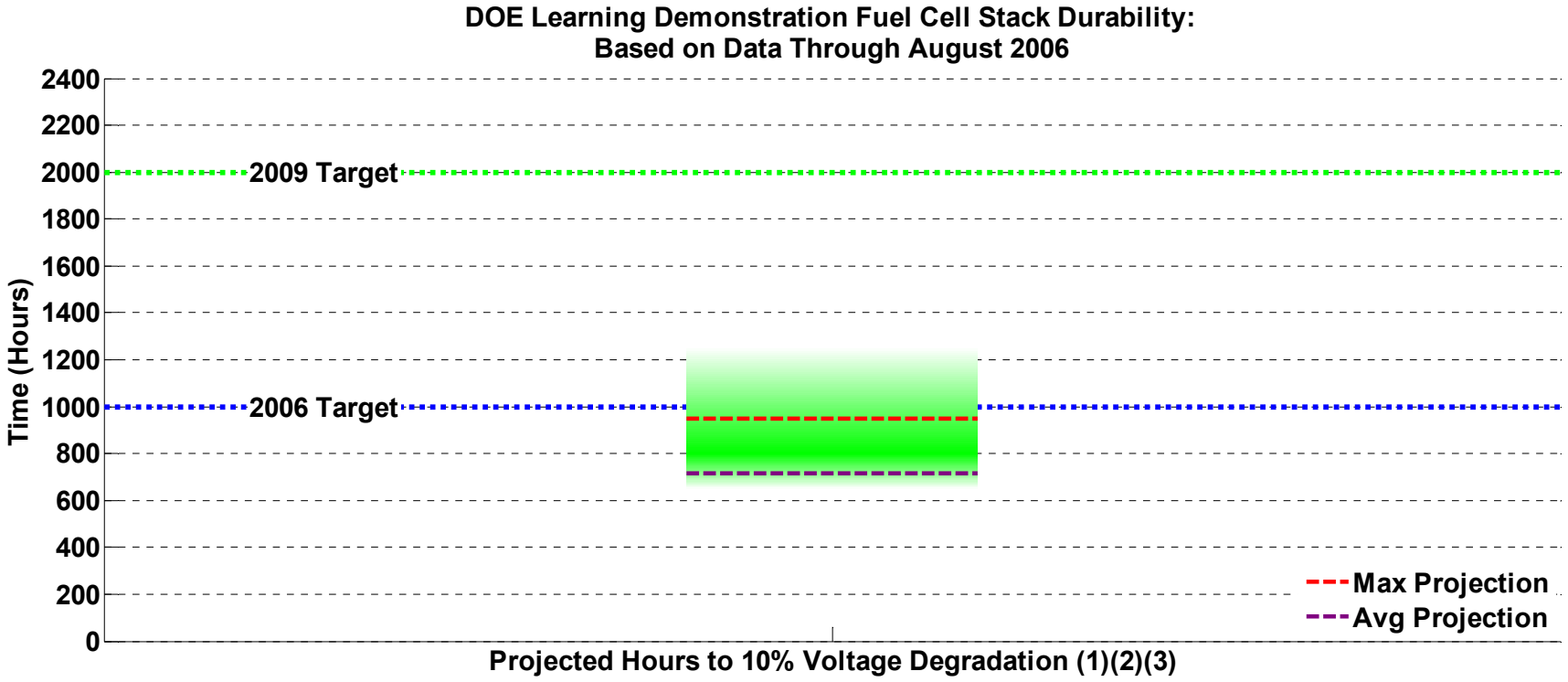
CDP#1A: Learning Demo Fuel Cell Stack Hours Accumulated Through August 2006



(1) Range bars created using one data point for each OEM.
(2) Range (highest and lowest) of the maximum operating hours accumulated to-date of any OEM's individual stack in "real-world" operation.
(3) Range (highest and lowest) of the average operating hours accumulated to-date of all stacks in each OEM's fleet.

Created: Oct-05-06 4:32 PM

CDP#1B: Projected Hours to 10% Stack Voltage Degradation



(1) Projection using on-road data -- degradation calculated at high stack current. This criterion is used for assessing progress against DOE targets, may differ from OEM's end-of-life criterion, and does not address "catastrophic" failure modes, such as membrane failure.
(2) Using one nominal projection per OEM: "Max Projection" = highest nominal projection, "Avg Projection" = average nominal projection. The shaded green bar represents an engineering judgment of the uncertainty due to data and methodology limitations. Projections will change as additional data are accumulated.
(3) Projections based on limited accumulated stack hours to date. Average stack hours accumulated to-date range between 139 and 272. Maximum stack hours accumulated to-date range between 256 and 485.

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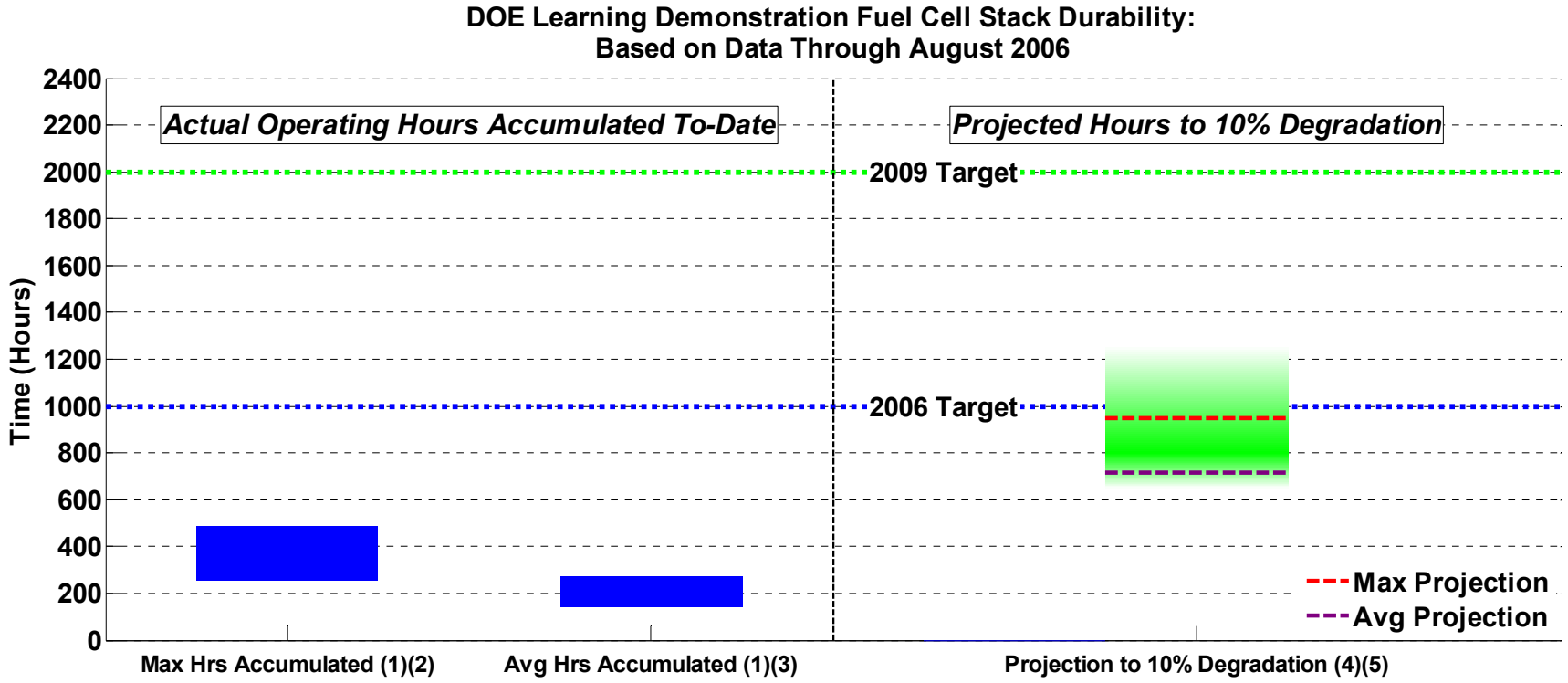
CDP#1C: Hours Accumulated and Projected Hours to 10% Stack Voltage Degradation



(1) Range bars created using one data point for each OEM.
(2) Range (highest and lowest) of the maximum operating hours accumulated to-date of any OEM's individual stack in "real-world" operation.
(3) Range (highest and lowest) of the average operating hours accumulated to-date of all stacks in each OEM's fleet.
(4) Projection using on-road data -- degradation calculated at high stack current. This criterion is used for assessing progress against DOE targets, may differ from OEM's end-of-life criterion, and does not address "catastrophic" failure modes, such as membrane failure.
(5) Using one nominal projection per OEM: "Max Projection" = highest nominal projection, "Avg Projection" = average nominal projection. The shaded green bar represents an engineering judgment of the uncertainty due to data and methodology limitations. Projections will change as additional data are accumulated.

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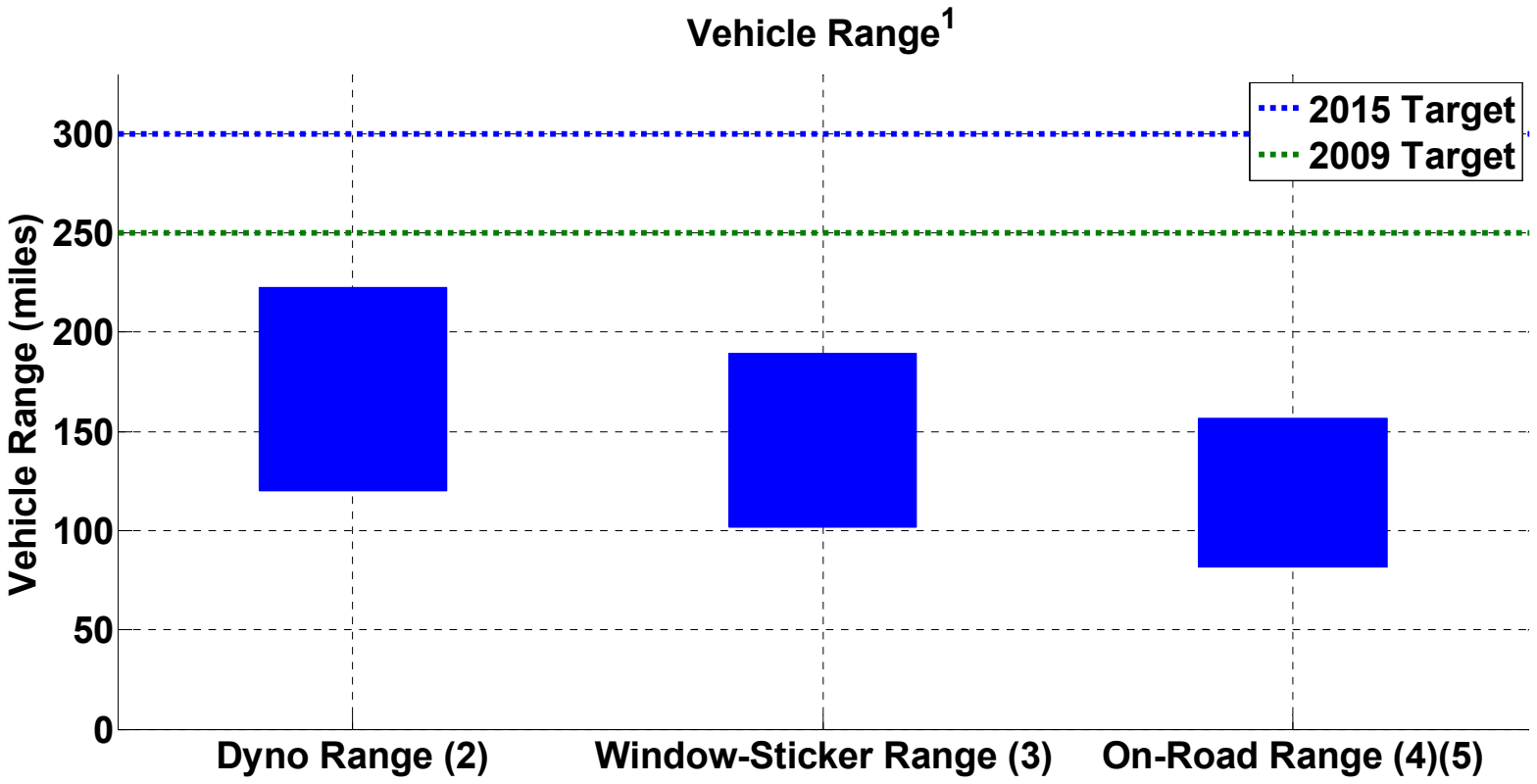
CDP#2: Vehicle Range



(1) Range is based on fuel economy and usable hydrogen on-board the vehicle. One data point for each make/model.
(2) Fuel economy from unadjusted combined City/Hwy per DRAFT SAEJ2572.
(3) Fuel economy from EPA Adjusted combined City/Hwy (0.78 x Hwy, 0.9 x City).
(4) Excludes trips < 1 mile. One data point for on-road fleet average of each make/model.
(5) Fuel economy calculated from on-road fuel cell stack current or mass flow readings.

