
Criteria and Toxic Air Pollutants Emissions Inventory for Base and Future Milestone Years

Assembly Bill (AB) 617
Community Air Initiatives

Technical Advisory Group Meeting
July 18, 2019



Source Attribution

What is source attribution?

Rigorous accounting of sources, their emissions and their contribution to cumulative exposure burden

Why are we doing this?

Meet AB617 statutory requirement: *provide “[a] methodology for assessing and identifying the contributing sources or categories of sources, including, but not limited to, stationary and mobile sources, and an estimate of their relative contribution to elevated exposure to air pollution in impacted communities...”*

Source Attribution Methodology - Options

Technical Approach	Description
Community Emissions Inventory	Calculating source-specific emissions or comparable activity data inside and external to a community.
Community-Specific Air Quality Modeling	Sensitivity simulations to estimate the impact and contributions of emission sources or categories in a community.
Targeted Air Monitoring/ Back Trajectory/ Pollution Roses/ Inverse Modeling	Combining emissions, air quality monitoring, and meteorology data to describe the sources affecting air quality at the monitoring locations.
Chemical Mass Balance	Utilize detailed chemically speciated air quality monitoring data to attribute emissions burden based on source test measurements of chemical species from emission sources.
Positive Matrix Factorization (PMF)	Multivariate factor analysis used to determine factor profiles and contributions composed of species identified from the same sources.

Source Attribution Methodology

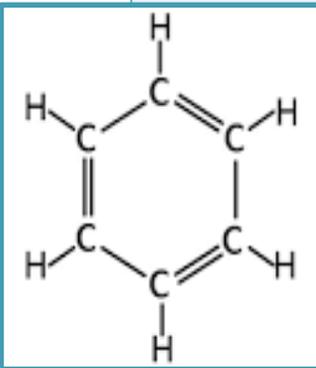
Technical Approach	Approach for the first year community
Community Inventory Ratios	✓
Community-Specific Air Quality Modeling	✓
Targeted Air Monitoring/ Back Trajectory/ Pollution Roses/ Inverse Modeling	N/A
Chemical Mass Balance	N/A
Positive Matrix Factorization (PMF)	N/A

Air Pollutants Included in the Source Attribution



Criteria Air Pollutants (CAP)

- VOC, NO_x, SO_x, NH₃, PM_{2.5} and Pb



Toxic Air Contaminants (TAC)

- 24 reported

Selected List of Air Toxic Containments and Their Associated Cancer Risk Factor

		Cancer unit risk 1/(ug/m3)	Relative factor To DPM
1	Benzene	6.77E-05	0.09
2	Ethylene oxide	8.80E-05	0.12
3	Formaldehyde	1.42E-05	0.02
4	Perchloroethylene	1.42E-05	0.02
5	1,3-Butadiene	4.06E-04	0.55
6	PAHs(Polycyclic aromatic hydrocarbon)	2.64E-03	3.55
7	Asbestos	1.90E-04	0.26
8	Cadmium	1.01E-02	13.58
9	Hexavalent chromium	3.45E-01	463.71
10	Nickel	6.16E-04	0.83
11	Arsenic	8.12E-03	10.91
12	Lead	2.84E-05	0.04
13	Diesel Particulate Matter (DPM)	7.44E-04	1.00

Emission Inventory

Point



Area



On-road Mobile



Off-road Mobile



Methodology for Point Source Emissions



Base Year Emissions

- Reported Emissions from South Coast AQMD's Annual Emissions Reporting (AER) Program
- Facilities that emit
 - 4 tons/year or more of VOC, NO_x, SO_x or PM, or
 - 100 tons/year or more of CO
- Approximately 1400 facilities required to report annually
- Criteria Pollutants and air toxics compounds

Future Year Emissions

- Growth and Control Factors are applied to the base year emissions



Methodology for On-road Source Emissions

On-road Mobile



Base Year Emissions

- 2017 Travel Activity Data from SCAG
 - Volumes and speeds for Light and Medium Duty and Heavy Duty vehicles
 - Emission factors are obtained from EMFAC 2017

Future Year Emissions

- Travel Demand forecasted by SCAG to meet the need of future economic and demographic growth
- Emission factors from EMFAC 2017 reflecting vehicle turnover to newer vehicles and regulations requiring cleaner vehicles



Methodology for Off-road Source Emissions

Off-road Mobile



Base Year Emissions

- Activity data obtained through mandatory or voluntary reporting, surveys, or other data sources
- Emissions allocated to known locations of activity, when possible, or allocated using gridded spatial surrogates
- Toxic emissions calculated based on CARB speciation profiles for VOC and PM, based on SCC classification

Future Year Emissions

- Sector-specific growth and control factors are applied to the base year emissions
- Updated survival/turnover rates for off-road equipment



Methodology for Area Source Emissions

Area



Base Year Emissions

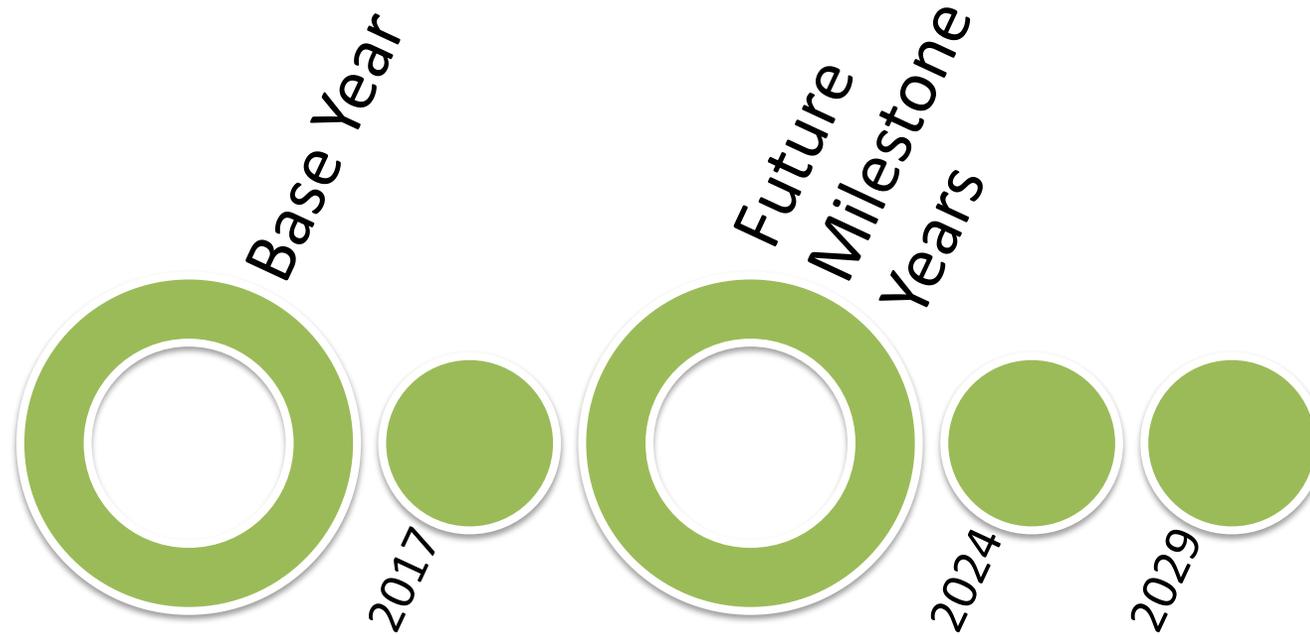
- Methodology for area sources is specific for each category. They are based on, for example, Statewide consumption, rule-based Basin specific sales, etc
- Emissions spatially allocated using gridded spatial surrogates
 - Typical surrogates include: population, VMT, total employment, industrial and retail employment, housing, land cover types
- Toxic emissions calculated based on CARB speciation profiles for VOC and PM

Future Year Emissions

- Sector-specific growth and control factors are applied to the base year emissions



Emissions Inventory Milestone Years



Emissions Forecasting

- Emissions are forecasted from base-year inventory using the following equation to incorporate the impacts of growth and regulations.

$$E_{FY} = E_{BY} \times GF \times CF$$

where:

E_{FY} = Future year emissions

E_{BY} = Base year emissions

GF = Growth Factor

CF = Control Factor

Regulations Reflected in the Future Emissions

Table 7. List of South Coast AQMD Rules Affecting Toxic Air Contaminant Emissions in the South Coast Air Basin

Rule	Description
1420	Emissions standard for Lead
1420.1	Emissions standard for Lead and other toxic air contaminants from large lead-acid battery recycling facilities
1420.2	Emission standards for Lead from metal melting facilities
1469	Hexavalent Chromium emissions from Chromium electroplating and Chromic acid anodizing operations
1421	Control of perchloroethylene emissions from dry cleaning systems
1122	Solvent degreasers

