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May 16, 2022

Michael Regan, Administrator
U.S. Environmental Protection Agency
Air and Radiation Docket and Information Center
EPA Docket Center, EPA WJC West Building
1301 Constitution Avenue, NW Room 3334
Washington, DC 20004
Attention: Docket ID No. EPA-HQ-OAR-2019-0055

Re: Proposed Rule – Control of Air Pollution From New Motor Vehicles: Heavy-Duty Engine and Vehicle Standards

Dear Administrator Regan:

The Northeast States for Coordinated Air Use Management (NESCAUM) is submitting comments to the U.S. Environmental Protection Agency (EPA) on its Notice of Proposed Rulemaking (NPRM) entitled *Control of Air Pollution from New Motor Vehicles: Heavy-Duty Engine and Vehicle Standards* [(87 Fed. Reg. 17414 (March 28, 2022)]. NESCAUM is the regional association of state air pollution control agencies in Connecticut, Maine, Massachusetts, New Hampshire, New Jersey, New York, Rhode Island, and Vermont. Our member agencies have the primary responsibility in their states for implementing clean air programs that achieve the public health and environmental protection goals of the federal Clean Air Act.

NESCAUM strongly supports EPA's development of new engine and vehicle emission standards and test procedures that will reduce emissions of oxides of nitrogen (NOx) from heavy-duty vehicles. NOx emissions are a primary precursor to the formation of ground-level ozone and secondary fine particulate matter ($PM_{2.5}$), and contribute to acid deposition, eutrophication, and visibility impairment in the NESCAUM region.

In 2016, many of the NESCAUM member state agencies and the New York City Department of Environmental Protection joined with the South Coast Air Quality Management District (SCAQMD) and other agencies in petitioning EPA to undertake a rulemaking to revise the on-road heavy-duty engine exhaust emission standards for NOx from 0.2 g/bhp-hr to 0.02 g/bhp-hr.[1] Also in 2016, NESCAUM requested that the Secretary of Energy incorporate research into

[1] South Coast Air Quality Management District, *et al.* "Petition to EPA for Rulemaking to Adopt Ultra-Low NOx Exhaust Emission Standards for On-Road Heavy-Duty Trucks and Engines," June 3, 2016. Available at https://www.epa.gov/sites/production/files/2016-09/documents/petition_to_epa_ultra_low_nox_hd_trucks_and_engines.pdf. (accessed May, 12, 2022).

advanced NOx reduction technologies in the Department of Energy (DOE) SuperTruck Program, given the substantial contribution heavy-duty trucks make to NOx pollution in the region.[2]

EPA's response to the 2016 petition clearly acknowledges the importance of NOx reductions to the Northeast and other states.[3] In addition, EPA's *Greenhouse Gas Emissions and Fuel Efficiency Standards for Medium- and Heavy-Duty Engines and Vehicles—Phase 2* final regulation also detailed the importance of NOx reductions to the Northeast, stating that:

> EPA received compelling letters and comments from [NACAA, NESCAUM, OTC, and SCAQMD], explaining the critical and urgent need to reduce NOx emissions that significantly contribute to ozone and fine particulate air quality problems in their represented areas. The comments describe the challenges many areas face in meeting both the 2008 and recently strengthened 2015 ozone NAAQS. These organizations point to the significant contribution of heavy-duty vehicles to NOx emissions in their areas.[4]

While it is now six years since EPA received the petition, NESCAUM welcomes this proposal to improve the emissions performance of on-road heavy-duty engines and vehicles. Below we describe the Northeast's need for EPA to promulgate a final rule that maximizes the pollution reductions achievable from these pollution sources.

Impact of NOx Emissions on Public Health and the Environment

The NESCAUM region includes the New York City (NYC) Combined Statistical Area (CSA) with over 20 million people living across portions of Connecticut, New Jersey, New York, and Pennsylvania. It is the largest CSA by population in the United States. While air pollution levels have dropped over the years across much of the United States, the NYC metropolitan area and surrounding regions continue to persistently exceed federal health-based air quality standards for ground-level ozone.

The chronically persistent high ozone concentrations compromise the health and welfare of the citizens living in the NYC CSA and elsewhere in the NESCAUM region. Epidemiological studies provide strong evidence that ozone is associated with respiratory effects, including increased asthma attacks, as well as increased hospital admissions and emergency department visits for people suffering from respiratory diseases. Ozone can cause chronic obstructive pulmonary disease (COPD), and long-term exposure may result in permanent lung damage, such as abnormal lung development in children. There is also consistent evidence that short-term exposure to ozone increases risk of death from respiratory causes.[5] Furthermore, more recent studies show that ozone concentrations below the current National Ambient Air Quality

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[2] NESCAUM letter to Dr. E. Moniz, Secretary, U.S. Department of Energy, re: SuperTruck II Initiative, May 18, 2016. Available at http://www.nescaum.org/documents/nescaum-doe-supertruckii-nox-tech-lttr-20160518.pdf/.
[3] U.S. EPA, "Memorandum in Response to Petition for Rulemaking to Adopt Ultra-Low NOx Standards for On-Highway Heavy-Duty Trucks and Engines," December 20, 2016. Available at https://www.epa.gov/sites/production/files/2016-12/documents/nox-memorandum-nox-petition-response-2016-12-20.pdf (accessed April 25, 2022).
[4] 81 Fed. Reg. 73478 (October 25, 2016), at 73523.
[5] U.S. EPA, "Health Effects of Ozone Pollution," https://www.epa.gov/ground-level-ozone-pollution/health-effects-ozone-pollution, last updated May 5, 2021 (accessed May 12, 2022).

Standards (NAAQS) contribute to the risk of premature death in sensitive populations, such as the elderly.[6]

While ozone is largely a summertime issue in the Northeast, NOx emissions are a year-round problem. During colder seasons, NOx emissions play a role in producing secondary $PM_{2.5}$ through the formation nitrates. $PM_{2.5}$ exposure is associated with a variety of health effects, including reduced lung function, irregular heartbeat, asthma attacks, heart attacks, and premature death in people with heart or lung disease.[7] Low-income communities and communities of color are often located near trucking corridors, ports, fleet garages, warehouses, and other trucking hubs. These communities are often affected by disproportionate amounts of diesel exhaust emissions and worsened health burdens due to poor air quality in US cities.[8,9] Health and economic impacts include increase in asthma and other respiratory illnesses, especially in children and older adults, leading to additional trips to doctors and emergency rooms, missed days of school and work, and thousands of premature deaths each year.

The public health and environmental impacts of NOx are summarized in Table 1.

Table 1: Adverse public health and environmental impacts of NOx in the Northeast.