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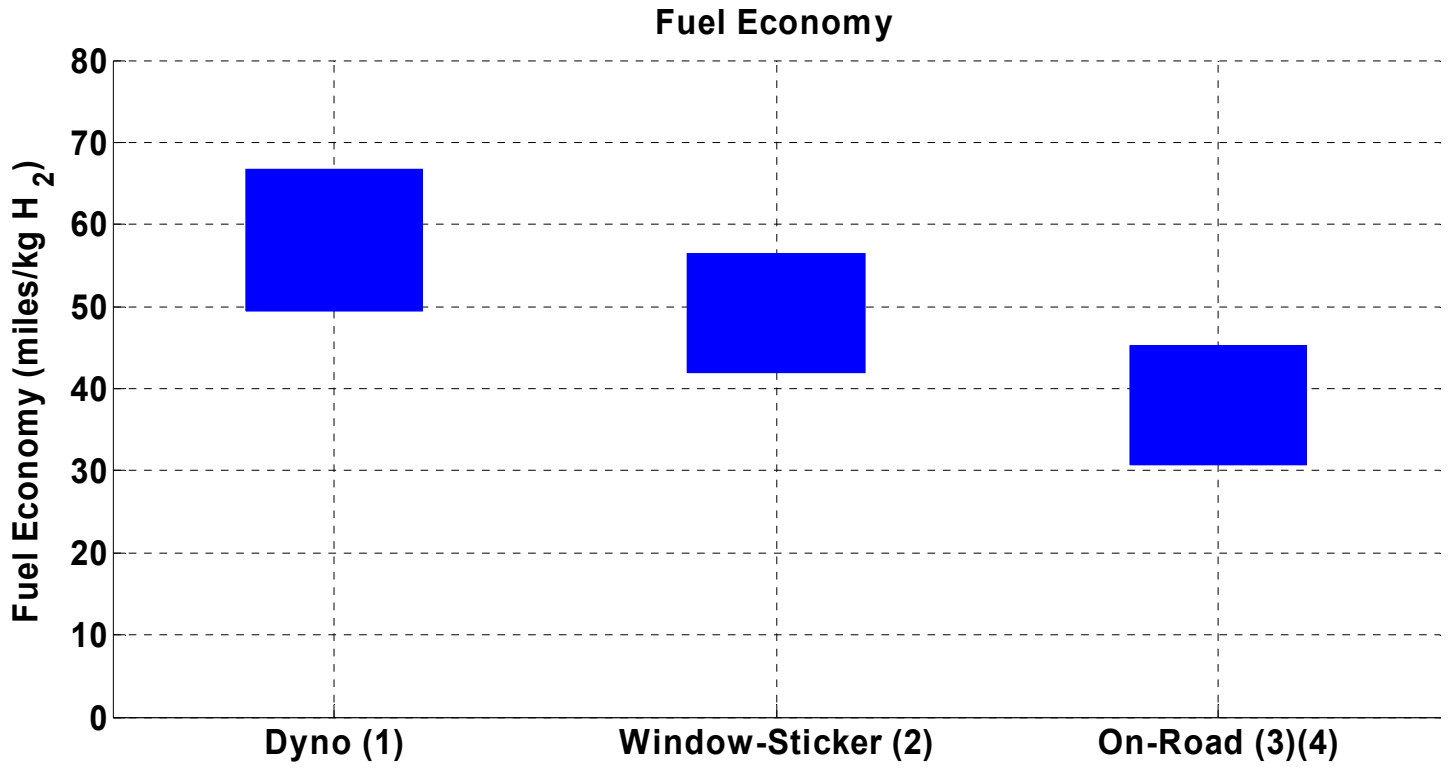
CDP#6: Fuel Economy



(1) One data point for each make/model. Combined City/Hwy fuel economy per DRAFT SAEJ2572.

(2) Adjusted combined City/Hwy fuel economy (0.78 x Hwy, 0.9 x City).

(3) Excludes trips < 1 mile. One data point for on-road fleet average of each make/model.

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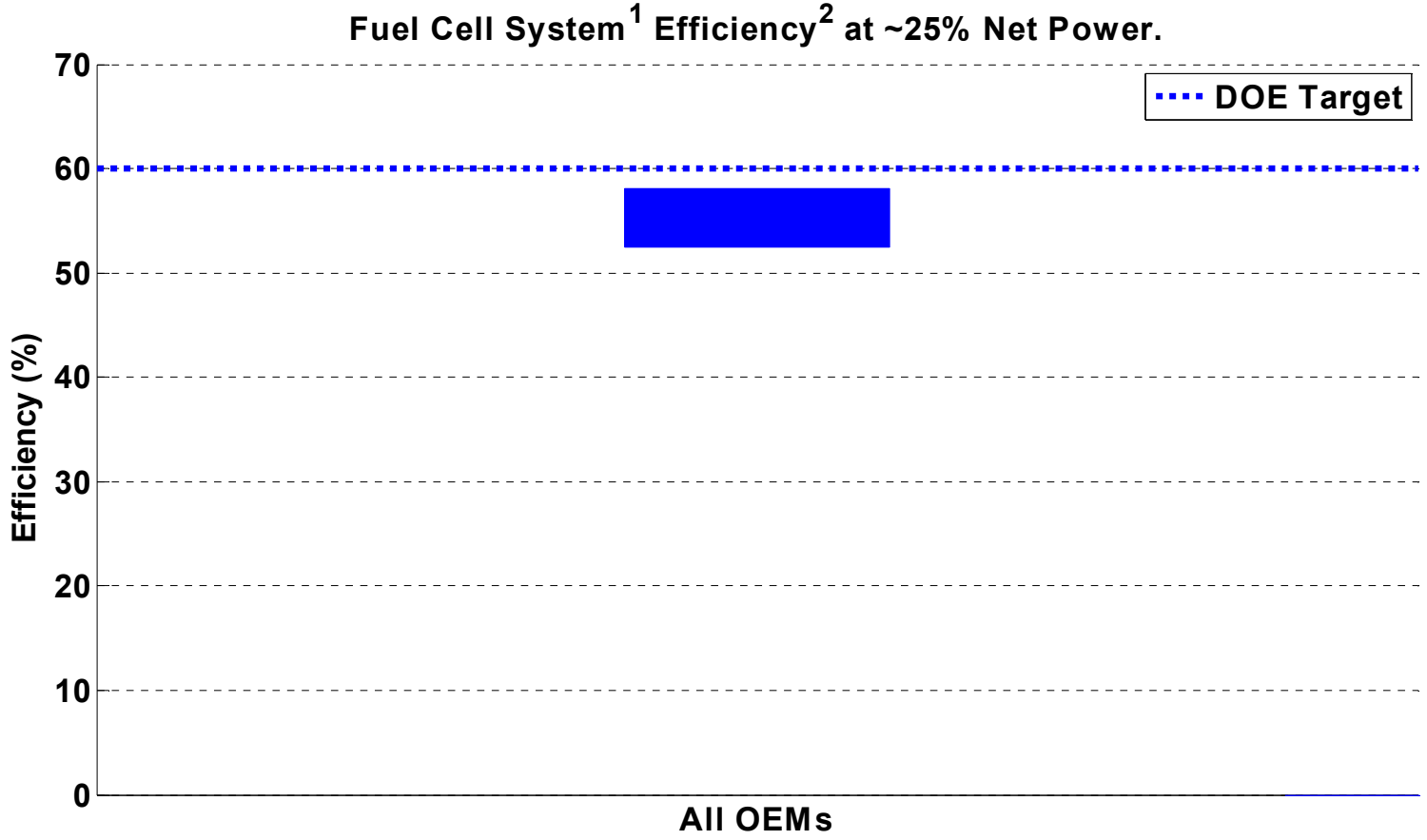
(4) Calculated from on-road fuel cell stack current or mass flow readings.

CDP#8: FC System Efficiency



[1] Gross stack power minus fuel cell system auxiliaries, per DRAFT SAEJ2615.

[2] Ratio of DC output energy to the lower heating value of the input fuel (hydrogen). Excludes power electronics and electric drive.

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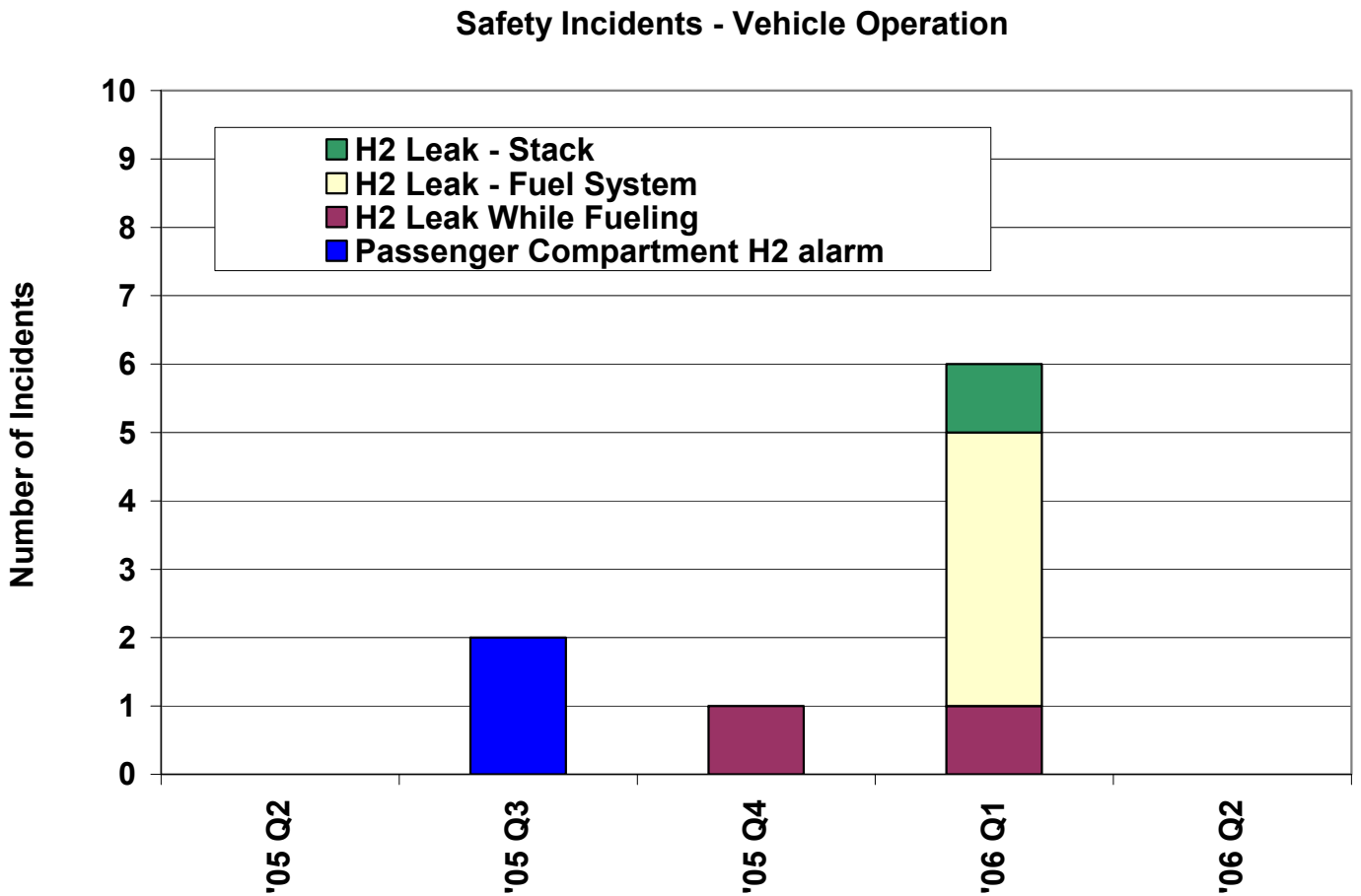
CDP#9: Safety Incidents – Vehicles