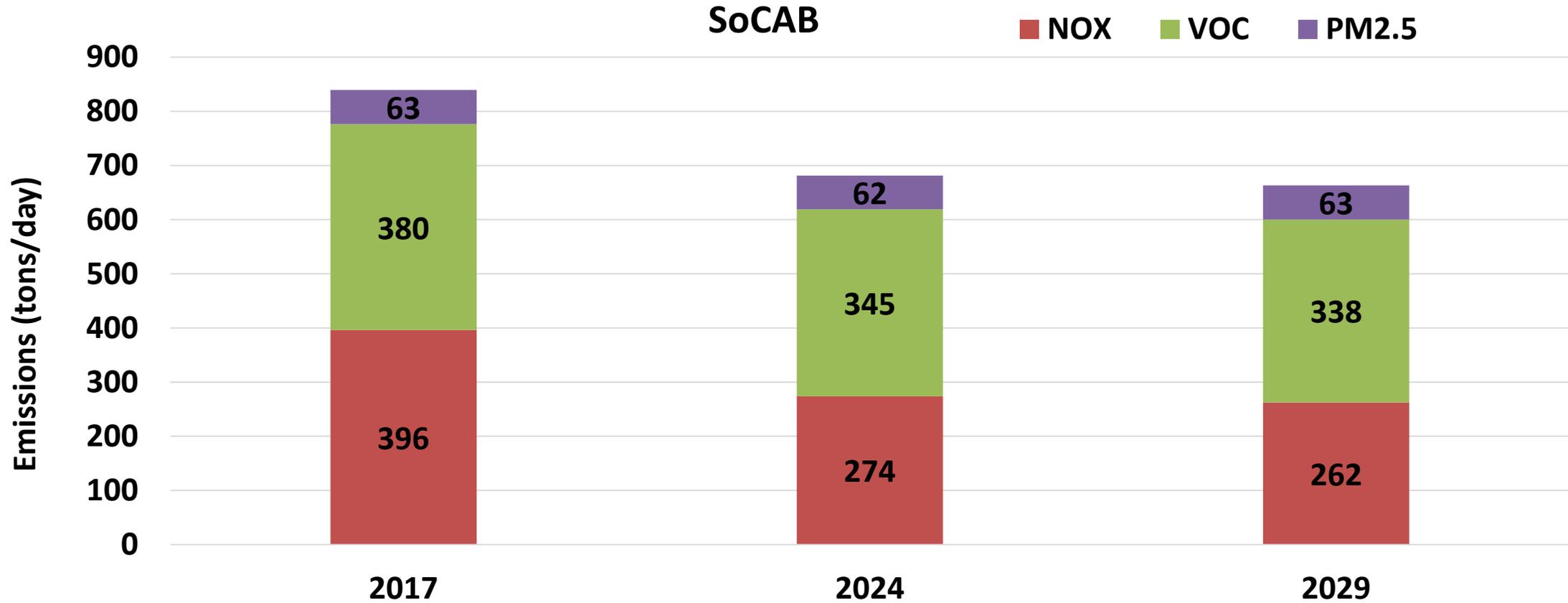


Regulations Reflected in the Future Emissions

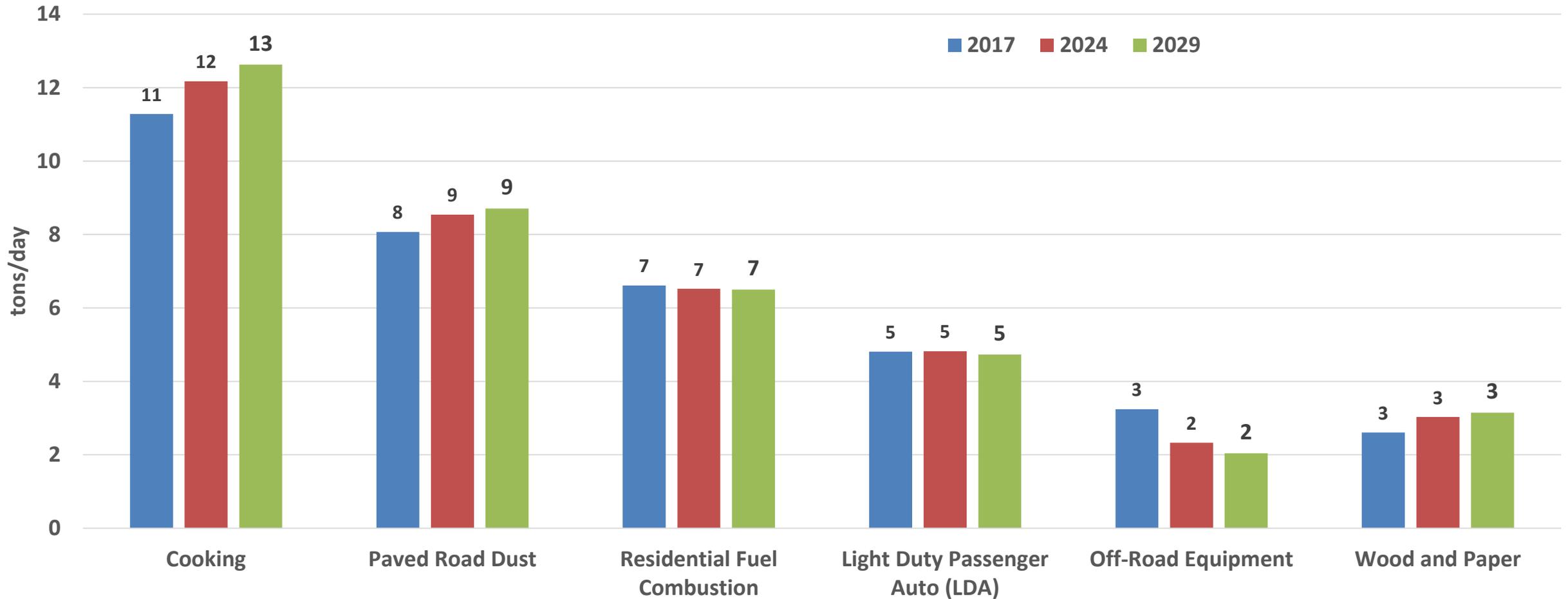
Table 4. Control Factors for Emissions from Diesel Vehicles

Regulation	Pollutant	Control Factor	
		2024	2029
Amendments to Smoke Opacity Regulation for Heavy-Duty Trucks	PM _{2.5}	0.754	0.748
Amendments to Heavy Duty Engine Warranty Requirement	PM _{2.5}	0.997	0.984
Amendments to Heavy Duty Engine Warranty Requirement	NOx	0.998	0.990
Innovative Clean Transit for Buses	PM _{2.5}	0.991	0.986
Zero Emission Airport Shuttle Buses	PM _{2.5}	insignificant	

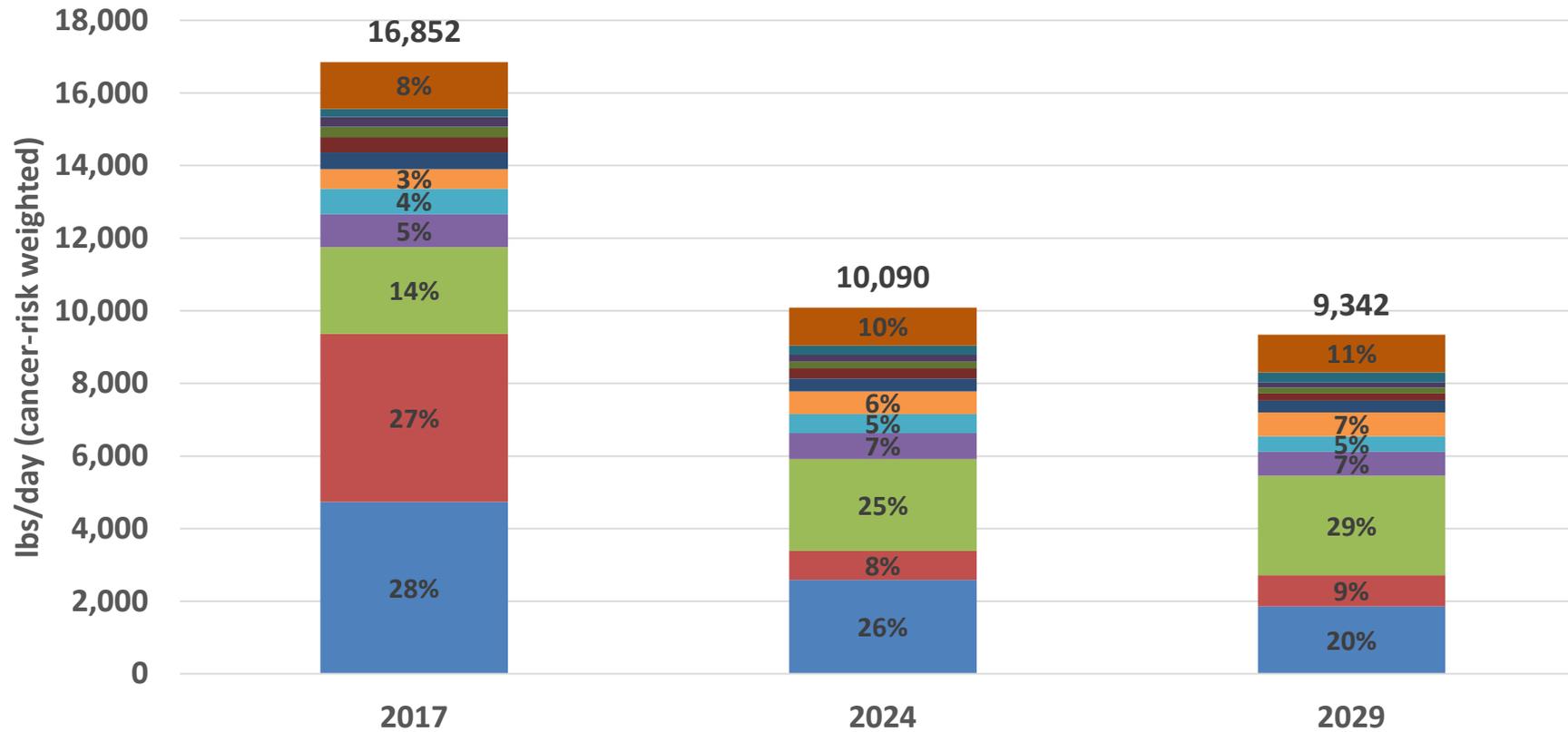
South Coast Air Basin Criteria Air Pollutants



Top 5 Sources of PM2.5 in the South Coast Air Basin

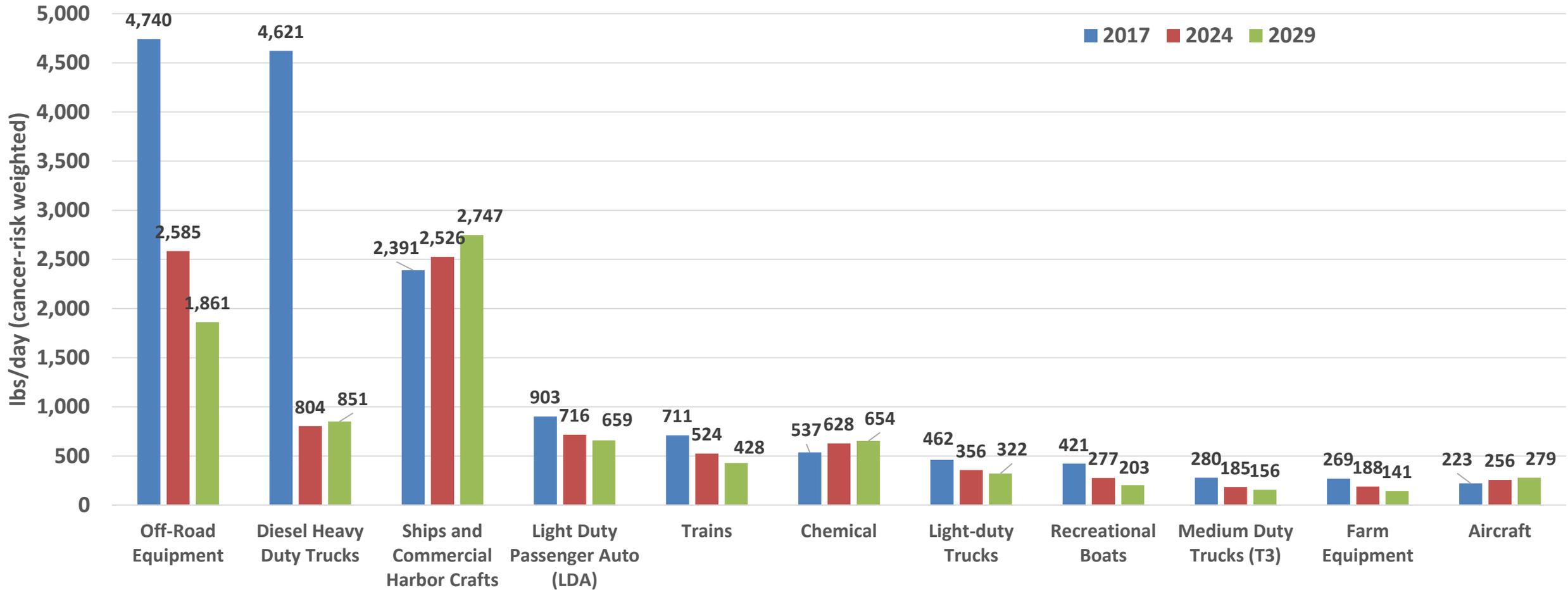


Trend of TAC Emissions in the South Coast Air Basin



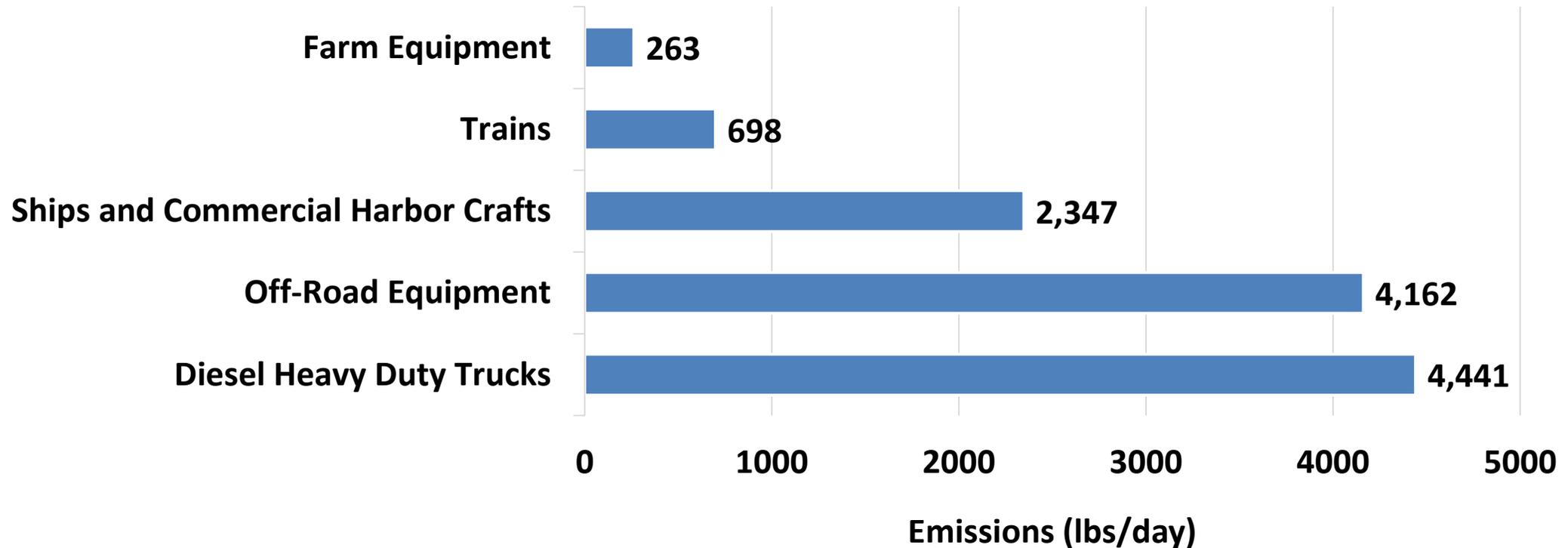
- Off-Road Equipment
- Diesel Heavy Duty Trucks
- Ships and Commercial Harbor Crafts
- Light Duty Passenger Auto (LDA)
- Trains
- Chemical
- Light-duty Trucks
- Recreational Boats
- Medium Duty Trucks (T3)
- Farm Equipment
- Aircraft
- Others

