Plume Capture Method to Characterize On-Road Emissions by Heavy-Duty Diesel Trucks

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Sept 14, 2018

But also…
A Community Network of 100 Low-Cost Black Carbon Sensors

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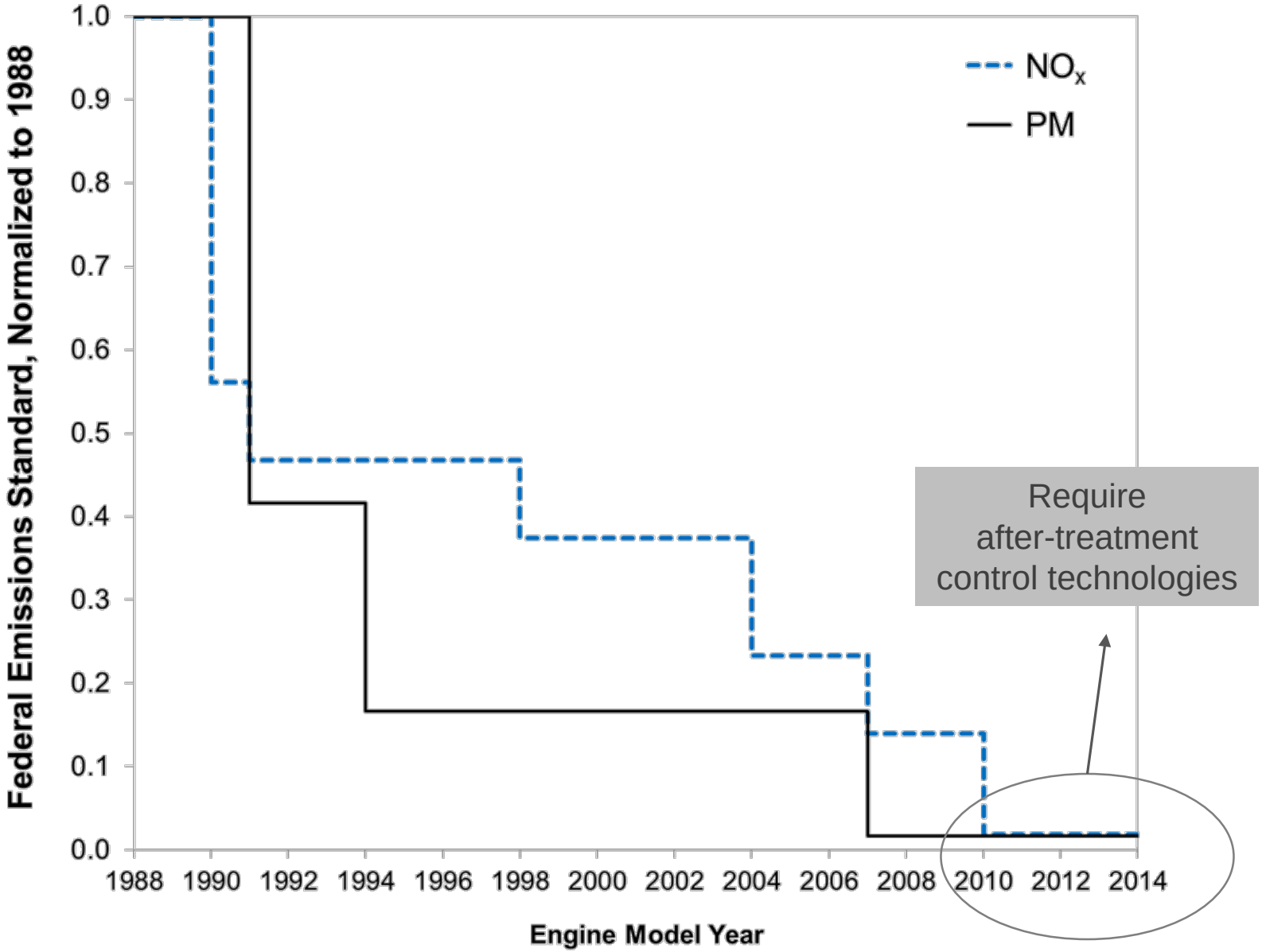
Increasingly stringent standards for HDDT



Tailpipe emissions sampled from above roadway

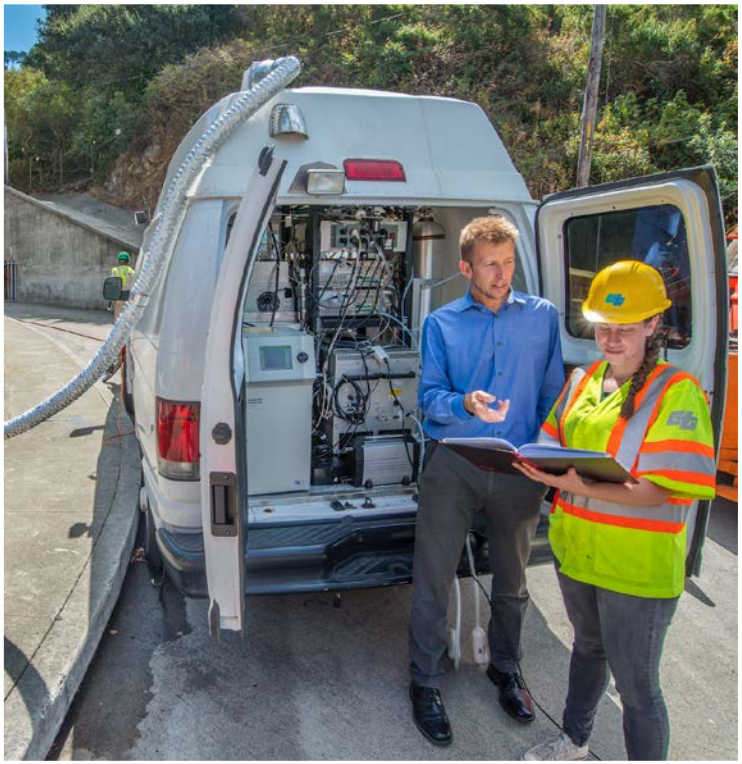
- Using a customized research platform, measured emission rates of pollutants from thousands of trucks in the Bay Area