Ozone and $PM_{2.5}$	• Reduces lung function, aggravates asthma and other chronic lung diseases • Can cause permanent lung damage from repeated exposures • Contributes to premature death • Disproportionate impact on Overburdened Communities
Acid deposition	• Damages forests • Damages aquatic ecosystems, e.g., Adirondacks and Great Northern Woods • Erodes manmade structures
Coastal and Marine Eutrophication	• Depletes oxygen in the water, which suffocates fish and other aquatic life in bays and estuaries, e.g., Chesapeake Bay, Narragansett Bay, and Long Island Sound
Visibility Impairment	• Contributes to regional haze that mars vistas and views in wilderness and urban areas

Progress Has Stalled in Reducing the Northeast's Ozone Pollution Burden

For several decades, ozone concentrations in the Northeast trended downward due to the adoption of measures that reduce emissions of ozone precursors. In recent years, however, air

[6] Di, Q., *et al*., "Air pollution and mortality in the Medicare population," *New England Journal of Medicine* 376: 2513-2522 (2017). DOI: 10.1056/NEJMoa1702747; Di, Q., *et al.* "Association of short-term exposure to air pollution with mortality in older adults," *JAMA* 318: 2446-2456 (2017). DOI: 10.1001/jama.2017.17923.

[7] U.S. EPA, "Health and Environmental Effects of Particulate Matter (PM)," https://www.epa.gov/pm-pollution/health-and-environmental-effects-particulate-matter-pm, last updated May 26, 2021 (accessed May 12, 2022).

[8] Demetillo, M.A.G.; Harkins, C.; McDonald, B.C.; Chodrow, P.S.; Sun, K.; Pusede, S. E., "Space-Based Observational Constraints on NO_2 Air Pollution Inequality From Diesel Traffic in Major US Cities," *Geophys. Res. Lett.* 48: e2021GL094333 (2021). DOI: 10.1029/2021GL094333. Available at https://agupubs.onlinelibrary.wiley.com/doi/10.1029/2021GL094333 (accessed May 12, 2022).

[9] Hunter Kerr, G.; Goldberg, D.L.; Anenberg, S.C., "COVID-19 pandemic reveals persistent disparities in nitrogen dioxide pollution," *PNAS* 118(30): e2022409118 (2021). DOI: 10.1073/pnas.2022409118. Available at https://www.pnas.org/doi/suppl/10.1073/pnas.2022409118 (accessed May 12, 2022).

quality monitoring data have shown a flattening trend. Figure 1 plots the number of days in Connecticut where maximum 8-hour ozone was measured above the 2008 and 2015 ozone NAAQS for each year from 1976 to 2021. After significant improvements in the earlier years, the number of ozone exceedance days in Connecticut have remained level or have slightly increased since 2011. Similar patterns have been recorded in other parts of the Northeast Corridor.

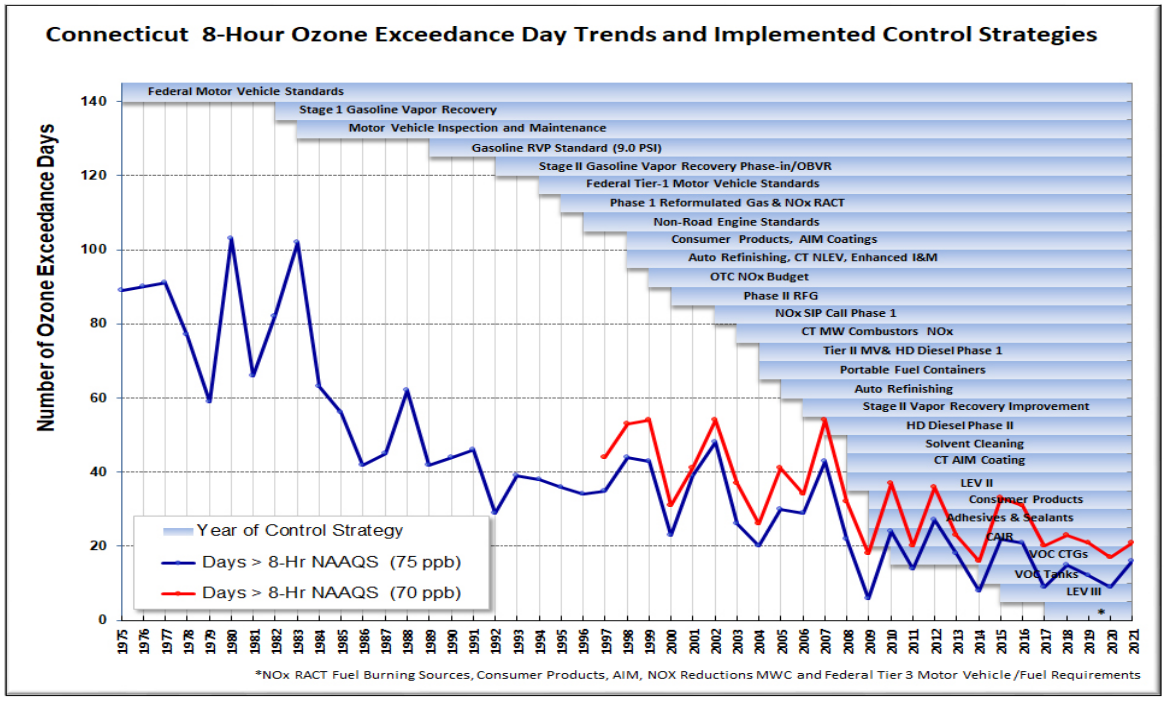

Figure 1: Connecticut 8-hour ozone exceedance trends and implemented NOx control measures.

In addition to the stalling trend in ozone improvements, the New York-Northern New Jersey-Long Island ozone nonattainment area saw an unusually high peak 1-hour ozone average of 143 ppb in July 2018, a level not seen in the NYC region in more than 10 years. This ozone nonattainment area was classified as a serious nonattainment area for the 2008 ozone NAAQS, but failed to meet its attainment deadline of July 20, 2021. As a result, on April 13, 2022, EPA proposed reclassifying it from serious to severe nonattainment status. The NYC metro area will need additional pollution reductions to meet the 2015 NAAQS.[10]

Also on April 13, 2022, EPA proposed reclassifying the Greater Connecticut nonattainment area from marginal nonattainment for the 2015 ozone NAAQS to moderate. EPA also proposed to reclassify a number of other areas in the Northeast Corridor from marginal to moderate nonattainment status for the 2015 ozone NAAQS, including the nonattainment areas of Baltimore, MD; Philadelphia-Wilmington-Atlantic City, PA-NJ-MD-DE; and Washington, DC-

[10] 87 Fed. Reg. 21825 (April 13, 2022).

MD-VA.[11] These areas failed to attain the 2015 ozone NAAQS by August 3, 2021, as required for marginal classifications, and similarly to the NYC reclassification for the 2008 ozone NAAQS, these areas will need additional pollution reductions, particularly from NOx emission sources, in order to meet the 2015 ozone NAAQS.

