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

Gary A. Bishop

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ON-ROAD VEHICLE EMISSION MEASUREMENTS AND THEIR USE IN EVALUATING EMISSION CONTROL EFFECTIVENESS

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Acknowledgments

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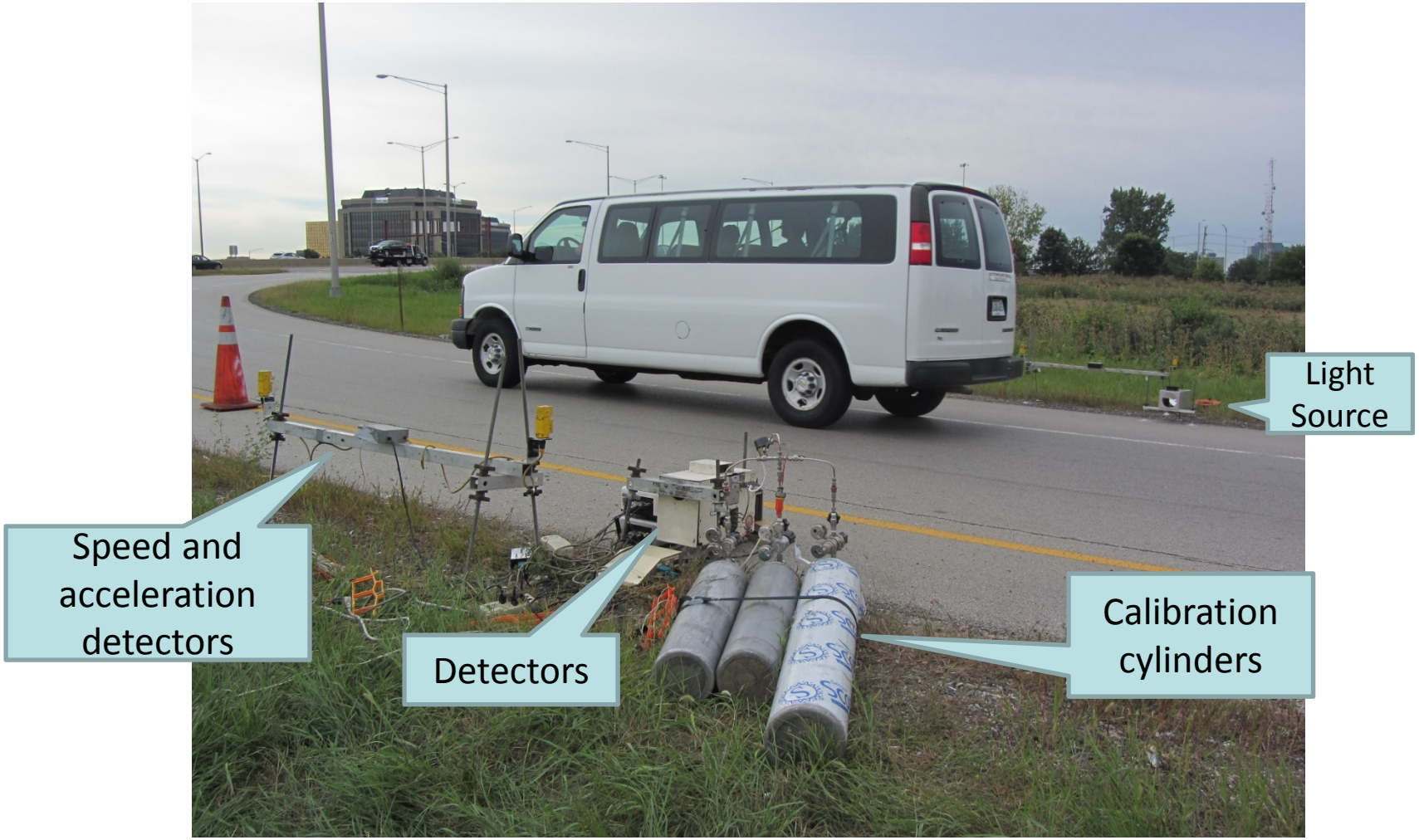
California Air Resources Board

