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On-road Vehicle Emission Measurements and Their use in Evaluating Emission Control Effectiveness {presentation}

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On-road Vehicle Emission Measurements and Their use in Evaluating Emission Control Effectiveness {presentation}

Publication Statement

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2022 CRC Mobile Source Air Toxics Workshop
Cyber Space
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ON-ROAD VEHICLE EMISSION MEASUREMENTS AND THEIR USE IN EVALUATING EMISSION CONTROL EFFECTIVENESS

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Acknowledgments

Coordinating Research Council

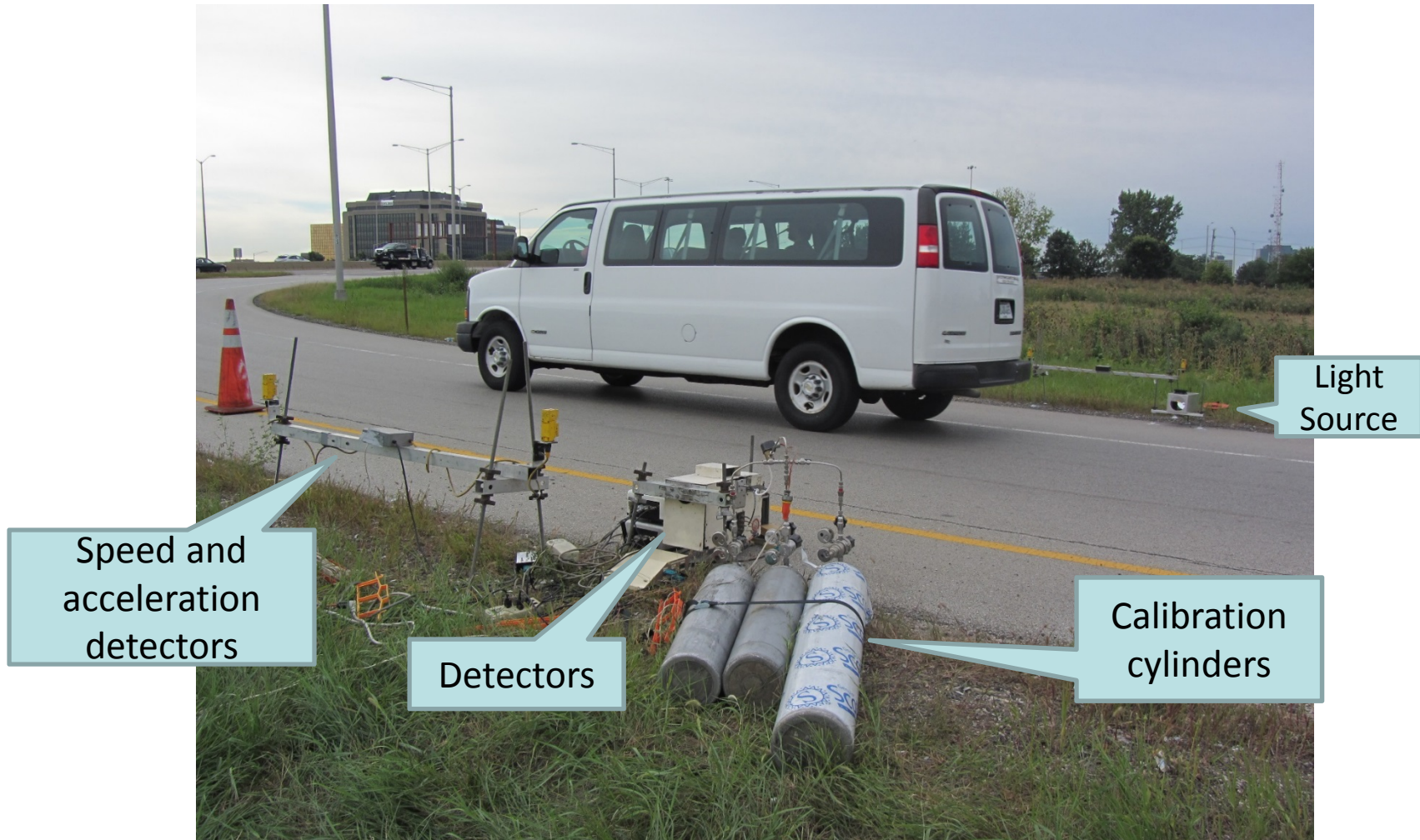
E-23 / E-106 / E-123 / E-124

California Air Resources Board

Utah Department of Environmental Quality

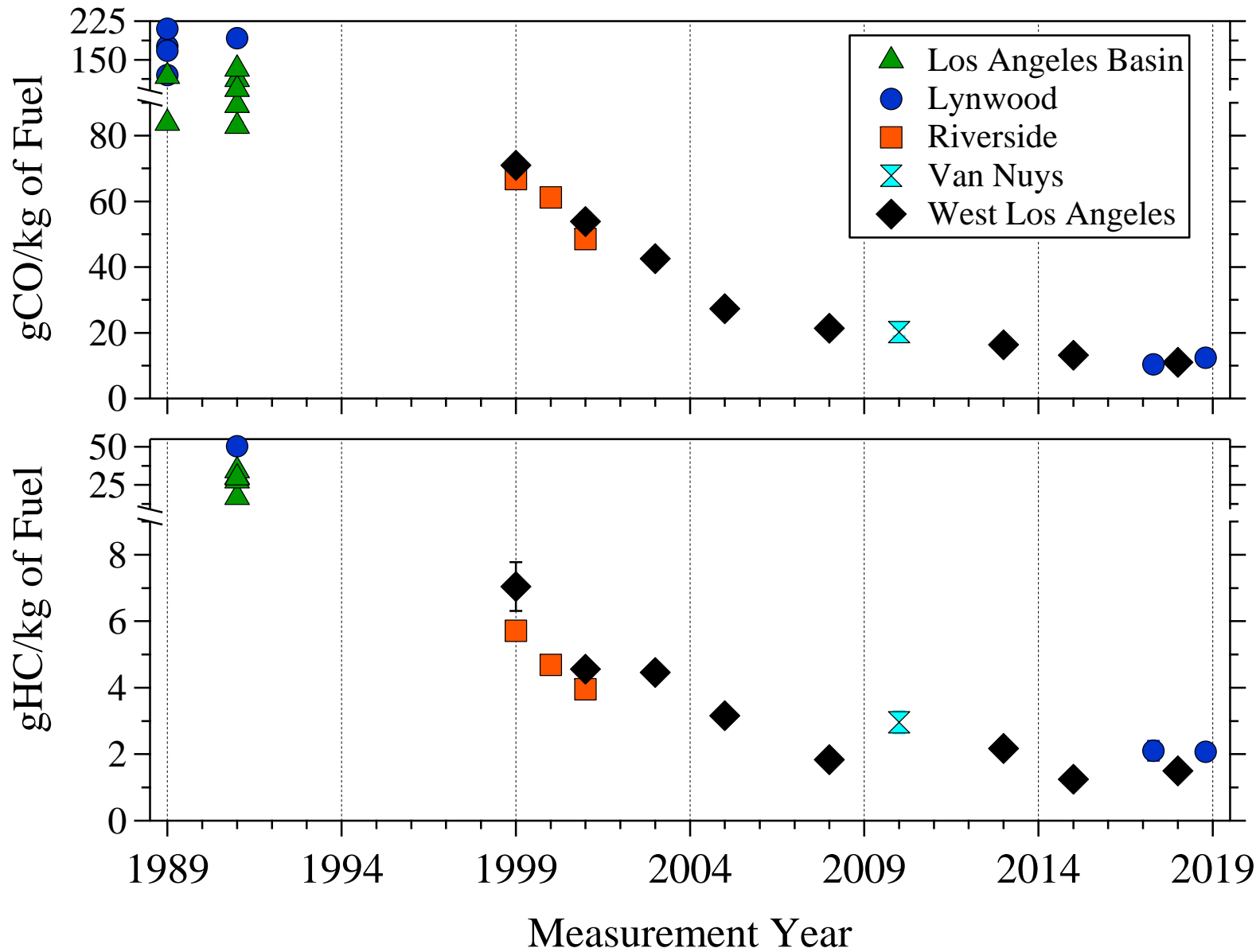
The Late Dr. Donald H. Stedman

Fuel Efficiency Automobile Test (FEAT)