Figure 1 also includes an extensive list of requirements that have been adopted by Connecticut and other states in the NESCAUM region to reduce emissions of ozone precursors from stationary sources, area sources, fuels, mobile sources, and consumer products. Imposing further control requirements on many of these source categories can be more costly than controlling heavy-duty engine emissions and create disproportionate economic burdens for those sources. For example, estimates of the costs for additional NOx controls on industrial, commercial, and institutional boilers that are 100 million British Thermal Units per hour in size range from $2,700 to $21,000 per ton of NOx reduced as compared to a cost range of $1,000 to $5,000 per ton of NOx reduced from heavy-duty vehicles (HDVs).[12,13]

In 2018, NESCAUM launched the Long Island Sound Tropospheric Ozone Study (LISTOS) to investigate the evolving nature of ozone formation and transport in the NYC region and downwind. LISTOS involves a large group of researchers from state and federal agencies and academia that bring a diverse set of resources, expertise, and instrumentation skills. LISTOS has provided detailed imagery and data on ozone and its precursors in the Northeast. To illustrate the relative scale of NOx emissions during the LISTOS effort, Figure 2 readily shows enhanced nitrogen dioxide (NO_2) concentrations (NO_2 is a major component of NOx) observed by satellite along the Northeast Corridor during the 2018 ozone season, with the highest weekday (Mon-Fri) NO_2 concentrations in the New York City area. Much of this NO_2 is associated with transportation sources, and these mobile source sectors are projected to continue to be significant contributors to ozone in future years.[14]

Figure 3 shows satellite imagery of NO_2 emissions in the Northeast and Mid-Atlantic on a single day in February during the 2019 winter. In addition to region-wide stagnation on this particular day, the strength of the NO_2 signal also reflects the longer NO_2 lifetime in winter. NO_2 levels are abundant and dominant along transportation corridors and in large cities across the region, again indicating a strong mobile source NOx contribution.

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[11] 87 Fed. Reg. 21842 (April 13, 2022).
[12] OTC/Lake Michigan Air Directors Consortium (LADCO), "Evaluation of Control Options for Industrial, Commercial and Institutional (ICI) Boilers," May 2010.
[13] Manufacturers of Emission Controls Association, "Technology Feasibility for Heavy-Duty Diesel Trucks in Achieving 90% Lower NOx Standards in 2027," February, 2020. Available at https://www.meca.org/wp-content/uploads/resources/MECA_2027_Low_NOx_White_Paper_FINAL.pdf (accessed May 12, 2022).
[14] Zawacki, M., *et al.*, "Mobile source contributions to ambient ozone and particulate matter in 2025." *Atmos. Envt.* 188: 129-141 (2018).

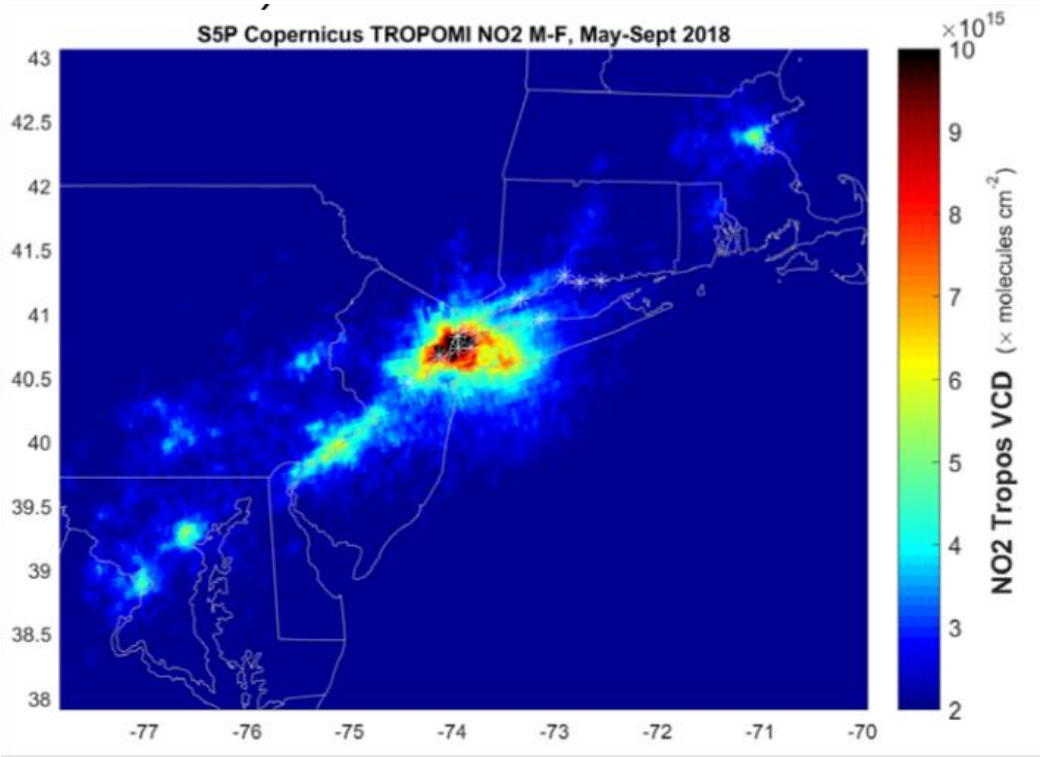

Figure 2: TROPOMI satellite imagery showing high NO_2 concentrations over the NY-NJ-CT metropolitan area during the 2018 ozone season.

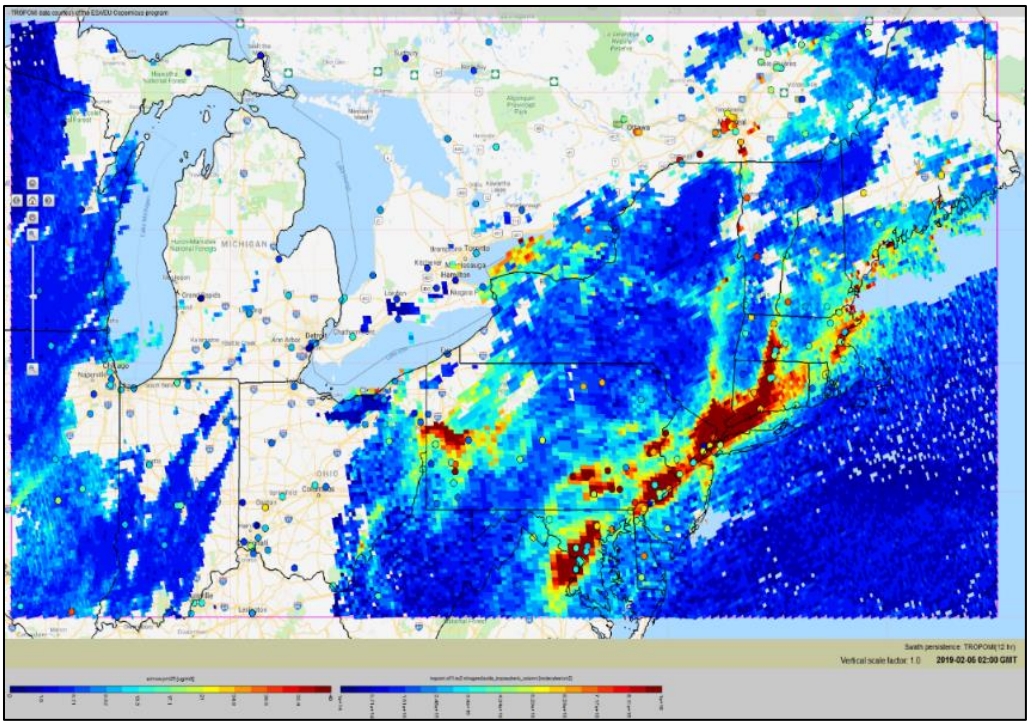

Figure 3: TROPOMI satellite observation of high wintertime NO_2 in mid-Atlantic and northeastern U.S. in February of 2019.