Top 10 Sources of TACs in the South Coast Air Basin

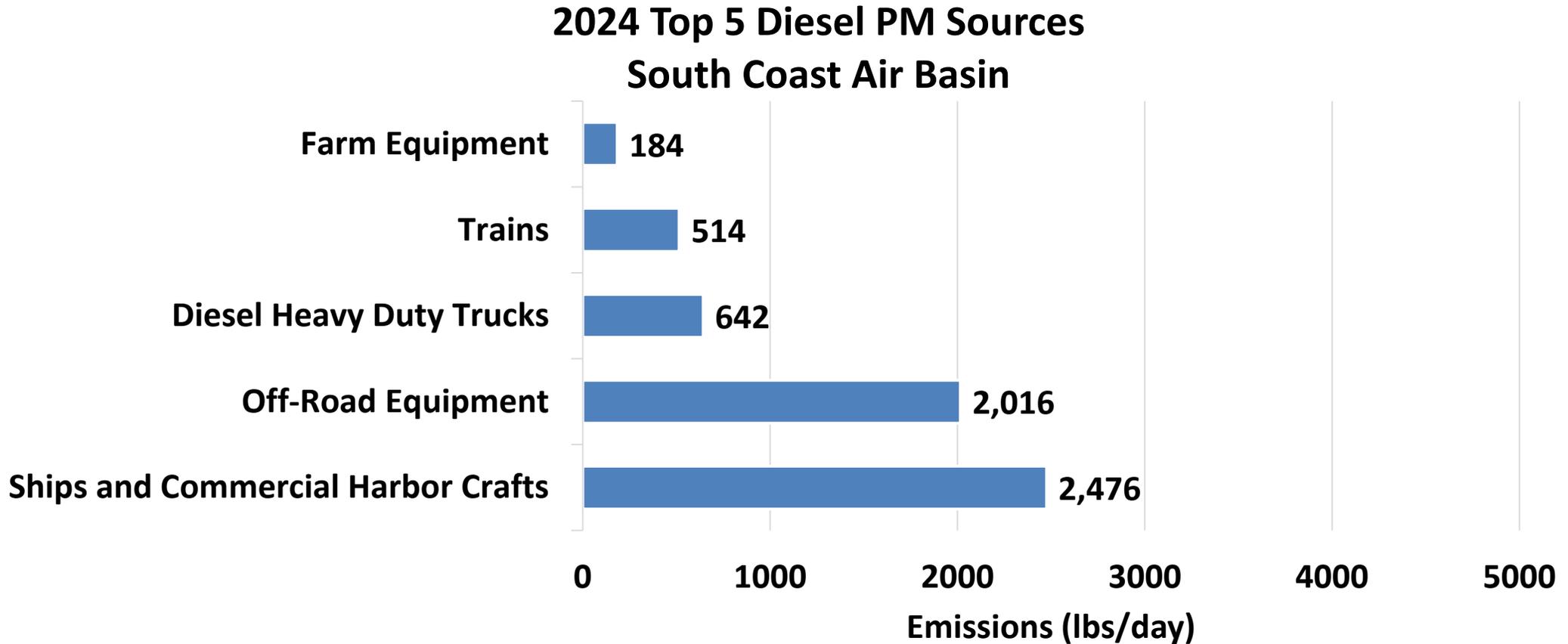


Top 5 DPM Sources in the South Coast Air Basin: 2017

2017 Top 5 Diesel PM Sources
South Coast Air Basin

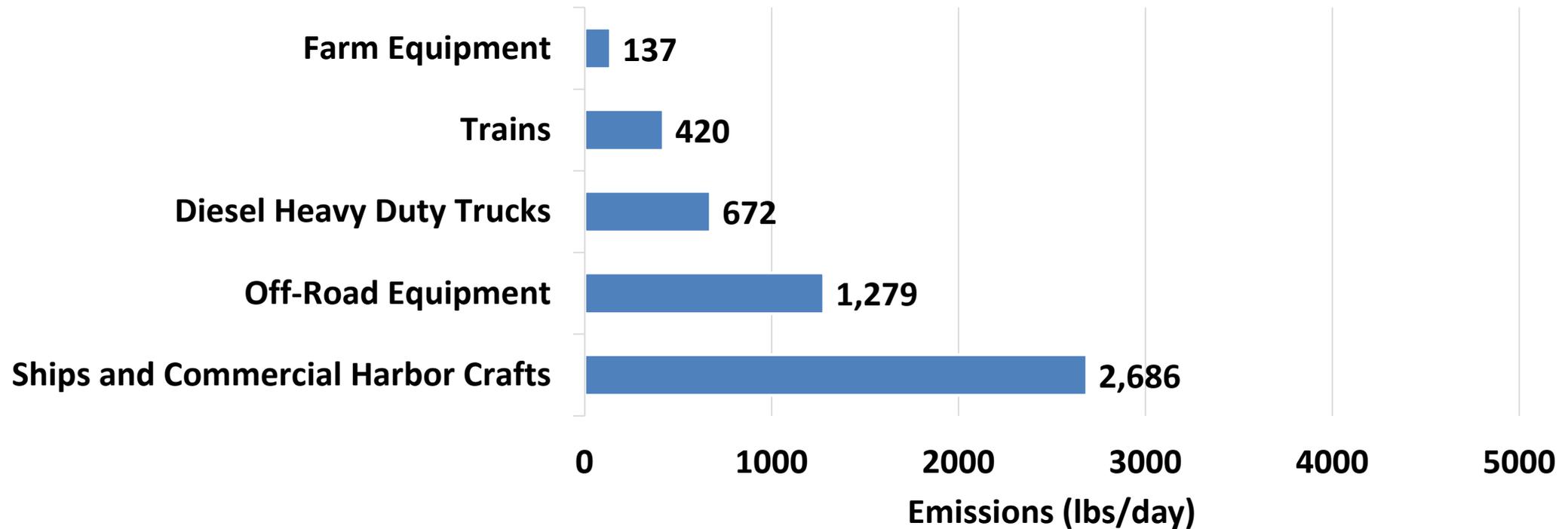


Top 5 DPM Sources in South Coast Air Basin: 2024

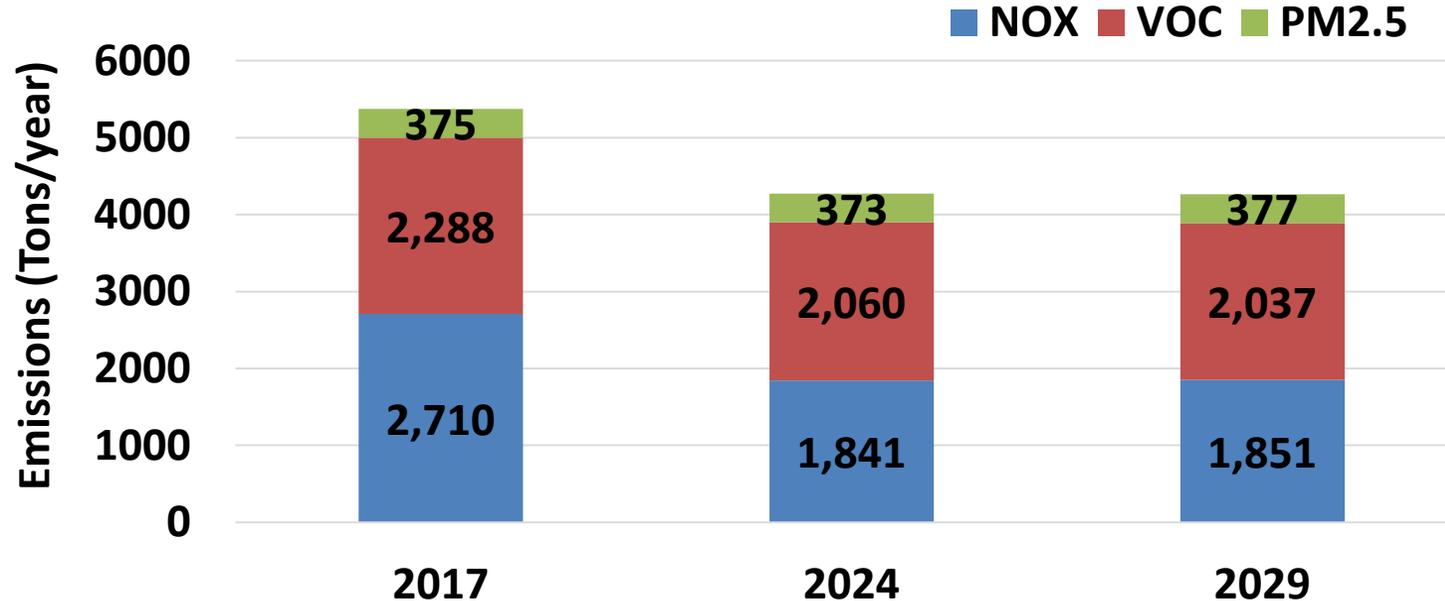


Top 5 DPM Sources in South Coast Air Basin: 2029

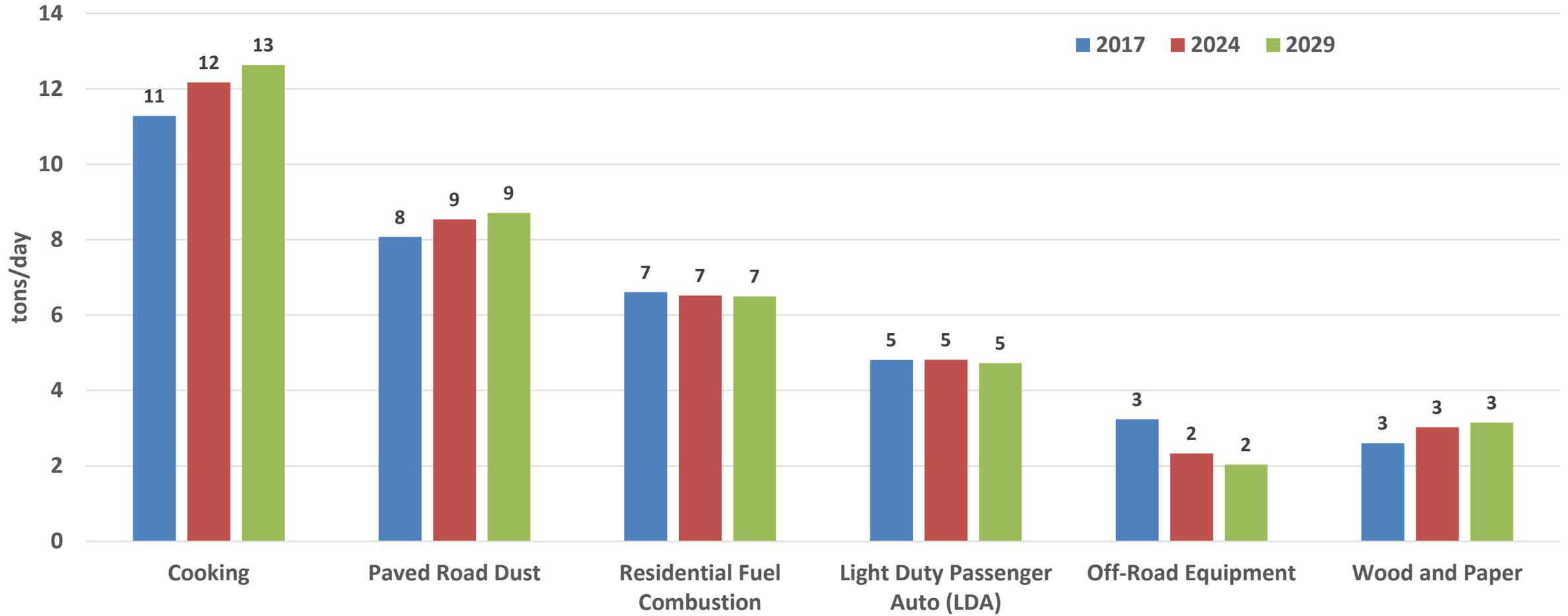
2029 Top 10 Diesel PM Sources
South Coast Air Basin



