



Benzo(a)pyrene Emissions in the Great Lakes Region: A Reassessment of 2002 Emissions

Benzo(a)Pyrene Emissions in the Great Lakes Region

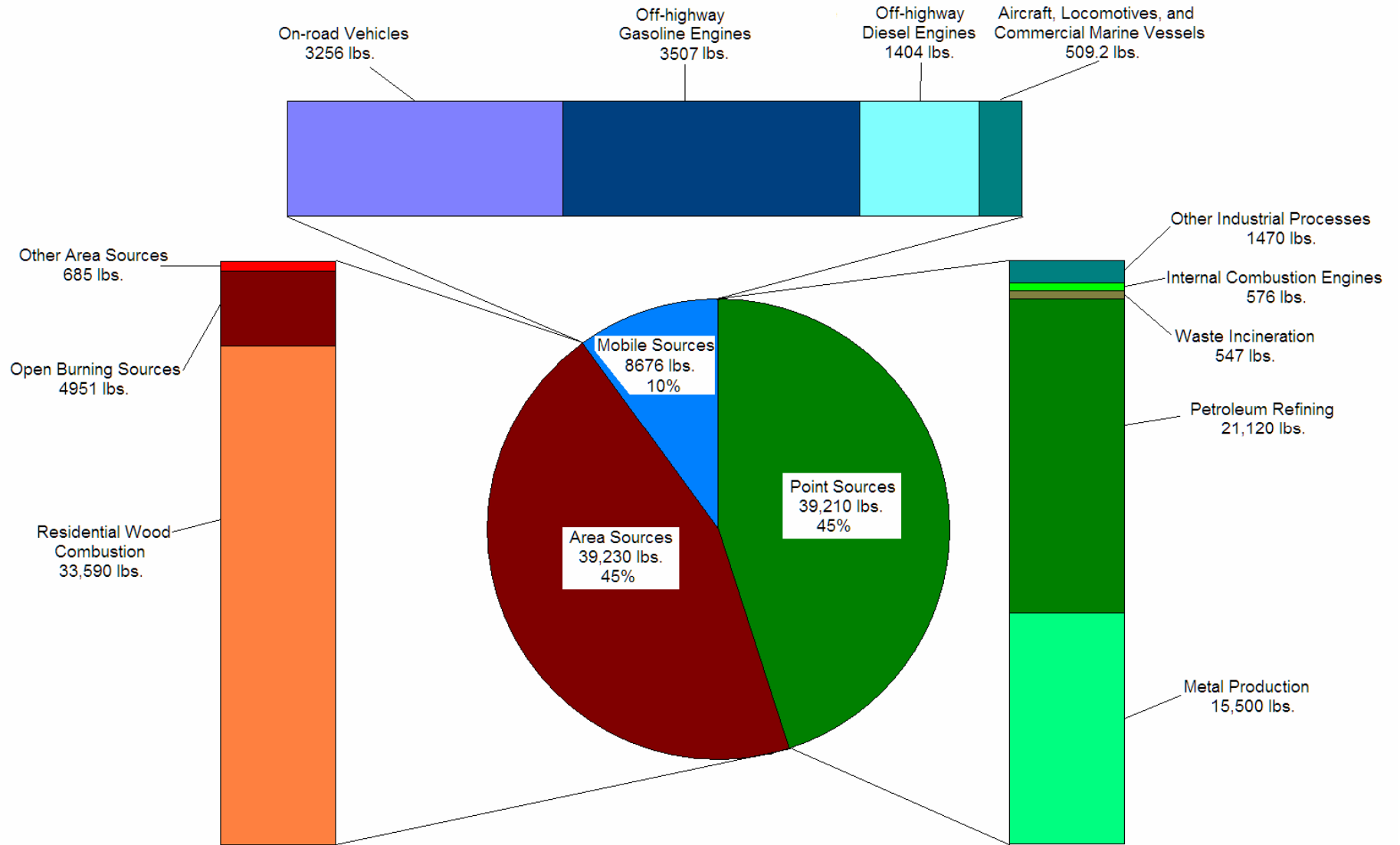
The Great Lakes Regional Toxic Air Emissions Inventory

- Integrates HAP inventories for 8 states and Ontario
- Inventories exist for 1996-2002
- Latest includes:
 - > 200 compounds
 - >2000 source types
 - ~12,000 facilities

Benzo(a)pyrene Assessment

- Review 2002 data by:
 - Comparing emission sources reported to existing emission factors
 - Comparing major regional categories
 - Examining specific sources or categories
- Create revised dataset