The NO_2 levels shown in Figure 3 align with the road major arteries where goods are being transported by truck from the ports of New York, Baltimore, and Philadelphia. Note also how clearly defined the area of red is along Interstate 91 in central Connecticut and Massachusetts.

The Need for NOx Reductions in the Northeast

To address the region's persistent air quality problems, reducing NOx emissions from heavy-duty vehicles is of the utmost importance due to its role in local and regional ground-level ozone formation, as well as its contributions to $PM_{2.5}$ (especially in the winter). As shown in Figure 4, on-road diesel vehicles, including HDVs, are the third largest NOx emissions source in the Northeast.[15]

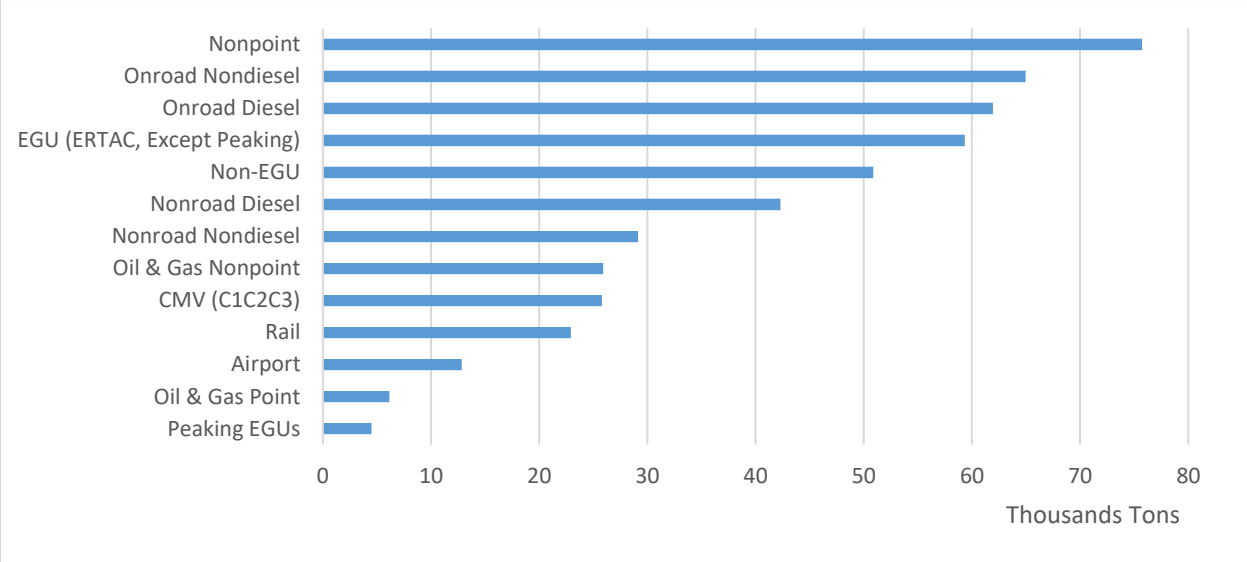

Figure 4: Modeled NOx Emissions in the Northeast (calendar year 2023).

The modeled NOx contribution from HDVs shown in Figure 4 is potentially underestimated because the mobile source model used in developing the inventory does not account for high emitting heavy-duty trucks, such as glider vehicles and HDVs with tampered emission control systems. In-use testing data suggest that real-world NOx emissions are higher than modeled estimates, underscoring the need to achieve substantial NOx reductions from the heavy-duty diesel truck sector.[16]

Absent adoption of stringent new engine NOx standards, emissions from HDVs will increase in the future as truck ton miles travelled is projected to increase by approximately 30 percent over the next 25 years (Figure 5). This growth in activity, if not counteracted by increased stringency of new engine and vehicle emissions standards, will result in significantly increased HDV emissions. We also note that highway trucks often travel long distances and can be registered in

[15] National Emissions Inventory Collaborative, "2016v1 Emissions Modeling Platform," 2019. Retrieved from http://views.cira.colostate.edu/wiki/wiki/10202.
[16] Tan, Y., *et al.*, "On-Board Sensor-Based NOx Emissions from Heavy-Duty Diesel Vehicles." *Environ. Sci. Technol.*, 53: 5504-5511 (2019). DOI: 10.1021/acs.est.8b07048.

states far from where they operate. Therefore, a strong national program is needed to reduce highway truck emissions and maximize public health benefits in the Northeast and nationally.

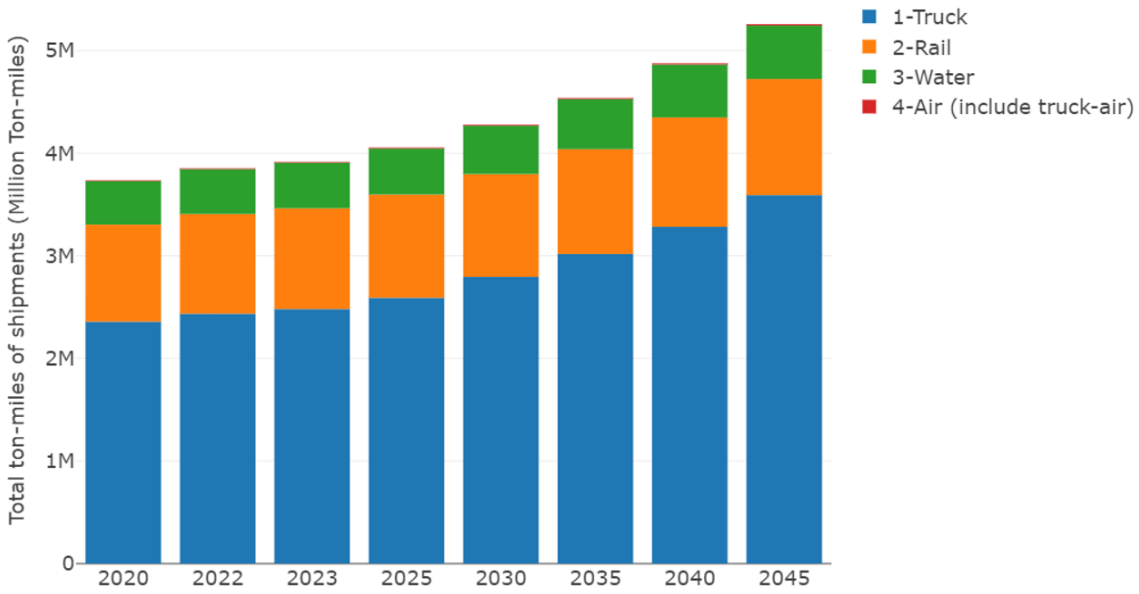

Figure 5: U.S. freight growth projections from 2020 to 2045. Source: Freight Analysis Framework Data Tabulation Tool.[17]

Due to the importance of heavy-duty vehicles to the overall NOx inventory, states in the Northeast have for decades measured, quantified, modeled, and published information on heavy-duty vehicle emissions in the region and articulated the need for further heavy-truck NOx reductions. Independently, and collaboratively with EPA and industry, states have conducted in-use emissions testing and data logging, implemented early heavy-truck periodic and roadside inspection and maintenance programs, and piloted technologies to reduce emissions from HDVs. In 2020, NESCAUM coordinated the signing of the Multi-state Medium- and Heavy-Duty Zero Emission Vehicle (MHD ZEV) Memorandum of Understanding (MOU) through the Multi-state ZEV Task Force.[18] Pursuant to the MHD ZEV MOU, 17 states, the District of Columbia, and the Canadian province of Quebec are working collaboratively to accelerate electrification of MHD trucks and buses to eliminate harmful emissions from these vehicles. Their collective goal is to ensure that 100 percent of all new truck and bus sales are ZEVs by no later than 2050, with an interim target of at least 30 percent by 2030. To provide a framework for meeting these goals, the participating jurisdictions, working through the Multi-State ZEV Task Force facilitated by NESCAUM, have developed a draft MHD ZEV Action Plan.

