



# Recommended Updates to MOVES Heavy-Duty Source Masses using VTRIS Data

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# Overview

- Background
- VTRIS
- Calculating Source Masses by Regulatory Class
- Preliminary Impact on MOVES Results
- Potential Further Changes
- Requested Feedback

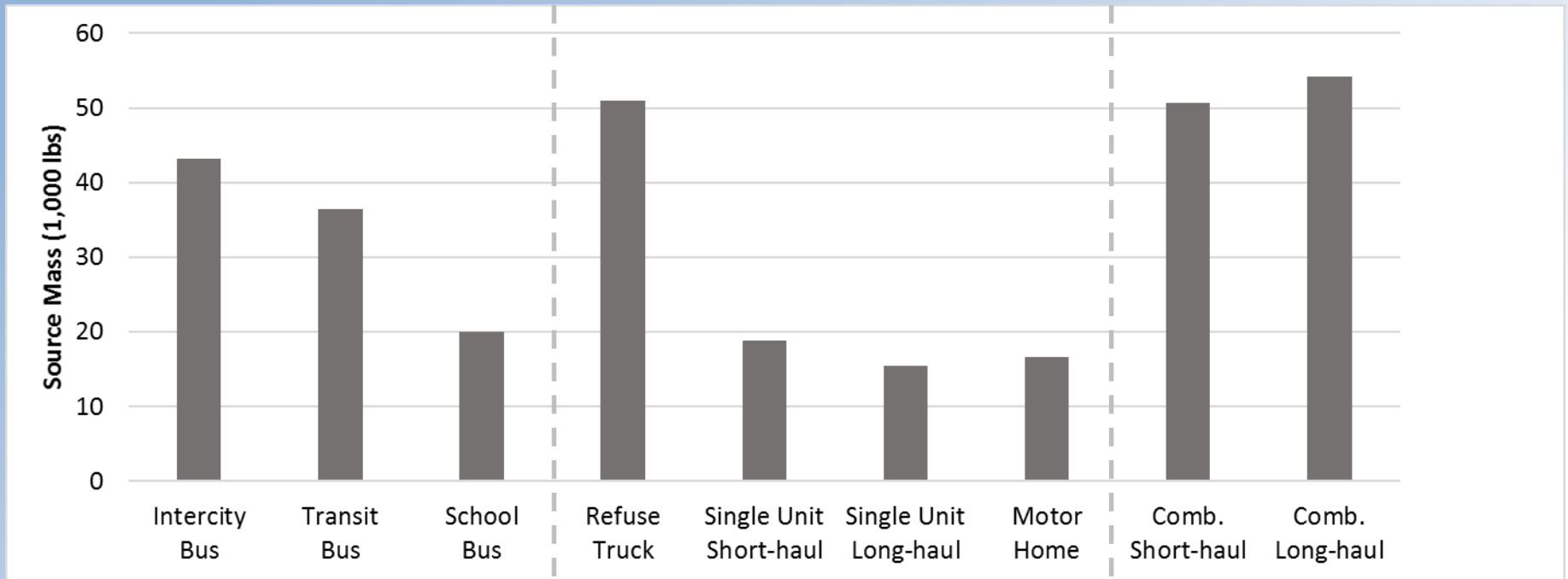


# Background

- Source mass represents the average weight of a given source type, which includes the weight of the vehicle, occupants, fuel, and payload
- It is used in calculating operating mode distributions from driving schedules, along with road load coefficients, and thus determines emissions
- The SourceUseTypePhysics table in the default database contains source mass and the A, B, and C road load coefficients
- In MOVES2014, these values could only vary by source type and model year, and are based on 2002 VIUS data
- Due to changes made to incorporate HD GHG Phase 2 in MOVES201X, these values can now also vary by regulatory class



