

Review of Fine Particulate Matter Emissions Inventories and Comparison of Emissions Estimates with Observations from Recent Field Studies

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Mobile sources

Summary of on-road mobile emissions inventories.		Summary of ambient mobile emissions inventories.	
Methodology provided by the EPA (2005-2006)	9% of ambient conditions	Methodology provided by the EPA (2005-2006)	9% of ambient conditions
Major source types	On-road vehicles (includes some tanks and trailers)	Major source types	Construction equipment, industrial equipment, aircraft, boats, ships, and boats, some equipment
Emissions approach	Only on-road vehicles and trailers	Emissions approach	Includes on-road vehicles and other mobile sources per different methods and methods of emissions based by vehicle type
Emissions approach	Indirect emissions of transportation equipment products	Emissions approach	Indirect emissions of transportation equipment products
Tracers used to quantify emissions	Indirect tracers used to quantify emissions	Tracers used to quantify emissions	Indirect tracers used to quantify emissions
Comparison	EC/OC ratio is 20-30% and 20-30% EC/OC and 20-30% EC/OC	Comparison	EC/OC ratio is 20-30% and 20-30% EC/OC
Site location	Urban public roads at ~10 km from	Site location	Urban public roads at ~10 km from

Comparison of top-down and bottom-up mobile emissions inventories					
Location	Inventory of On-Road Mobile Emissions Inventory (Emissions from On-Road Mobile Sources)		Summary of Ambient Mobile Emissions Inventory (Emissions from On-Road Mobile Sources)		Discrepancy between inventories
	Method	Approach	Method	Approach	
Atlanta	10	15	20		20-30
San Joaquin Valley	10	15	20		20-30
Los Angeles	10	15	20		15, 20-30
Texas (Houston)	10	15	20		20-30
Florida	10	15	20		20-30
New York (New York City)	10	15	20		20-30
Washington	10	15	20		20-30
Illinois	10	15	20		20-30
Ohio	10	15	20		20-30
Arizona	10	15	20		20-30
Florida	10	15	20		20-30
Midwest average	10	15	20		15, 20, 20-30

- ❖ On-road emissions uncertainties highlighted by fact that study comparing fuel-based and VMT emissions estimates varied by a factor of 2-4
- ❖ Tire and brake wear estimates are still very uncertain
- ❖ In-depth traffic data are needed for proper temporal and spatial resolution
- ❖ EC/OC fraction from diesel and gasoline vehicles found to vary significantly based on vehicle type and driving conditions.
- ❖ Uncertainty in non-road emissions estimates comes from the fact that emissions factors are based on tests of a few types of equipment and applied to a wide range of equipment.
- ❖ Activity factors for non-road equipment are not well characterized.
- ❖ Little information is available on size distribution and composition of PM from non-road equipment.

Fugitive Dust

Summary of fugitive dust emissions inventories.			
Methodology provided by the EPA (2005-2006)	9% of ambient conditions	Methodology provided by the EPA (2005-2006)	9% of ambient conditions
Major source types	On-road vehicles (includes some tanks and trailers)	Major source types	Construction equipment, industrial equipment, aircraft, boats, ships, and boats, some equipment
Emissions approach	Only on-road vehicles and trailers	Emissions approach	Includes on-road vehicles and other mobile sources per different methods and methods of emissions based by vehicle type
Emissions approach	Indirect emissions of transportation equipment products	Emissions approach	Indirect emissions of transportation equipment products
Tracers used to quantify emissions	Indirect tracers used to quantify emissions	Tracers used to quantify emissions	Indirect tracers used to quantify emissions
Comparison	EC/OC ratio is 20-30% and 20-30% EC/OC and 20-30% EC/OC	Comparison	EC/OC ratio is 20-30% and 20-30% EC/OC
Site location	Urban public roads at ~10 km from	Site location	Urban public roads at ~10 km from

- ❖ The NEI predicts that dust makes up a third of all fine PM emissions
- ❖ Ambient measurements differ from the NEI by a factor of 2 to 10
- ❖ Current road dust estimates may not properly account for silt loading, vehicle weight, and vehicle speed
- ❖ Construction dust emissions calculated using one factor for all sites – this does not account for silt loading, soil moisture or activity types
- ❖ Near source deposition may account for some of the discrepancy between top-down and bottom-up estimates
- ❖ A great deal of work is needed to resolve discrepancies.

Residential Fuel Combustion and Outdoor Burning

Summary of residential fuel combustion and outdoor burning inventories.			
Methodology provided by the EPA (2005-2006)	9% of ambient conditions	Methodology provided by the EPA (2005-2006)	9% of ambient conditions
Major source types	On-road vehicles (includes some tanks and trailers)	Major source types	Construction equipment, industrial equipment, aircraft, boats, ships, and boats, some equipment
Emissions approach	Only on-road vehicles and trailers	Emissions approach	Includes on-road vehicles and other mobile sources per different methods and methods of emissions based by vehicle type
Emissions approach	Indirect emissions of transportation equipment products	Emissions approach	Indirect emissions of transportation equipment products
Tracers used to quantify emissions	Indirect tracers used to quantify emissions	Tracers used to quantify emissions	Indirect tracers used to quantify emissions
Comparison	EC/OC ratio is 20-30% and 20-30% EC/OC and 20-30% EC/OC	Comparison	EC/OC ratio is 20-30% and 20-30% EC/OC
Site location	Urban public roads at ~10 km from	Site location	Urban public roads at ~10 km from