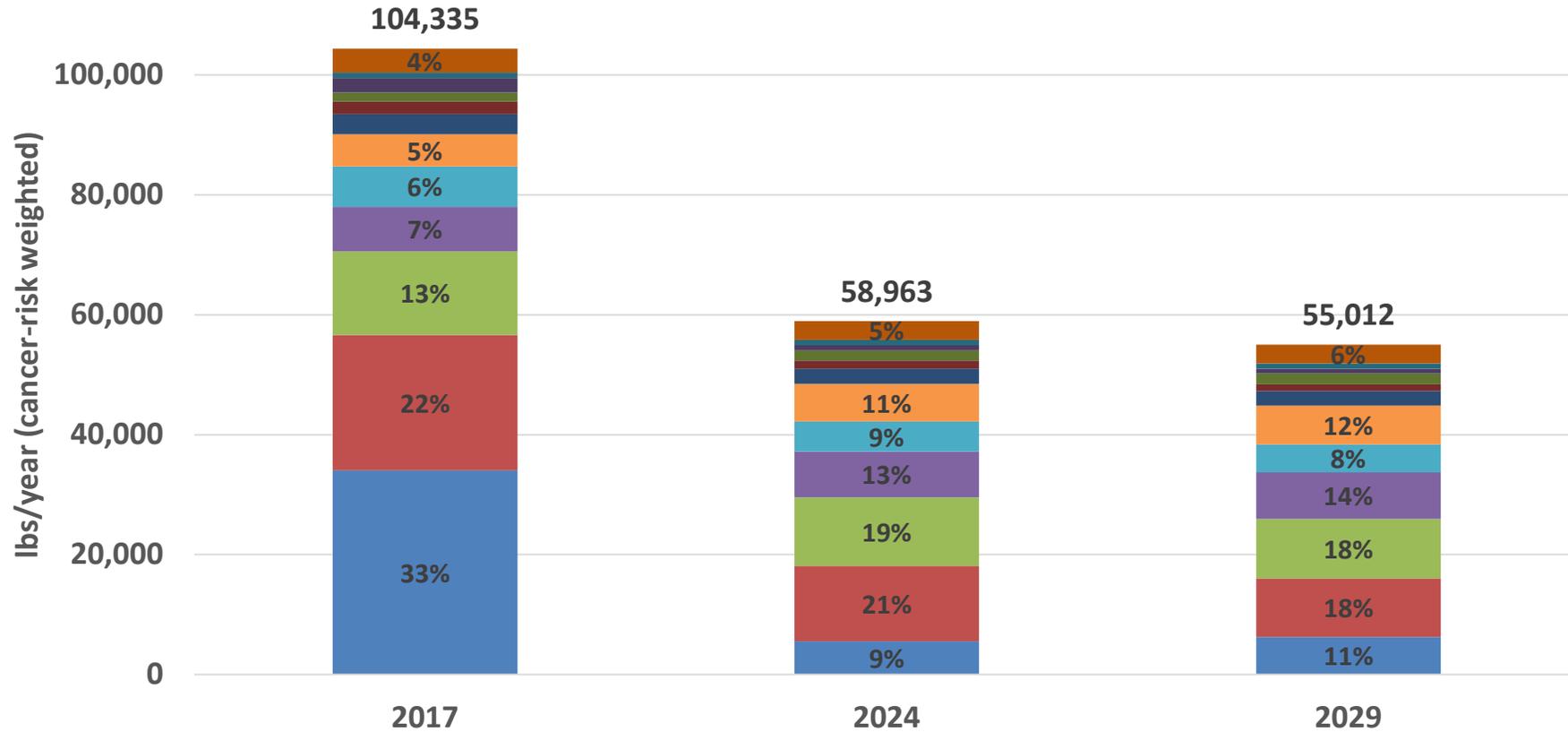
Criteria Air Pollutants in the Boyle Heights, East LA, West Commerce community



Top 5 Sources of PM2.5 in the Boyle Heights, East LA, West Commerce Community

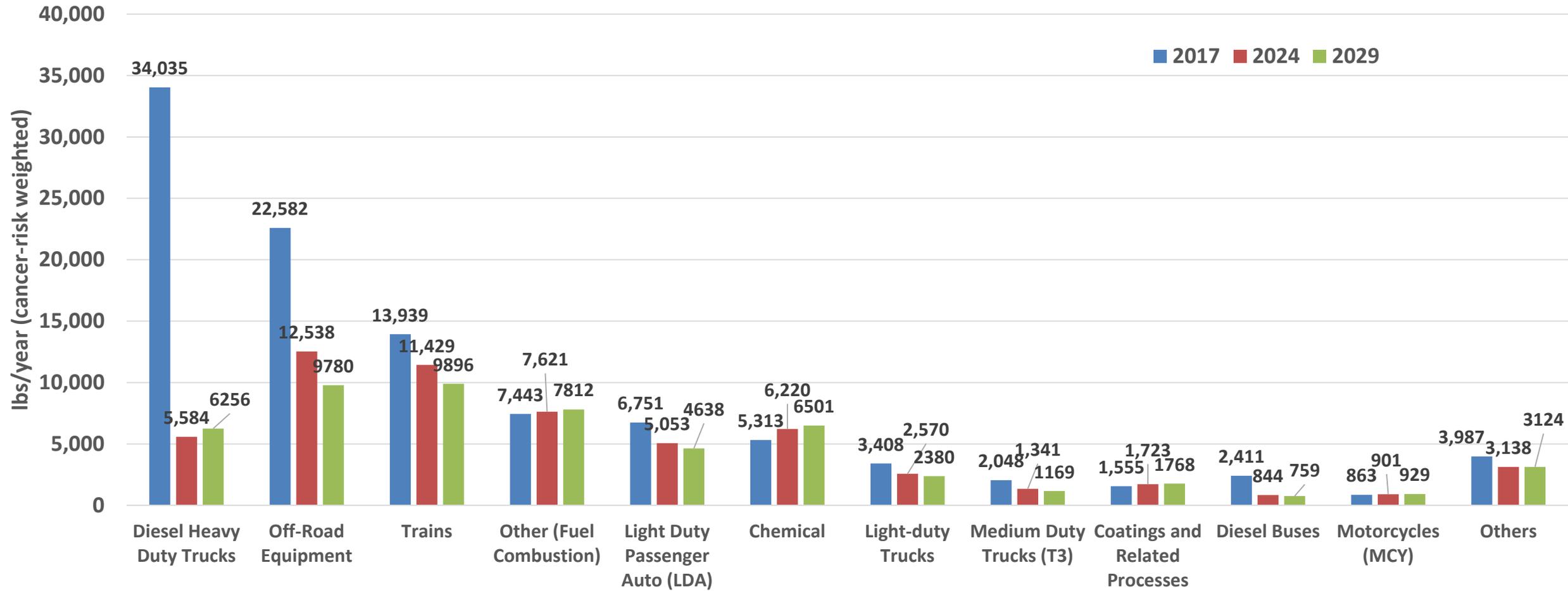


TACs in the Boyle Heights, East LA, West Commerce community



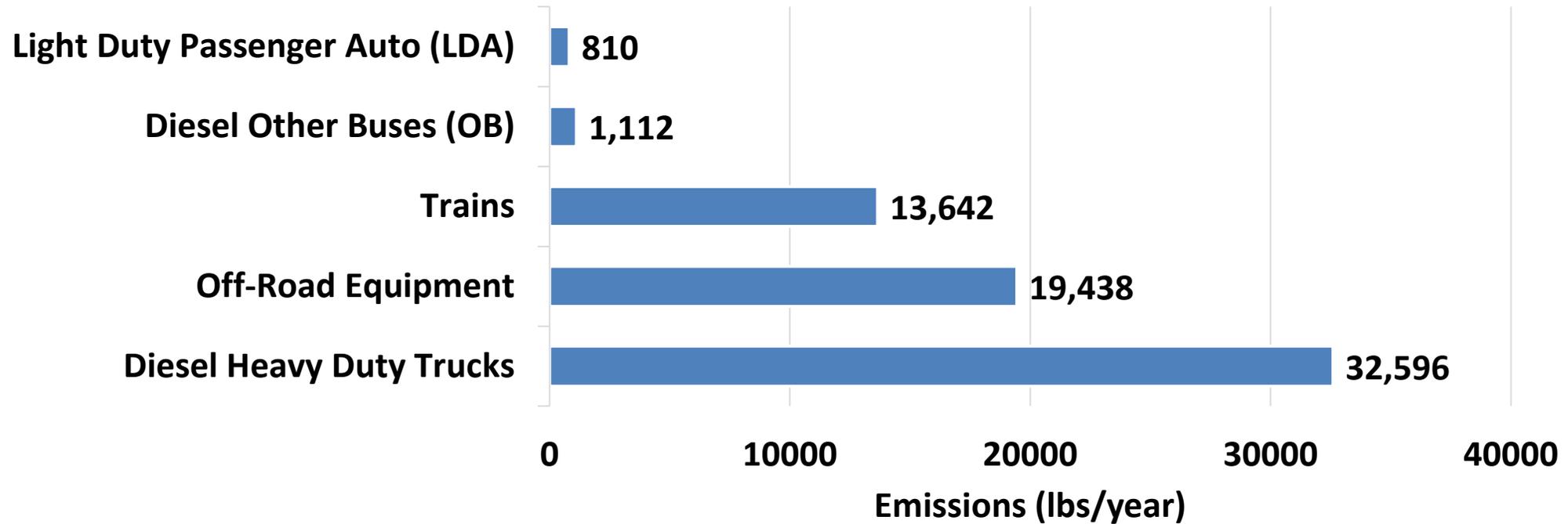
- Diesel Heavy Duty Trucks
- Off-Road Equipment
- Trains
- Other (Fuel Combustion)
- Light Duty Passenger Auto (LDA)
- Chemical
- Light-duty Trucks
- Medium Duty Trucks (T3)
- Coatings and Related Processes
- Diesel Buses
- Motorcycles (MCY)
- Others

Top 10 Sources of TACs in the Boyle Heights, East LA, West Commerce Community



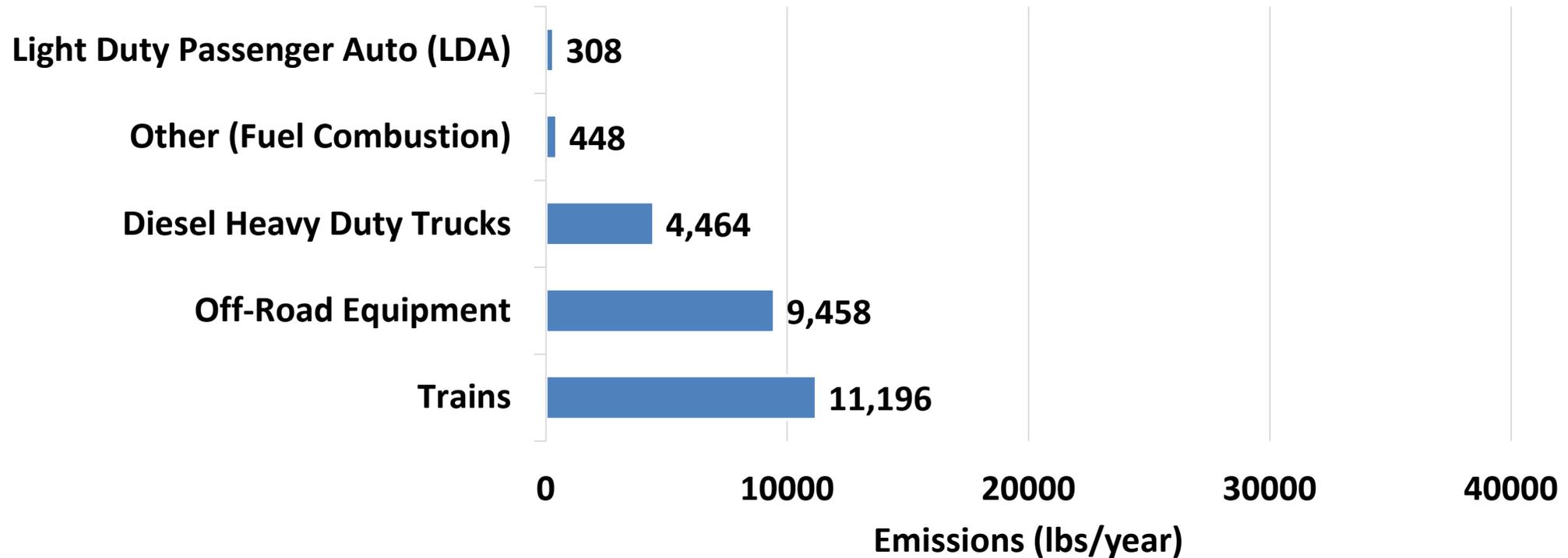
Top 5 DPM Sources in Boyle Heights, East LA, West Commerce: 2017