En route to Port of Oakland

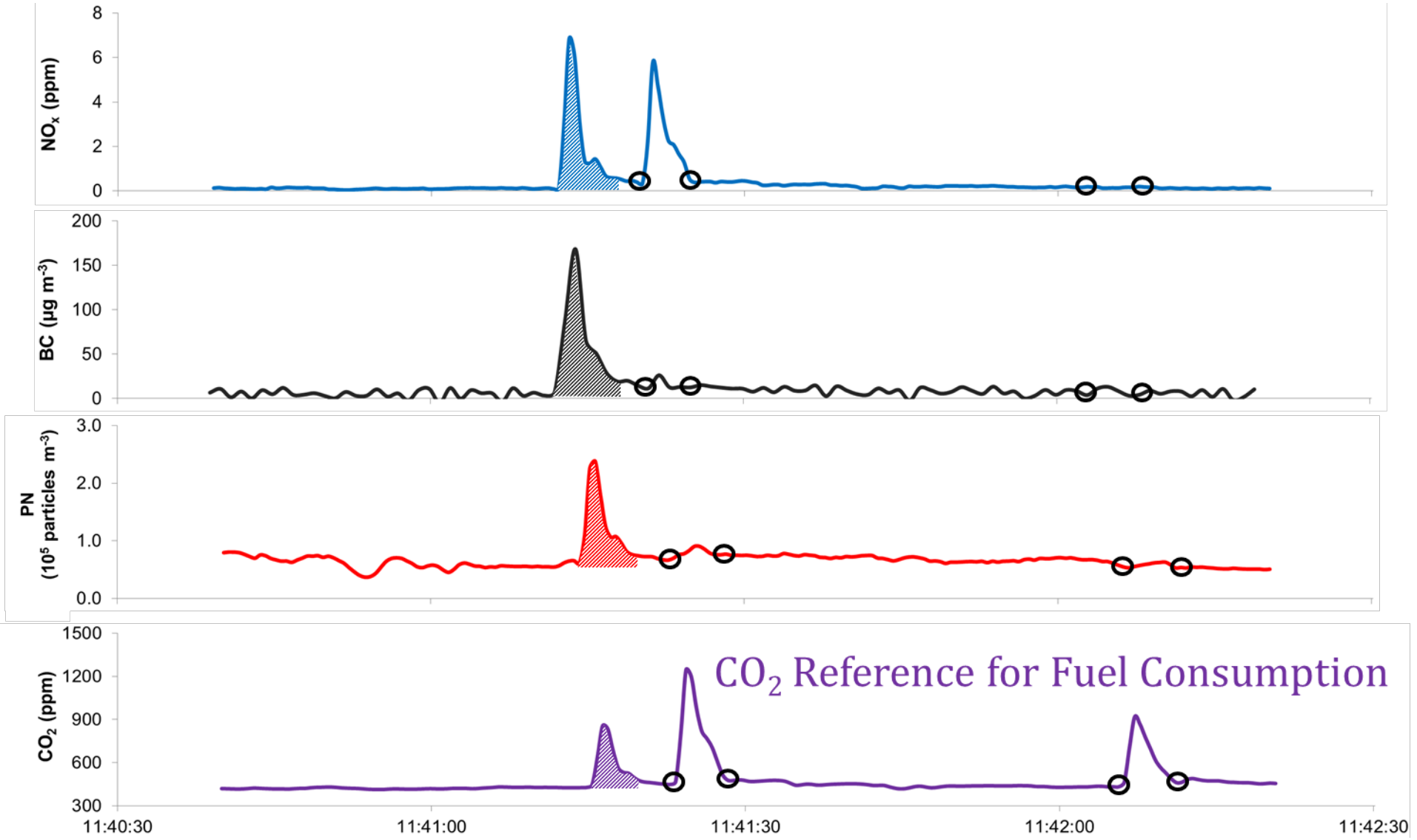
Entering Caldecott Tunnel

Plume capture for emissions characterization

- Research-grade analyzers with fast response time (1 Hz or faster) captured on-road truck plumes in real time