Original Inventory

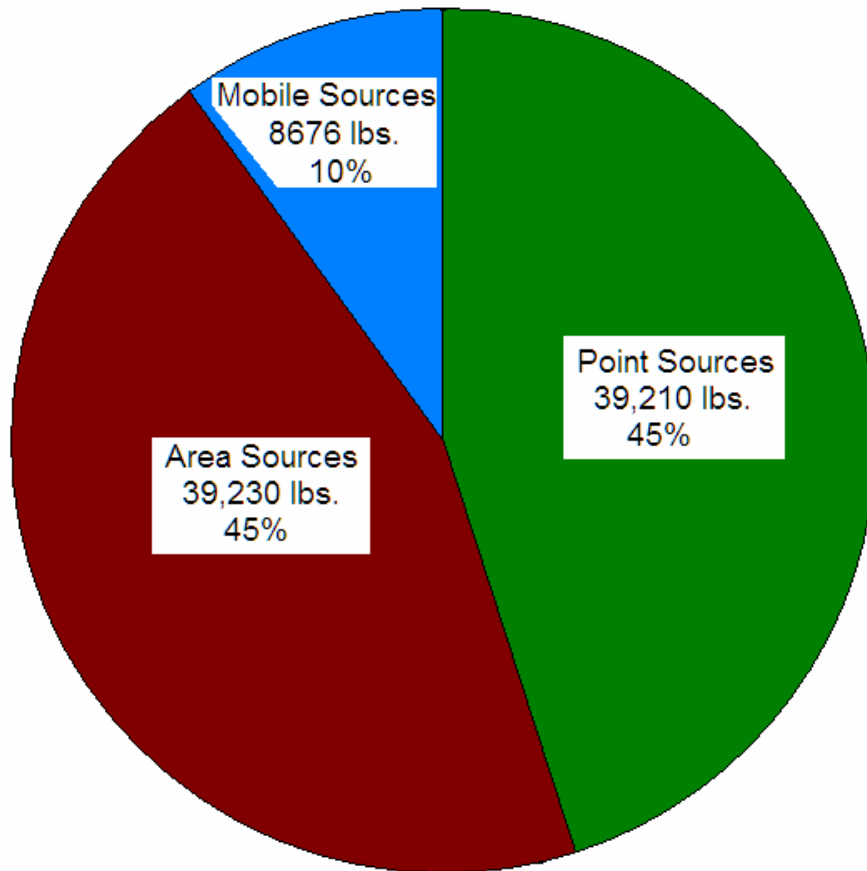


Major areas of change

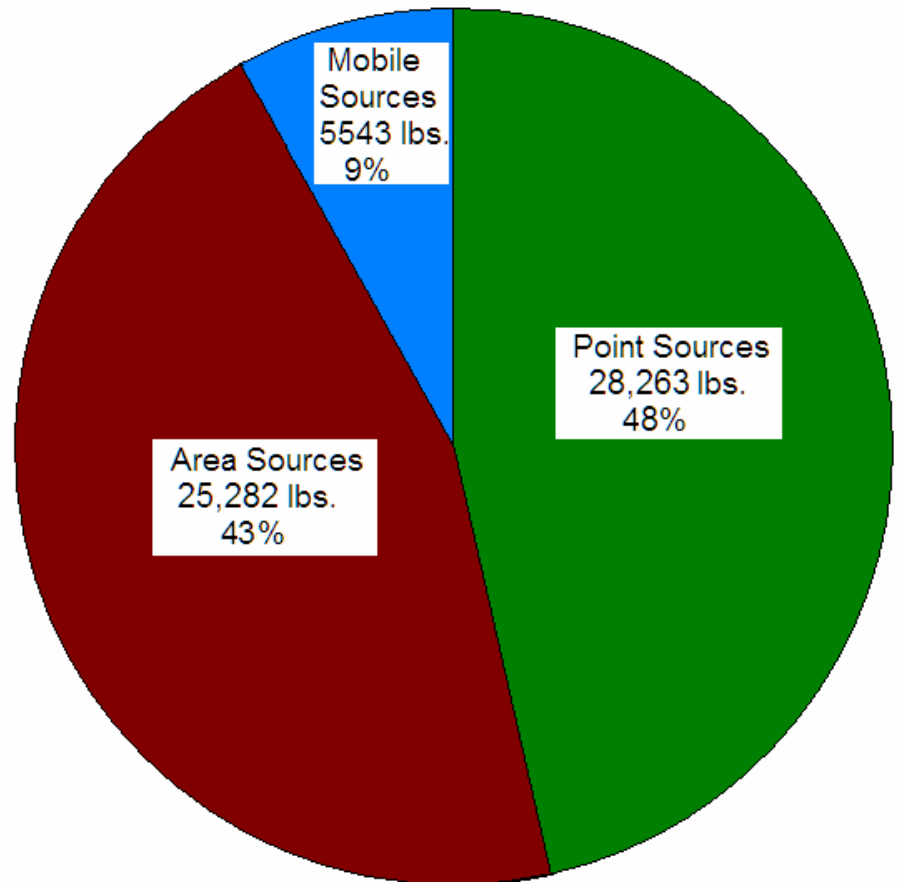
Category		Pre-Assessment Inventory		Post-Assessment Inventory		% Change
		Emissions (lbs.)	Percent of Total	Emissions (lbs.)	Percent of Total	
Point	Metal Production	15,500	17.8%	19,430	32.9%	25.4%
	Petroleum Refining	21,120	24.2%	6615	11.2%	-68.7%
	Waste Incineration	547	0.6%	922	1.6%	68.6%
	Internal Combustion Engines	576	0.7%	1006	1.7%	74.7%
	External Combustion Boilers	95.27	0.1%	99.4	0.2%	4.3%
	Other Industrial Processes	1375	1.6%	192	0.3%	-86.0%
Area	Residential Wood Burning	33,590	38.5%	16,720	28.3%	-50.2%
	Open Burning Sources	4951	5.7%	7,848	13.3%	+58.6%
	Stationary Fuel Combustion	231.4	0.3%	36.97	0.1%	-84.0%
	Other Area Sources	494.9	0.6%	681.2	1.2%	37.6%
Mob.	On-road Vehicles	3256	3.7%	3409	5.6%	4.7%
	Non-road Eng. and Veh.	5420	6.2%	2134	3.5%	-60.6%
Total		87,157		59,087		-32.2%