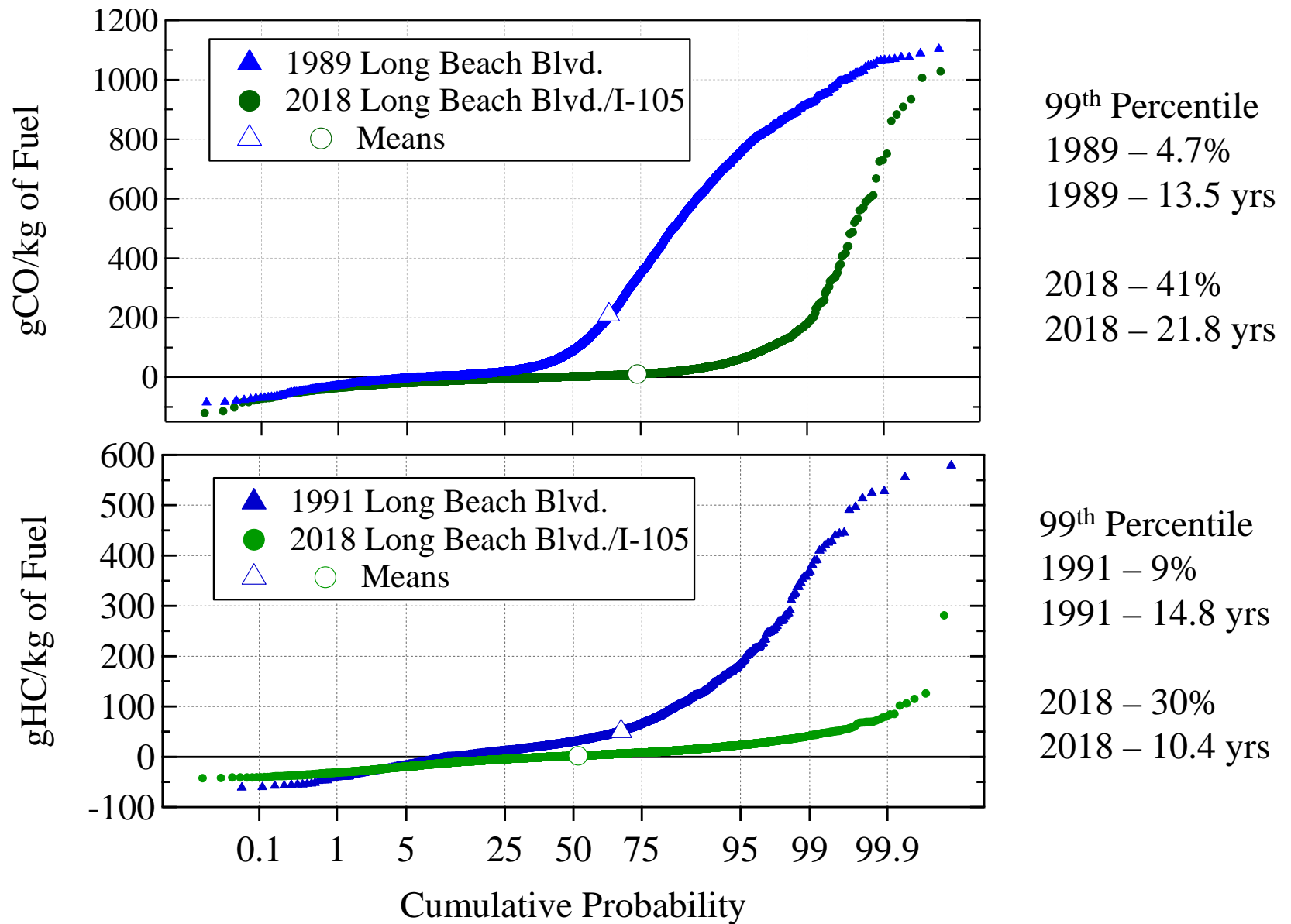


FEAT measures fuel specific (g/kg of fuel) emissions for CO (± 4 g/kg), HC (± 4 g/kg), NO (± 0.4 g/kg), NH₃ (± 0.05 g/kg) SO₂ and NO₂ (± 0.2 g/kg).