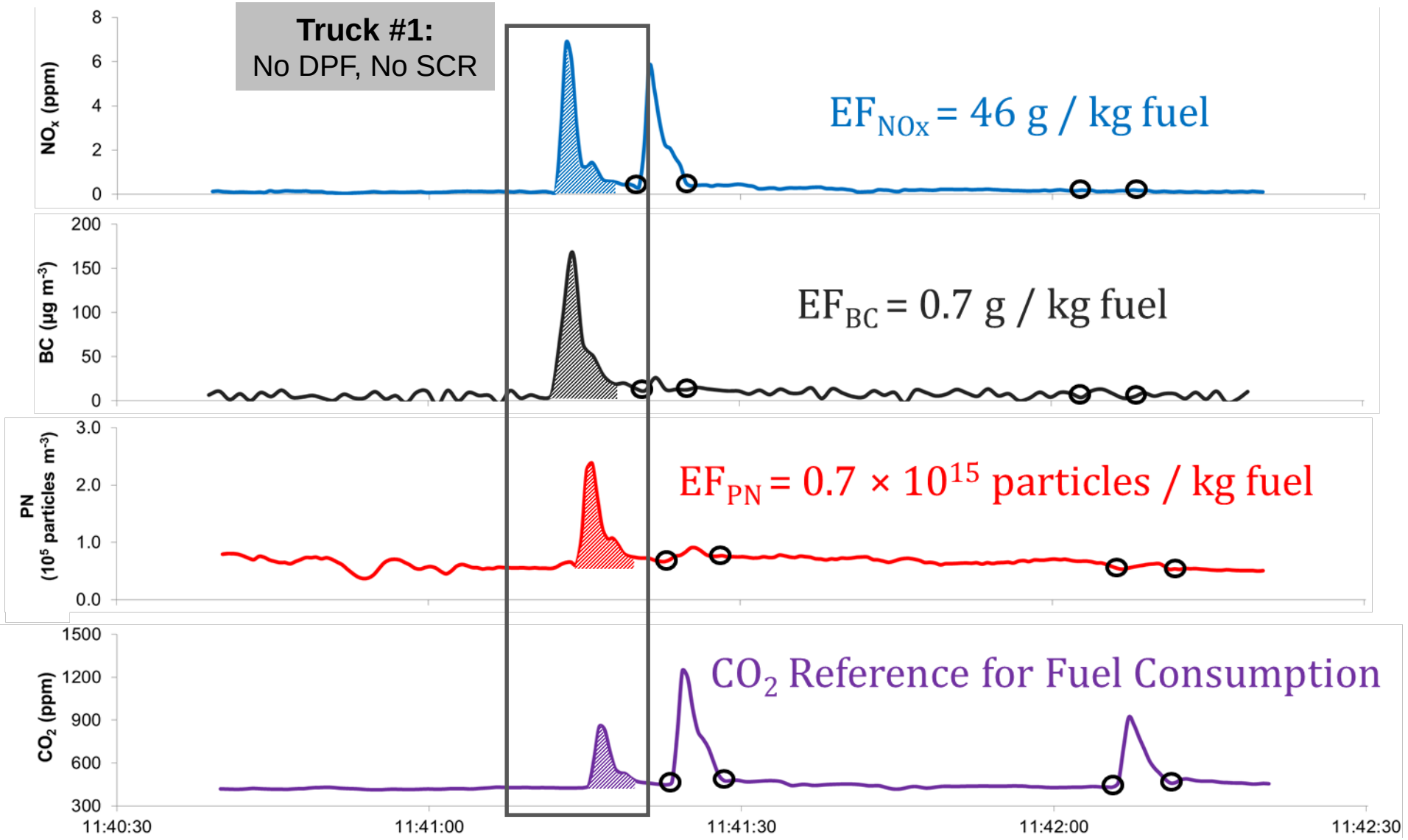


Plume capture method



2013-03-27, Port of Oakland

Plume capture method



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