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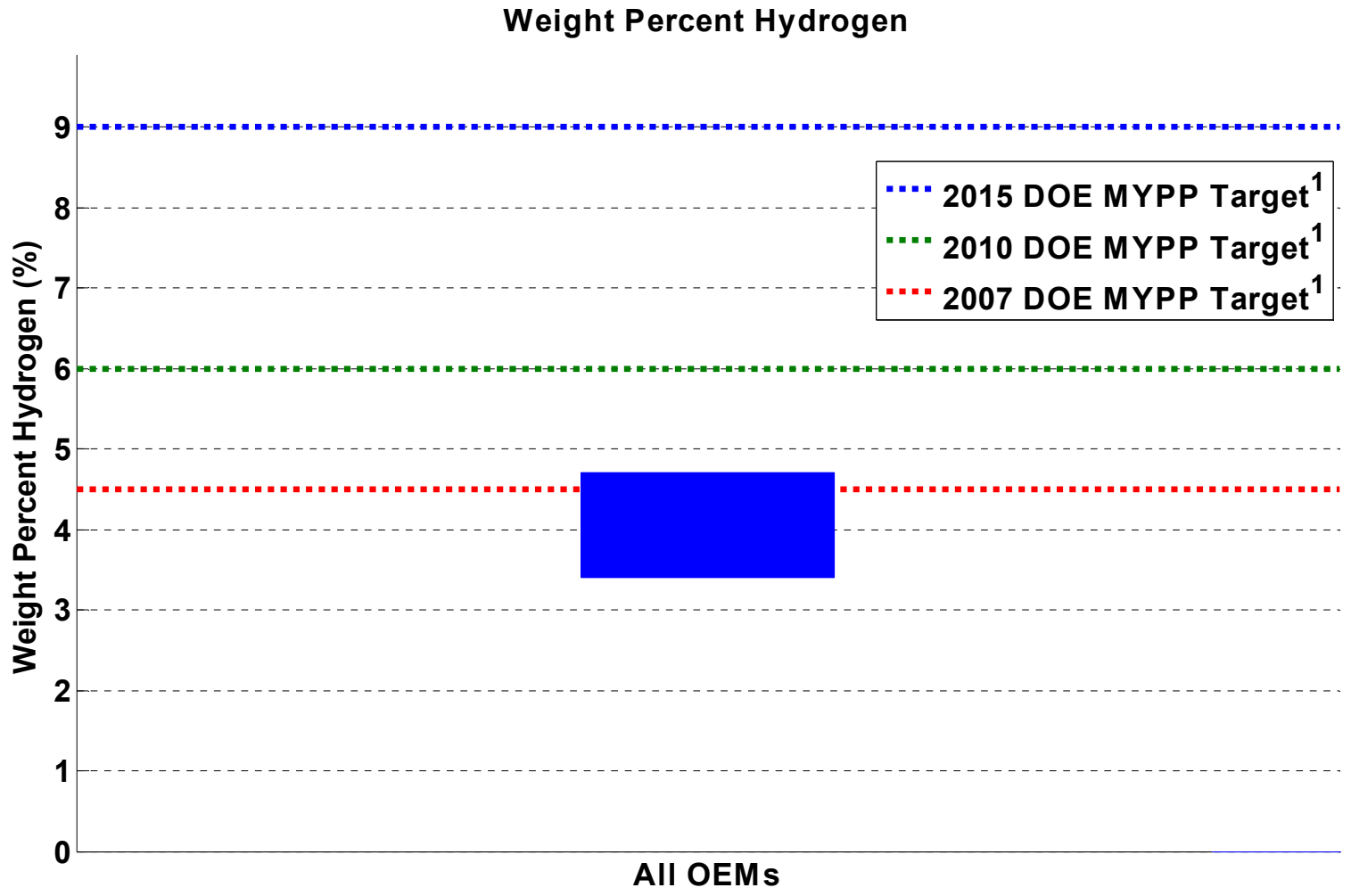
CDP#10: Storage Weight % Hydrogen



[1]Some near-term targets have been achieved with compressed and liquid tanks. Emphasis is on advanced materials-based technologies.

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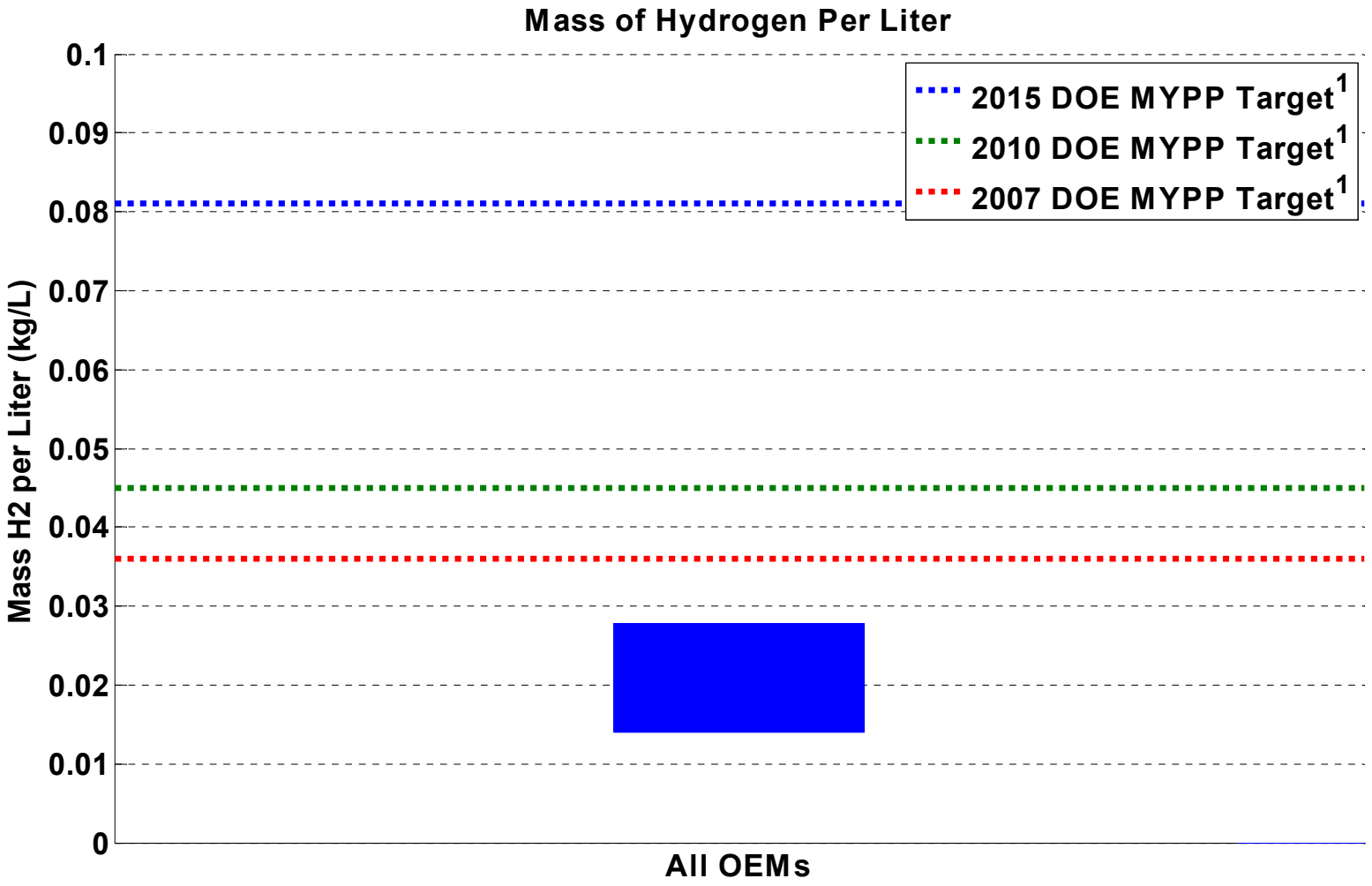
CDP#11: Volumetric Capacity of H2 Storage



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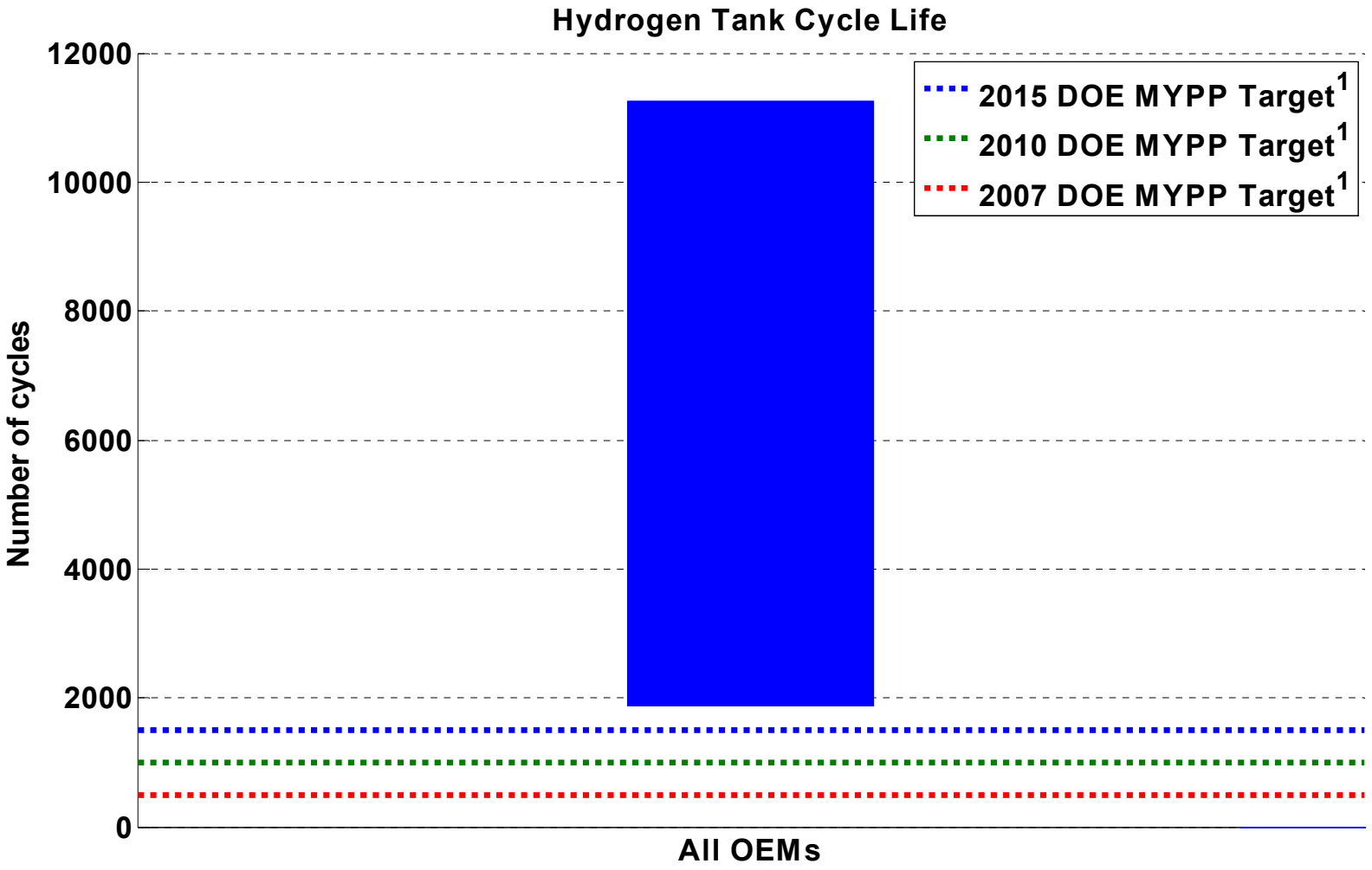
[1]Emphasis is on advanced materials-based technologies.