California Light-duty Historical CO and HC Trends

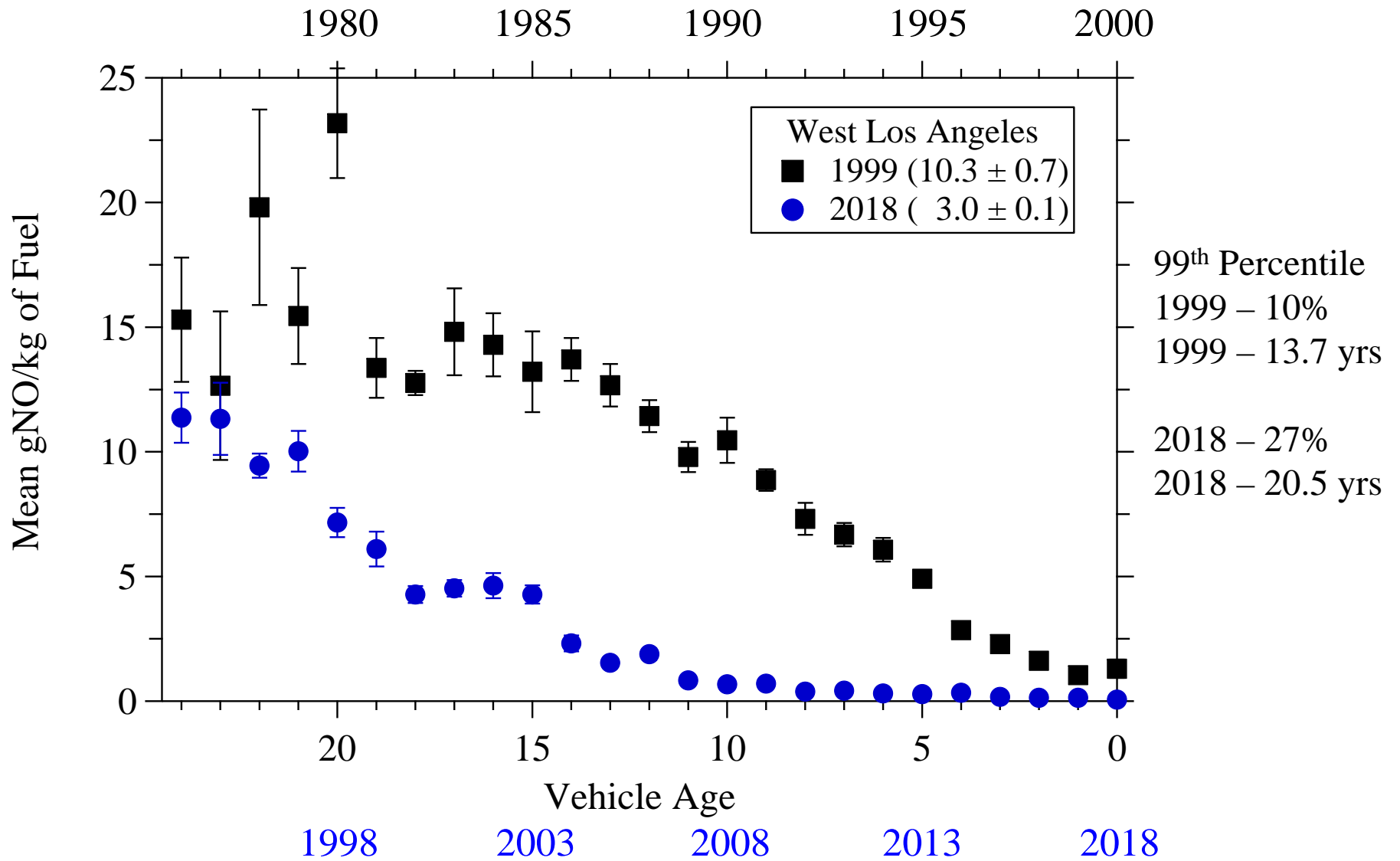


CO and HC Emissions Distribution Comparison

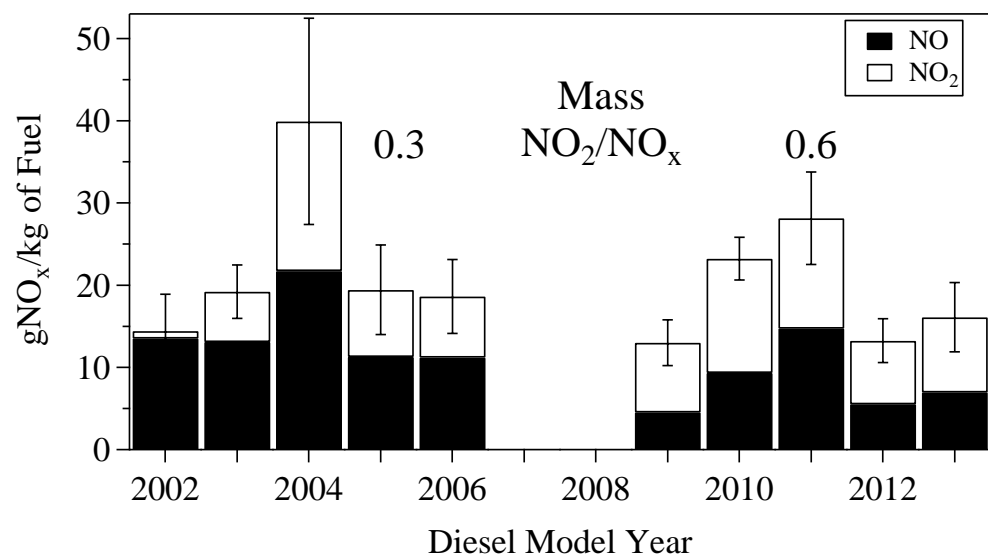
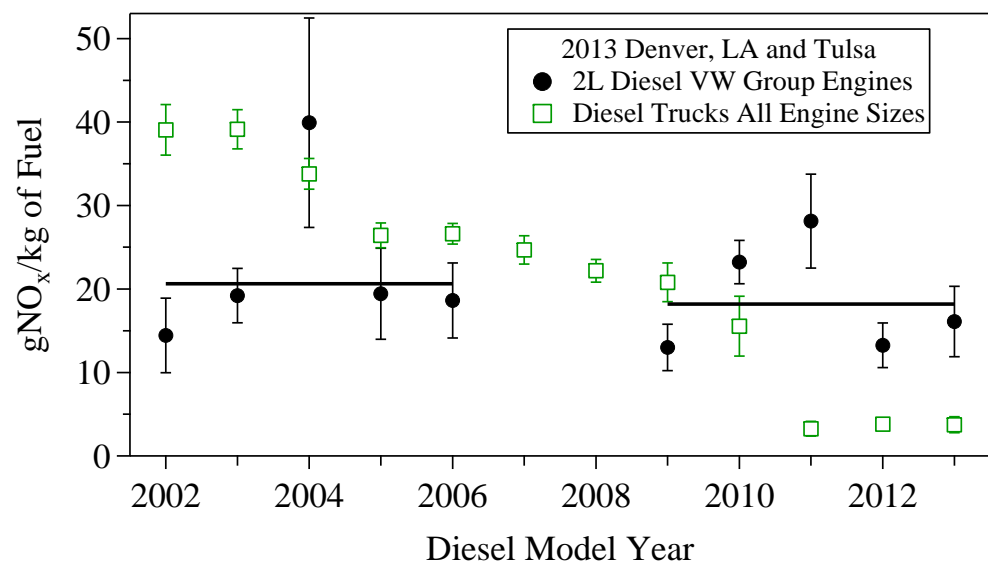


Bishop, G. A., Three Decades of On-road Mobile Source Emissions Reductions in South Los Angeles. *J. Air Waste Manage. Assoc.* **2019**, 967-976, DOI: 10.1080/10962247.2019.1611677.