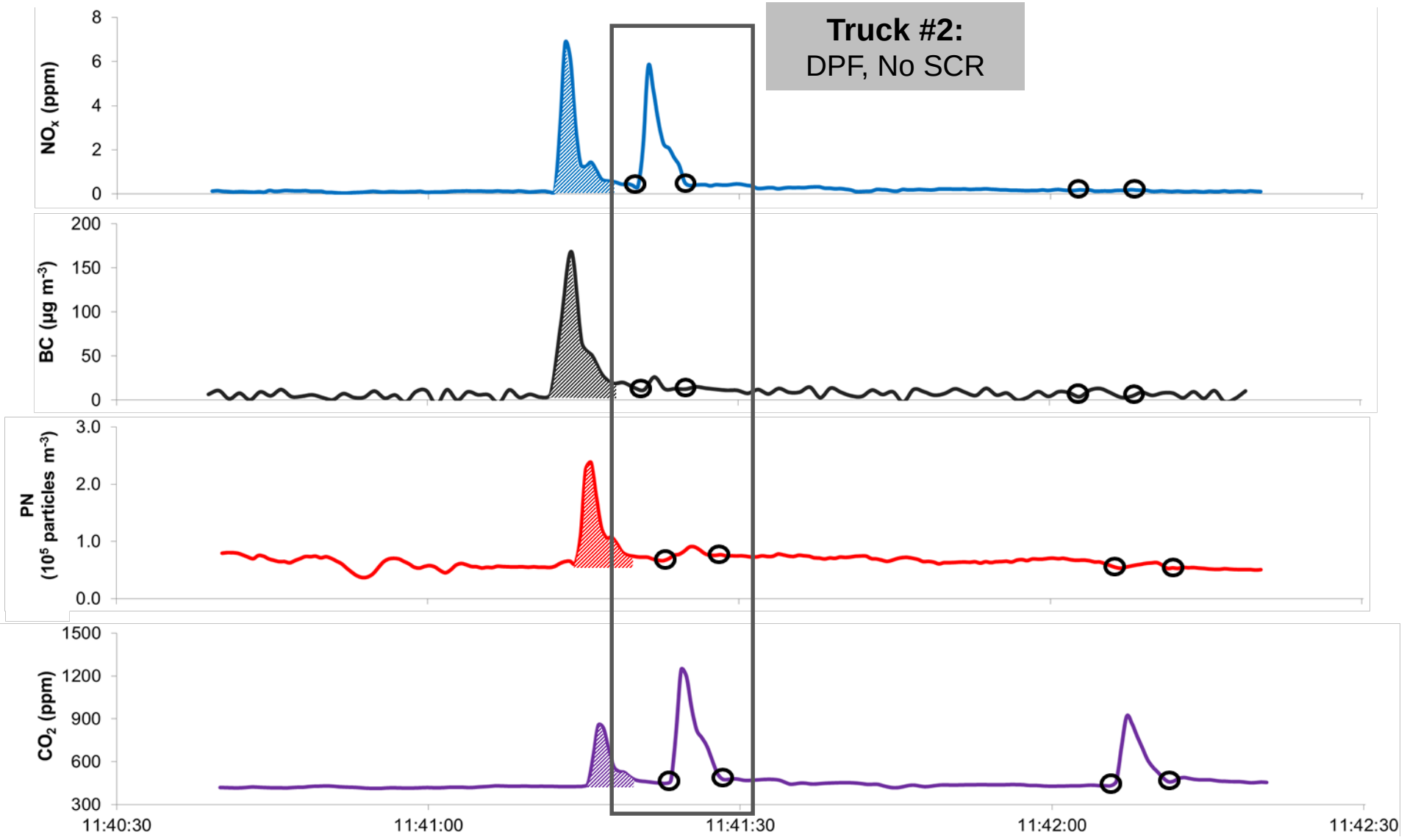
Plume capture method



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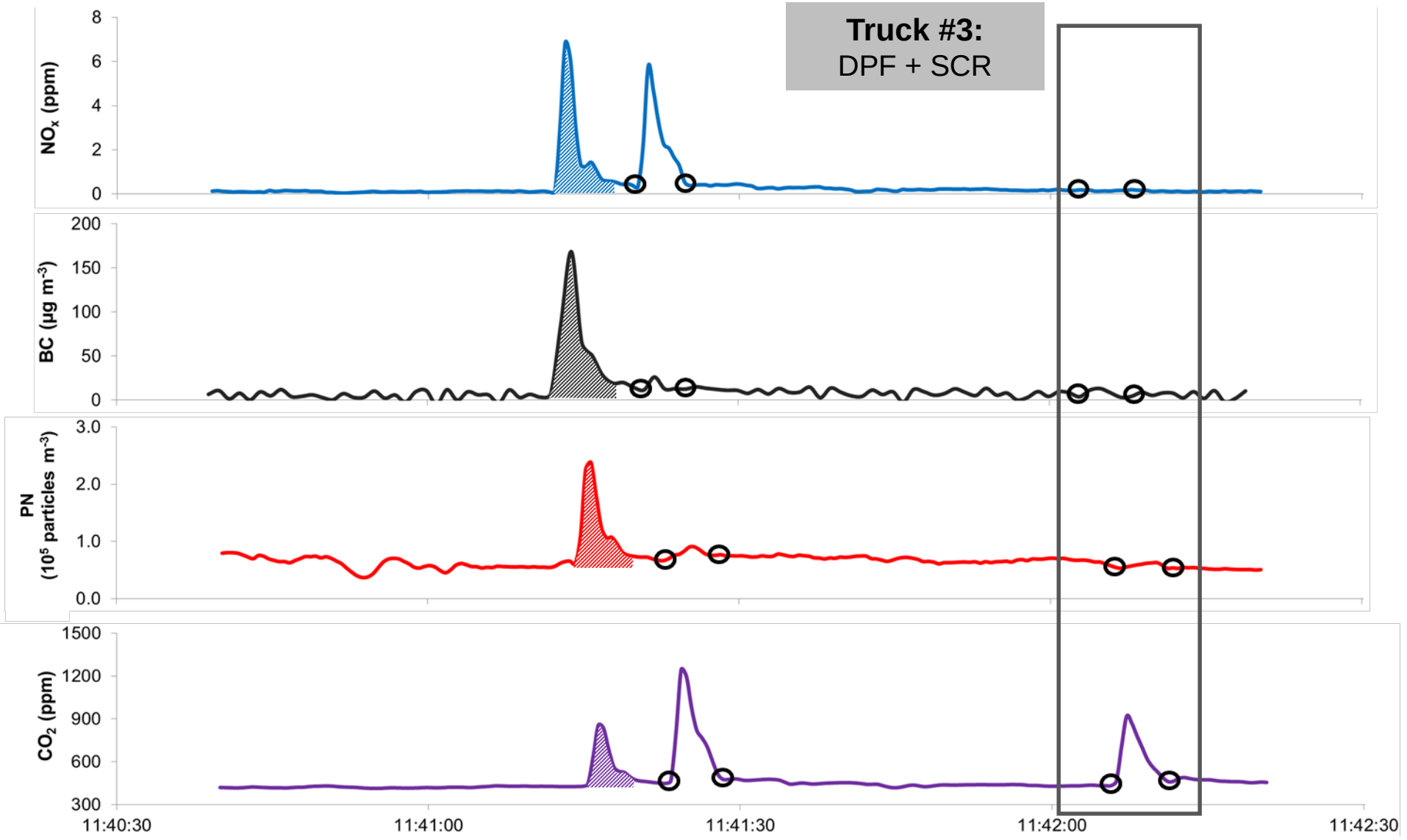