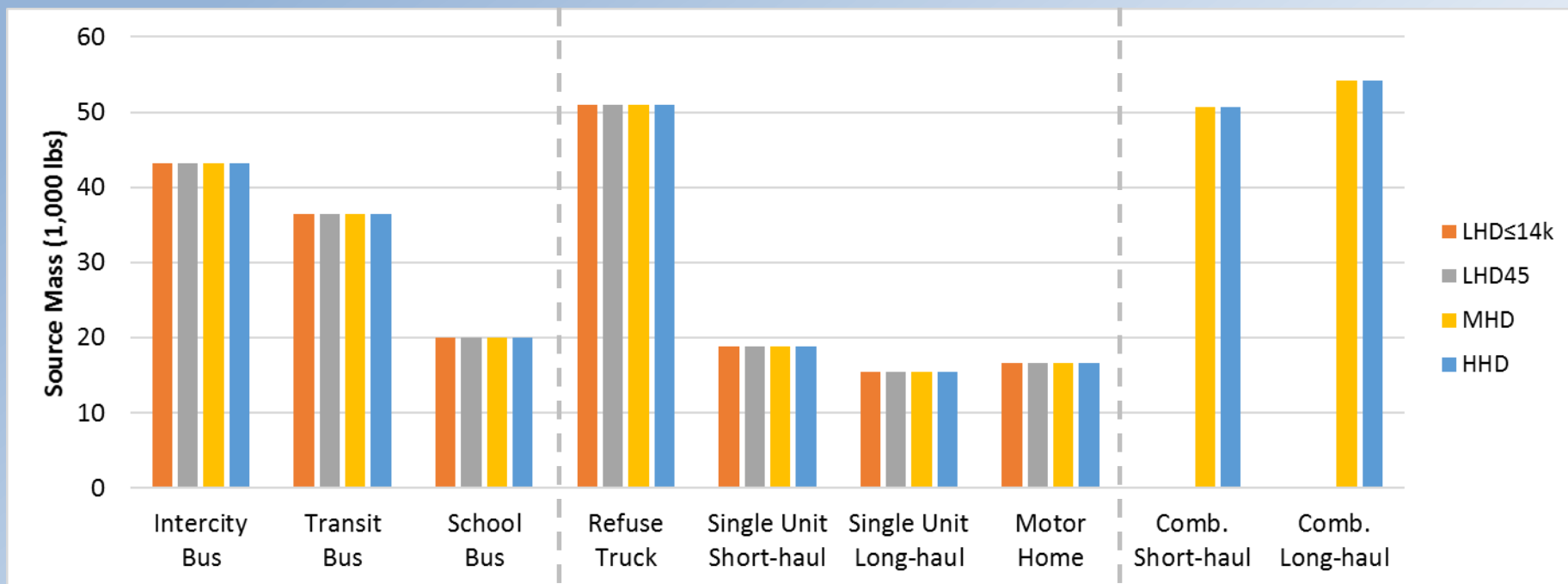
# MOVES2014 Source Masses



- Although each source type has one average mass, each source type has a distribution of one or more regulatory classes



# MOVES2014 Source Masses in the MOVES201X Framework



Regulatory Class	Description	GVWR Range (lbs)
LHD≤14k	Class 2b “dualies” and Class 3	8,500 < GVWR ≤ 14,000
LHD45	Classes 4 and 5	14,000 < GVWR ≤ 19,500
MHD	Classes 6 and 7	19,500 < GVWR ≤ 33,000
HDD	Class 8	GVWR > 33,000

# Vehicle Travel Information System

- The Federal Highway Administration compiles truck weight measurements, typically from weigh-in-motion systems
- These data are made available through VTRIS<sup>1</sup> by truck type and axle count for a particular state and year

## Sample data:

FHWA VEHICLE CLASS	AVERAGE NUMBER WEIGHED	EPA estimated weight class		
		AVERAGE GROSS		Class
		WT kg	WT lb	
Single Unit Trucks: 2-axle, 6-tire	508	4852	10,697	3
Single Unit Trucks: 3 axle	90	11167	24,619	6
Single Unit Trucks: 4 axle, or more	10	24477	53,962	8
<b>All Single Unit</b>	608	6435	14,187	
Single Trailer Trucks: 4-axles, or less	161	13040	28,748	7
Single Trailer Trucks: 5-axle	2714	24927	54,954	8
Single Trailer Trucks: 6-axle, or more	34	29464	64,956	8
<b>All Single Trailer</b>	2909	24271	53,508	
Multi-Trailer Trucks: 5-axle, or less	99	25612	56,464	8
Multi-Trailer Trucks: 6-axle	28	26322	58,029	8
Multi-Trailer Trucks: 7-axle, or more	8	43000	94,798	8
<b>All Multi-Trailer</b>	135	26906	59,317	
<b>All TRUCKS:</b>	3652	21076	46,464	
<b>All COMB.</b>	3044	24376	53,739	



# Calculating Source Masses by Regulatory Class

- MOVES needs national source masses which can vary by source type, regulatory class, and model year
- This analysis used the following mapping between FHWA Vehicle Classes and MOVES Source Types and Regulatory Classes:

Source Types	Regulatory Class	FHWA Vehicle Class
Refuse Truck Single-unit Short-haul Truck Single-unit Long-haul Truck Motor Home	LHD≤14k	Single-unit Trucks: 2-axle 6-tire
	LHD45	Single-unit Trucks: 2-axle 6-tire
	MHD	Single-unit Trucks: 3-axle
	HHD	Single-unit Trucks: 4-axle or more
Combination Short-haul Truck Combination Long-haul Truck	MHD	Single Trailer Trucks: 4-axles or less
	HHD	Single Trailer Trucks: 5-axle, 6-axle or more All Multi-Trailer Trucks
Intercity Buses Transit Buses School Buses	LHD≤14k	Single-unit Trucks: 2-axle 6-tire
	LHD45	Single-unit Trucks: 2-axle 6-tire
	MHD	Single-unit Trucks: 3-axle Single Trailer Trucks: 4-axles or less
	HHD	Single-unit Trucks: 4-axle or more Single Trailer Trucks: 5-axle, 6-axle or more All Multi-Trailer Trucks

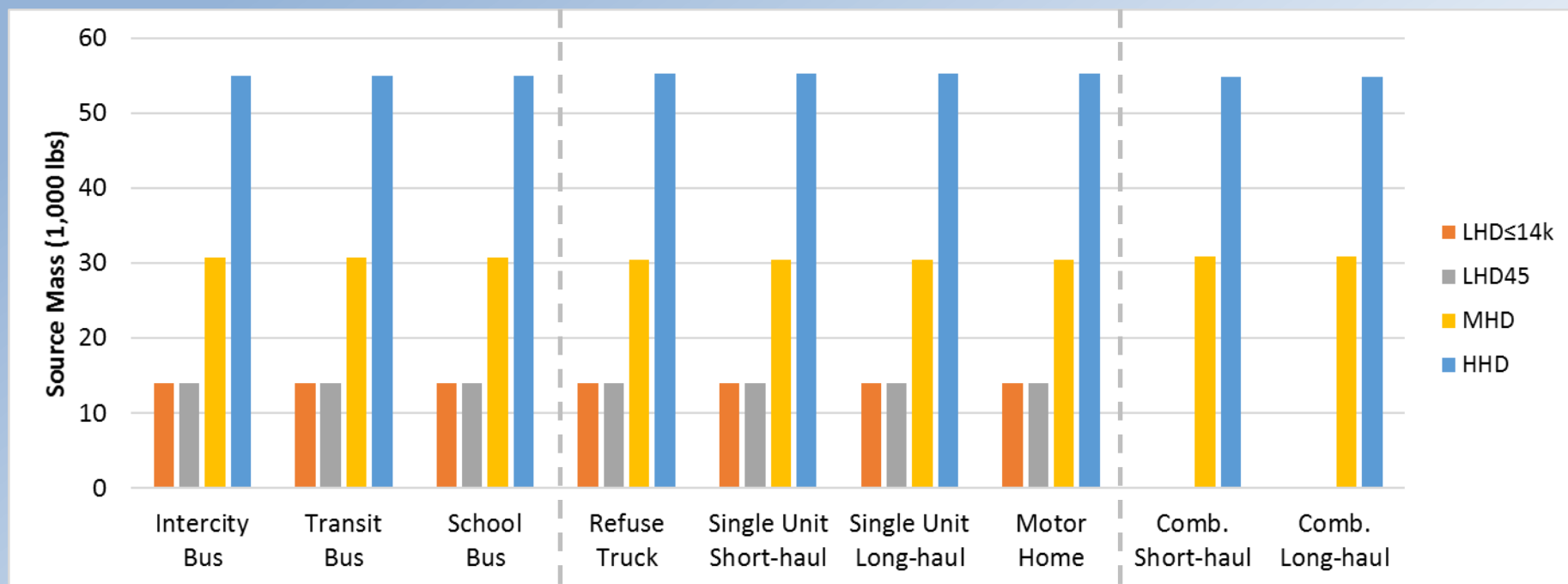
# Calculating Source Masses by Regulatory Class

- Where multiple classes map to source type / regulatory class combination, an average mass was calculated by weighting with number of observations
- The national average source masses were calculated by VMT-weighting each state's average mass using VM-2 data<sup>2</sup>
- VTRIS data from 2013 were used as the basis for all model years; masses MY2014+ were then modified to account for the Heavy-Duty Greenhouse Gas rules