NO Emissions Changes

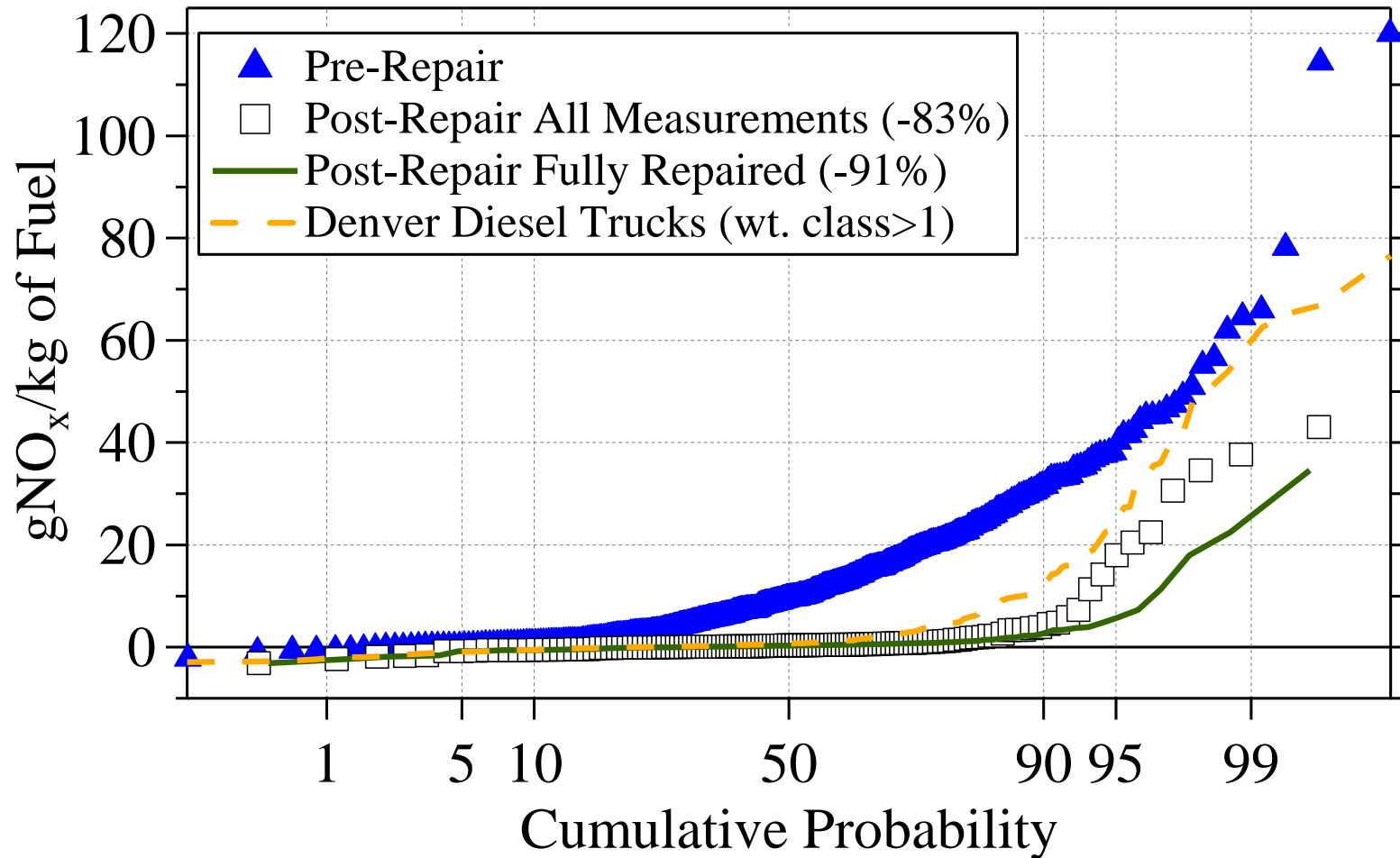


2013 Diesel Vehicle Emissions



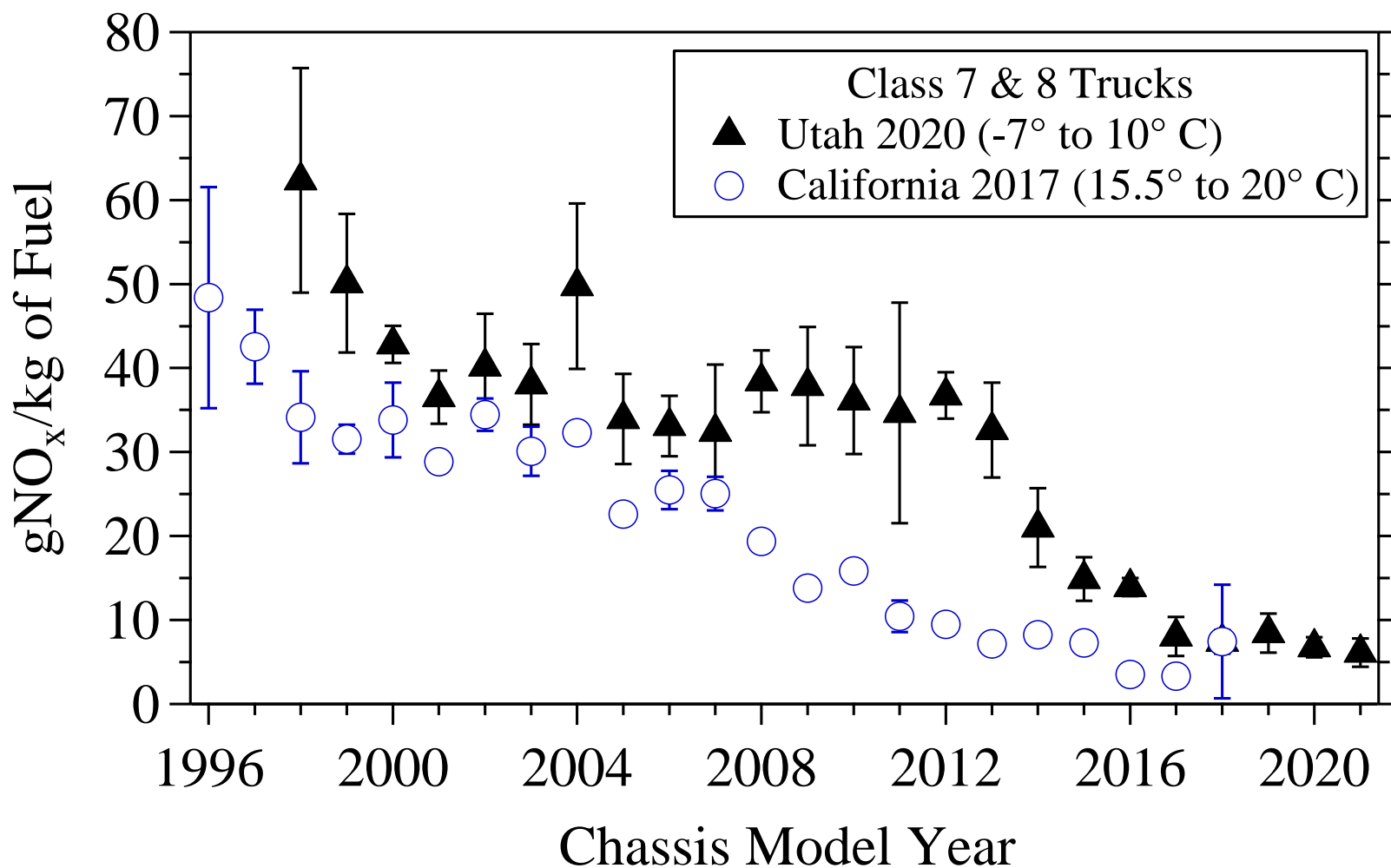
Bishop, G. A.; Stedman, D. H., Reactive Nitrogen Species Emission Trends in Three Light-/Medium-Duty United States Fleets. *Environ. Sci. Technol.* **2015**, 49, (18), 11234-11240, DOI: 10.1021/acs.est.5b02392.