2013-03-27, Port of Oakland


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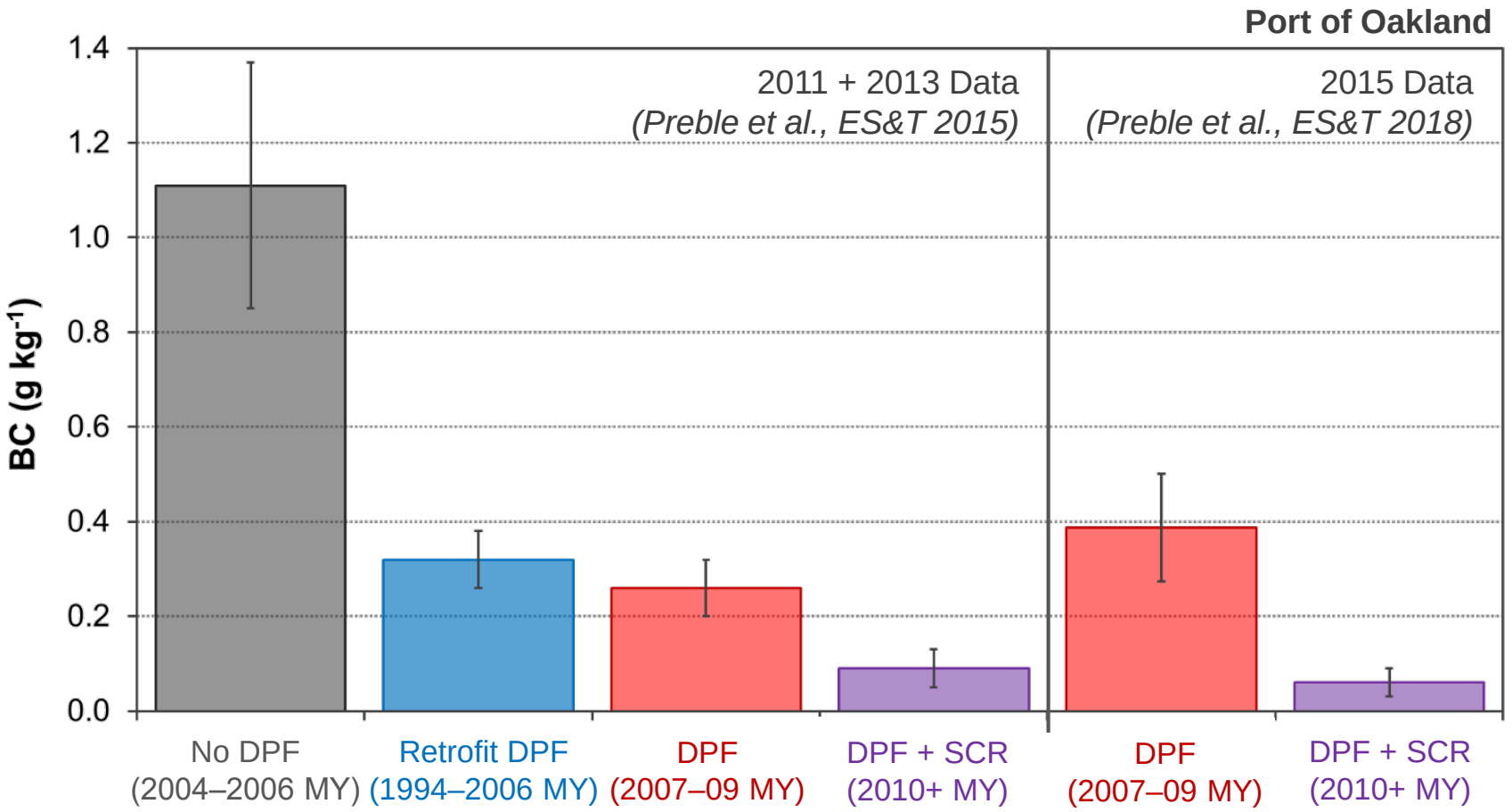
DPF performance may decline with age