NESCAUM's specific comments on the NPRM are provided in the following sections.

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[17] Oak Ridge National Laboratory, Center for Transportation Analysis, "Freight Analysis Framework Data Tabulation Tool (FAF4)." Available at https://faf.ornl.gov/fafweb/Extraction1.aspx (accessed May 11, 2022).
[18] Multi-state Medium- and Heavy-Duty Zero Emission Vehicle Memorandum of Understanding (announced July 14, 2020, most recent state signing on March 29, 2022). Available at https://www.nescaum.org/documents/mhdv-zev-mou-20220329.pdf.

Heavy-Duty Engine and Vehicle NOx Standards for Model Year 2027-2030

Given the urgent need to reduce NOx emissions from heavy-duty vehicles to improve public health and air quality, we strongly encourage EPA to finalize model year 2027 engine NOx emission limits equivalent to those in the California Air Resources Board (CARB)'s Heavy-Duty Omnibus Regulation. The Clean Air Act requires ozone NAAQS attainment "as expeditiously as practicable," and EPA's proposed Options 1 and 2 do not meet this requirement. Since the introduction of EPA's 2007/2010 heavy-duty engine emissions standards, there have been significant technology advances that provide a foundation for reducing NOx emissions a further 90 percent beyond current standards. To do this, manufacturers can introduce hardware upgrades and new aftertreatment systems that, while significant, build upon the architecture of current emissions control systems. Manufacturers will have ample time to integrate new technologies into heavy-duty engines assuming standards will be implemented for model year 2027 engines and vehicles.

NESCAUM supports the adoption of a 0.020 gram NOx engine standard in 2027 at intermediate useful life and a 0.035 gram NOx standard at full useful life as specified in CARB's Omnibus regulation. Ample data from CARB, EPA, and other research programs exist supporting the feasibility of introducing a 0.020 gram NOx standard at intermediate useful life in 2027.[19,20,21,22,23,24] EPA also released a memo on May 3, 2022 presenting heavy-duty diesel engine test results similarly indicating that current engines are already approaching this NOx standard, therefore supporting its feasibility by MY2027.[25]

We note that the Clean Air Act is a "technology forcing" statute in which Congress clearly intended to pull technology forward, rather than wait for technology to advance before setting future requirements.[26] Even if the technology feasibility record was less robust, and it is already

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[19] Manufacturers of Emission Controls Association, "Technology Feasibility for Heavy-Duty Diesel Trucks in Achieving 90% Lower NOx Standards in 2027," February 2020. Available at https://www.meca.org/wp-content/uploads/resources/MECA_2027_Low_NOx_White_Paper_FINAL.pdf (accessed May 4, 2022).
[20] Southwest Research Institute, "Update on Heavy-Duty Low NOx Demonstration Programs at SwRI," November 2019. Available at https://ww3.arb.ca.gov/msprog/hdlownox/files/workgroup_20190926/guest/swri_hd_low_nox_demo_programs.pdf (accessed May 12, 2022).
[21] Sharp, C.; Neely, G.; Rao, S.; Zaval, B., "An Update on Continuing Progress Towards Heavy-Duty Low NOX and CO2 in 2027 and Beyond," Southwest Research Institute, WCX, Detroit, Michigan, April 5-7, 2022.
[22] U.S. EPA, "Control of Air Pollution from New Motor Vehicles: Heavy-Duty Engine and Vehicle Standards Draft Regulatory Impact Analysis," March 28, 2022. Available at https://nepis.epa.gov/Exe/ZyPDF.cgi?Dockey=P10144K0.pdf.
[23] Achates Power, "Heavy Duty Opposed Piston Engine Demonstration," CRC Real World Emissions Workshop, March 15, 2022.
[24] Mendoza Villafuerte, P.; Demuynck, J.; Bosteels, D., "Ultra-Low NOx Emissions with a Close-Coupled Emission Control System on a Heavy-Duty Truck Application," Society of Automotive Engineers, September 21, 2021. Available at https://www.aecc.eu/wp-content/uploads/2021/09/2021-01-1228.pdf (accessed April 25, 2022).
[25] U.S. EPA, "Test Results from EPA Diesel Engine Demonstration," Memorandum from J. Sanchez, OAR/OTAQ/ASD, to Docket EPA-HQ-OAR-2019-0055, May 3, 2022. Available at https://www.regulations.gov/document/EPA-HQ-OAR-2019-0055-1082 (accessed May 12, 2022).
[26] *See* Krier. J.E.; Ursin, E., "Pollution and Policy: A Case Essay on California and Federal Experience with Motor Vehicle Air Pollution 1940–1975," University of California Press: Berkeley, CA, 1977, *quoting* Sen. Edmund Muskie of Maine during debate on 1970 Clean Air Act:

quite robust, it would be contrary to congressional intent to promulgate a NOx limit that aims low. The introduction of readily foreseeable effective and available heavy-duty engine and vehicle pollution reduction technologies capable of achieving a 0.02 gram NOx standard in MY 2027 will assist jurisdictions in the NESCAUM region to reach attainment of the ozone standards. This is the most "expeditiously as practicable" path called for by the Clean Air Act and anything less than this will not be acceptable.

Should EPA instead promulgate Option 1, we urge the Agency to make the following changes to the proposed standards:

Low Load Cycle (LLC): We strongly support the establishment of EPA's proposed low load certification cycle and the inclusion of auxiliary load in the cycle. Test data collected by EPA, CARB, the International Council on Clean Transportation (ICCT), NESCAUM, and others demonstrate the substantial contribution to overall heavy-duty engine emissions from low load operation.[27,28,29,30] In the Northeast and mid-Atlantic regions, recent data logging of on-road tractor trailers over 100 days of travel found that 10 percent to 40 percent of tractor trailer NOx was emitted at low load.[31] Taken together, these studies strongly point to the need for additional NOx controls at low load cycles. Figure 6 shows the NOx mass emissions for idle (bin 1), low load (bin 2), and high load (bin 3) over 100 days of data logging of truck tractors in the NESCAUM study. The green bar shows the contribution of NOx emissions at low load as a fraction of total NOx emissions.