Utah Department of Environmental Quality

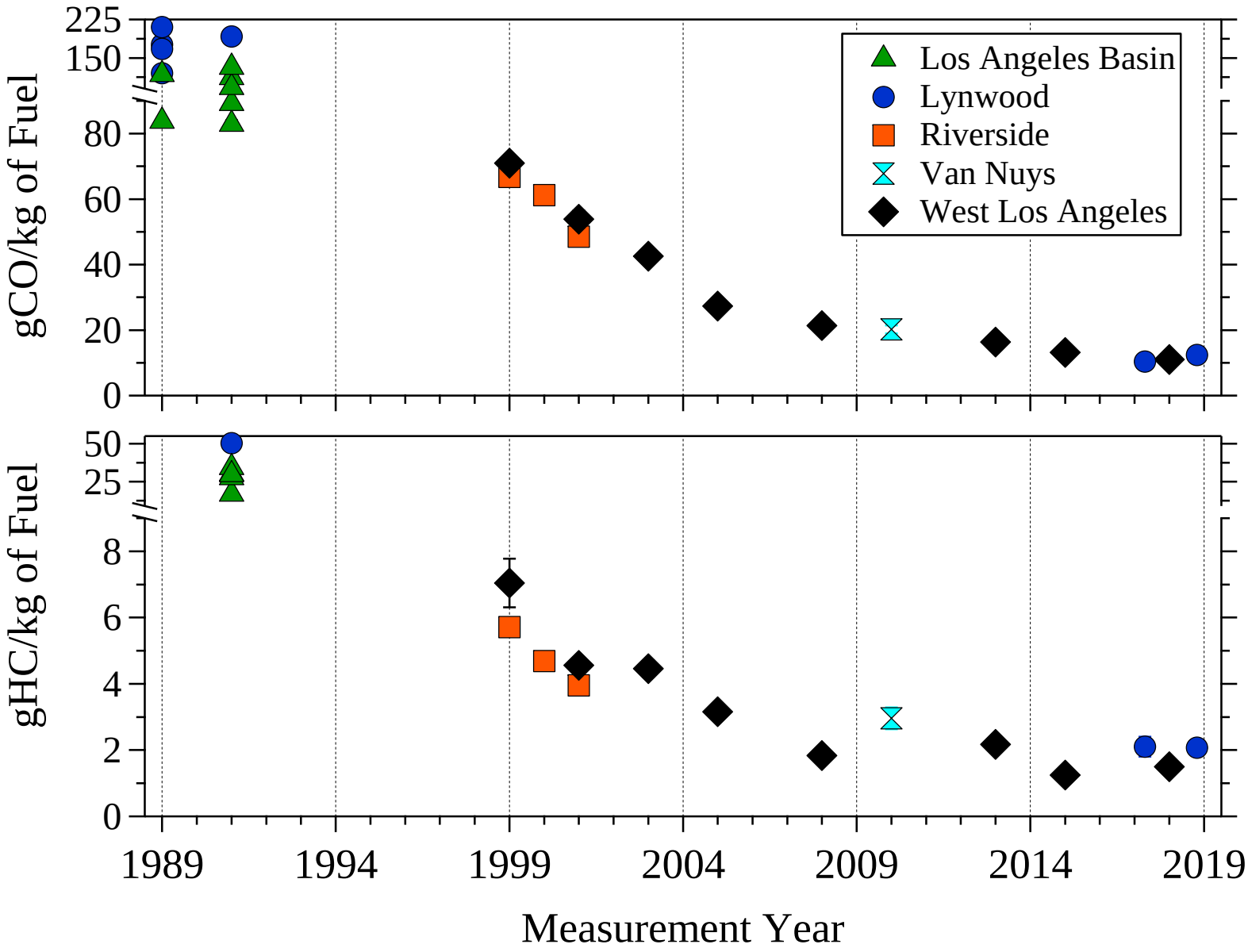
The Late Dr. Donald H. Stedman

Fuel Efficiency Automobile Test (FEAT)