VW NO_x Emission Distribution Comparisons



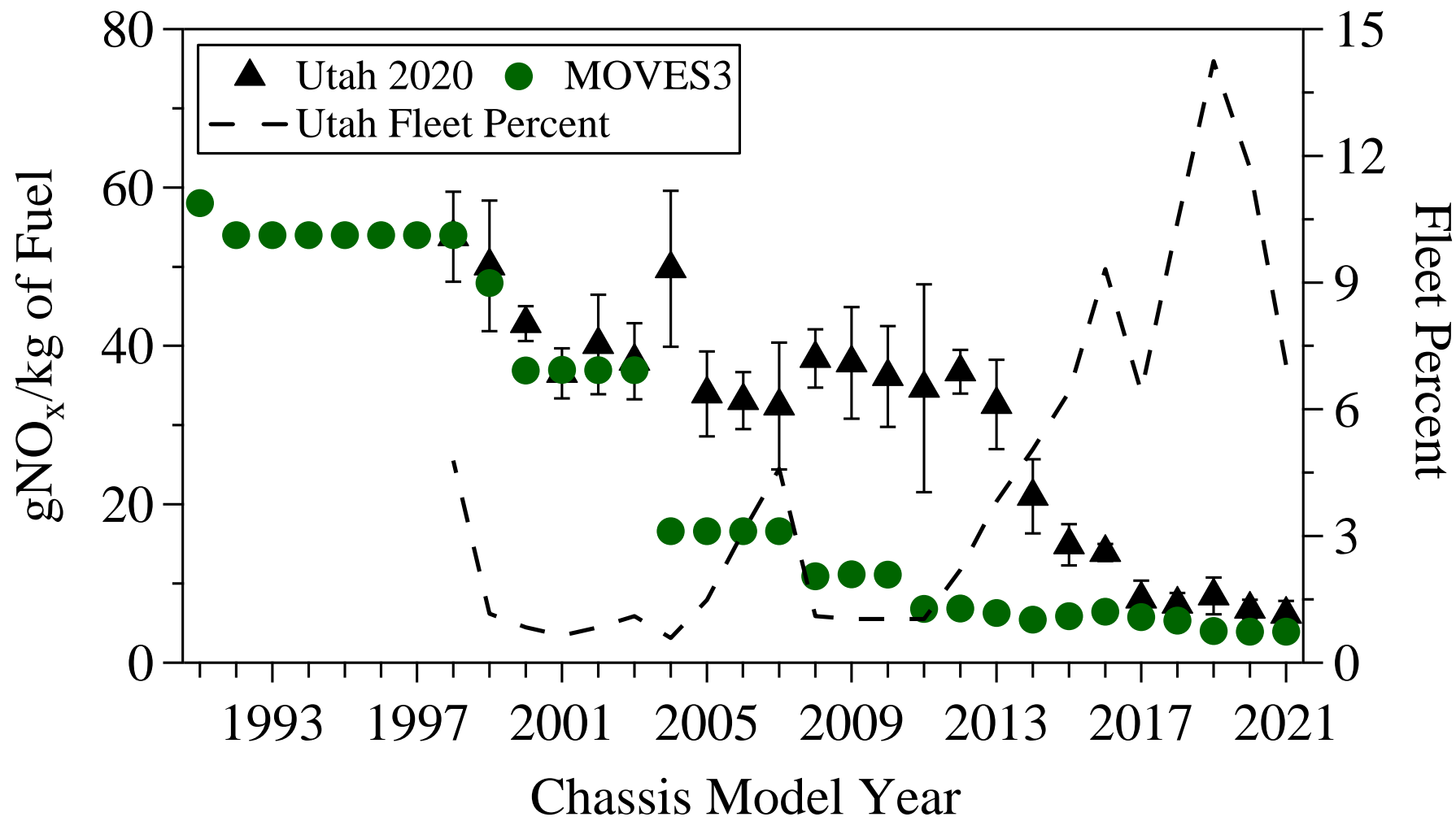
Bishop, G. A., On-Road NO_x Emissions Evaluation of the Repair Effectiveness for Recalled Volkswagen Group Light-Duty Diesel Vehicles in the United States. *Environ. Sci. Technol.* **2021**, 55, (24), 16581-16585, DOI: 10.1021/acs.est.1c06826.