Comparison of top-down and bottom-up residential fuel combustion and outdoor burning inventories					
Location	Inventory of Residential Fuel Combustion and Outdoor Burning Inventory (Emissions from Residential Fuel Combustion and Outdoor Burning)		Summary of Ambient Mobile Emissions Inventory (Emissions from On-Road Mobile Sources)		Discrepancy between inventories
	Method	Approach	Method	Approach	
Atlanta	10	15	20		20-30
San Joaquin Valley	10	15	20		20-30
Los Angeles	10	15	20		15, 20-30
Texas (Houston)	10	15	20		20-30
Florida	10	15	20		20-30
New York (New York City)	10	15	20		20-30
Washington	10	15	20		20-30
Illinois	10	15	20		20-30
Ohio	10	15	20		20-30
Arizona	10	15	20		20-30
Florida	10	15	20		20-30
Midwest average	10	15	20		15, 20, 20-30

- ❖ Estimates made from ambient measurements cannot accurately distinguish between residential fuel combustion and forest fires/prescribed burns.
- ❖ The use of potassium as a tracer is problematic as it is also found in cooking PM
- ❖ The use of levoglucosan as a tracer is promising

Commercial cooking

Summary of commercial cooking emissions inventories.			
Methodology provided by the EPA (2005-2006)	9% of ambient conditions	Methodology provided by the EPA (2005-2006)	9% of ambient conditions
Major source types	On-road vehicles (includes some tanks and trailers)	Major source types	Construction equipment, industrial equipment, aircraft, boats, ships, and boats, some equipment
Emissions approach	Only on-road vehicles and trailers	Emissions approach	Includes on-road vehicles and other mobile sources per different methods and methods of emissions based by vehicle type
Emissions approach	Indirect emissions of transportation equipment products	Emissions approach	Indirect emissions of transportation equipment products
Tracers used to quantify emissions	Indirect tracers used to quantify emissions	Tracers used to quantify emissions	Indirect tracers used to quantify emissions
Comparison	EC/OC ratio is 20-30% and 20-30% EC/OC and 20-30% EC/OC	Comparison	EC/OC ratio is 20-30% and 20-30% EC/OC
Site location	Urban public roads at ~10 km from	Site location	Urban public roads at ~10 km from

- ❖ Estimation methods have recently been developed and employed.
- ❖ Limited top-down and bottom-up comparisons in reasonable agreement
- ❖ Ambient measurements are hard to make accurately due to lack of truly unique tracer
- ❖ Organic acids (oleic and palmitic acids) hold promise as tracers

Comparison of top-down and bottom-up commercial cooking emissions inventories					
Location	Inventory of Commercial Cooking Emissions Inventory (Emissions from Commercial Cooking)		Summary of Ambient Mobile Emissions Inventory (Emissions from On-Road Mobile Sources)		Discrepancy between inventories
	Method	Approach	Method	Approach	
Atlanta	10	15	20		20-30
San Joaquin Valley	10	15	20		20-30
Los Angeles	10	15	20		15, 20-30
Texas (Houston)	10	15	20		20-30
Florida	10	15	20		20-30
New York (New York City)	10	15	20		20-30
Washington	10	15	20		20-30
Illinois	10	15	20		20-30
Ohio	10	15	20		20-30
Arizona	10	15	20		20-30
Florida	10	15	20		20-30
Midwest average	10	15	20		15, 20, 20-30

Point Sources

Summary of point source emissions inventories.			
Methodology provided by the EPA (2005-2006)	9% of ambient conditions	Methodology provided by the EPA (2005-2006)	9% of ambient conditions
Major source types	On-road vehicles (includes some tanks and trailers)	Major source types	Construction equipment, industrial equipment, aircraft, boats, ships, and boats, some equipment
Emissions approach	Only on-road vehicles and trailers	Emissions approach	Includes on-road vehicles and other mobile sources per different methods and methods of emissions based by vehicle type
Emissions approach	Indirect emissions of transportation equipment products	Emissions approach	Indirect emissions of transportation equipment products
Tracers used to quantify emissions	Indirect tracers used to quantify emissions	Tracers used to quantify emissions	Indirect tracers used to quantify emissions
Comparison	EC/OC ratio is 20-30% and 20-30% EC/OC and 20-30% EC/OC	Comparison	EC/OC ratio is 20-30% and 20-30% EC/OC
Site location	Urban public roads at ~10 km from	Site location	Urban public roads at ~10 km from

- ❖ Many point source emissions are estimated using emissions factors from EPA's AP-42.
- ❖ These emissions factors have varying degrees of reliability

Comparison of top-down and bottom-up point source emissions inventories					
Location	Inventory of Point Source Emissions Inventory (Emissions from Point Source Emissions)		Summary of Ambient Mobile Emissions Inventory (Emissions from On-Road Mobile Sources)		Discrepancy between inventories
	Method	Approach	Method	Approach	
Atlanta	10	15	20		20-30
San Joaquin Valley	10	15	20		20-30
Los Angeles	10	15	20		15, 20-30
Texas (Houston)	10	15	20		20-30
Florida	10	15	20		20-30
New York (New York City)	10	15	20		20-30
Washington	10	15	20		20-30
Illinois	10	15	20		20-30
Ohio	10	15	20		20-30
Arizona	10	15	20		20-30
Florida	10	15	20		20-30
Midwest average	10	15	20		15, 20, 20-30