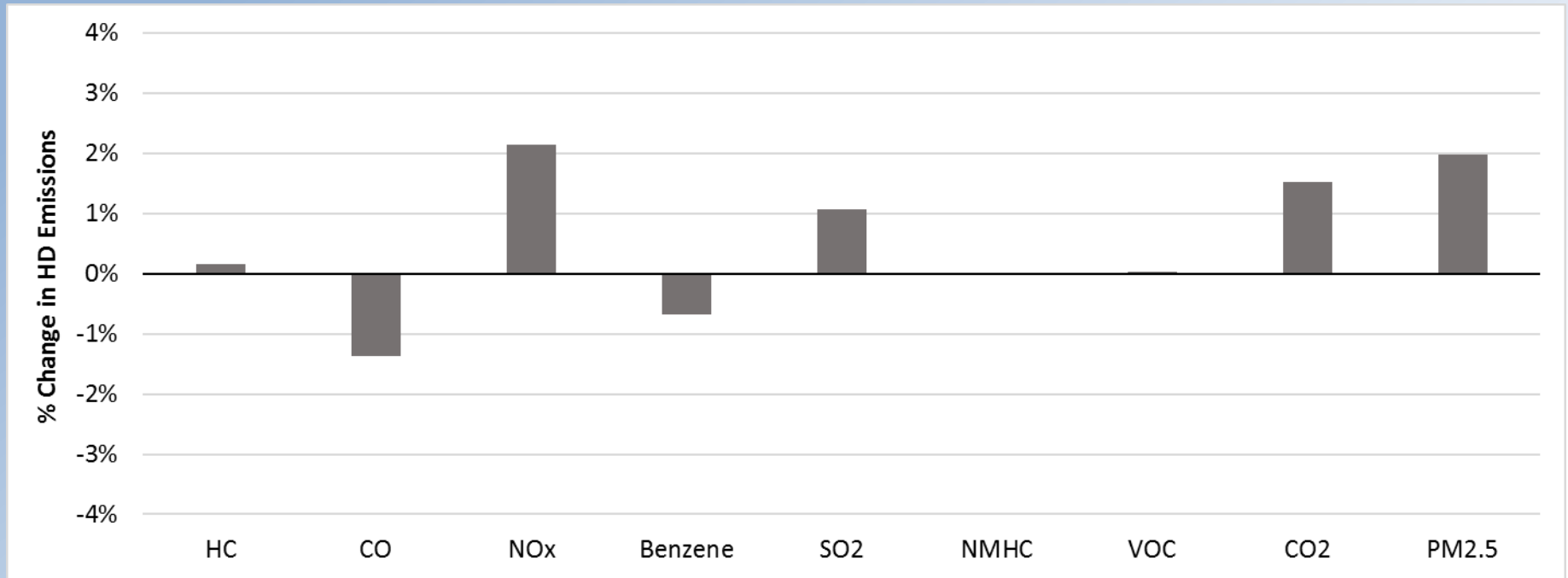
# Preliminary Results



- This methodology calculates masses by regulatory class for buses, single unit trucks, and combination trucks
- Results show little variation between vehicle classes



# Preliminary MOVES Impacts



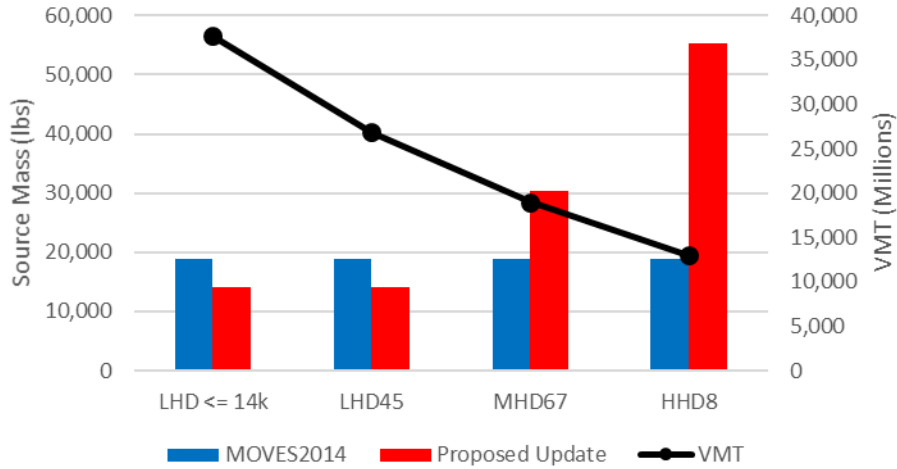
- Preliminary impacts calculated using all HD source types and fuel types, looking at tailpipe and running crankcase emissions
- Positive differences are emission increases
- Results are for 2010 at the national scale