December 2020 Utah HDV Emissions



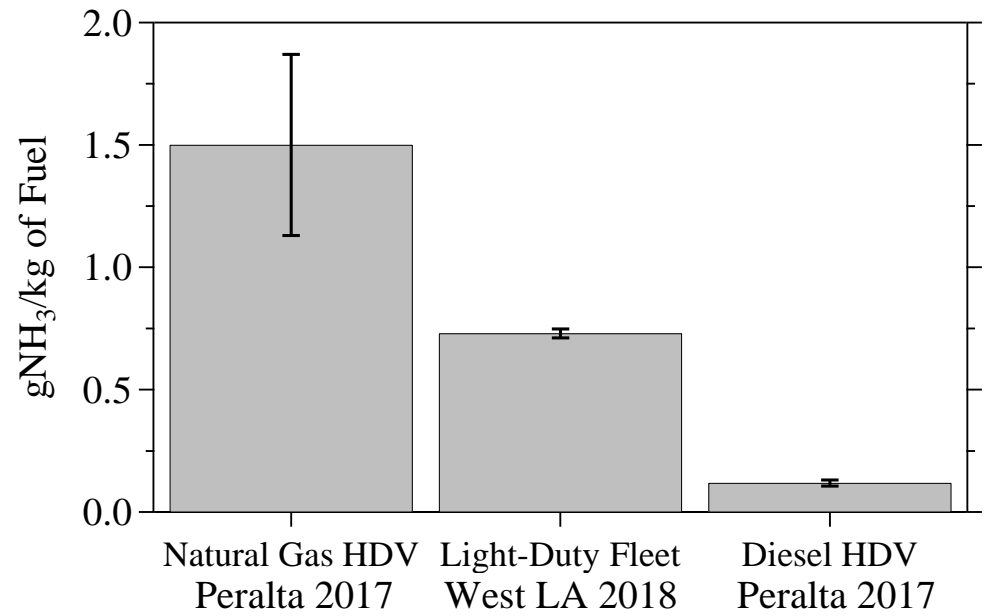
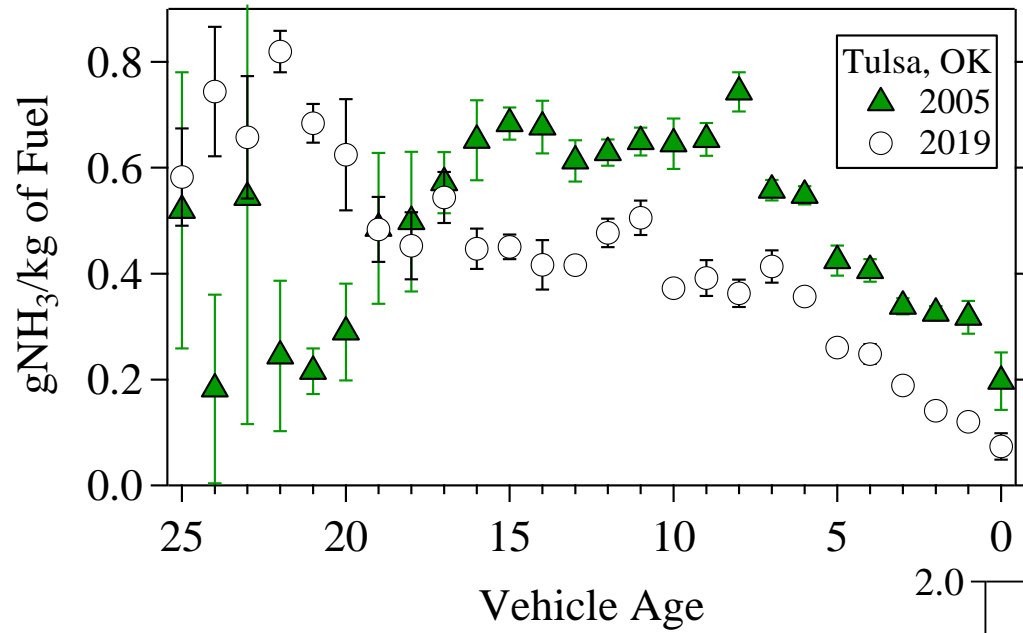
Bishop, G. A.; Haugen, M. J.; McDonald, B. C.; Boies, A. M., Utah Wintertime Measurements of Heavy-Duty Vehicle Nitrogen Oxide Emission Factors. *Environ. Sci. Technol.* **2022**, DOI: 10.1021/acs.est.1c06428.