2017 Top 5 Diesel PM Sources
East Los Angeles, Boyle Heights, West Commerce



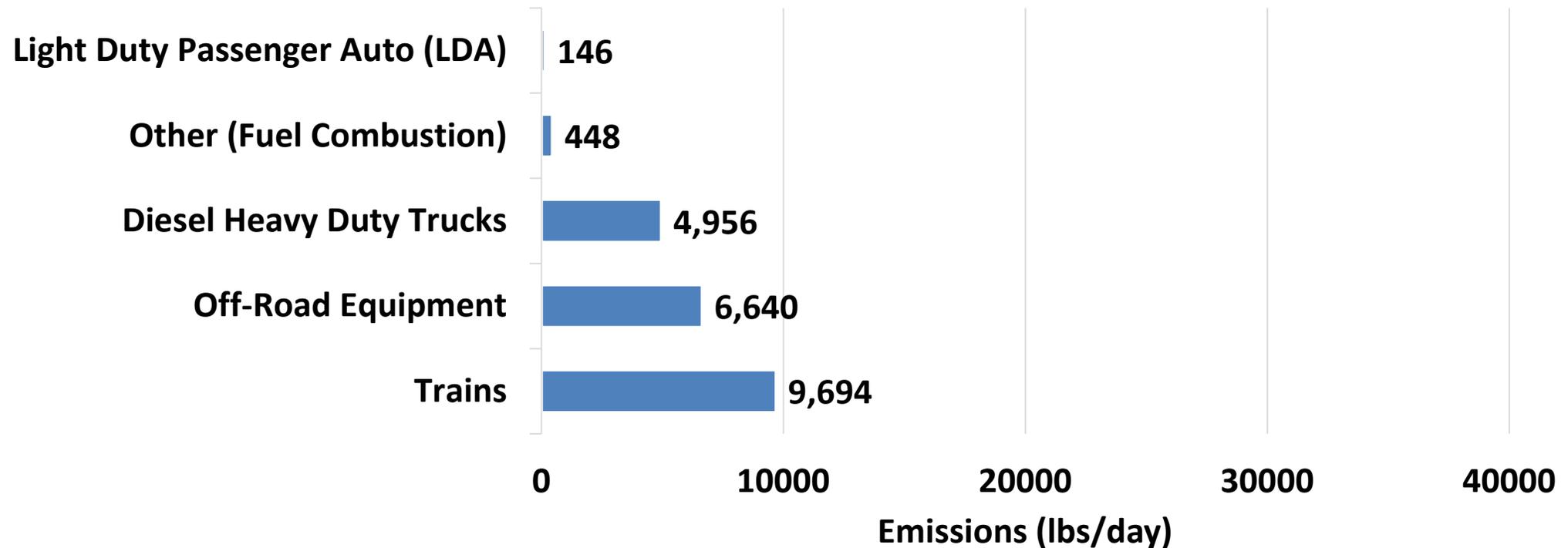
Top 5 DPM Sources in Boyle Heights, East LA, West Commerce: 2024

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East Los Angeles, Boyle Heights, West Commerce

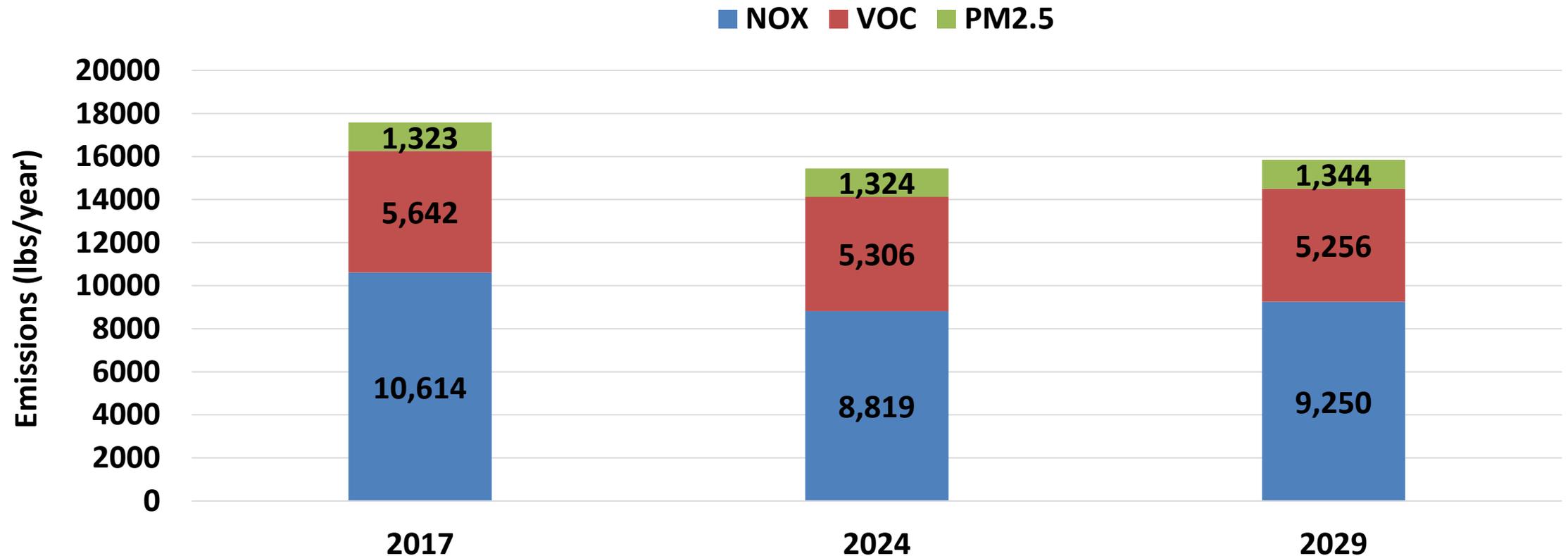


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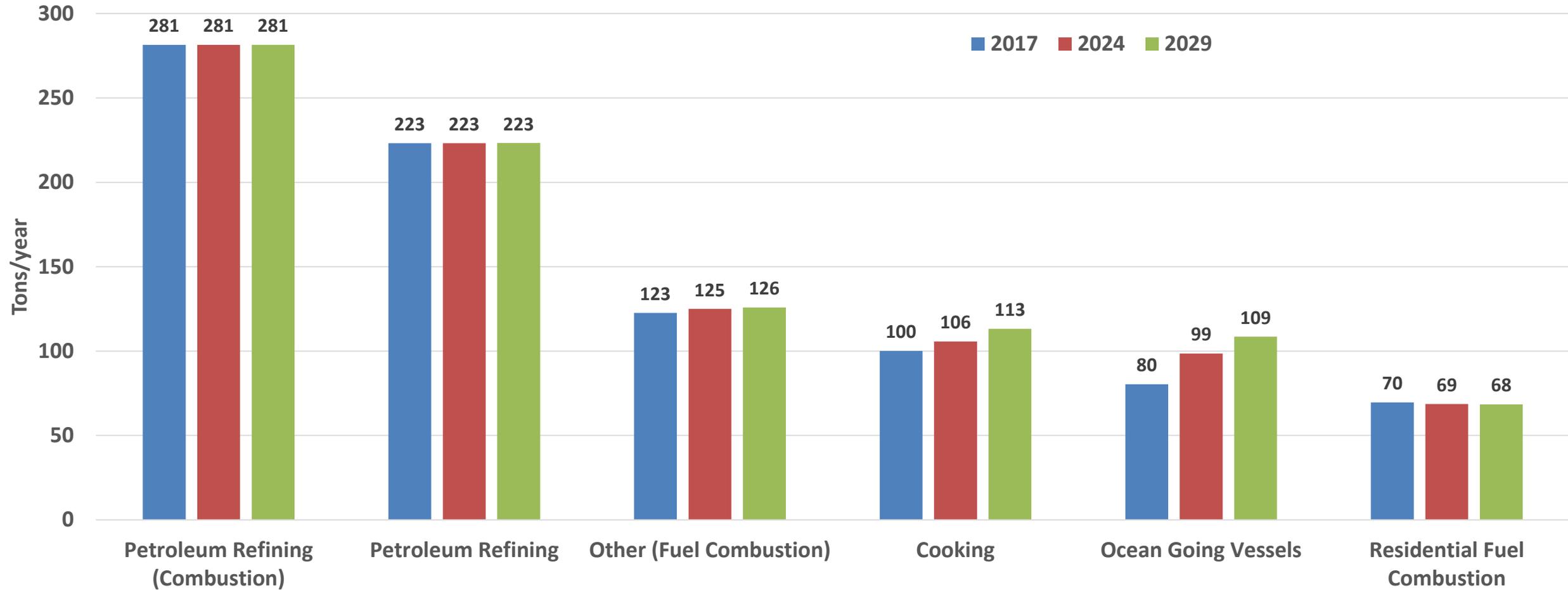
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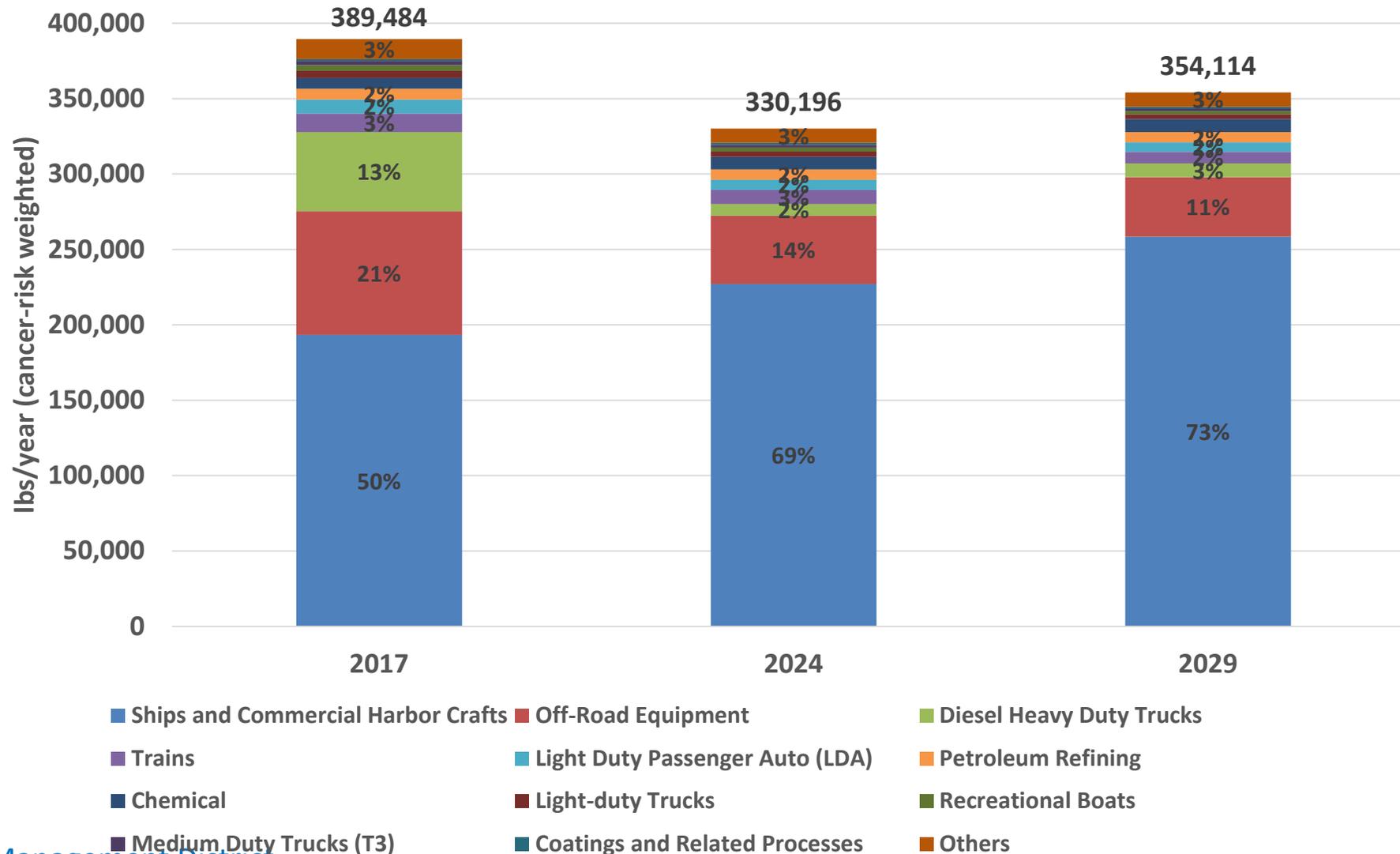
Criteria Pollutants in the Wilmington, Carson and West Long Beach Community