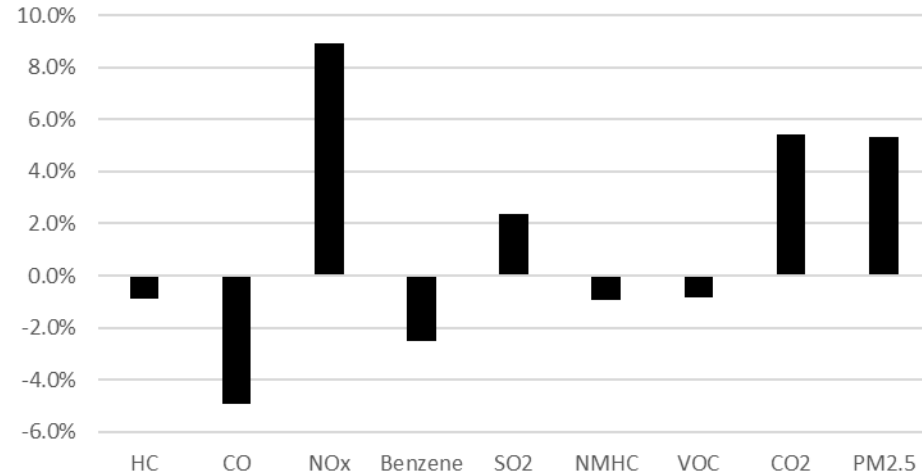
# Preliminary MOVES Impacts

## Subset: Single Unit Short-haul Trucks

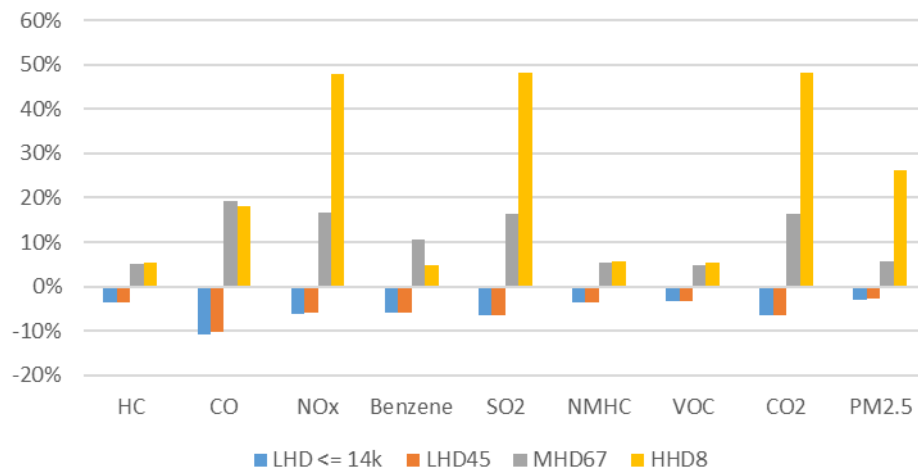
Source Mass and VMT by Regulatory Class



Preliminary Inventory Impact



Preliminary Impact by Regulatory Class



# Potential Further Changes

- EPA is evaluating changes to Class 8 Refuse Trucks source masses because these trucks are subject to a lower Federal weight limit
- EPA is also evaluating changes to bus source masses:
  - A study by the American Public Transportation Association<sup>3</sup> has estimates of transit bus masses
  - An average source mass could be derived by weighting these masses with data from the National Transit Database<sup>4</sup>



# Requested Feedback

- Are the data sources and analysis approaches described here appropriate and reasonable?
- Are there better data sources or techniques for estimating national bus source masses?



# References

1. Federal Highway Administration. *Vehicle Travel Information System (VTRIS)*.  
<https://www.fhwa.dot.gov/ohim/ohimvtis.cfm>.
2. Federal Highway Administration. *Highway Statistics Series*.  
<https://www.fhwa.dot.gov/policyinformation/statistics.cfm>.
3. American Public Transportation Association. *An Analysis of Transit Bus Axle Weight Issues*. November, 2014.
4. Federal Transit Administration. *National Transit Database*.  
<https://www.transit.dot.gov/ntd>