Utah Heavy-duty Vehicle Fleet vs. MOVES3

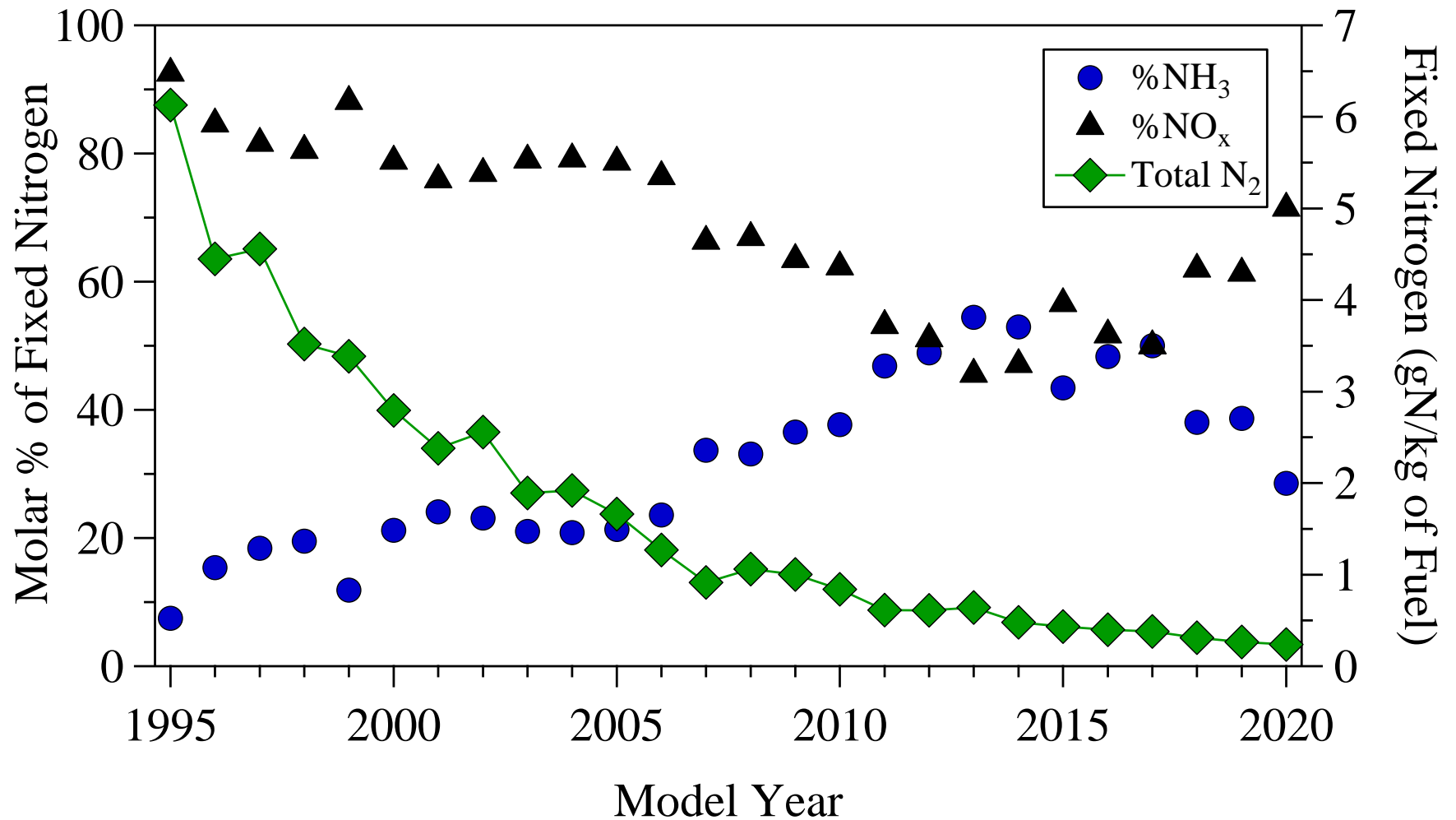


Bishop, G. A.; Haugen, M. J.; McDonald, B. C.; Boies, A. M., Utah Wintertime Measurements of Heavy-Duty Vehicle Nitrogen Oxide Emission Factors. *Environ. Sci. Technol.* **2022**, DOI: 10.1021/acs.est.1c06428.

Ammonia Emissions and Sources



Denver 2020 Fixed Nitrogen Emissions



Conclusions

- Light and heavy-duty vehicle emissions have decreased significantly over the past 3 decades.
- Light-duty emission distributions are still skewed with a small number of vehicles being responsible for a significant portion of the total emissions.
- Laboratory emission measurements are not always to be relied upon.
- Early generation SCR systems in heavy-duty vehicles have on average lost their NO_x reduction capabilities.
- Vehicle fleets are a significant source of ammonia emissions in urban areas.