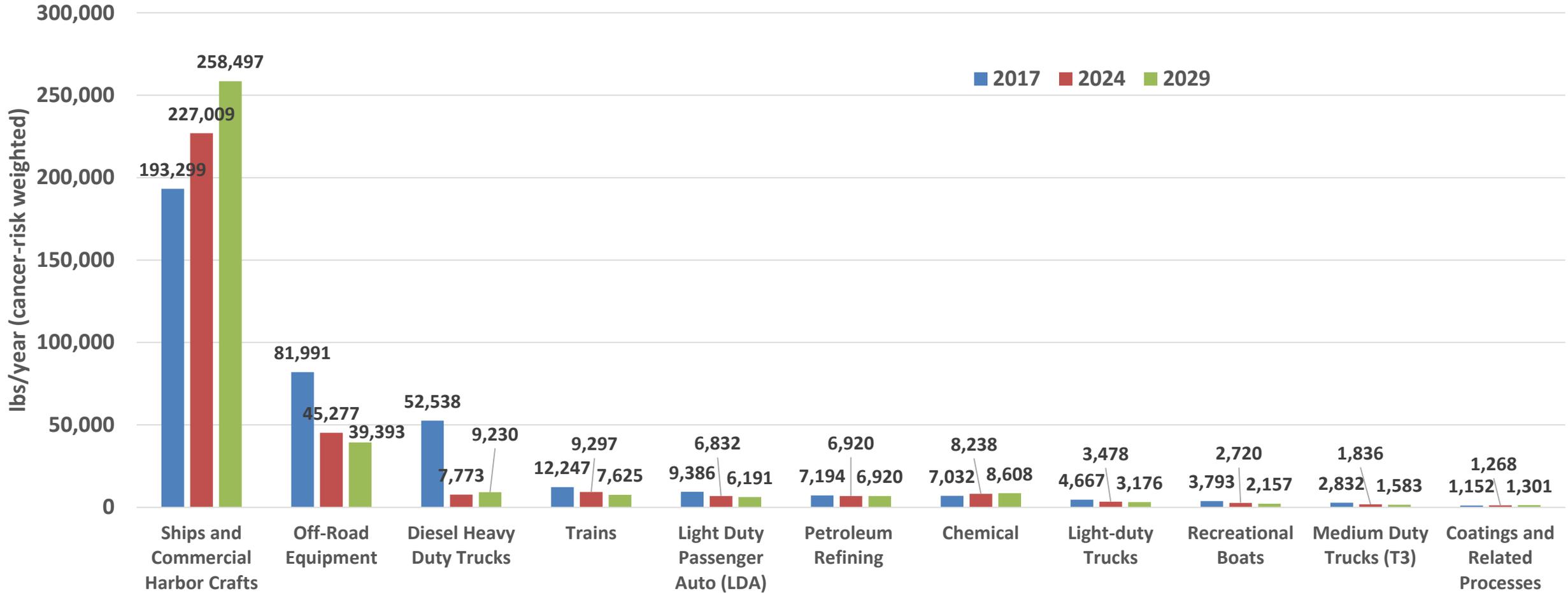
Top 5 Sources of PM2.5 Emissions in the Wilmington, Carson and West Long Beach



TACs in the Wilmington, Carson and West Long Beach Community

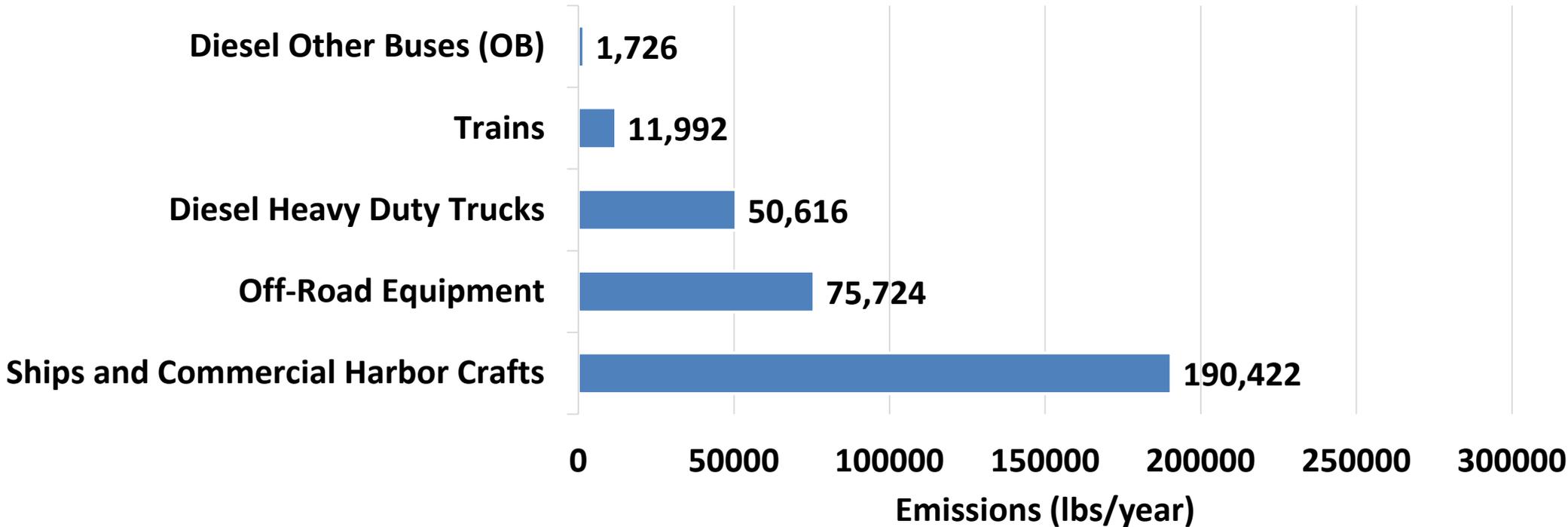


Top 10 Sources of TAC Emissions in the Wilmington, Carson and West Long Beach Community



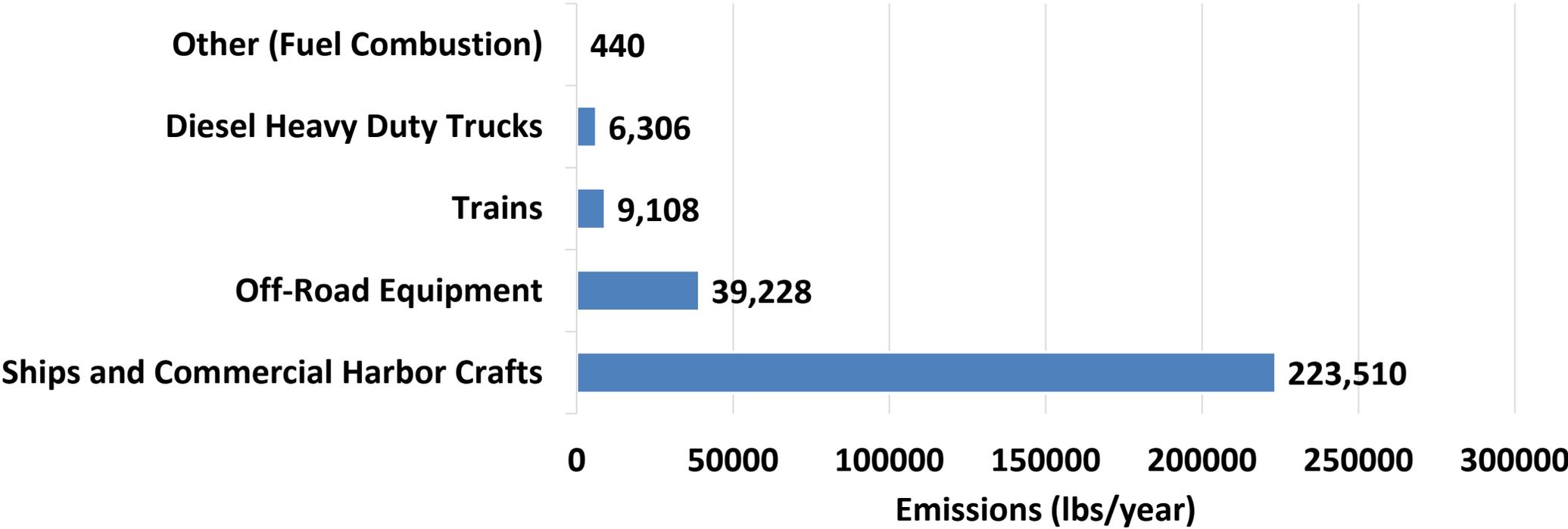
Top 5 DPM Sources in the Wilmington, Carson and West Long Beach community: 2017

2017 Top 5 Diesel PM Sources
Wilmington, Carson, West Long Beach



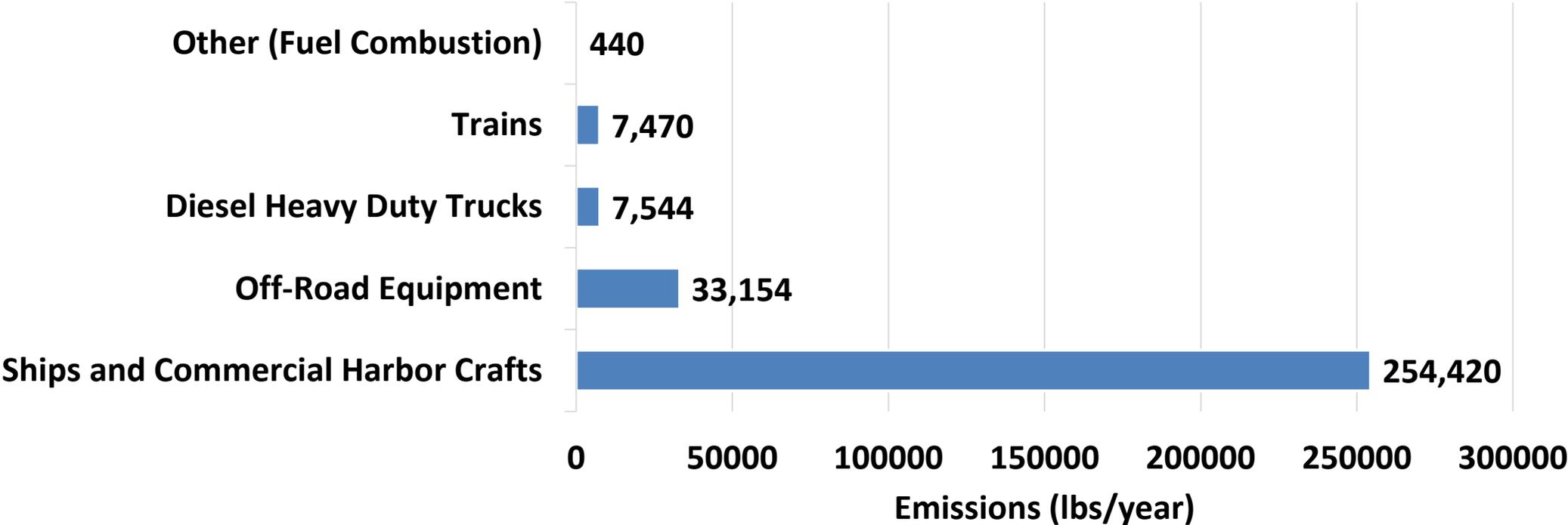
Top 5 DPM Sources in the Wilmington, Carson and West Long Beach community: 2024