CDP#12: Vehicle Hydrogen Tank Cycle Life



[1]Some near-term targets have been achieved with compressed and liquid tanks. Emphasis is on advanced materials-based technologies.

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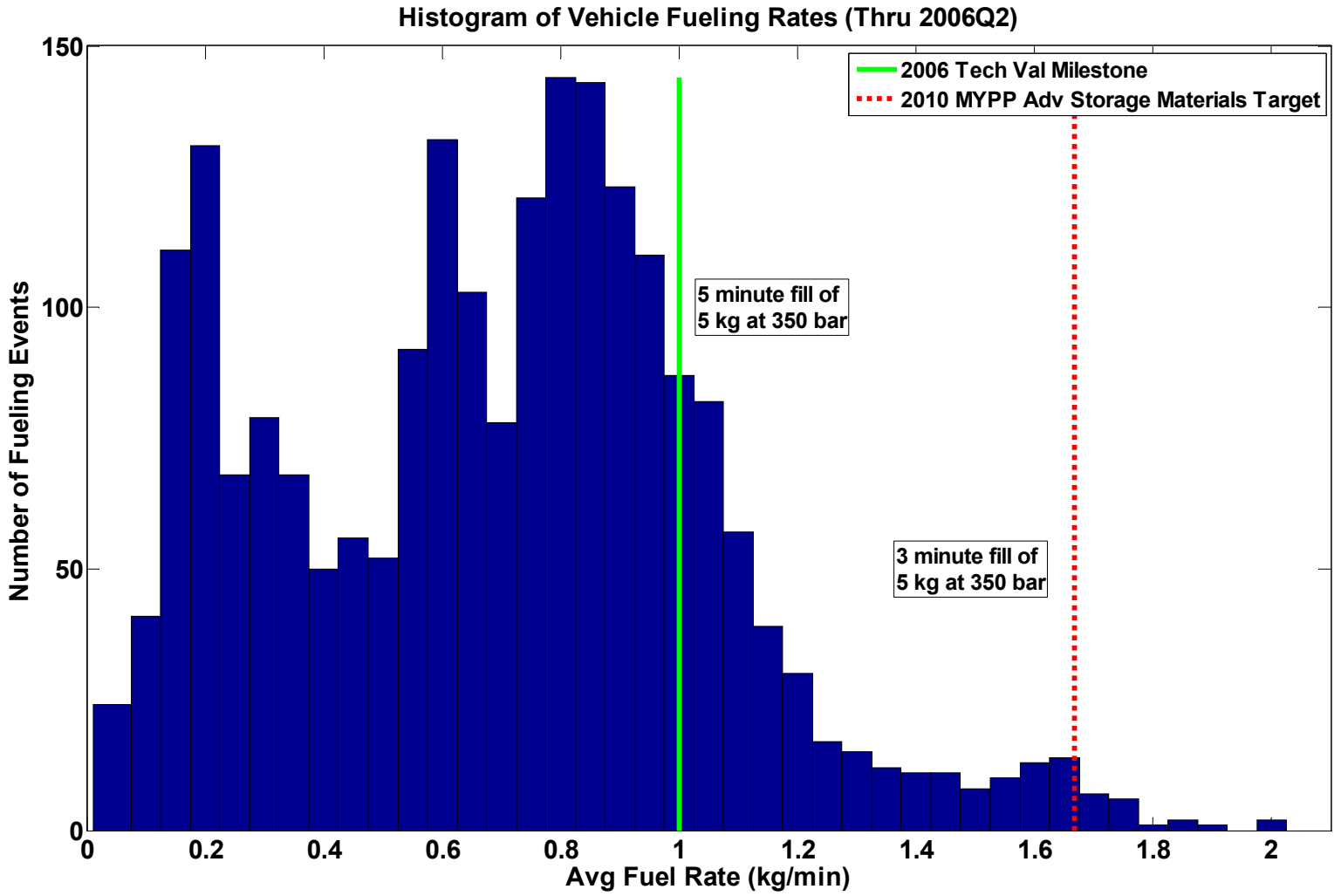
CDP#18: Histogram: Refueling Rate



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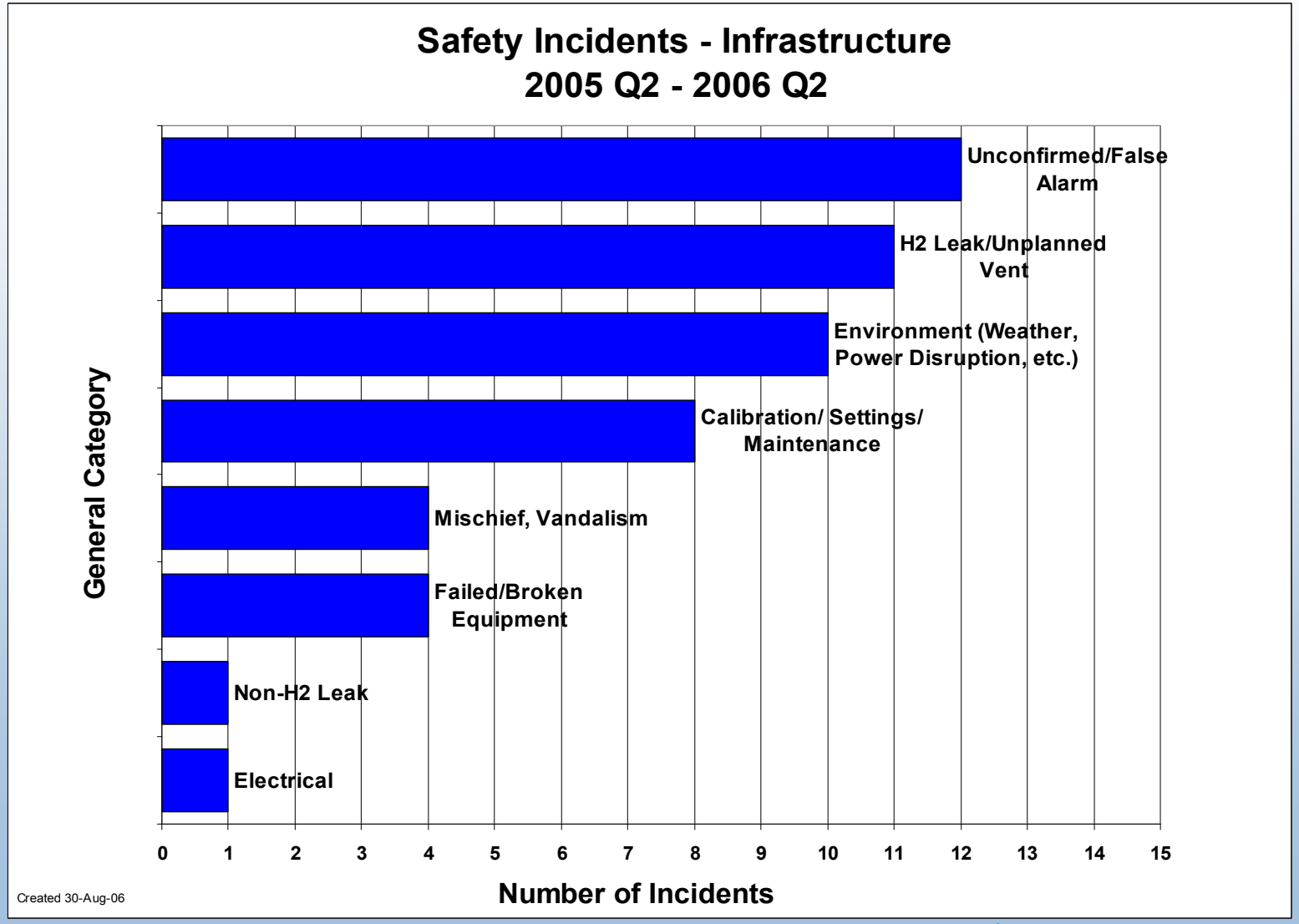
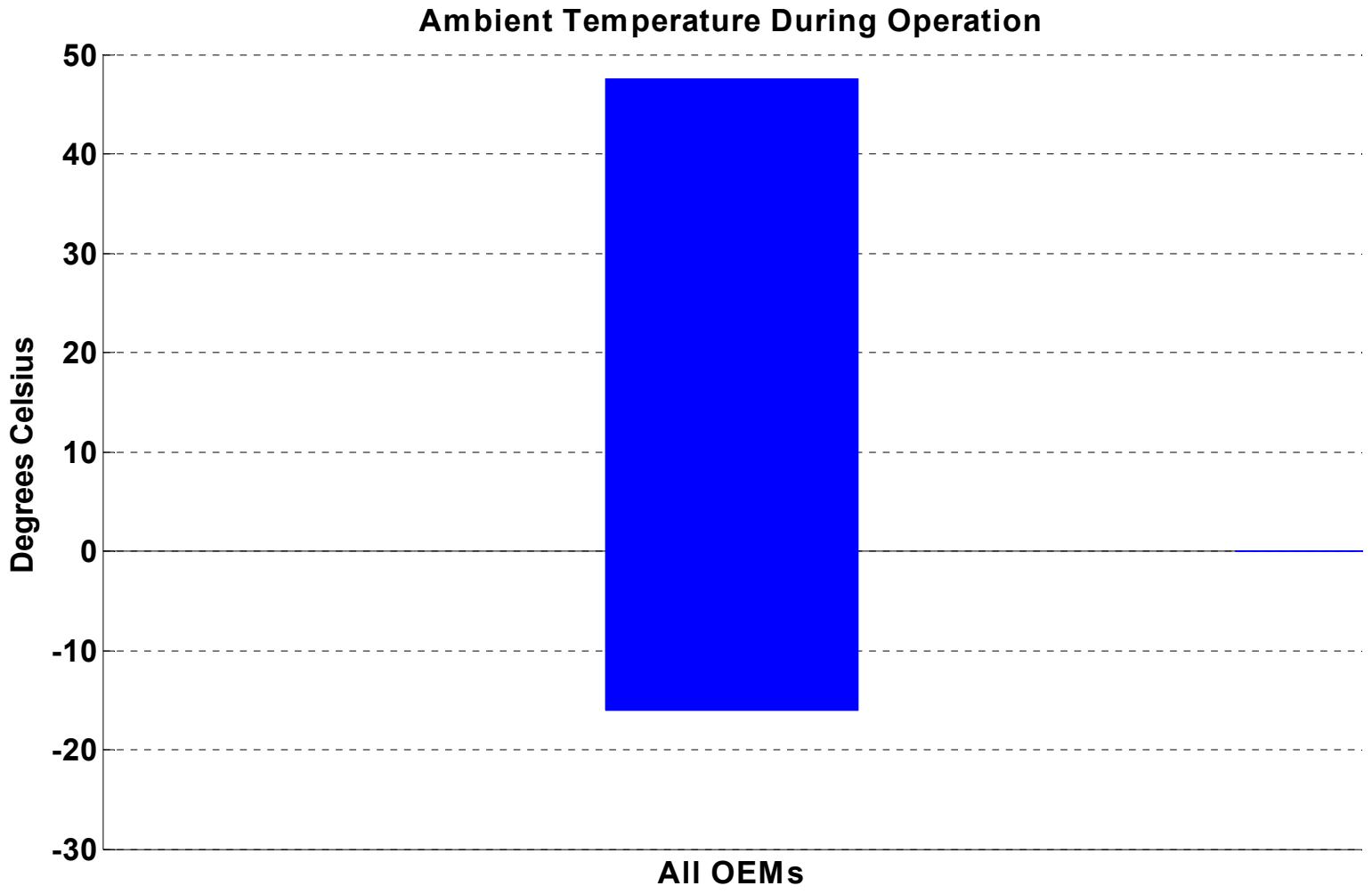
CDP#20: Safety Incidents – Infrastructure