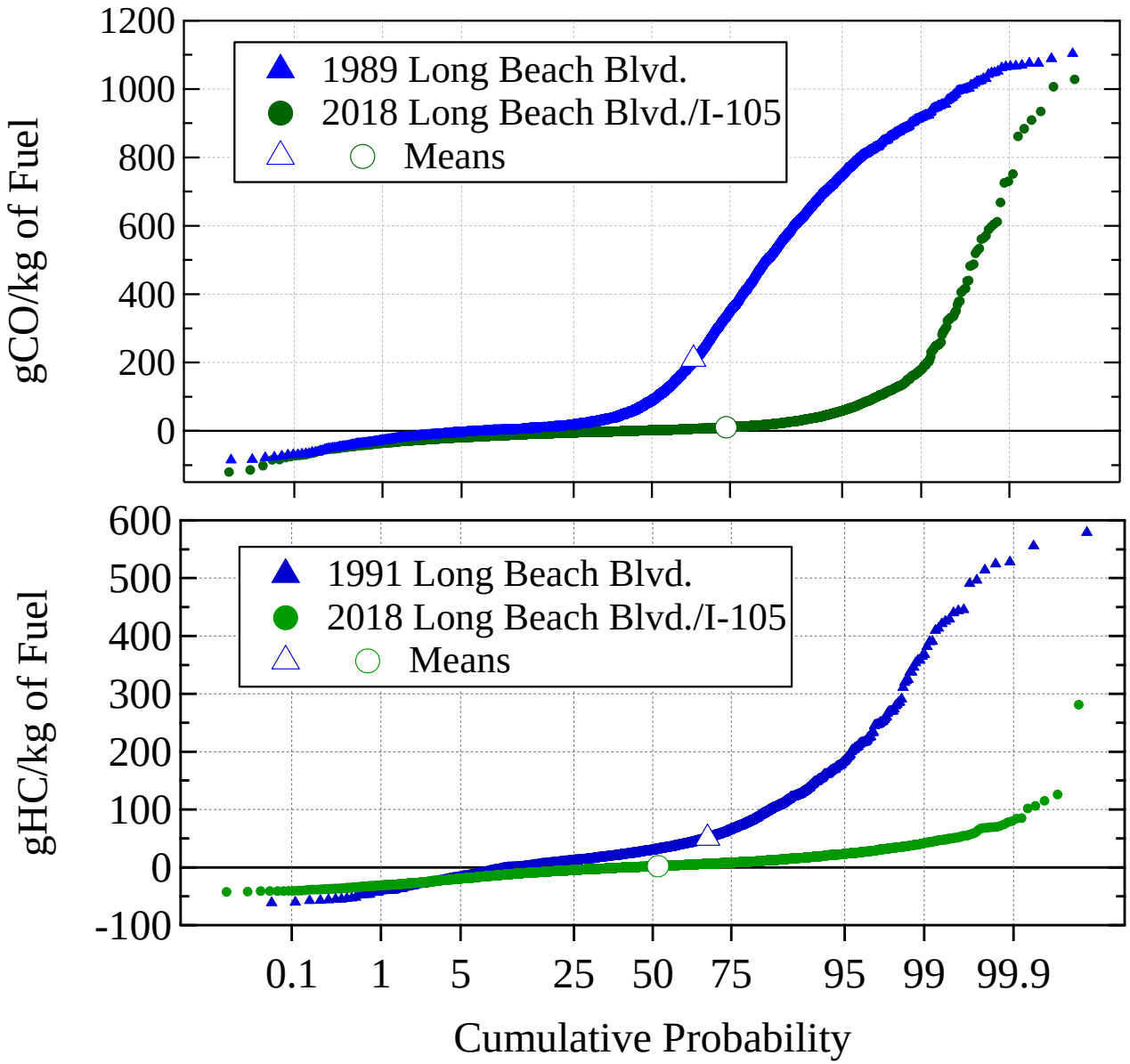


FEAT measures fuel specific (g/kg of fuel) emissions for CO (±4 g/kg), HC (±4 g/kg), NO (±0.4 g/kg), NH_3 (±0.05 g/kg) SO_2 and NO_2 (±0.2 g/kg).