Even with this important contribution, the green bar understates total low load NOx emissions because the NOx sensors were not active at exhaust temperatures below 190 degrees Celsius. The right-hand graph in Figure 6 shows the percent of time the NOx sensor was active for each truck at low load conditions. On average, NOx sensors were inactive for 31 percent of the time. Not shown in the graph is NOx sensor activity at idle. NOx sensors were inactive for 67 percent of the time at idle. A proper accounting of NOx emissions when the NOx sensors were inactive would increase the amount of NOx emitted at low load and idle. It is important to note that these trucks are tractor trailers that spend a significant portion of the time at speeds above 60 miles per

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> *The first responsibility of Congress is not the making of technological or economic judgments—or even to be limited by what is or appears to be technologically feasible. Our responsibility is to establish what the public interest requires to protect the health of persons. This may mean that people and industries will be asked to do what seems to be impossible at the present time. But if health is to be protected, these challenges must be met.*

[27] U.S. EPA, "Control of Air Pollution from New Motor Vehicles: Heavy-Duty Engine and Vehicle Standards, Draft Regulatory Impact Analysis," March 2022, *see* page 84.
[28] Badshah, H.; Posada, F.; Muncrief, R., "Current State of NOx Emissions from In-Use Heavy-Duty Diesel Vehicles in the United States," 26 November 2019. Available at https://theicct.org/publications/nox-emissions-us-hdv-diesel-vehicles (accessed May 12, 2022).
[29] Sharp, C., "Update on Heavy-Duty Low NOx Demonstration Program at SwRI," Southwest Research Institute, September 26, 2019. Available at Update on Heavy-Duty Low NOx Demonstration Programs at SwRI (accessed April 25, 2022).
[30] NESCAUM and Environment and Climate Change Canada, "Heavy-Duty Vehicle In-Use NOx Testing Report, Interim Results, July 2021, submitted for publication, available upon request.
[31] *Ibid.*

hour. For delivery trucks, buses, and other vocational vehicles, low load emissions comprise an even larger share of total emissions.

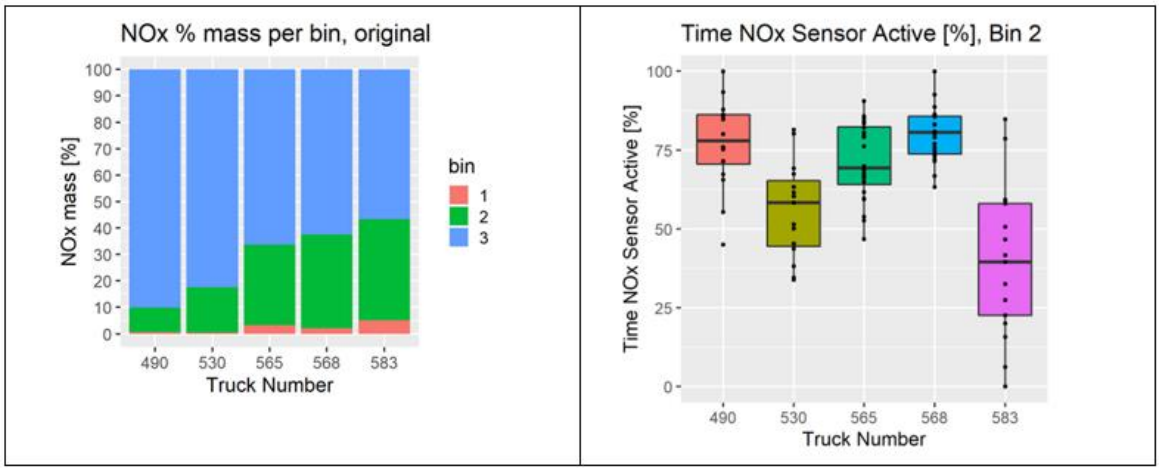

Figure 6: NOx mass in bins 1, 2, and 3 (left); and time NOx sensors were active in bin 2 for each of five trucks data logged (right).

Low load cycles and excess NOx emissions are of particular concern in Overburdened Communities located near busy truck routes and where trucks operate in stop and go conditions where exhaust temperatures are potentially too low to enable selective catalytic reduction (SCR) emissions control function. The truck data logging study found that for current engines, cold ambient temperatures reduce the amount of time NOx sensors are active, indicating potentially greater NOx emissions at low load in the wintertime. In addition to exacerbating localized heavy-duty truck emissions, lack of NOx sensor activity and SCR performance in cold weather are a concern for regional haze.

While we support the low load certification test cycle proposed by EPA, we request that EPA finalize a more stringent low load NOx standard for model year 2027-2030 engines. The proposed standard in Option 1 of 90 milligrams/hp-hour is significantly higher than data show is achievable in 2027. For example, an upgraded Cummins engine with cylinder deactivation, improved engine calibration, and advanced aftertreatment had low load cycle (LLC) NOx emissions of 0.036 and 0.053 g/bhp-hr.[32,33] Results from EPA's Heavy-duty Low NOx Stage 3 Research Program show the proposed Option 1 LLC standards are well above what the test data demonstrate are feasible at 435,000, 600,000, and 800,000 miles.[34,35] EPA's test data indicate a

[32] CARB, "Heavy-Duty Low NOx Program Low Load Cycle," Public Workshop, September 26, 2019. Available at https://ww3.arb.ca.gov/msprog/hdlownox/files/workgroup_20190926/staff/03_llc.pdf (accessed April 25, 2022).
[33] Sharp, C., "Update on Heavy-Duty Low NOx Demonstration Program at SwRI," Southwest Research Institute, September 26, 2019. Available at Update on Heavy-Duty Low NOx Demonstration Programs at SwRI (accessed April 25, 2022).
[34] U.S. EPA, "Control of Air Pollution from New Motor Vehicles: Heavy-Duty Engine and Vehicle Standards Draft Regulatory Impact Analysis," March 2022. Available at Control of Air Pollution from New Motor Vehicles: Heavy-Duty Engine and Vehicle Standards – Draft Regulatory Impact Analysis (EPA-420-D-22-001, March 2022).
[35] U.S. EPA, "Test Results from EPA Diesel Engine Demonstration," Memorandum from J. Sanchez, OAR/OTAQ/ASD, to Docket EPA-HQ-OAR-2019-0055, May 3, 2022. Available at https://www.regulations.gov/document/EPA-HQ-OAR-2019-0055-1082 (accessed May 12, 2022).

35 to 40 mg/bhp-hr standard is feasible in 2027. NESCAUM supports a more stringent low load certification standard beginning in model year 2027. Achieving the greatest technically feasible NOx reductions in 2027 and subsequent model year heavy-duty vehicles is essential to the Northeast to meet air quality requirements and to improve public health.

Idle Standard: We request that EPA finalize a mandatory idle standard of 5 g/hr for model year 2027 and later engines consistent with CARB's finalized Omnibus regulation, rather than an optional standard. A Center for Environmental Research and Technology (CE-CERT) study found that vocational vehicles spend approximately 33% of the time at idle.[36] Idling trucks emit pollution in crowded urban areas in communities already overburdened with air pollution.[37] Southwest Research Institute's Stage 3 research program measured idle emissions at 435,000 miles in the range of 0.30 to 1.40 grams NOx per hour on five different duty cycles and 0.40 to 3.3 grams per hour at 800,000 miles.[38] These values are well below the proposed standard and demonstrate the feasibility of NOx control at idle through 800,000 miles. Given these and other test results, we encourage EPA to make the idle standard mandatory and increase the stringency of the standard in the final rule.