CDP#21: Range of Ambient Temperature During Vehicle Operation



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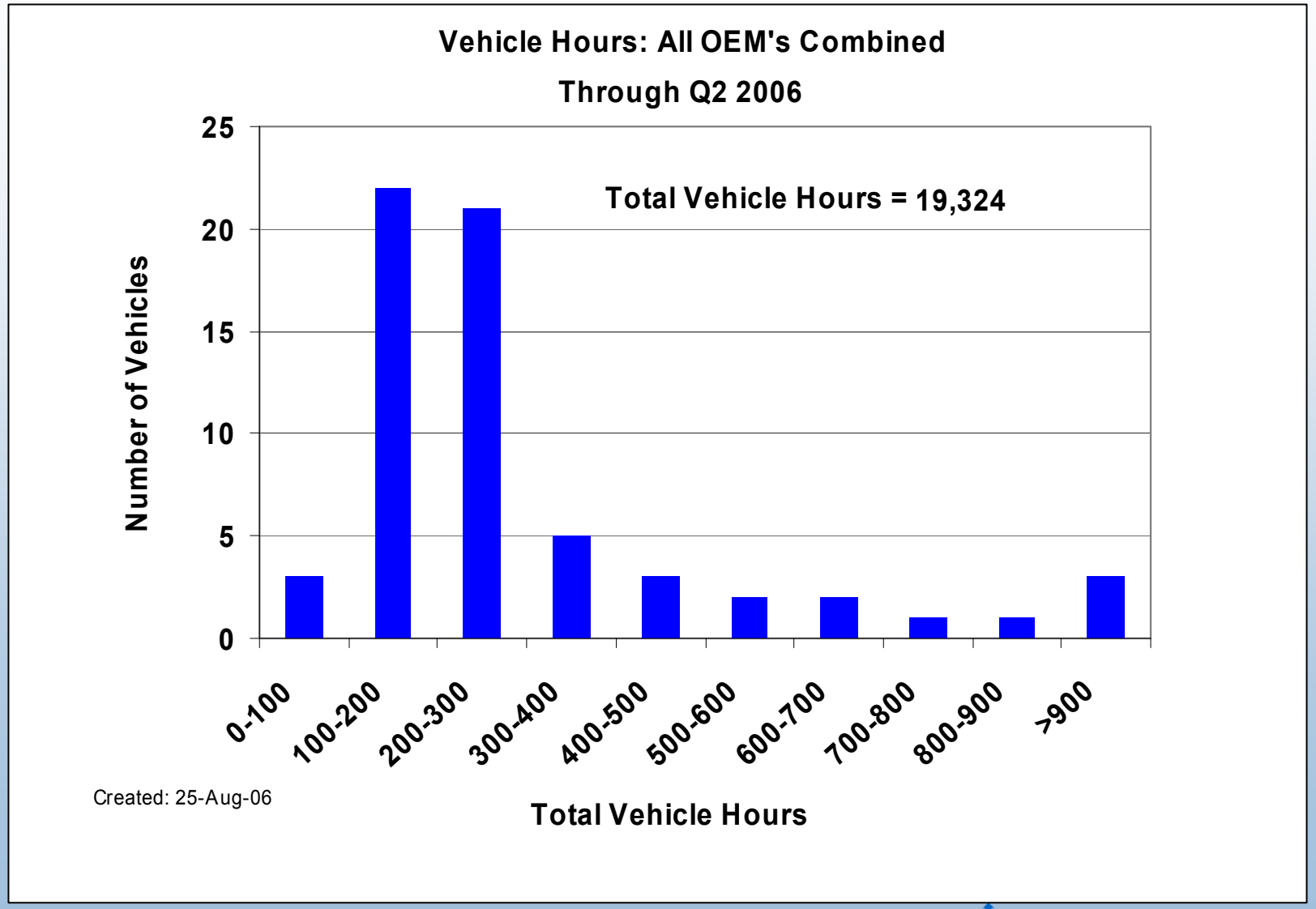
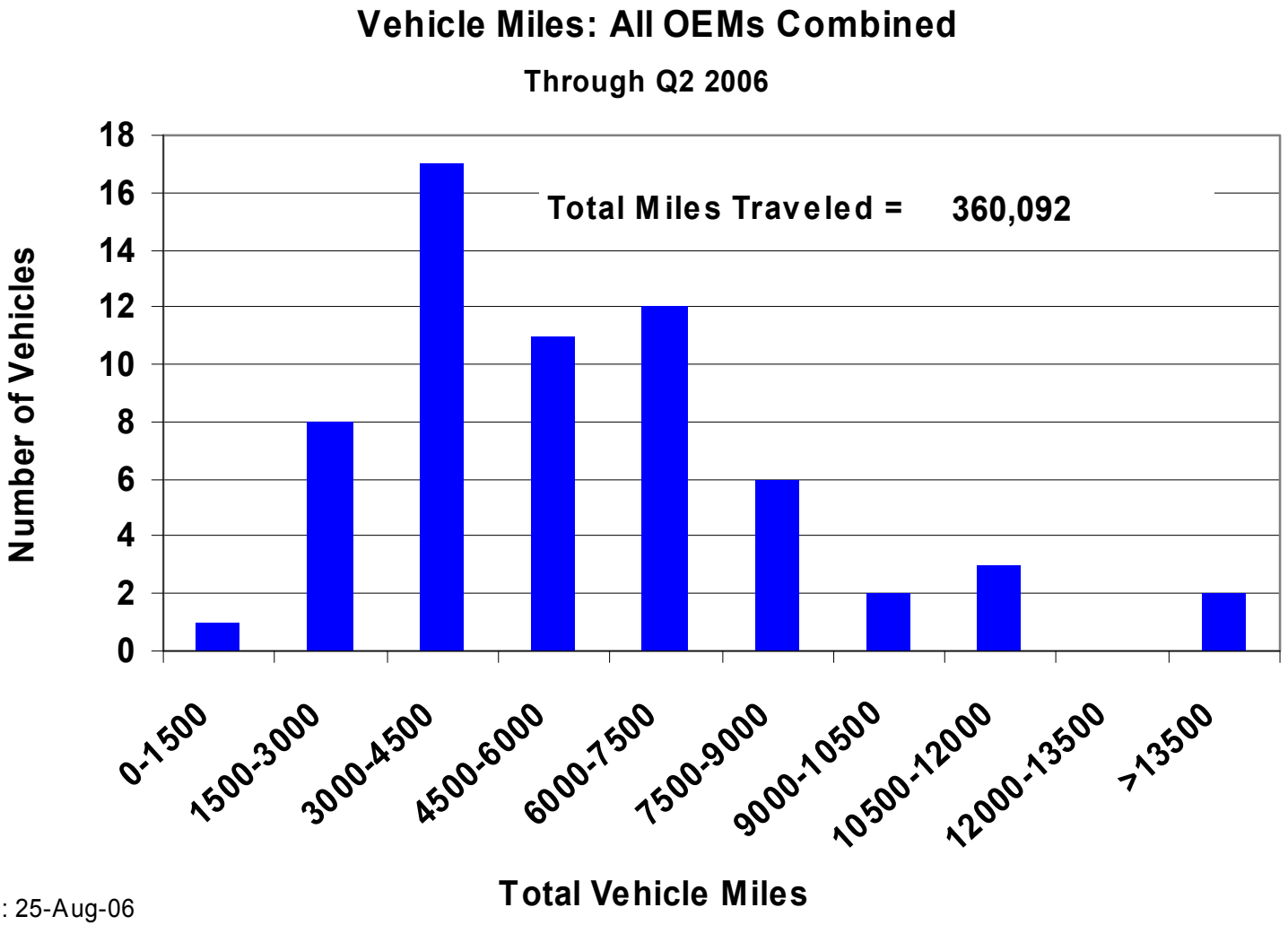
CDP#22: Vehicle Operating Hours