California Light-duty Historical CO and HC Trends



CO and HC Emissions Distribution Comparison



99th Percentile
1989 – 4.7%
1989 – 13.5 yrs

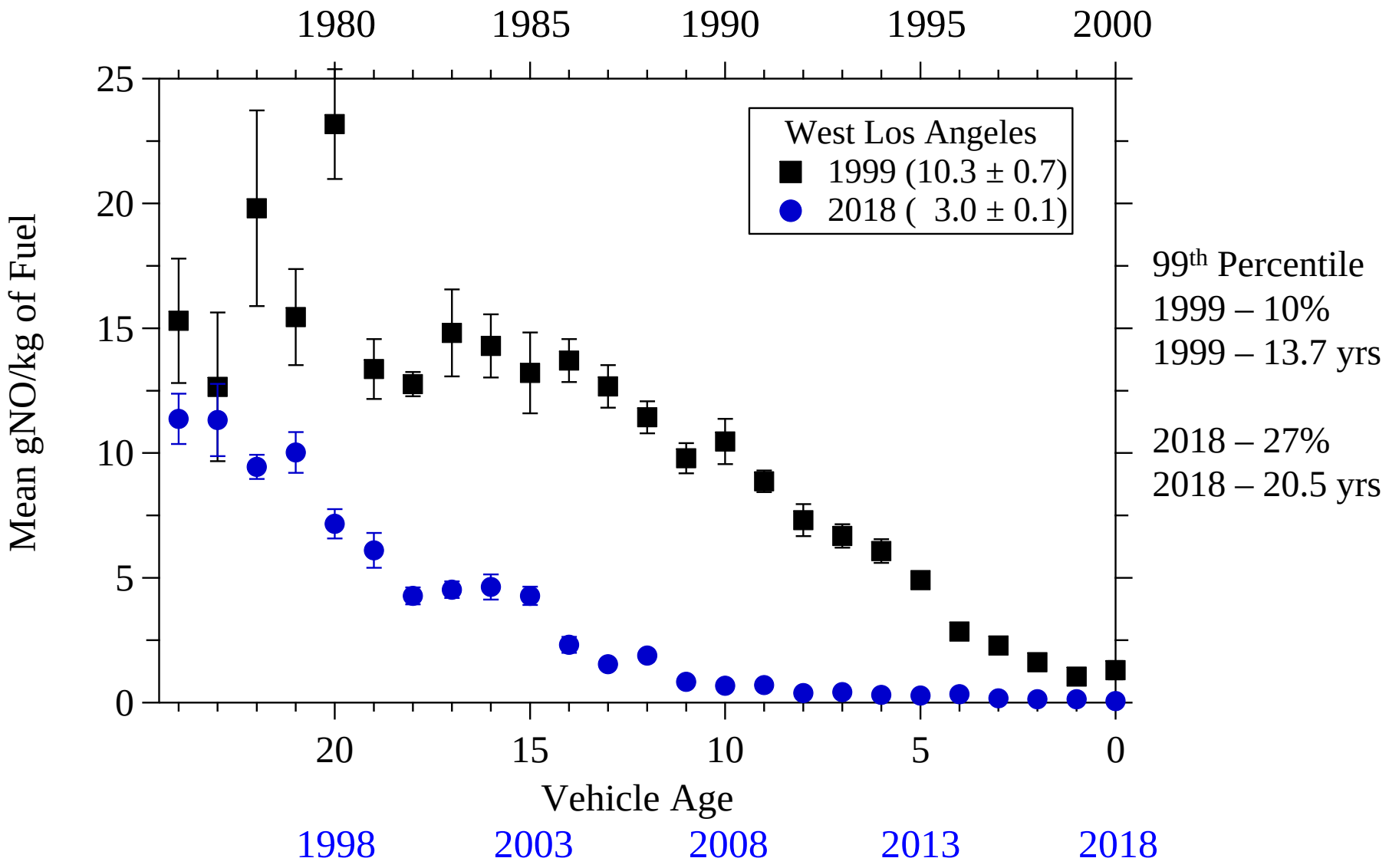
2018 – 41%
2018 – 21.8 yrs

99th Percentile
1991 – 9%
1991 – 14.8 yrs

2018 – 30%
2018 – 10.4 yrs

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.