Calculation of HD ZEVs in the Baseline: EPA estimated the percent sales of HD ZEVs in the baseline to be 1.5 percent ZEV sales in 2027. We urge EPA to update this estimation in the final rule to reflect recent substantial changes in heavy-duty ZEV technology, the regulatory landscape, and the market for heavy-duty ZEVs. EPA relied on the "medium" projection case from the NREL Electrification Futures study and EIA's 2018 Annual Energy Outlook for its heavy-duty ZEV sales estimate for 2027. Since the 2018 EIA Outlook and the Electrification Futures study have been published, CARB finalized the Advanced Clean Trucks regulation and five states outside of California have adopted the regulation as of April 2022 – Massachusetts, New Jersey, New York, Oregon, and Washington. Taken together, registered trucks and buses in these six states comprise over 20 percent of registered trucks and buses in the U.S.[39] In addition, CARB has proposed the Advanced Clean Fleets rule[40] that will increase the percent requirement for heavy-duty ZEVs above and beyond the ACT requirement in California. As a result of these regulatory actions, NESCAUM estimates a minimum of 30,000 class 4 to 8 heavy-duty ZEVs will be required to be sold in 2027 in California and states that have finalized the ACT regulation combined. In 2028, the number of class 4 to 8 heavy-duty ZEVs that will be required to be sold in the states that have adopted the ACT regulation will exceed 45,000 vehicles. This estimate likely underestimates the number of ZEVs that will be introduced as it does not account for

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[36] EPA, "Control of Air Pollution from New Motor Vehicles: Heavy-Duty Engine and Vehicle Standards," Draft Regulatory Impact Assessment, March 28, 2022. *See* page 75, Control of Air Pollution from New Motor Vehicles: Heavy-Duty Engine and Vehicle Standards – Draft Regulatory Impact Analysis (EPA-420-D-22-001, March 2022).
[37] Michael J. Bradley & Associates, "Newark Community Impacts of Mobile Sources." November 2020. Available at MJBA_Report_NewarkCommunityElectrification_Nov2020.pdf (accessed May 12, 2022).
[38] Sharp, C., "Update on Heavy-Duty Low NOx Demonstration Program at SwRI," Southwest Research Institute, September 26, 2019. Available at Update on Heavy-Duty Low NOx Demonstration Programs at SwRI (accessed April 25, 2022).
[39] Federal Highway Administration, "Highway Statistics 2019." Available at Highway Statistics 2019 - Policy | Federal Highway Administration.
[40] California Air Resources Board, "Advanced Clean Fleets" Regulation." Available at Advanced Clean Fleets | California Air Resources Board.

heavy-duty ZEV sales in states outside of Section 177 states that have adopted ACT. It also does not account for the adoption of ACT in states that are currently proceeding with ACT adoption but have not yet finalized the regulation. Nor does it account for state specific heavy-duty zero emission sales requirements and goals above and beyond ACT requirements.[41] As noted above, heavy-duty ZEV sales in years subsequent to 2027 will increase significantly as required by the ACT regulation. These requirements should be taken into consideration in EPA's baseline assessment.

In addition to changes in the regulatory landscape, much has changed from a cost and technology standpoint since the studies EPA relied on in its analysis were published. The Electrification Futures study was published in 2017 and relied on studies published in 2016 for battery cost information. Since that time, significant improvements in battery technology have occurred. Rapid advances in battery chemistries, increased energy density, and more efficient pack design have driven sharp reductions in battery costs, which are the single largest factor influencing ZEV purchase prices. During the last decade, battery prices declined by nearly 90 percent and a steady decline in battery prices is forecasted through 2030. Declining battery costs and technology advances will be reflected in lower prices and longer ranges for vehicles, leading to an improved business case for electrification and making zero-emission trucks and buses more affordable.

EPA asks for comment on whether or not the "medium" NREL Electrification Future study assumptions should be used in the Agency's assessment of heavy-duty ZEV sales in 2027. For the above reasons, NESCAUM recommends EPA not rely on the NREL "medium" scenario. We urge EPA to conduct a more up-to-date analysis to estimate heavy-duty ZEV sales in model years 2027 and later. An up-to-date analysis would estimate heavy-duty ZEV sales resulting from ACT regulation adoption in California and Section 177 states, quantify sales resulting from additional state heavy-duty ZEV requirements, and use more recent projections of heavy-duty ZEV sales, such as NREL's March 2022 study and ACT Research's 2021 analysis.[42,43]

SCR inducement: The maximum speeds for low-speed vehicles given in Proposed Inducement Schedules, Table IV-13 as 50, 45, 40, and 35 miles per hour (mph) should be revised. NESCAUM recommends that the maximum speeds given for all four proposed engine hours of operation for low-speed vehicles be reduced. Owners of low-speed vehicles, which are often locally driven delivery vehicles, will not be induced to repair their vehicles quickly with the proposed maximum speeds given in Table IV-13. A locally driven delivery vehicle could operate at the lowest speed of 35 mph without much of a performance penalty in a congested traffic area. Many roads in urban areas have speed limits of 25 mph or lower. In addition, many of the problems cited by commentators that arise when an engine is derated would not greatly affect

[41] An example is New York State Education Law §3628 that requires no later than July 1, 2027, every school district shall only purchase or lease zero-emission school buses when purchasing or leasing new buses.
[42] National Renewable Energy Laboratory, "Decarbonizing Medium- & Heavy-Duty On-Road Vehicles: Zero Emission Vehicles Cost Analysis," March 2022. Available at Decarbonizing Medium- & Heavy-Duty On-Road Vehicles: Zero-Emission Vehicles Cost Analysis (accessed May 12, 2022).
[43] ACT Research, "Charging Forward 2020-2040 BEV & FCEV Forecast & Analysis," updated December 2021. Available at CV Electrification Study - ACT Research Co., LLC (accessed May 12, 2022).

low-speed, locally driven vehicles, such as large towing expenses and stranding vehicles and drivers far from home. Therefore, it is not appropriate or necessary to allow locally driven low-speed vehicles to drive as fast as allowed in the proposed Inducement Schedule.

Even for vehicles where the engine derating is an incentive to perform required maintenance, the new schedule allows for up to 60 hours of operation before the final inducement goes into effect. This could amount to 60 hours of driving on local streets, near schools, small businesses, and residences, without emissions control. We strongly urge EPA to reconsider the low-speed vehicle inducement schedule and make the derated vehicle speeds significantly lower.

Interim In-Use Standards: EPA is considering finalizing higher temporary in-use standards for all the proposed duty cycle and off-cycle heavy-duty engines and requests comment on whether the Agency should consider including in the final rule interim in-use standards to account for potential variabilities in performance during the early years of implementing new technology. Tables IV-16 and IV-17 of the preamble list potential low-end and high-end ranges for the proposed in-use standards. NESCAUM requests that EPA not finalize the proposed interim in-use standards, or if interim standards are finalized, that they be significantly more stringent than the ones proposed. With regard to the proposed low load interim in-use standards, test data show that NOx emissions of 0.036 to 0.053 g/bhp-hr on the CARB low load cycle are technically feasible. Manufacturers will have five years to prepare for commercial application of technologies to reduce low load emissions and finalizing NOx emissions standards in-use between 0.07 to 0.20 g/bhp-hr (70 mg/bhp-hr to 200 mg/bhp-hr) would substantially weaken the low load emissions requirements. Similarly, the FTP, SET, and idle interim in-use standards EPA is considering are significantly higher than what has already been demonstrated at intermediate and full useful life.