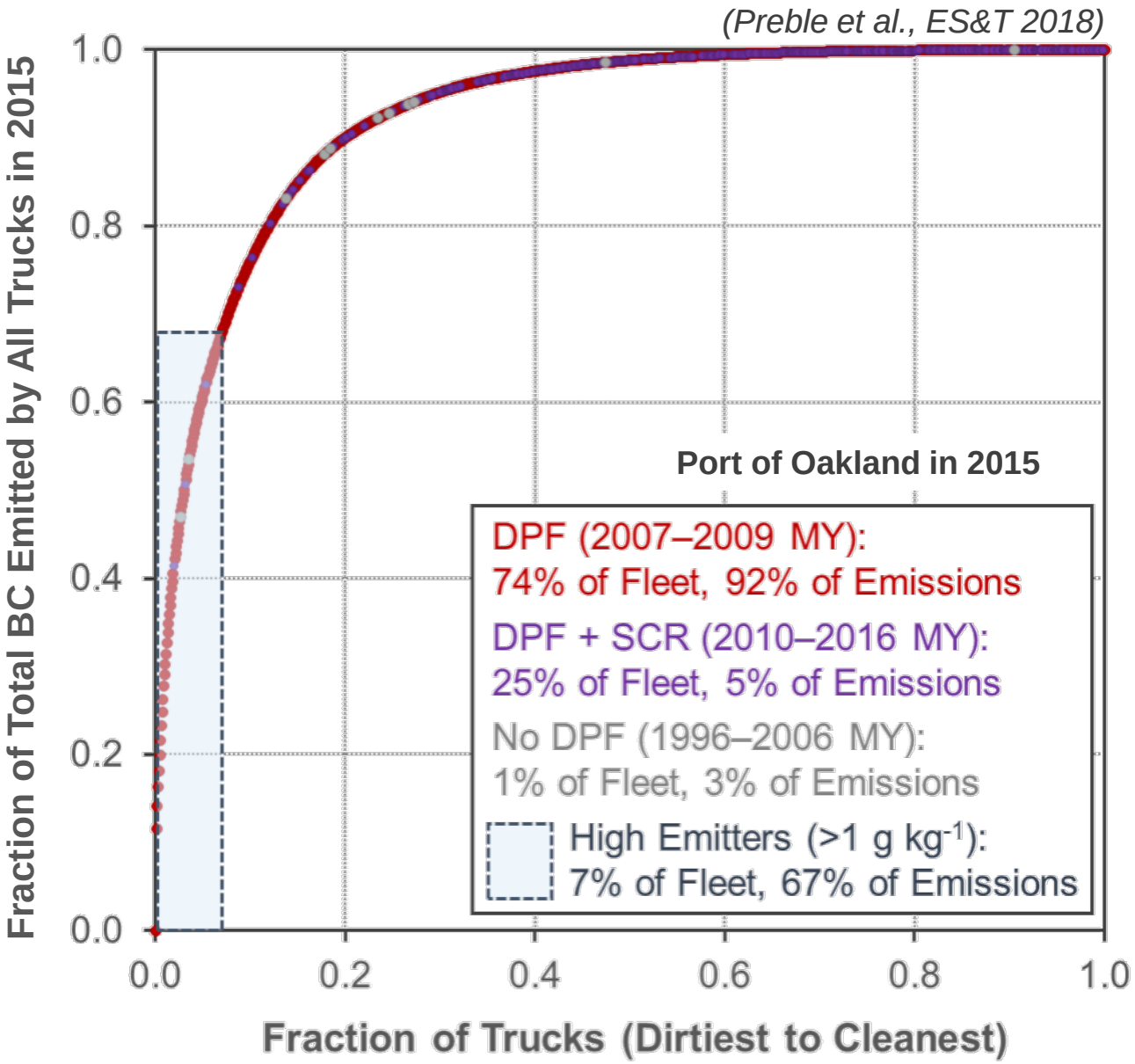
Average BC emission rate by 2007–2009 MY engines with DPFs increased by 50%:

2011 + 2013
Median = 0.06 g kg^{-1}
Average = 0.26 g kg^{-1}

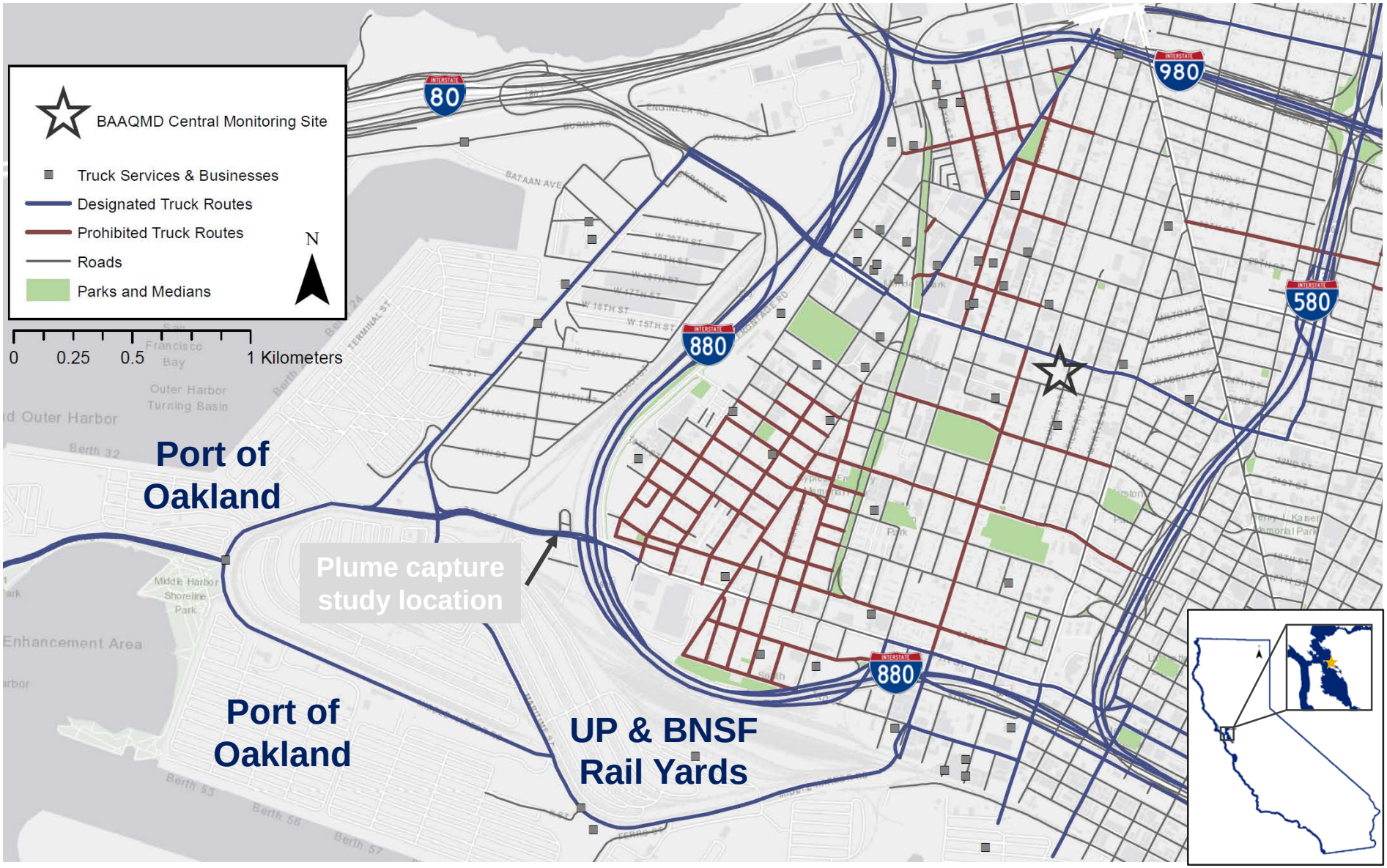
→

2015
Median = 0.04 g kg^{-1}
Average = 0.39 g kg^{-1}

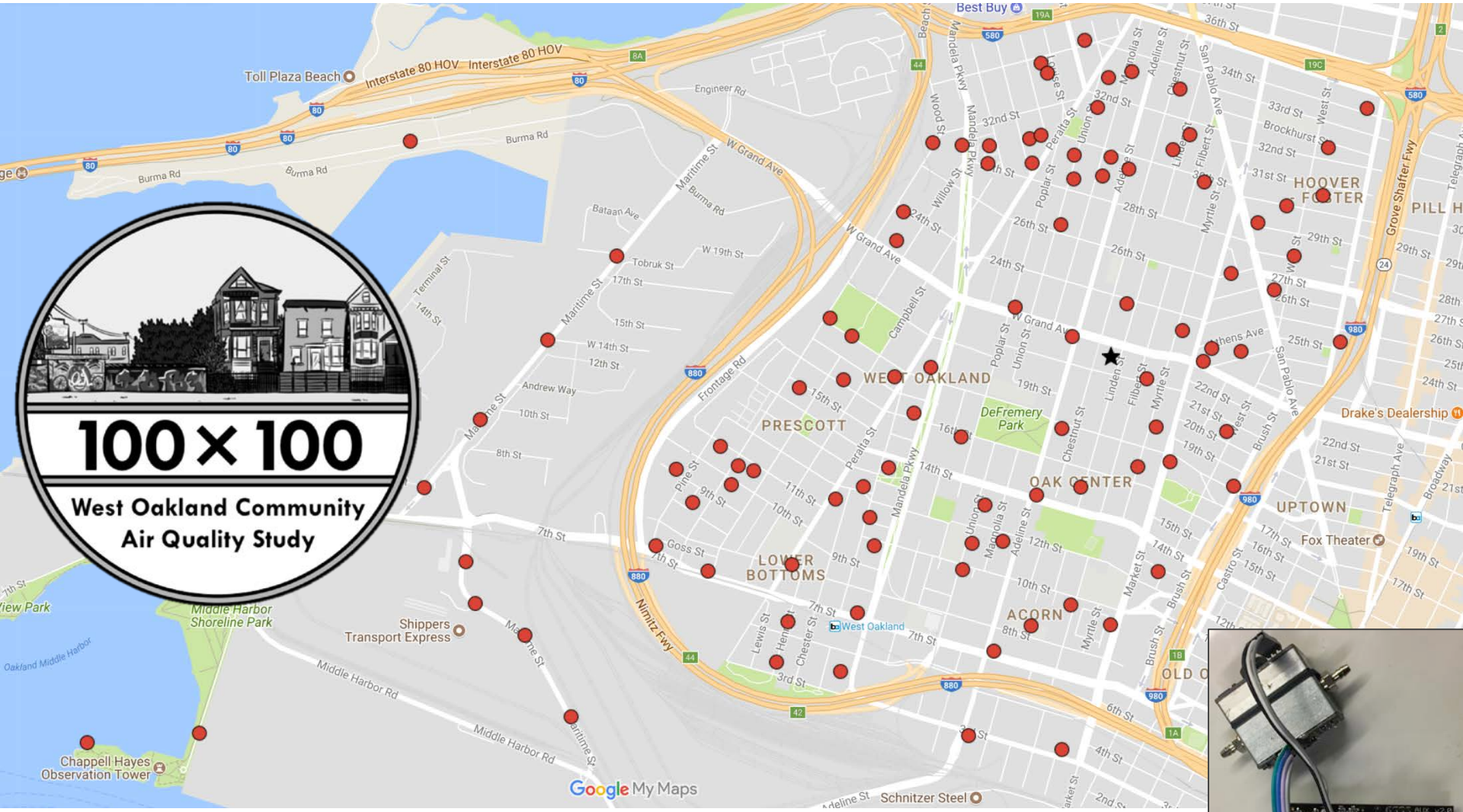
High-emitters dominated by 2007–2009 engines