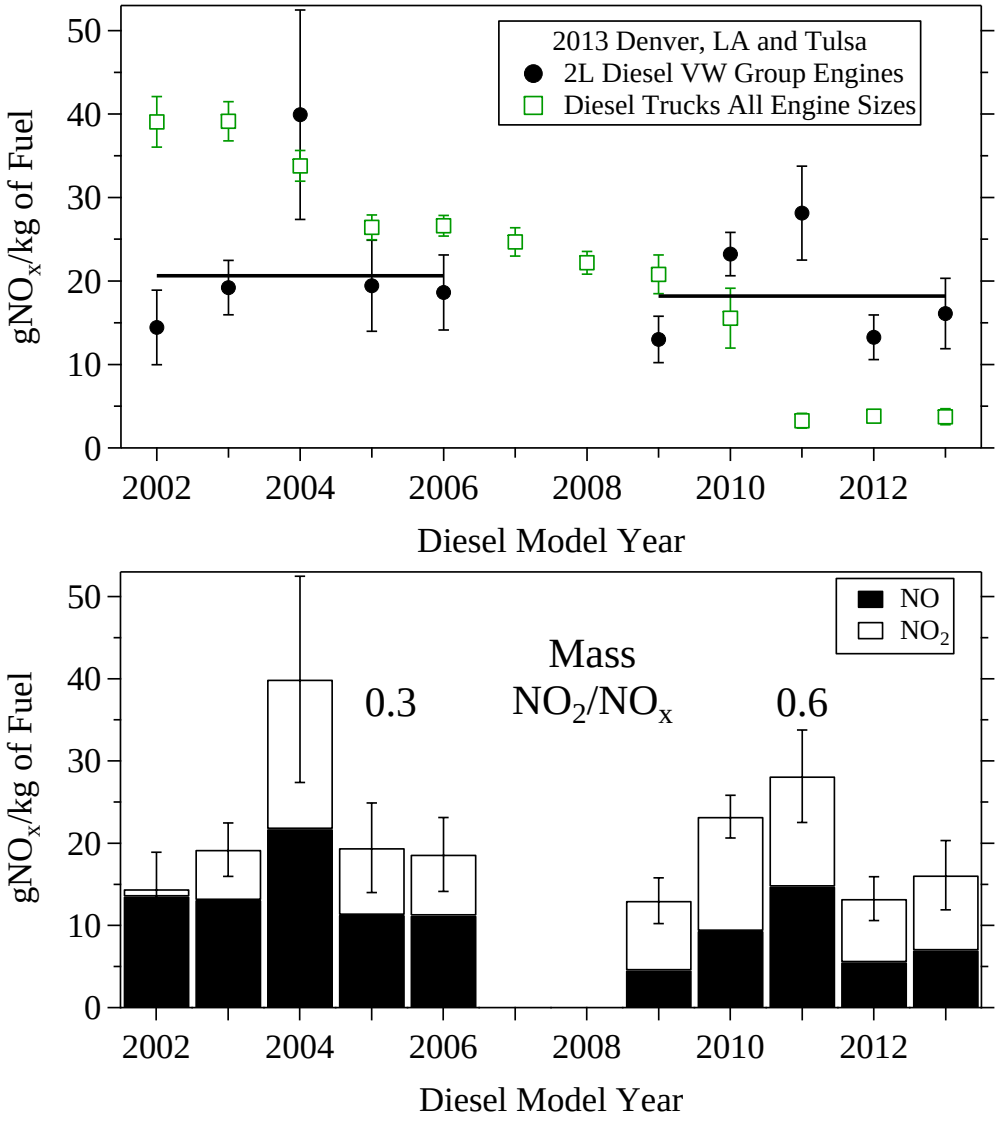
NO Emissions Changes



99th Percentile
1999 – 10%
1999 – 13.7 yrs

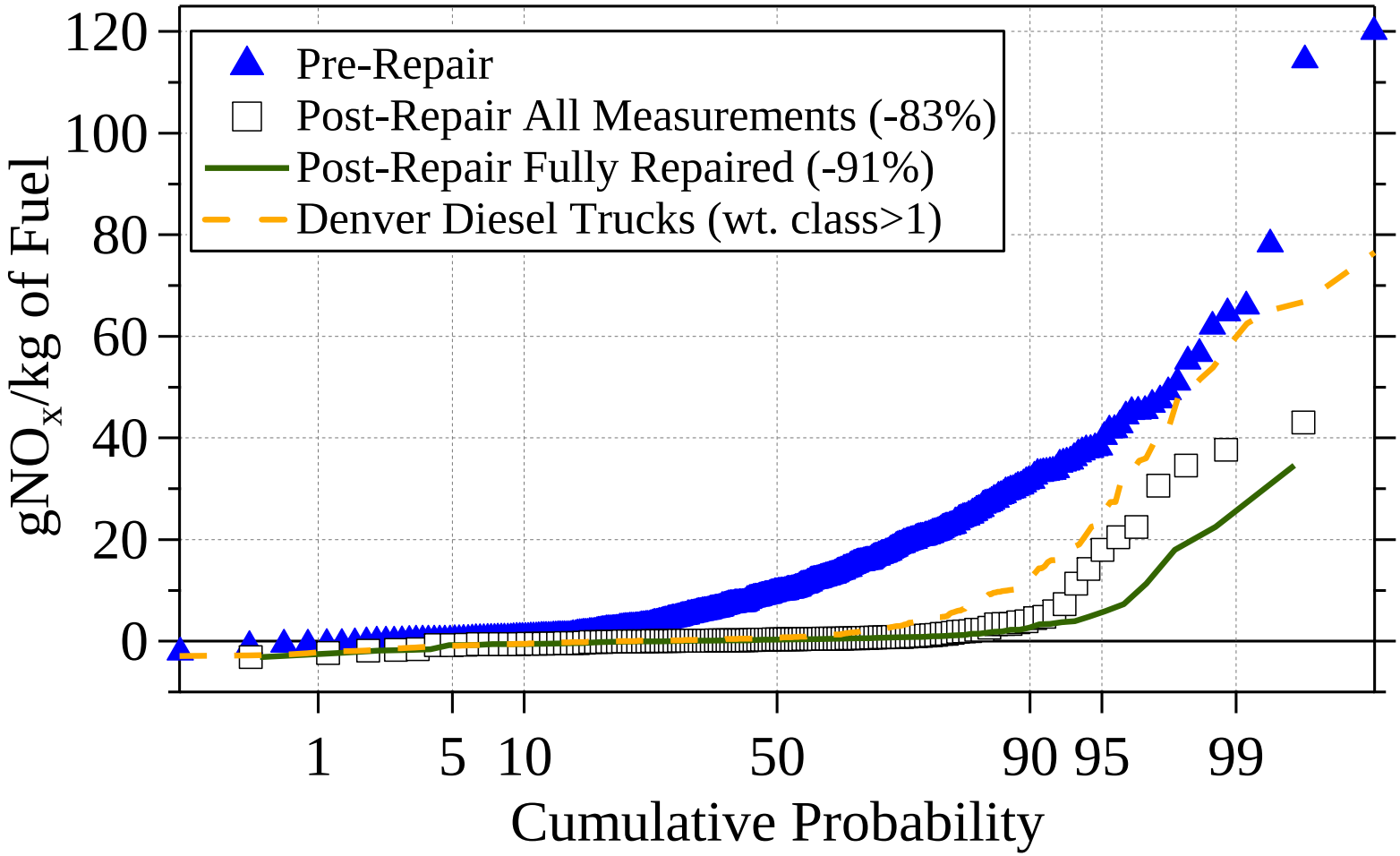
2018 – 27%
2018 – 20.5 yrs

2013 Diesel Vehicle Emissions



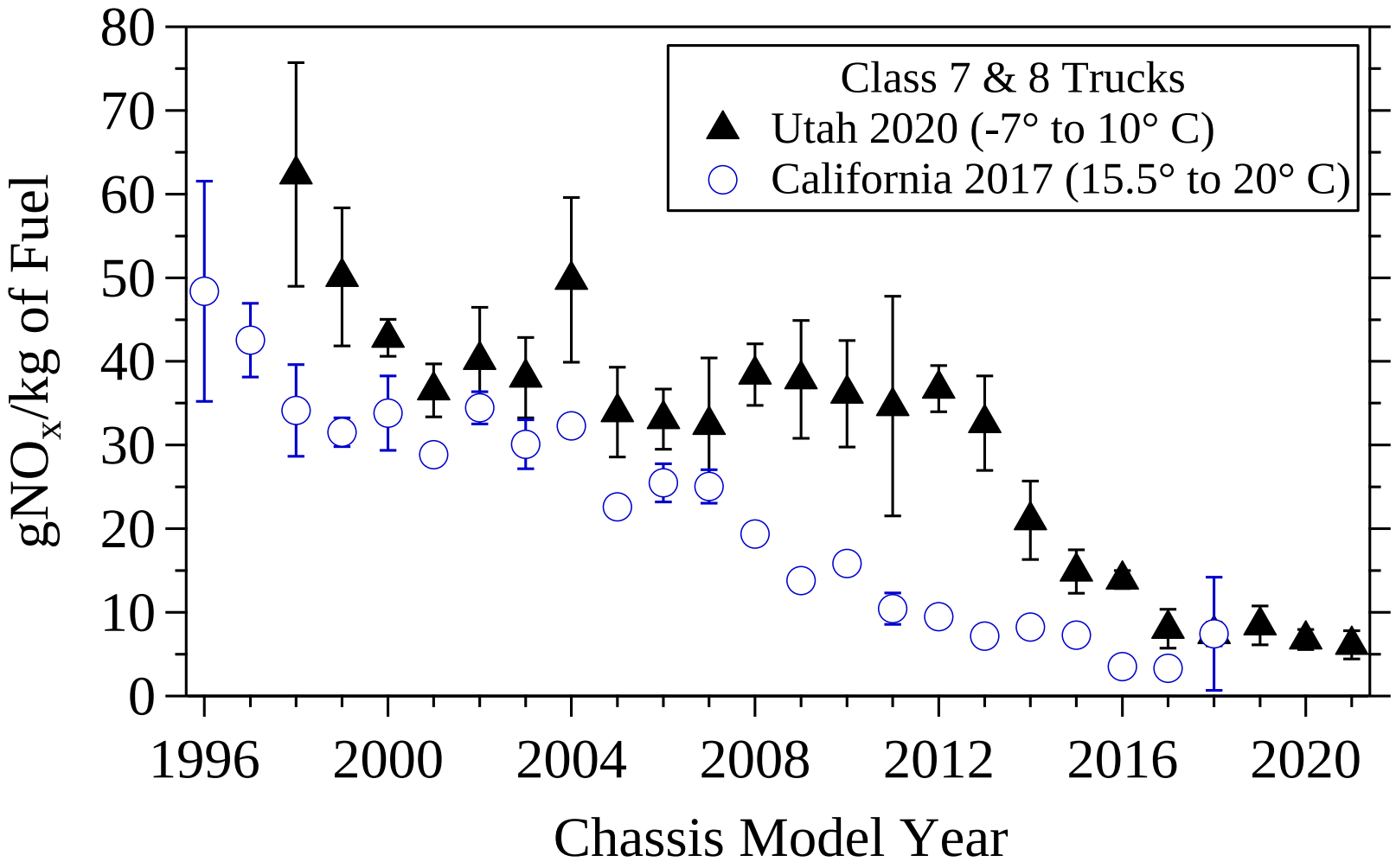