2024 Top 5 Diesel PM Sources
Wilmington, Carson, West Long Beach

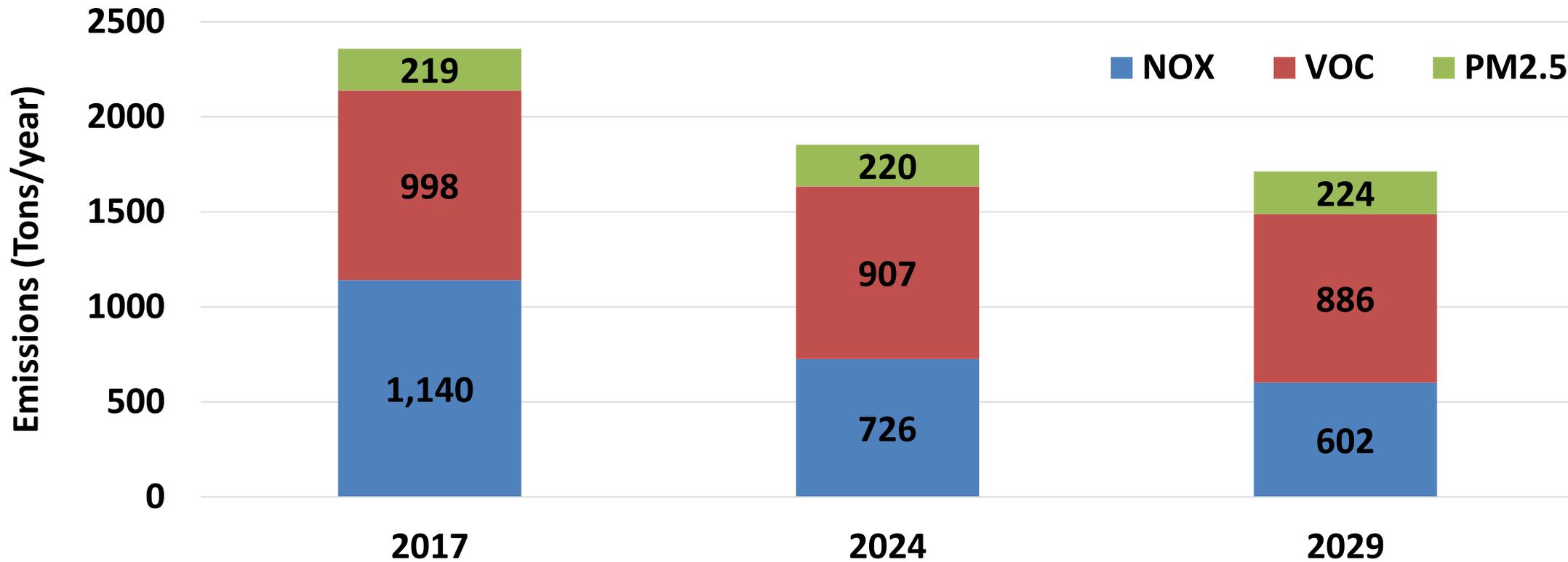


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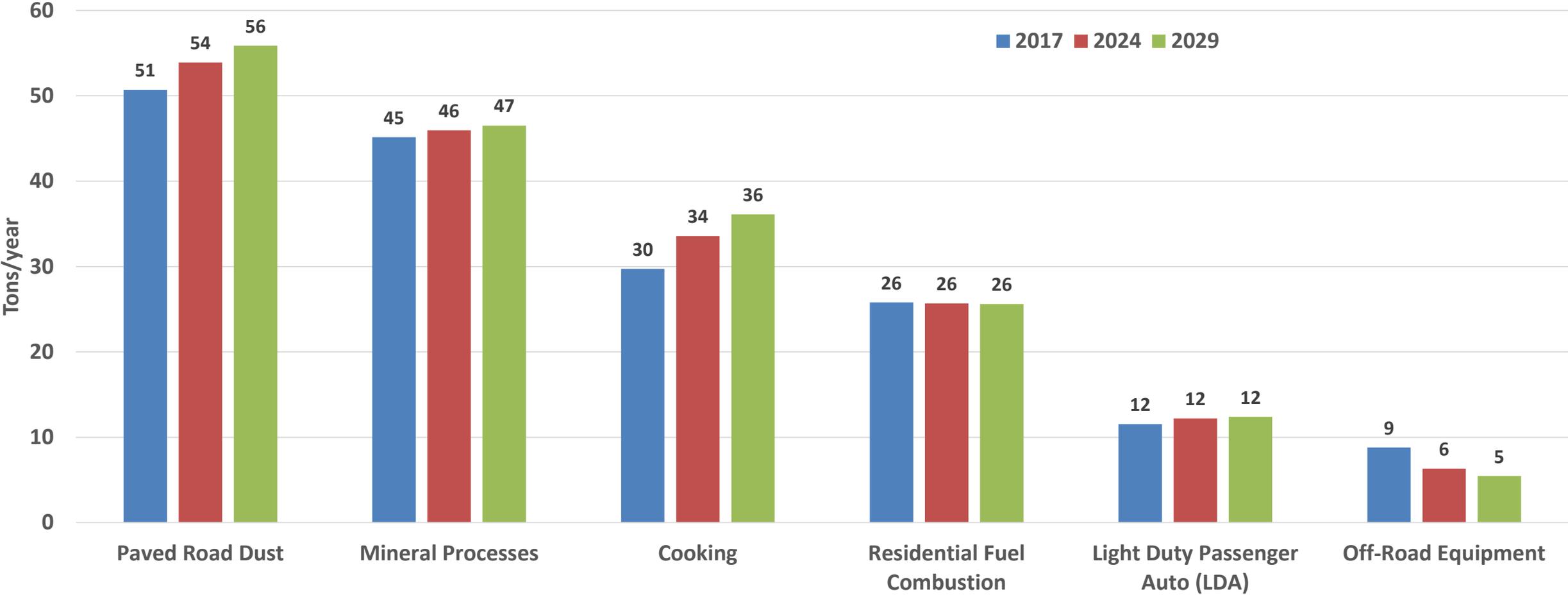
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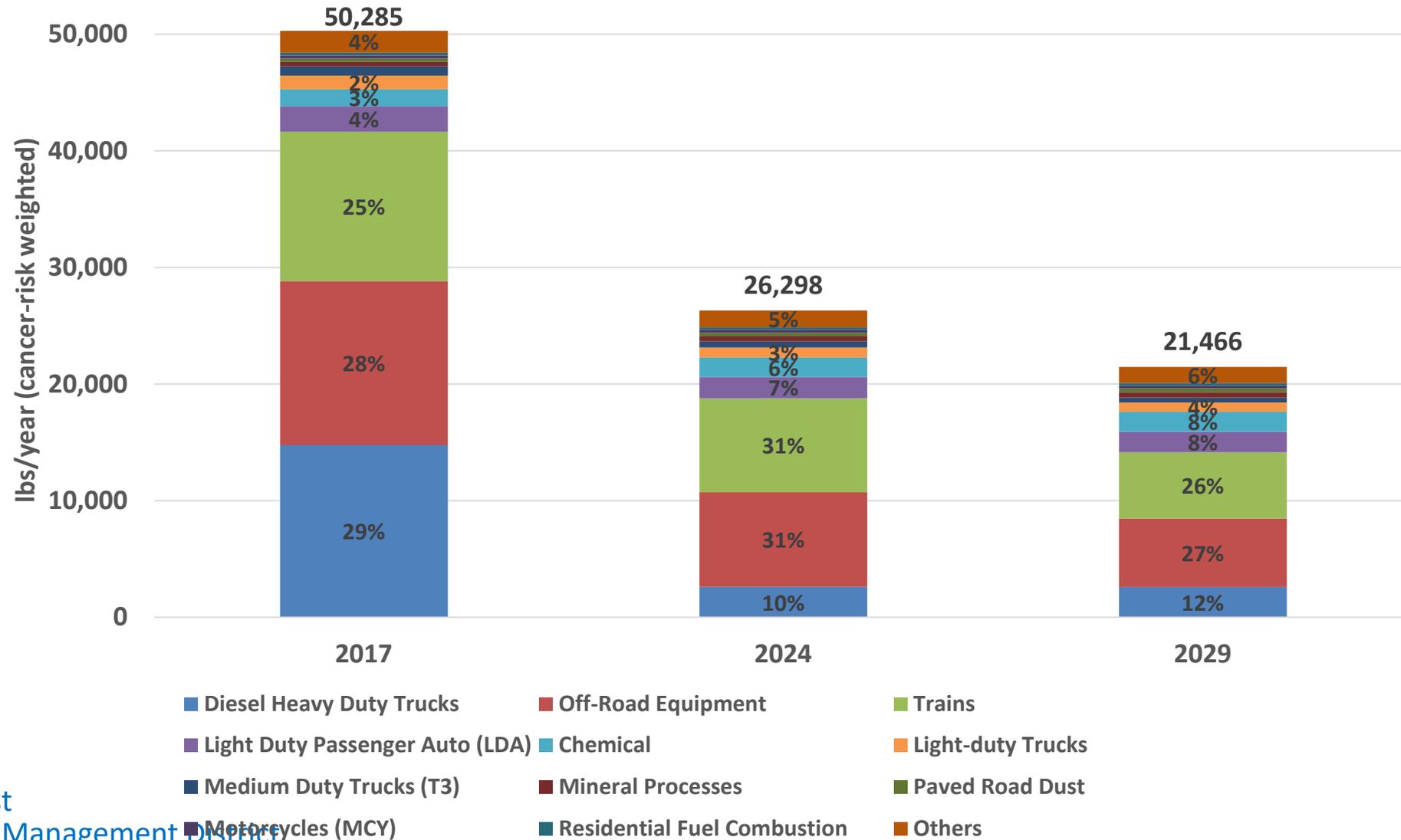
Criteria Pollutants in the San Bernardino and Muscoy Community



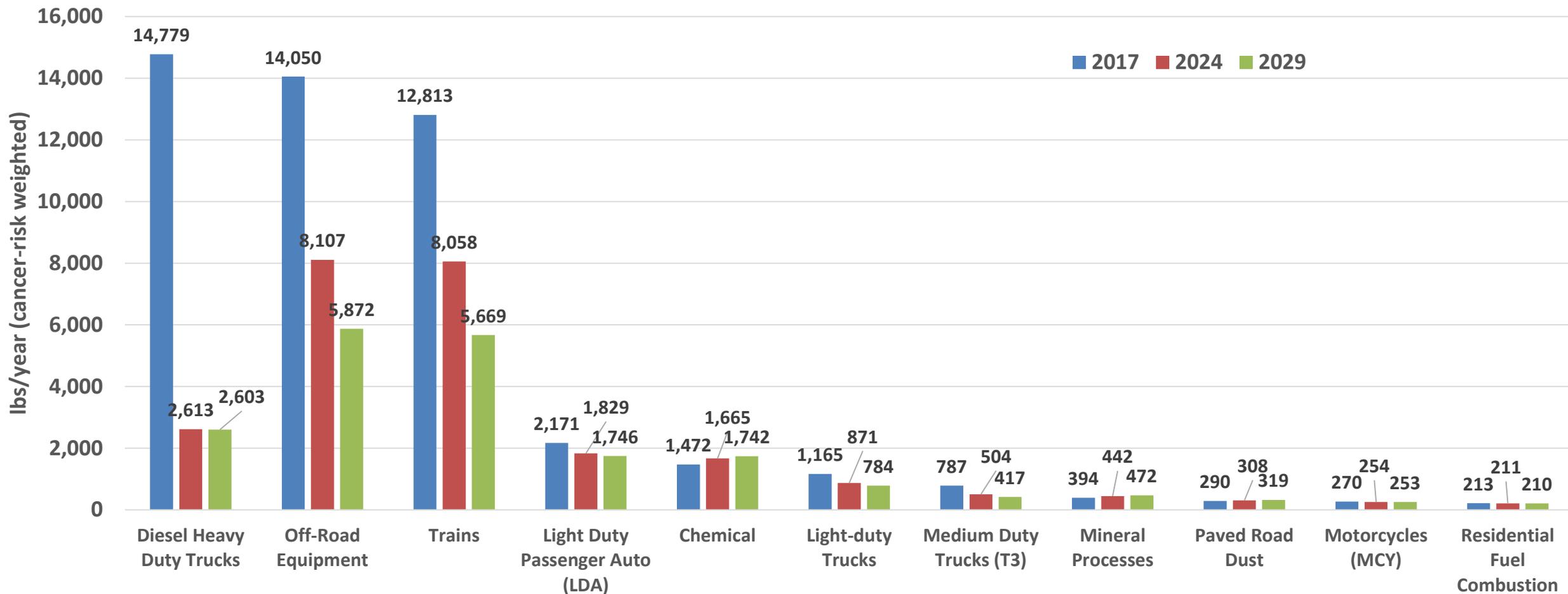
Top 5 Sources of PM2.5 Emissions in the San Bernardino and Muscoy Community