West Oakland community burdened by diesel



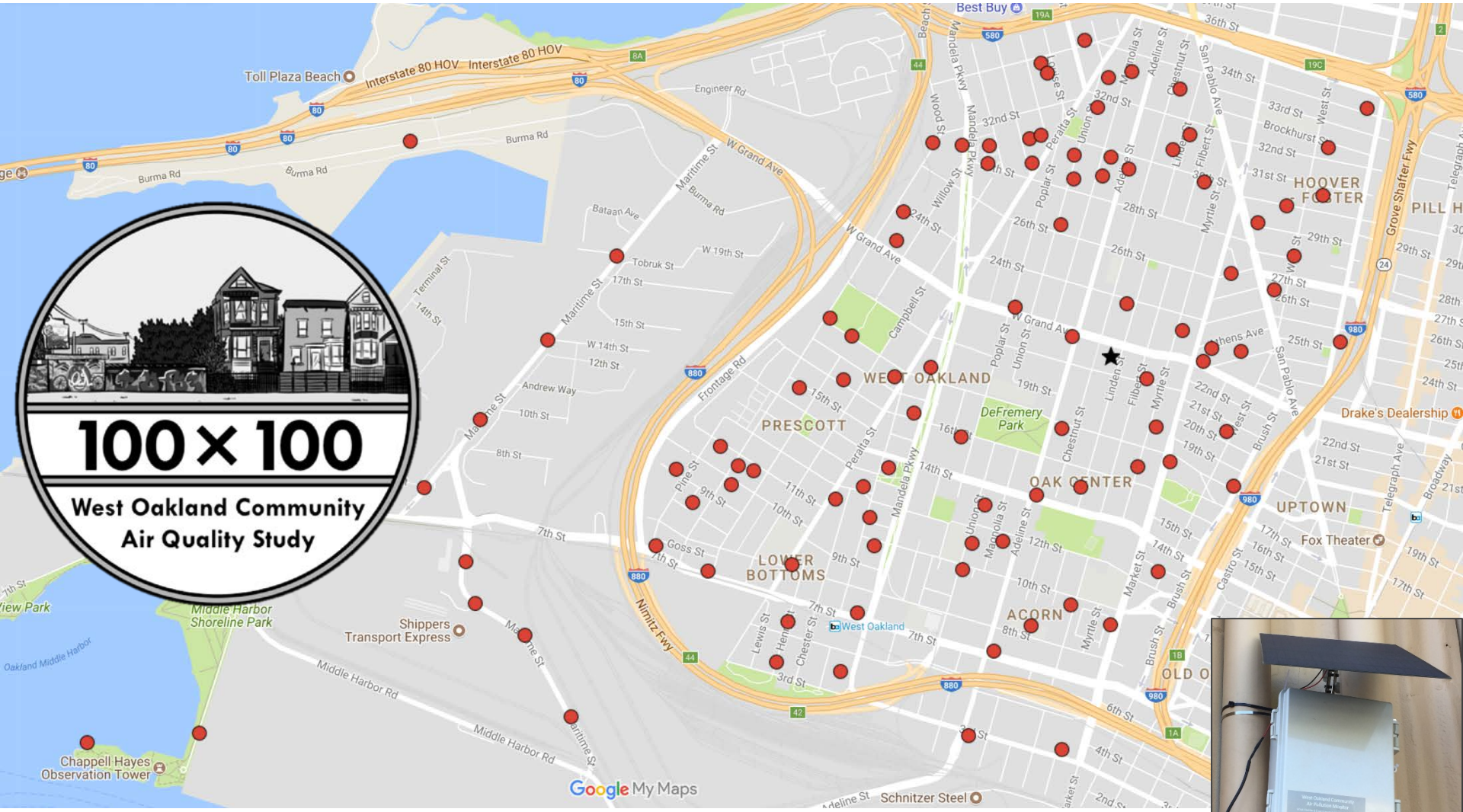
Dense network of custom low-cost BC sensors



Aerosol Black Carbon Detector (ABCD)

Caubel et al. (Sensors, 2018)

Dense network of custom low-cost BC sensors



Aerosol Black Carbon Detector (ABCD)

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Community partnerships made this work possible

- West Oakland Environmental Indicators Project
- Environmental Defense Fund
- Bay Area Air Quality Management District
- California Air Resources Board

Conclusions & Next Steps

- Plume capture method allows for characterization of on-road heavy-duty diesel truck emissions under real world conditions
  - Identify high-emitting trucks with failing control systems
  - Next step: develop autonomous package for long-term emissions tracking
- Heavy-duty diesel truck activity drives spatial and temporal gradients in West Oakland
  - Dense sensor networks provide tons of data but require lots of time and resources to operate