CDP#23: Vehicles vs. Miles Traveled



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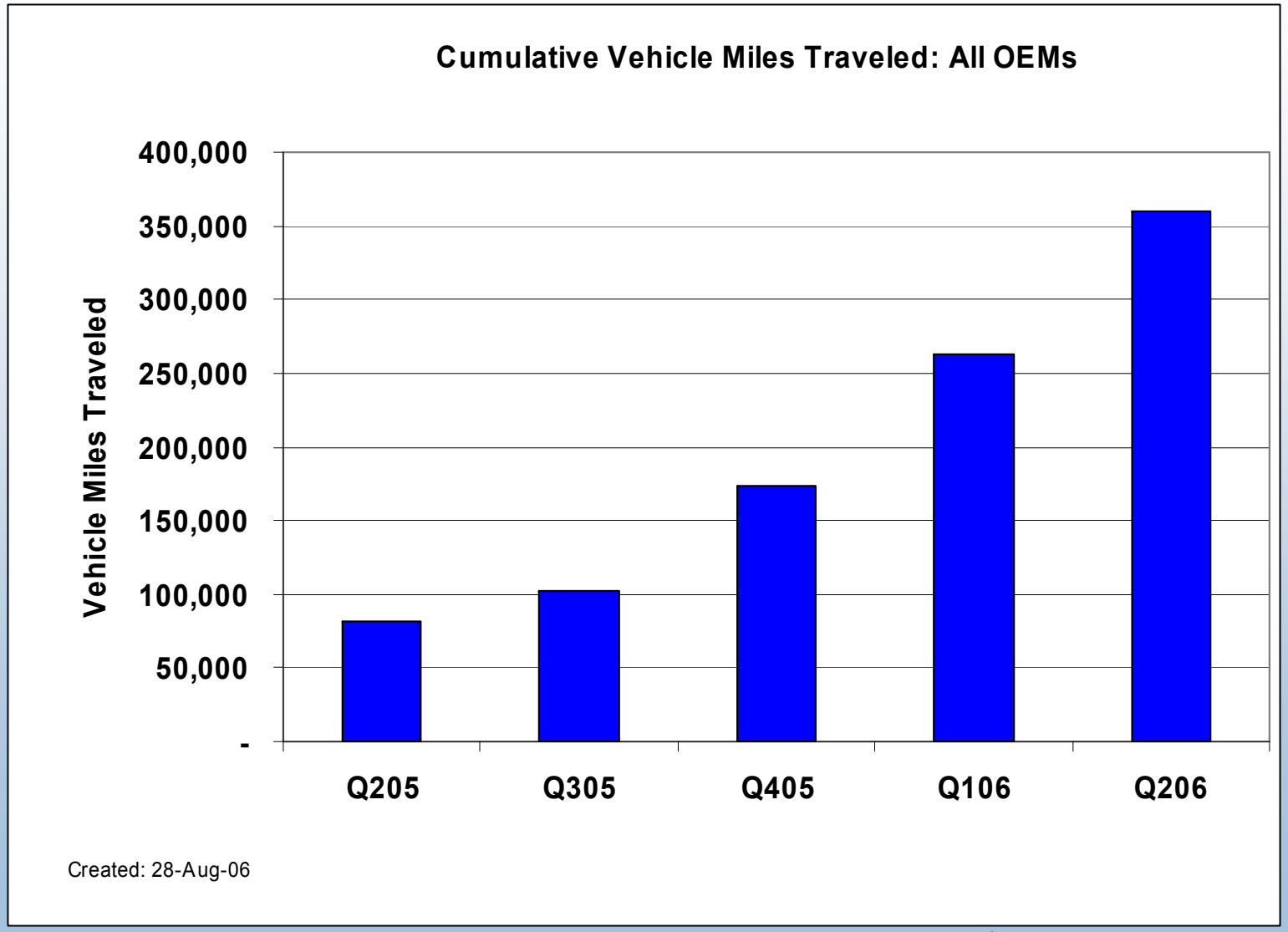
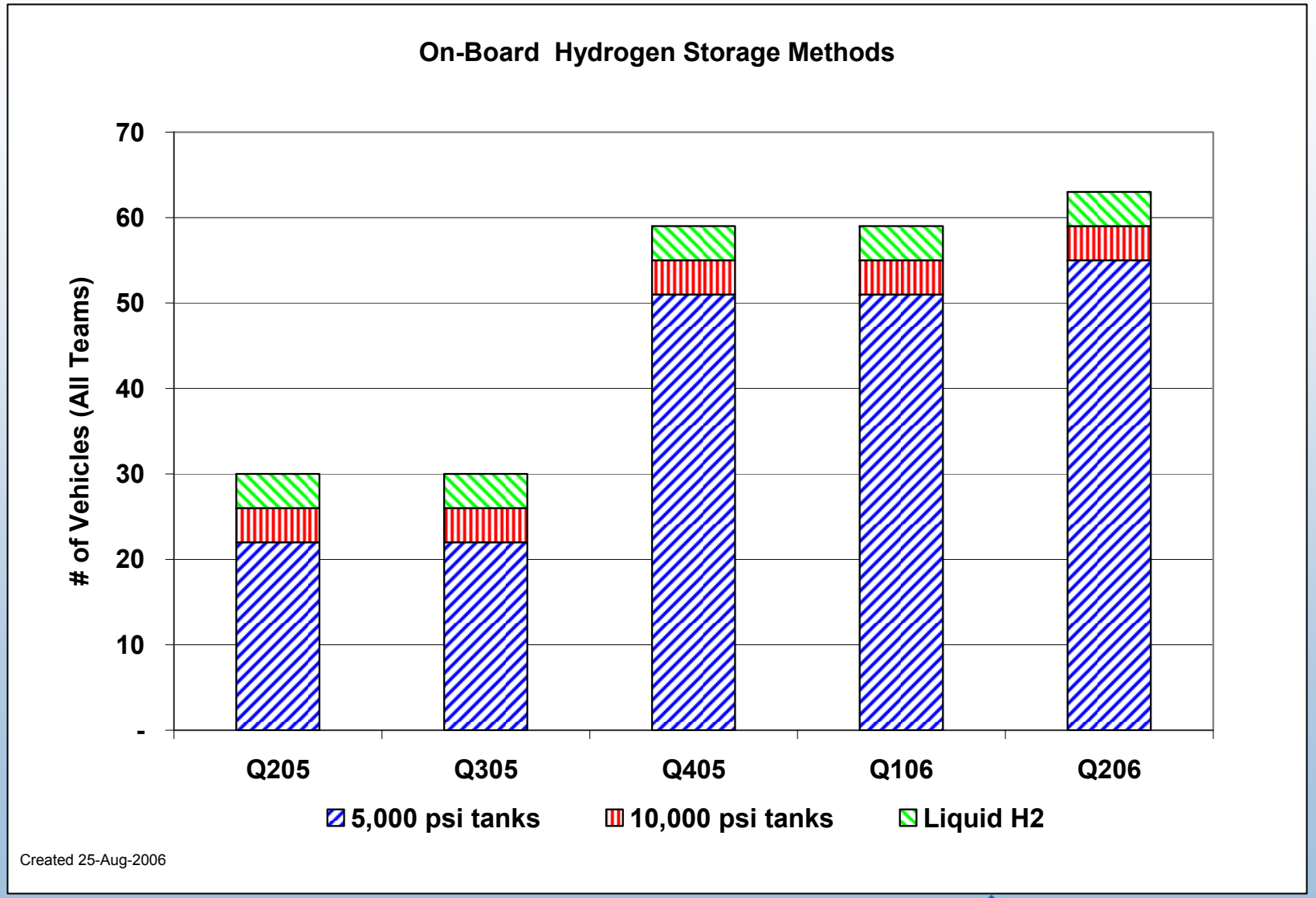
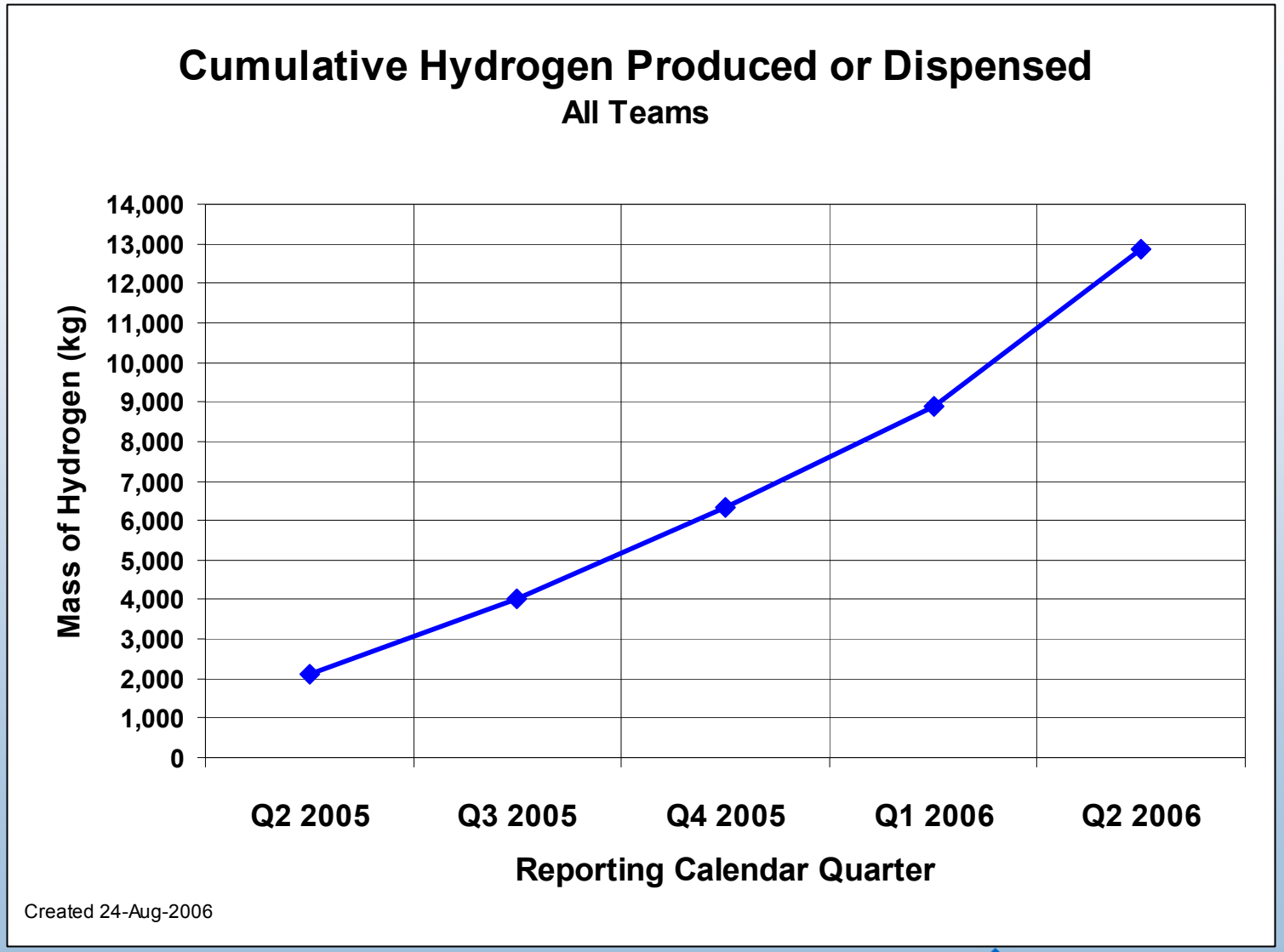
CDP#24: Cumulative Vehicle Miles Traveled