Averaging Banking and Trading: We support EPA's proposal to not allow Averaging, Banking, and Trading (ABT) for PM or hydrocarbons for model year 2027 and later engines. EPA proposes to continue to allow ABT of NOx credits generated against applicable heavy-duty diesel engine NOx standards. As part of this proposal, manufacturers could certify battery electric and fuel cell vehicles to generate NOx emissions credits. NESCAUM does not support the inclusion of a NOx emission credit or ABT scheme.

EPA acknowledges in the NPRM that its proposed NOx standards are feasible without the use of credits.[44] Even so, the agency proposes a NOx credit-generation scheme and ABT that would allow manufacturers to use credits generated from engines with emission levels below the standards to produce engines with emission levels above the standards. We are especially concerned that EPA's proposed family emission limit (FEL) cap of 0.15 grams of NOx between 2027 and 2030 could cause significant erosion of the stringency of the heavy-duty engine NOx standards. In particular, if heavy-duty ZEV sales exceed the sales projections that EPA assumed in the NPRM, substantial heavy-duty engine NOx credits would be available in the ABT program. The projections for heavy-duty ZEV sales in the NPRM relied on data from 2016 or

[44] 87 Fed. Reg. 17414 (March 28, 2022), at 17550.

earlier and significant technical and policy developments have occurred since those studies were published. Examples are reductions in battery cell and pack costs, improvements in range, and reductions in battery weight. In addition, the policy landscape has changed with the finalization of the CARB Advanced Clean Trucks (ACT) and Advanced Clean Fleets regulations and the adoption of ACT in five Clean Air Act Section 177 states.

Given the urgent need to reduce NOx emissions in the Northeast, we are opposed to heavy-duty engine NOx ABT.

Deterioration factor demonstration: EPA has proposed to establish a new deterioration factor determination option, where manufacturers would be able to perform dynamometer testing of an engine and aftertreatment system to a mileage that is less than regulatory useful life. Manufacturers would then bench age the aftertreatment system to regulatory useful life and combine the aftertreatment system with an engine that represents the engine family. Manufacturers would run the combined engine and bench-aged aftertreatment for at least 100 hours before collecting emission data for determination of the deterioration factor. NESCAUM encourages EPA to continue to include the engine in the deterioration factor determination. While it may be possible to move to the proposed new bench-aged aftertreatment option with more data, we do not believe there is sufficient data to ensure this method accurately evaluates the durability of the emission-related components in a certified configuration. We encourage EPA to align with CARB on the procedure for the deterioration factor determination. We believe both significant engine operation and accelerated aftertreatment are needed, and not accelerated aftertreatment aging alone.

PM Anti-Backsliding: NESCAUM notes the potent toxicity and impact of diesel particulate ($PM_{2.5}$) and welcomes EPA's proposal of a PM anti-backsliding standard, based on use of a diesel particulate filter, of 5 mg/hp-hr, down from the current level of 10 mg/hp-hr. We encourage EPA to finalize this standard.

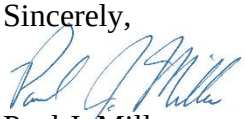
Onboard Diagnostics: EPA's existing onboard diagnostics (OBD) requirements, adopted in 2009, allow manufacturers to demonstrate how the OBD system they designed to comply with California's OBD requirements also complies with the intent of EPA's OBD requirements. (EPA maintains separate OBD regulations but manufacturers currently seek approval from California for OBD systems in engine families applying for 50-state certification and then use that approval to demonstrate compliance with EPA's requirements.) In this rulemaking, EPA proposes to update its OBD regulations by incorporating by reference the California Air Resources Board's (CARB) 2019 OBD regulations "as the starting point for our updated OBD regulations" and then "exclude or revise certain CARB provisions that we believe are not appropriate for a federal program" and "include additional elements to improve the usefulness of OBD systems for users." NESCAUM urges EPA to update its OBD requirements and incorporate by reference CARB's current program without omission so there is alignment between the federal and California programs.

Tampering related provisions: The NESCAUM states are prioritizing detection and enforcement against tampered vehicles because tampered vehicles substantially increase vehicle NOx emissions. Given the importance of identifying tampered vehicles and enforcing against emission control system tampering, NESCAUM supports EPA's proposed provision to ensure that there are measures in place to prevent engine control module (ECM) tampering. EPA proposes that manufacturers include a document at the time of certification that outlines and describes the process and/or industry technical standards that were used to prevent unauthorized access to the ECM on the vehicle. This document shall describe the measures that a manufacturer has used to: prevent unauthorized access to the ECM; ensure that calibration values, software, or diagnostic features cannot be overwritten or otherwise disabled; and respond to repeated, unauthorized attempts to reprogram the ECM, if they become aware of such attempts.

Option 2: We strongly oppose Option 2 in EPA's proposal. EPA is proposing to establish an FTP and SET standard of 50 milligrams or 0.05 g/bhp-hr for 2027 and subsequent model year engines. Technical analyses demonstrate that substantially more stringent NOx controls are feasible and cost effective for model year 2027 and subsequent heavy-duty engines and vehicles than would be required under this option. Certification data from current model year engines show that mass NOx emissions from some engines are already close to the level proposed for the Option 2 FTP and SET NOx standards for model year 2027 and later engines.[45,46,47] The standards proposed for Option 2 would only require minor calibration adjustments and minimal hardware modification. Further, EPA's own analysis found that Option 2 is less cost effective than Option 1. Option 2 will not deliver the needed emissions reductions in Overburdened Communities or provide sufficient assistance to states in attaining the ozone NAAQS and would leave substantial and cost-effective NOx reductions on the table.

We look forward to working with EPA in the development of new heavy-duty engine emissions standards and test procedures and stand ready to assist the Agency in this effort.

Sincerely,



Paul J. Miller
Executive Director

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[45] CARB Executive Order A-242-0139, "Volvo Group Trucks Technology," (FTP of 0.06 g/bhp-hr, SET of 0.04 g/bhp-hr), January 3, 2020, *see* https://ww3.arb.ca.gov/msprog/onroad/cert/mdehdehdv/2020/volvogrouptrucks_hhdd_a2420139_12d8_0d20-0d01.pdf (accessed April 25, 2022).

[46] CARB Executive Order A-021-0723, Cummins engine family MCEXH0912XCA (FTP of 0.07 g/bhp-hr, SET of 0.03 g/bhp-hr), *see* "New Vehicle and Engine Certification: Executive Orders for MY2021 Medium-Duty and Heavy-Duty Engines" at https://ww2.arb.ca.gov/new-vehicle-and-engine-certification-executive-orders-my2021-medium-duty-and-heavy-duty-engines (accessed April 25, 2022).

[47] CARB Executive Order A-290-0168-1, Detroit Diesel Corporation engine family KDDXH12.8FED (FTP of 0.06 g/bhp-hr, SET of 0.02 g/bhp-hr), *see* "New Vehicle and Engine Certification: Executive Orders for MY2019 Medium-Duty and Heavy-Duty Engines" at https://ww2.arb.ca.gov/new-vehicle-and-engine-certification-executive-orders-my2019-medium-duty-and-heavy-duty-engines (accessed April 25, 2022).

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