Bishop, G. A.; Stedman, D. H., Reactive Nitrogen Species Emission Trends in Three Light-/Medium-Duty United States Fleets. *Environ. Sci. Technol.* **2015,** 49, (18), 11234-11240, DOI: 10.1021/acs.est.5b02392.

VW NO_x Emission Distribution Comparisons



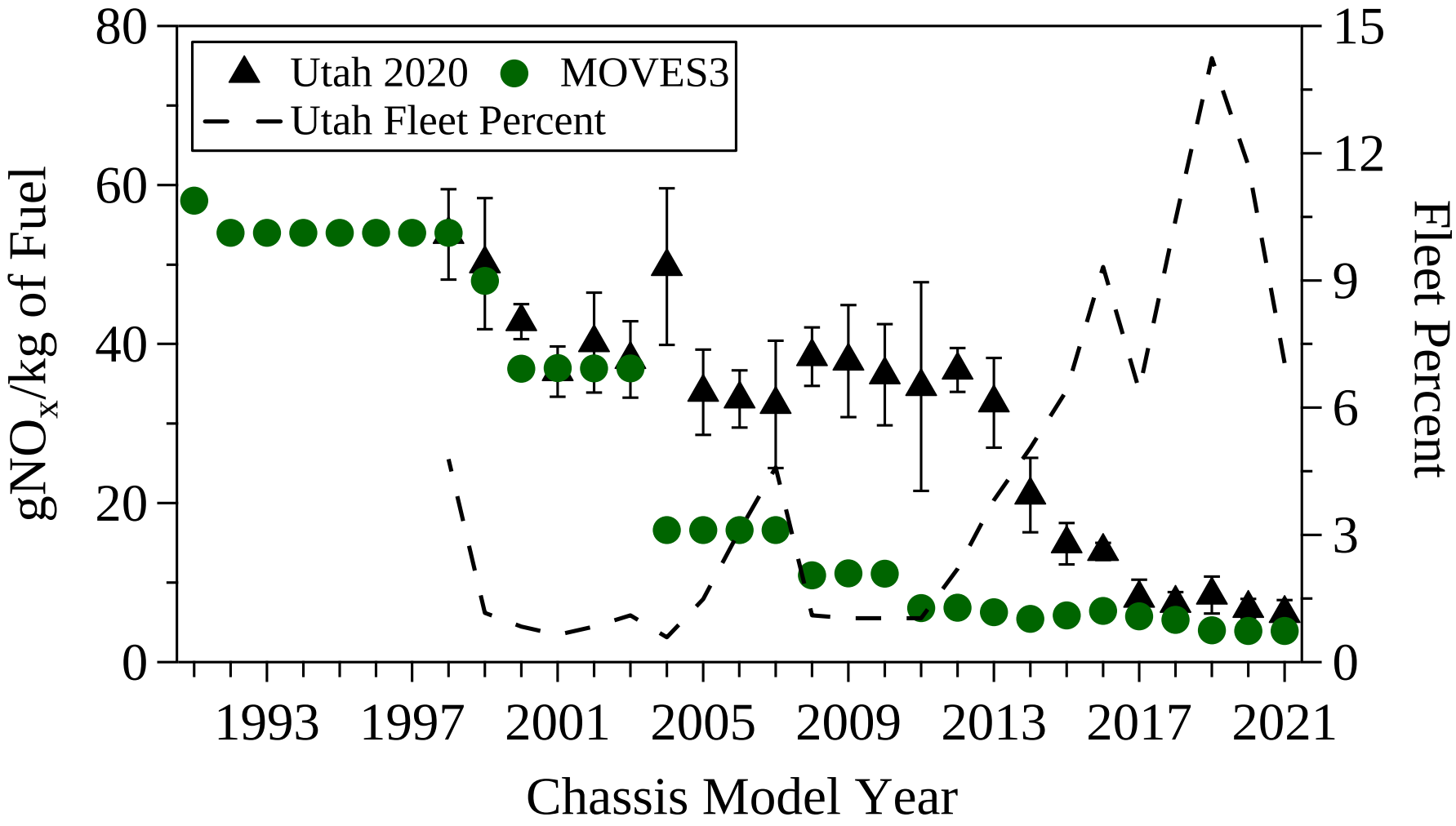
Bishop, G. A., On-Road NOx Emissions Evaluation of the Repair Effectiveness for Recalled Volkswagen Group Light-Duty Diesel Vehicles in the United States. *Environ. Sci. Technol.* **2021,** 55, (24), 16581-16585, DOI: 10.1021/acs.est.1c06826.