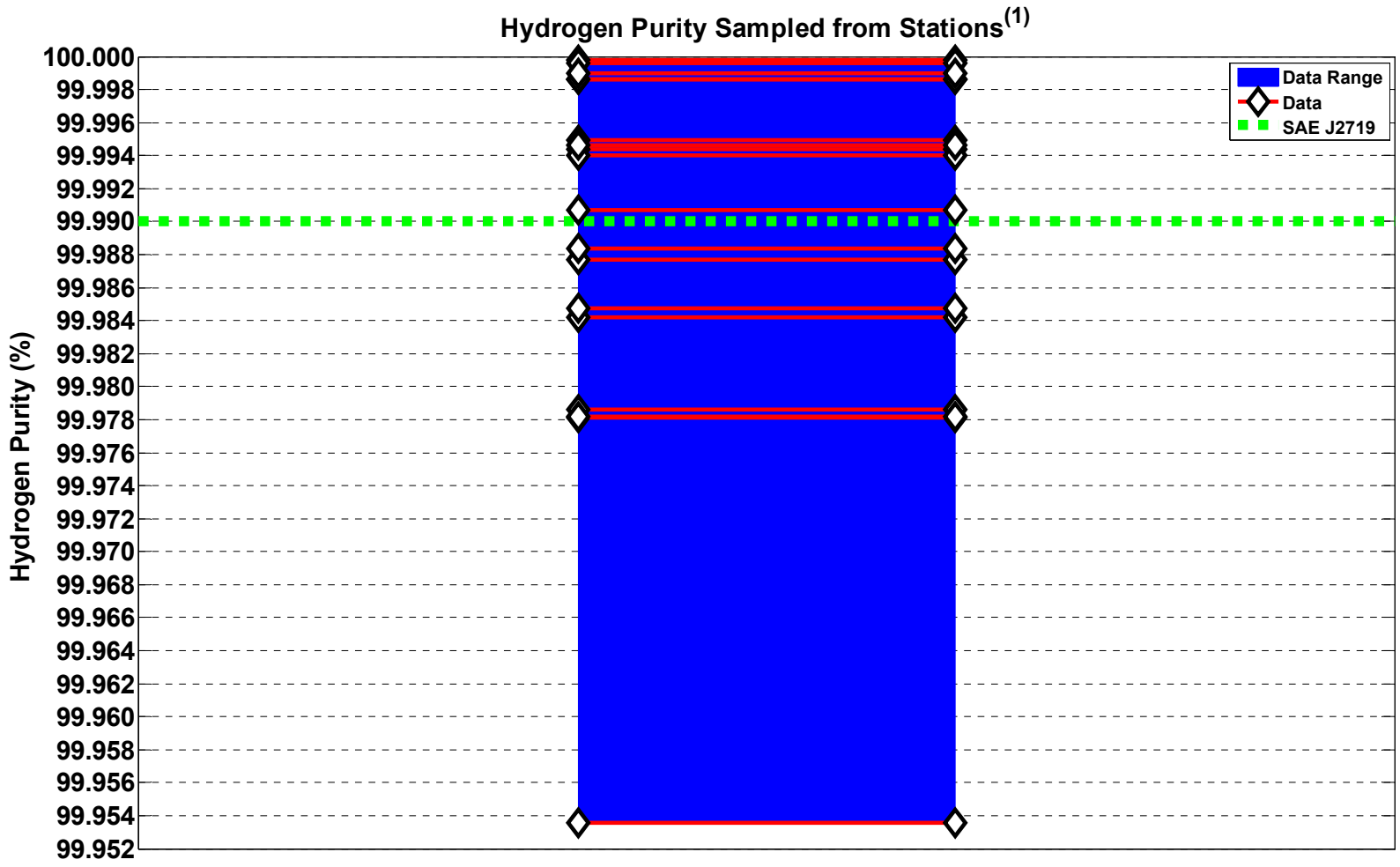
CDP#25: Vehicle H2 Storage Technologies



CDP#26: Cumulative H2 Produced or Dispensed



CDP#27: Hydrogen Purity Scatter Plot



(1) Includes sampling from both electrolysis and reforming

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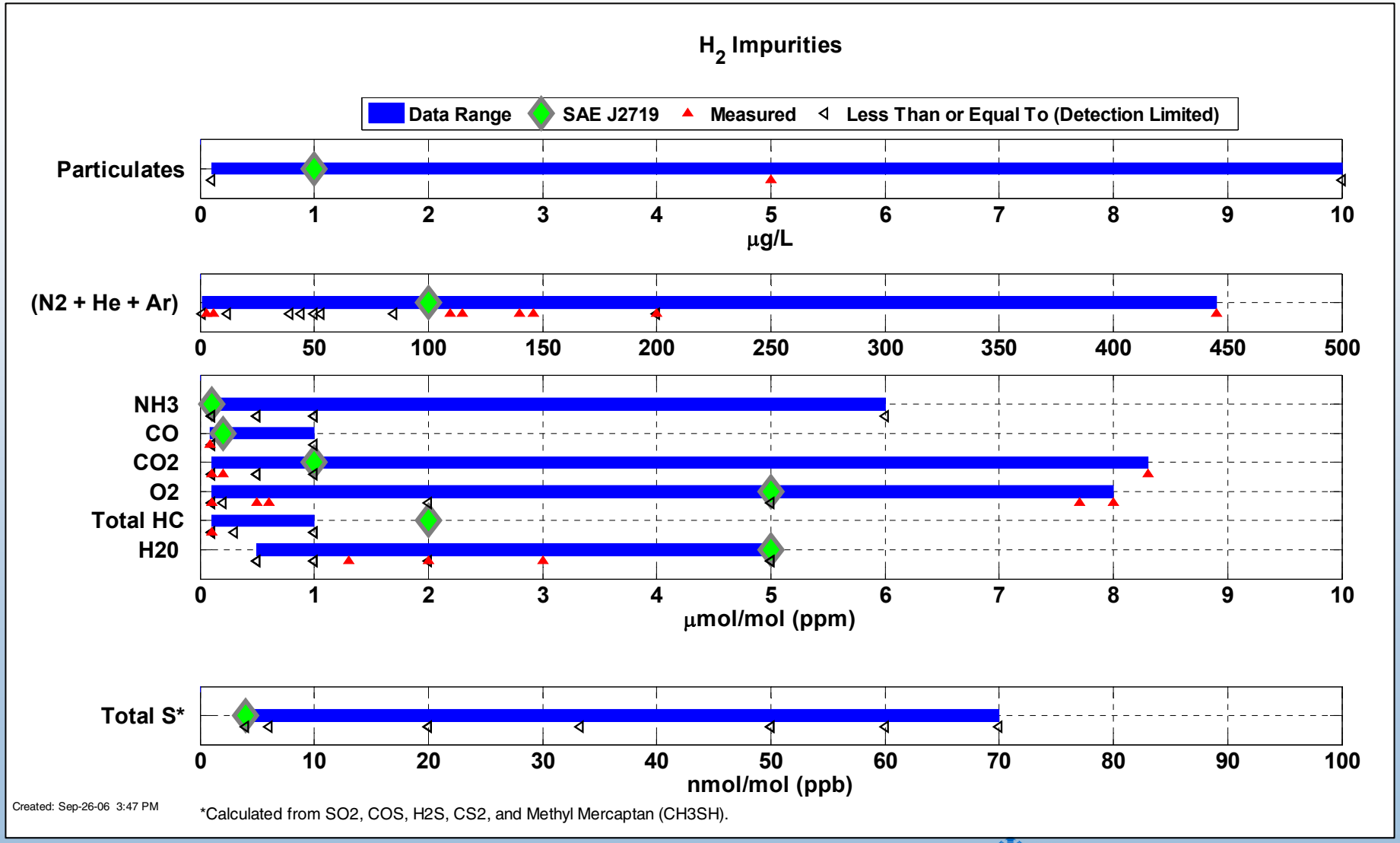
CDP #28: Hydrogen Impurities Scatter Plot



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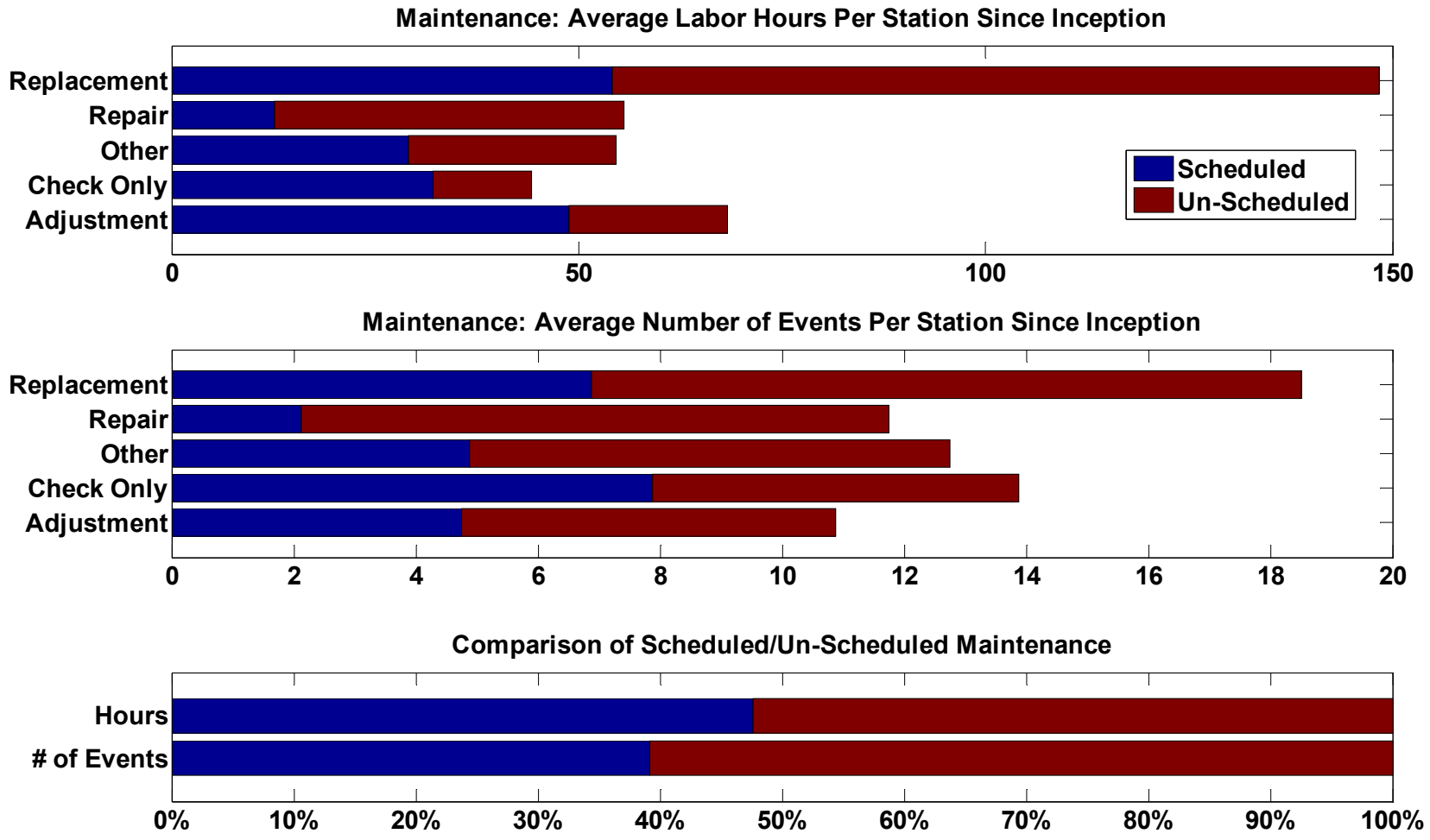
*Calculated from SO2, COS, H2S, CS2, and Methyl Mercaptan (CH3SH).