TAC emissions in the San Bernardino and Muscoy Community

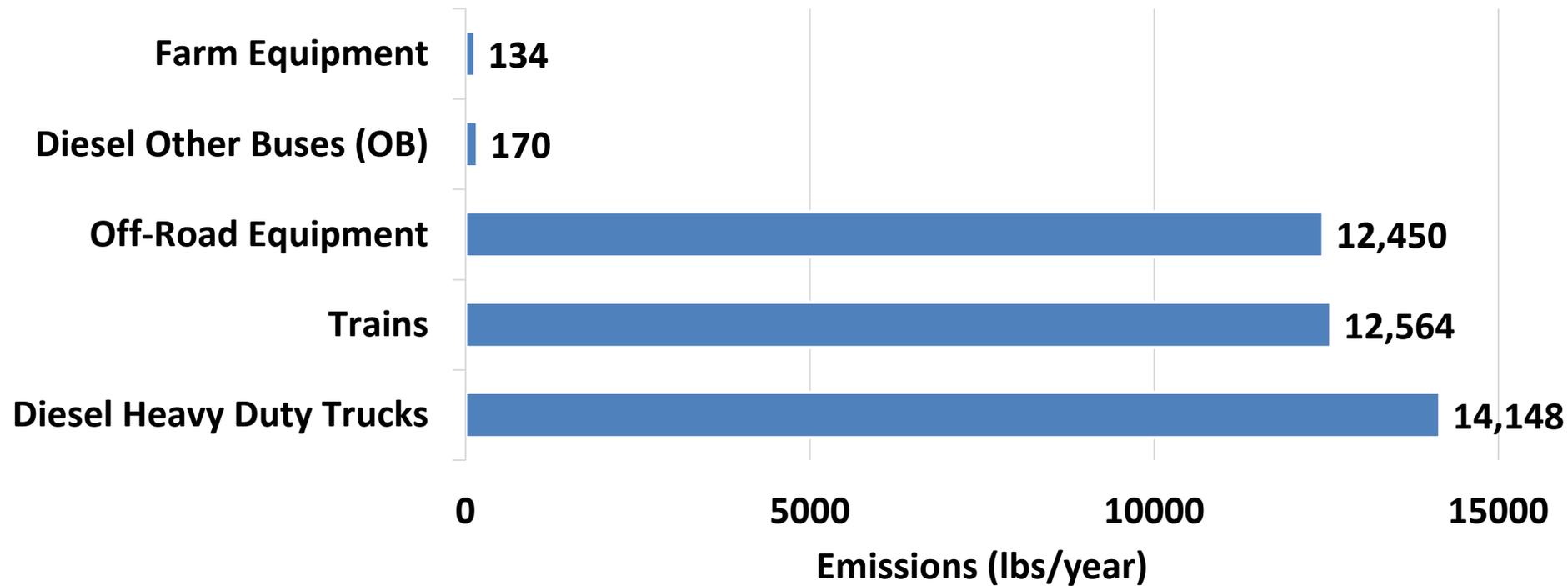


Top 10 Sources of TAC Emissions in the San Bernardino and Muscoy Community

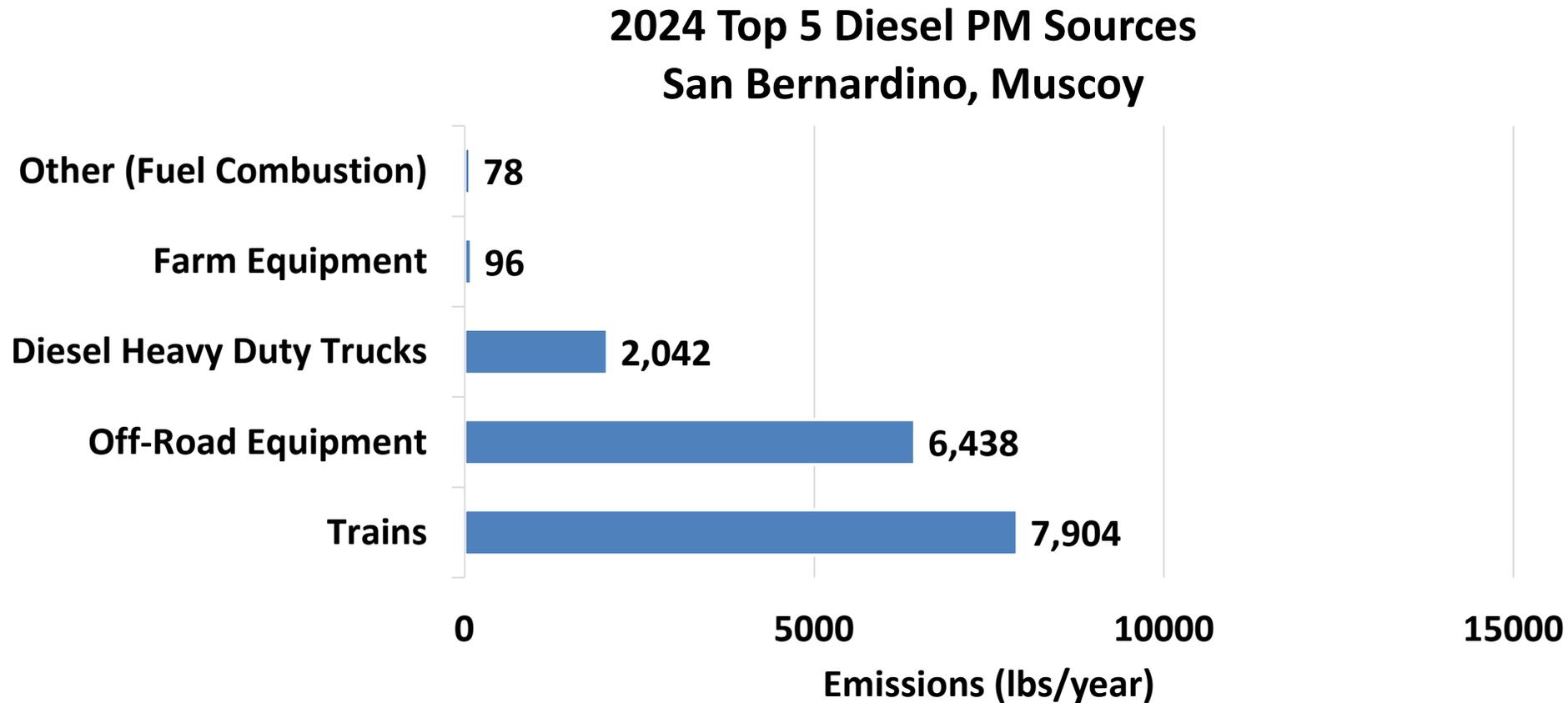


Top 5 DPM Sources in the San Bernardino and Muscoy: 2017

2017 Top 5 Diesel PM Sources
San Bernardino, Muscoy

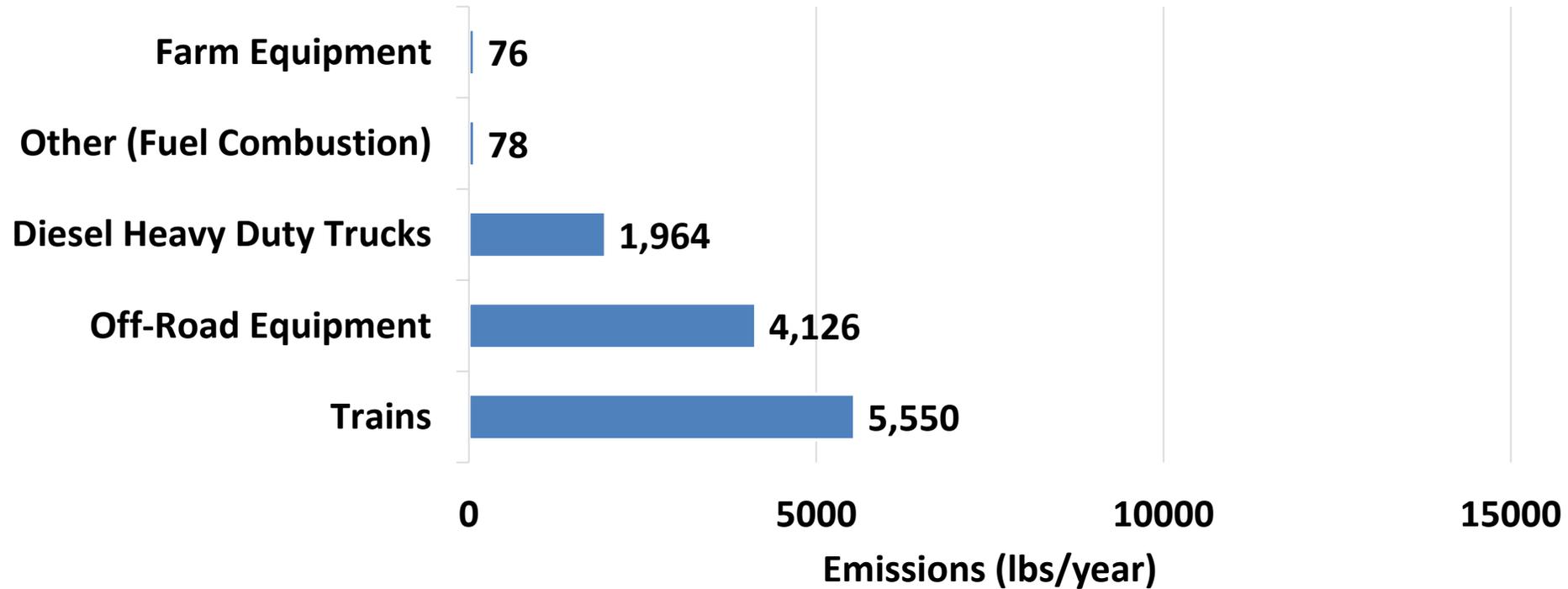


Top 5 DPM Sources in the San Bernardino and Muscoy: 2024



Top 5 DPM Sources in the San Bernardino and Muscoy: 2029

2029 Top 5 Diesel PM Sources
San Bernardino, Muscoy

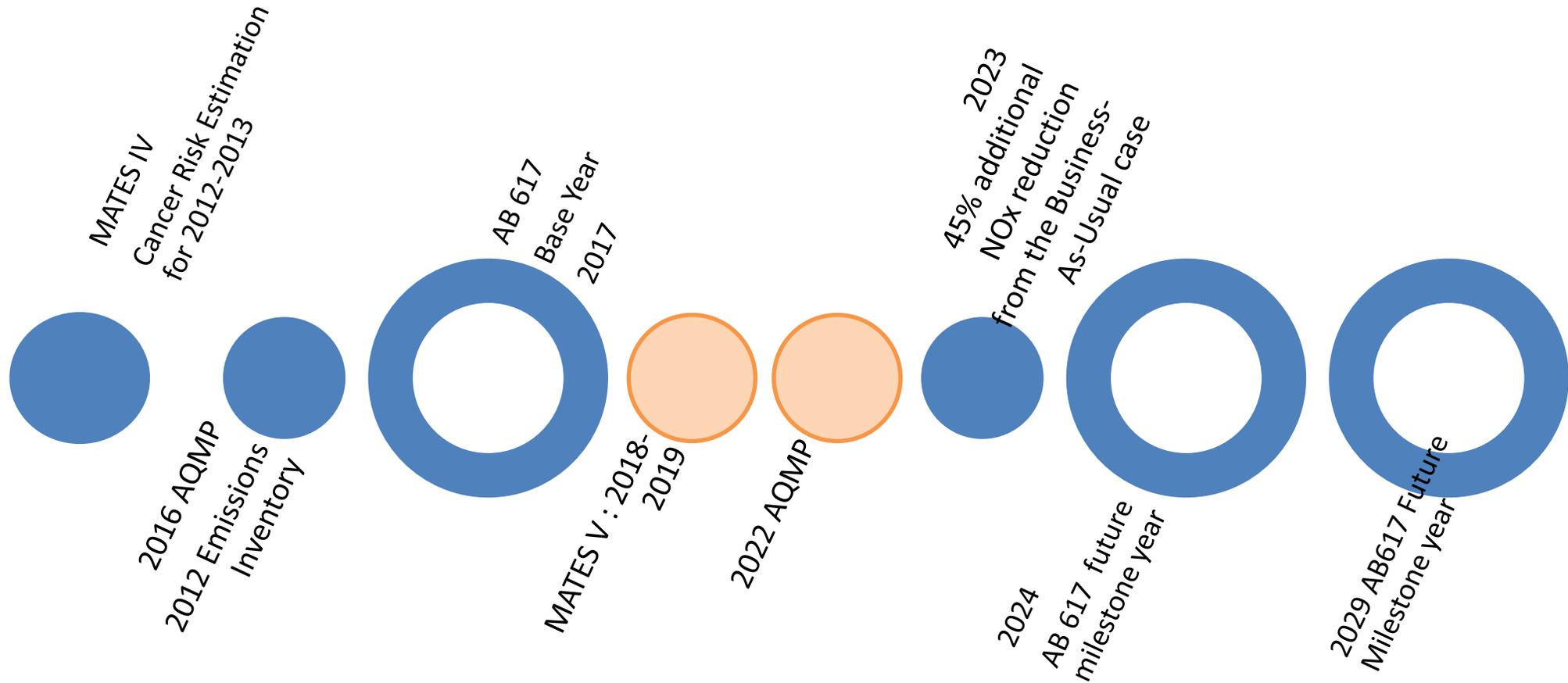


Limitations and Uncertainties

- Emissions inventory does not account for transport
 - Additional source attribution techniques will be used in the future (e.g. MATES V, community monitoring)
- Grid resolution impacts the accuracy of data within a community
- Area and off-road categories rely on generic spatial surrogates to assign emissions at a specific location. This allocation might not reflect the precise locations of these emissions within a community
- Uncertainties in VOC chemical speciation and air toxics speciation profiles for toxics



Updates to Emissions Inventory and Air Quality Modeling



Summary

- On-road and off-road sources dominate air pollutant and toxic air contaminant emissions in all Year 1 communities as well as the South Coast Air Basin
- Diesel PM is the dominant TAC in the three communities
- On-road Diesel PM is expected to decline significantly, but overall, Diesel PM continues to be the most prevalent TAC in the future
 - Trains are projected to become the largest emitter in ELABHWC and SBM
 - Emissions from ships are projected to grow, and are by far, the largest contributor to Diesel PM in WCWLB

Questions