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.

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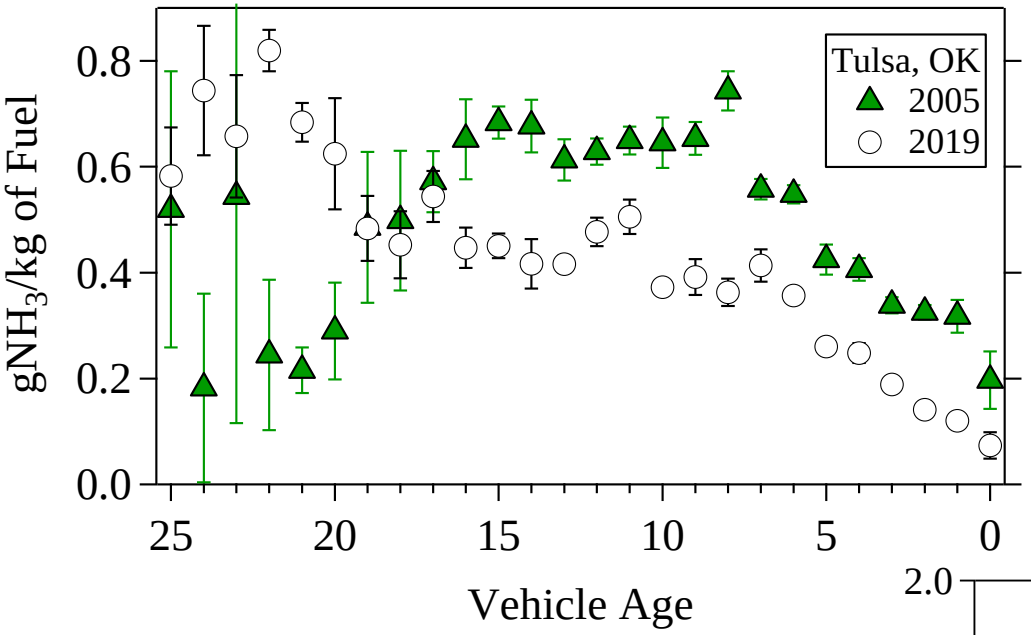
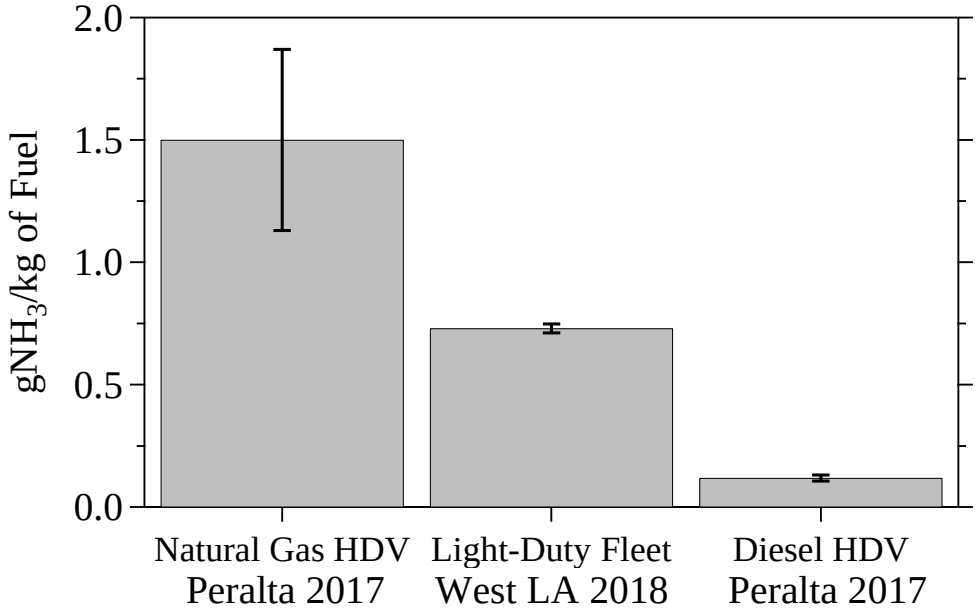
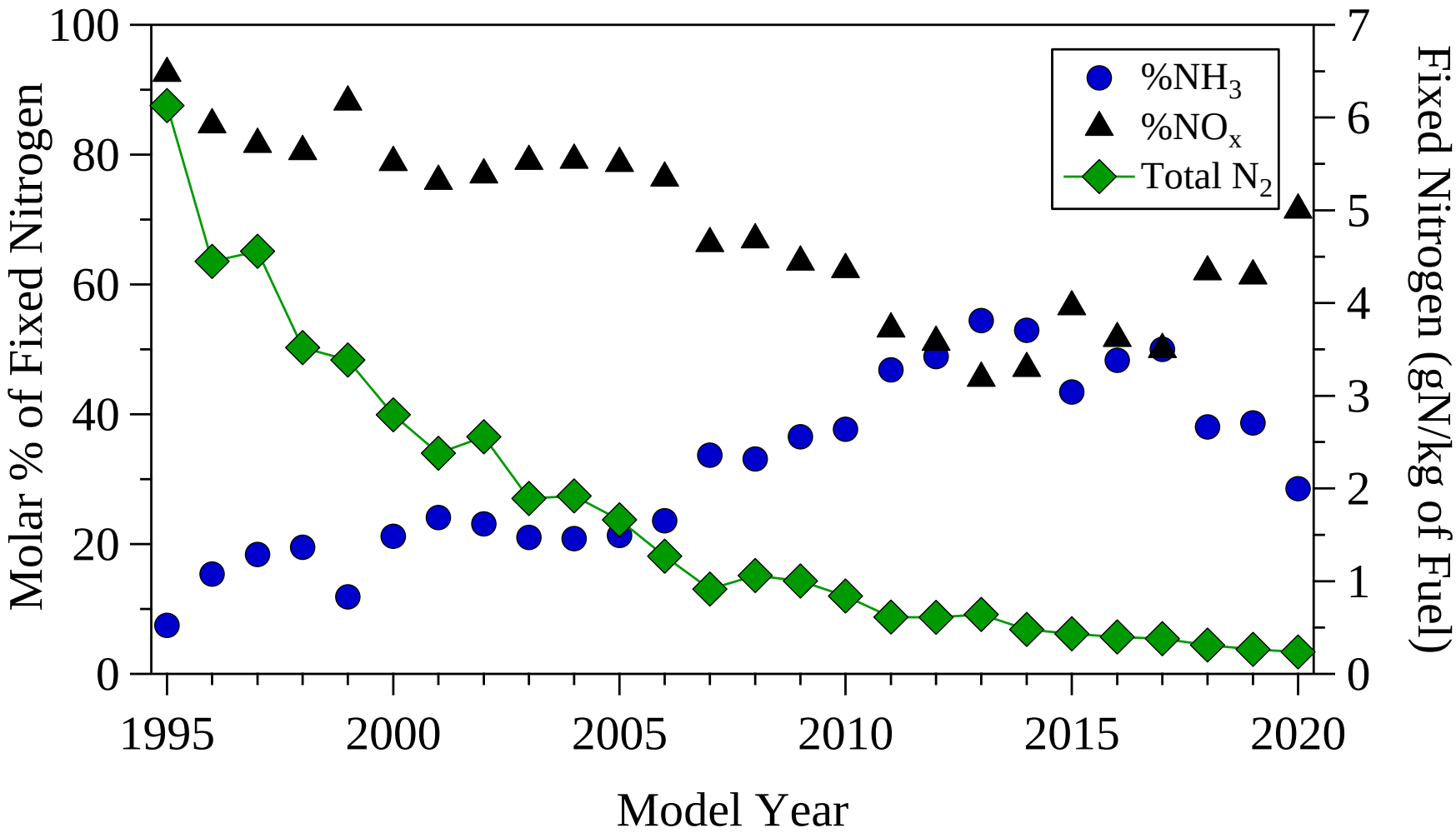
Ammonia Emissions and Sources





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 NOx reduction capabilities.
- Vehicle fleets are a significant source of ammonia emissions in urban areas.