CDP#30: Infrastructure Maintenance



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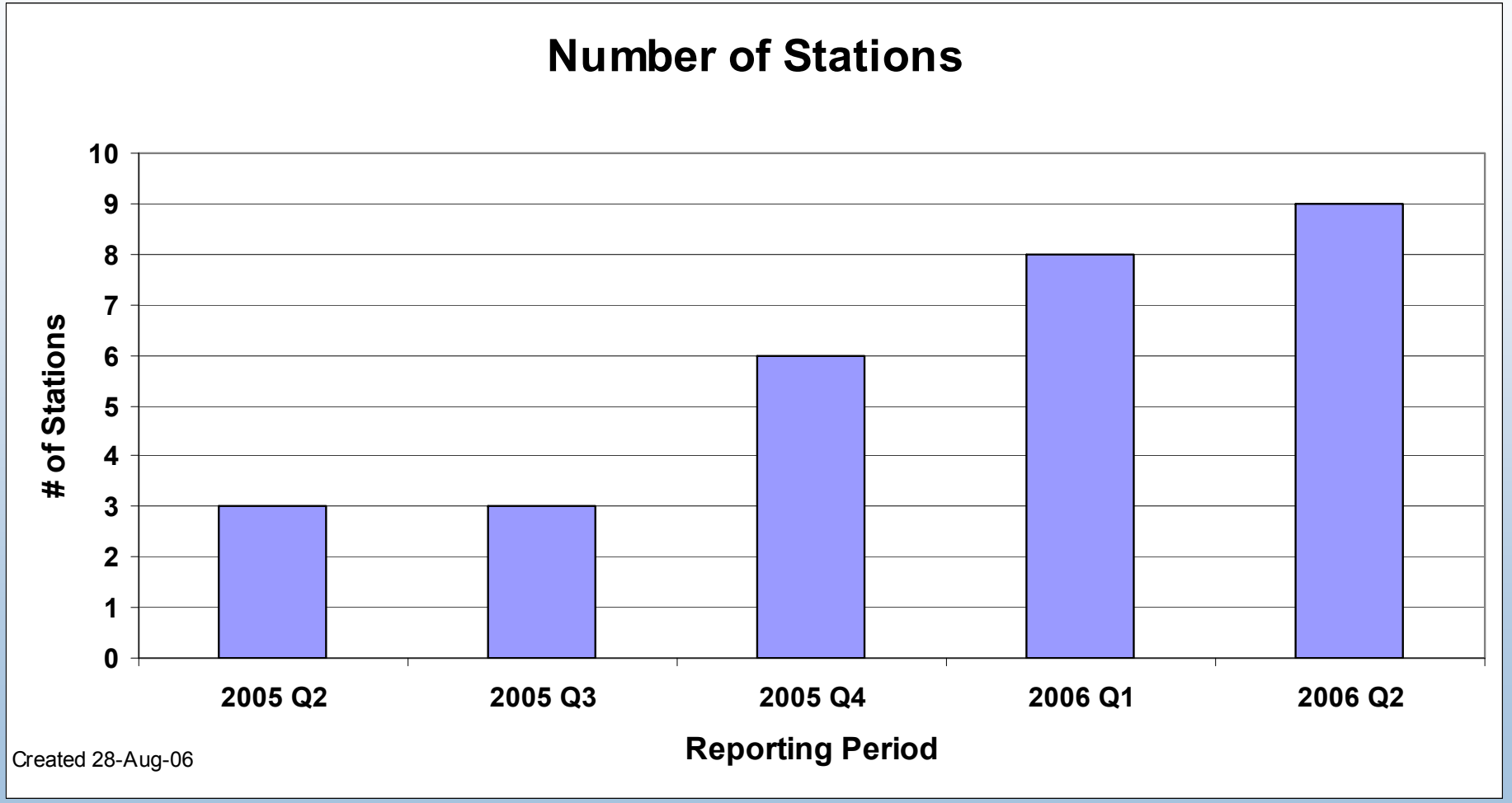
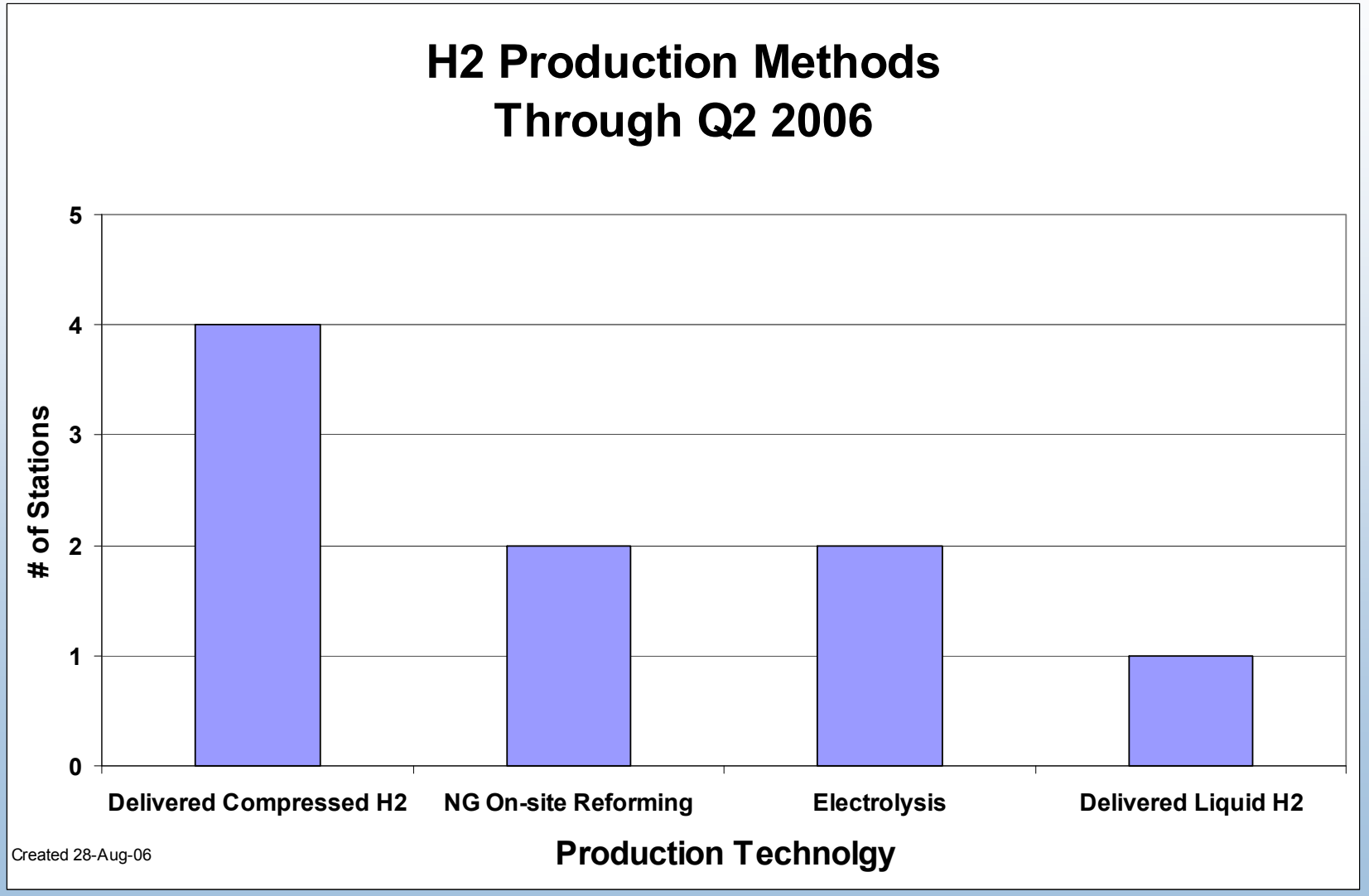
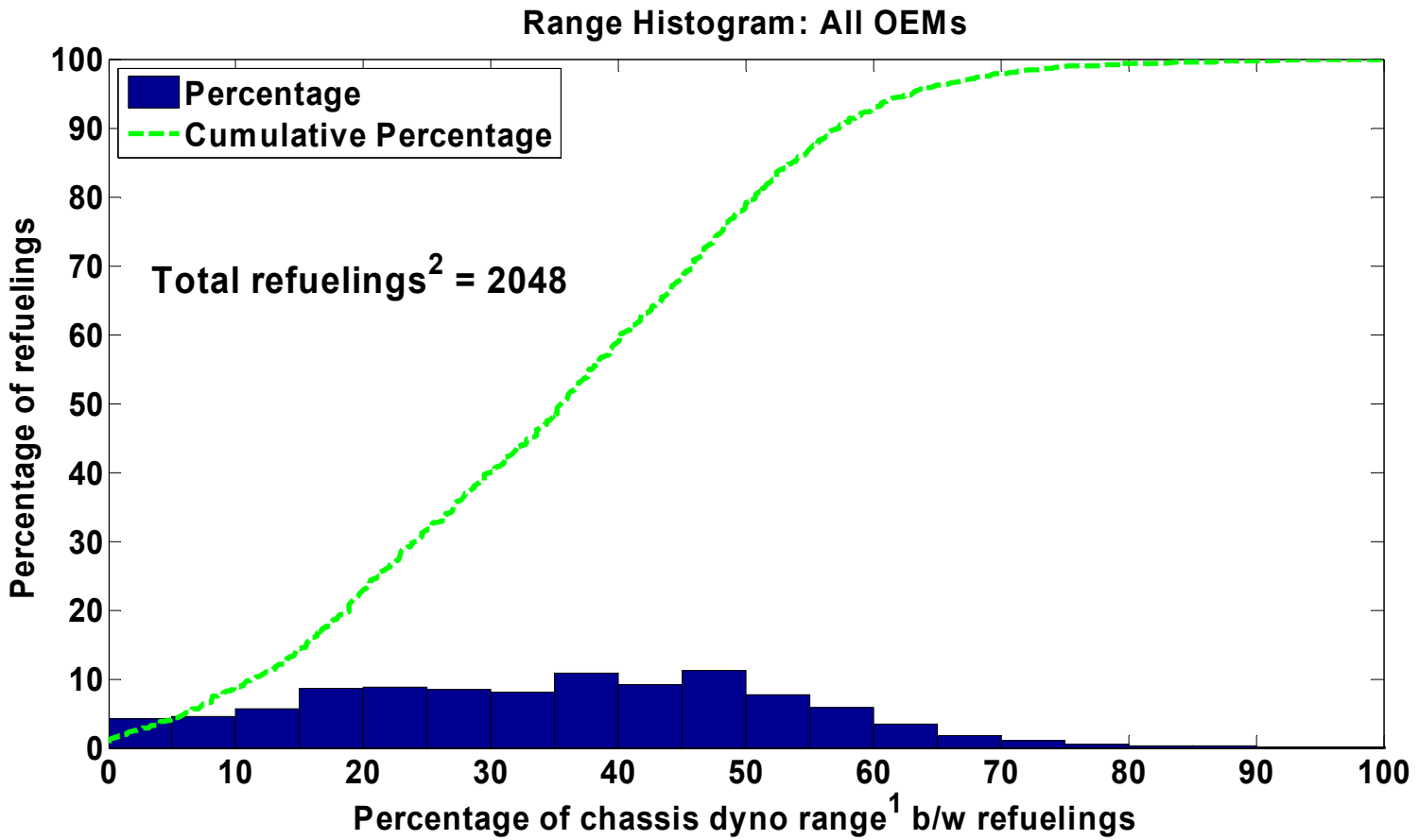
CDP#31: Number of Reporting Stations



CDP#32: Hydrogen Production Methods



CDP#33: Percentage of Theoretical Range Between Refuelings



1. Range calculated using the combined city/hwy fuel economy from dyno testing (not EPA adjusted) and usable fuel on board.

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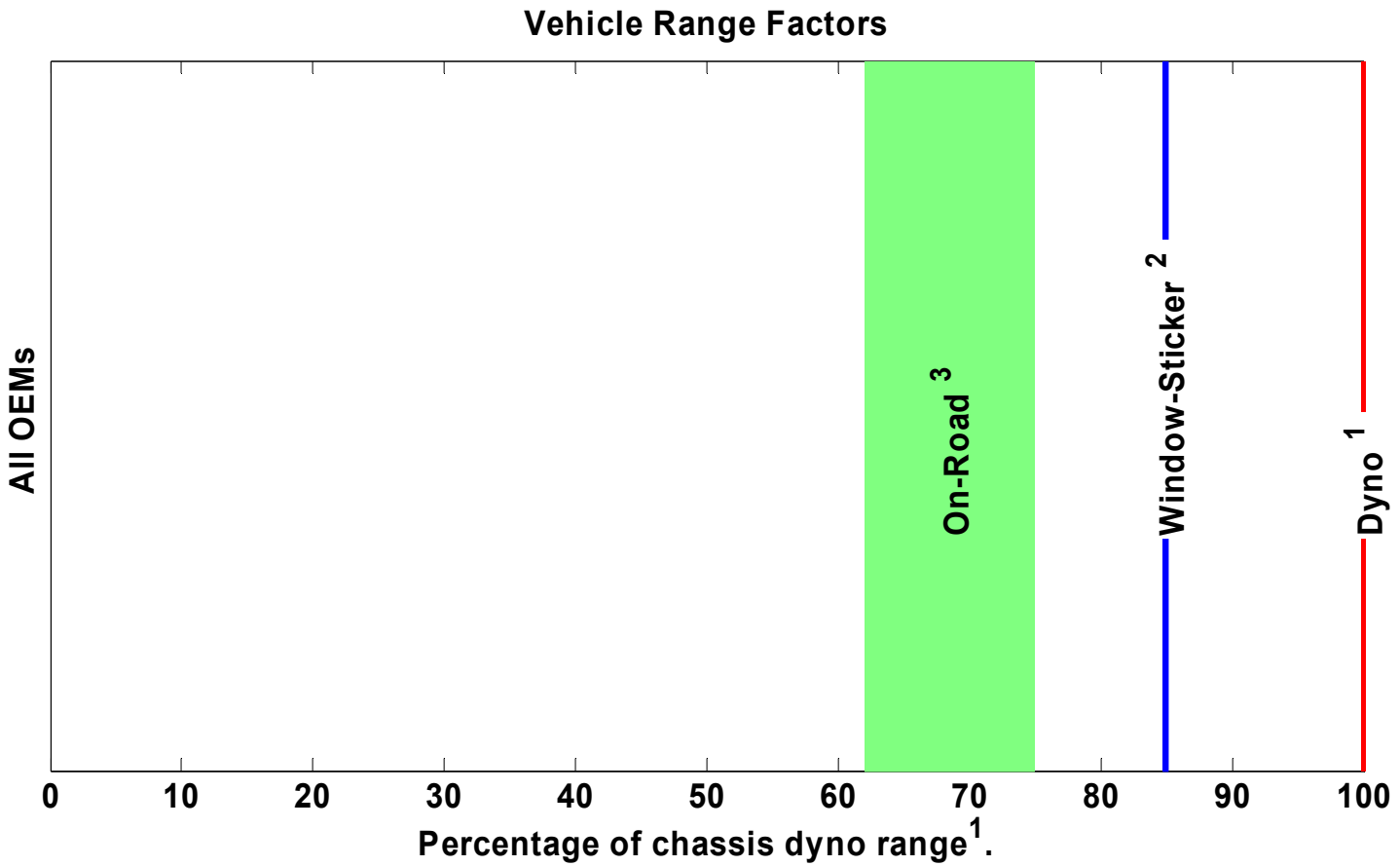
2. Some refueling events are not detected/reported due to data noise or incompleteness.

CDP#34: Effective Vehicle Range



1. Calculated using the combined city/hwy fuel economy from dyno testing (non-adjusted) and usable fuel on board
2. Applying window-sticker correction factors for fuel economy: 0.78 x Hwy and 0.9 x City
3. Using fuel-economy from on-road data (excluding trips > 1 mile, consistent with other data products)

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REPORT DOCUMENTATION PAGE

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4. TITLE AND SUBTITLE
Completed Learning Demonstration Composite Data Products as of 12/01/06

5a. CONTRACT NUMBER
DE-AC36-99-GO10337

5b. GRANT NUMBER

5c. PROGRAM ELEMENT NUMBER

6. AUTHOR(S)
Keith Wipke

5d. PROJECT NUMBER
NREL/TP-560-41090

5e. TASK NUMBER
H270-8100

5f. WORK UNIT NUMBER

7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES)
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NREL/TP-560-41090

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14. ABSTRACT *(Maximum 200 Words)*
These public technical analysis results from DOE's Controlled Hydrogen Fleet and Infrastructure Demonstration and Validation Project are generated in the form of composite data products.

15. SUBJECT TERMS
composite data products; technology validation; Controlled Hydrogen Fleet and Infrastructure Demonstration and Validation Project; learning demonstration

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