Revisions by Source Type

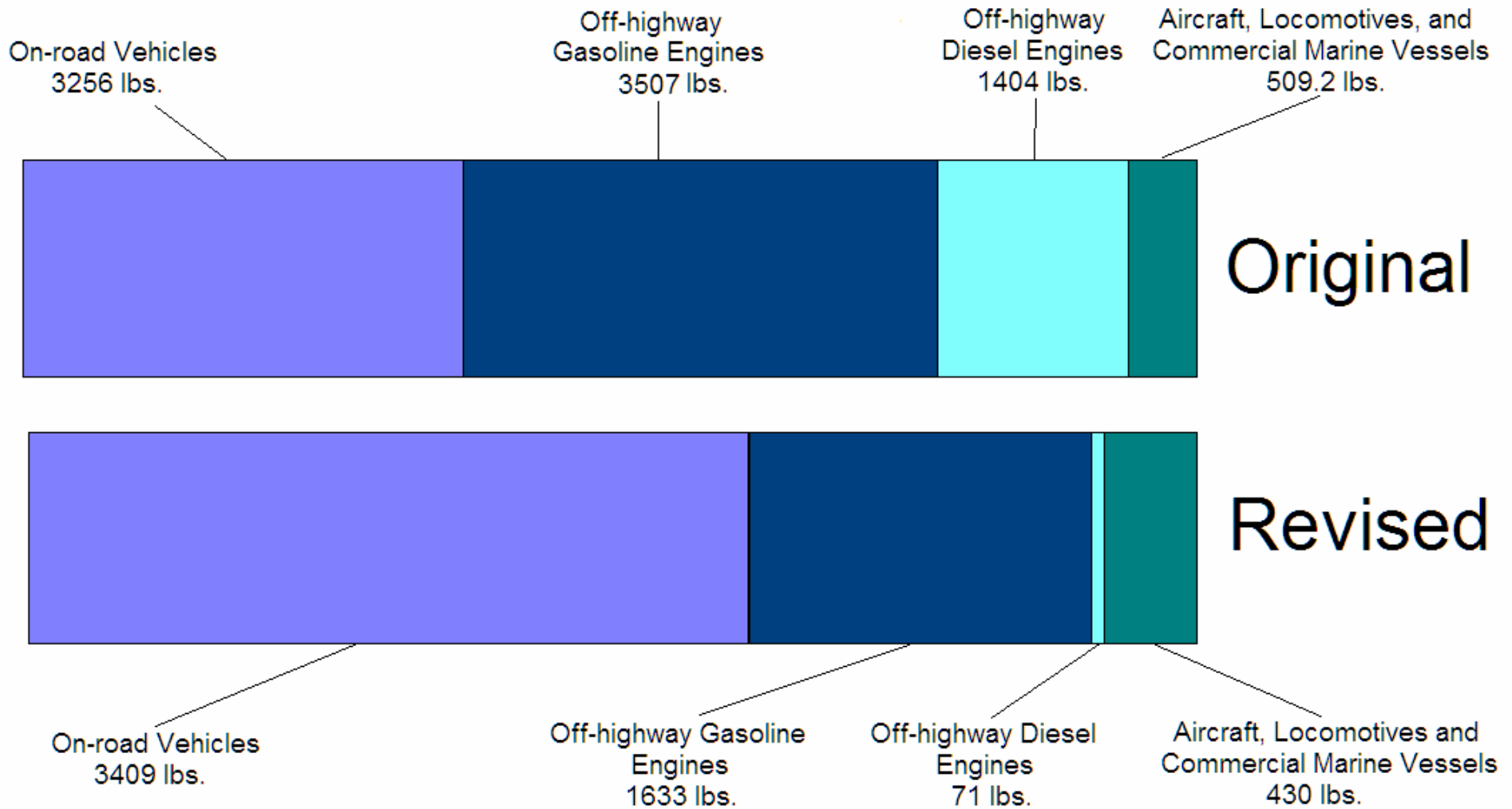
Original



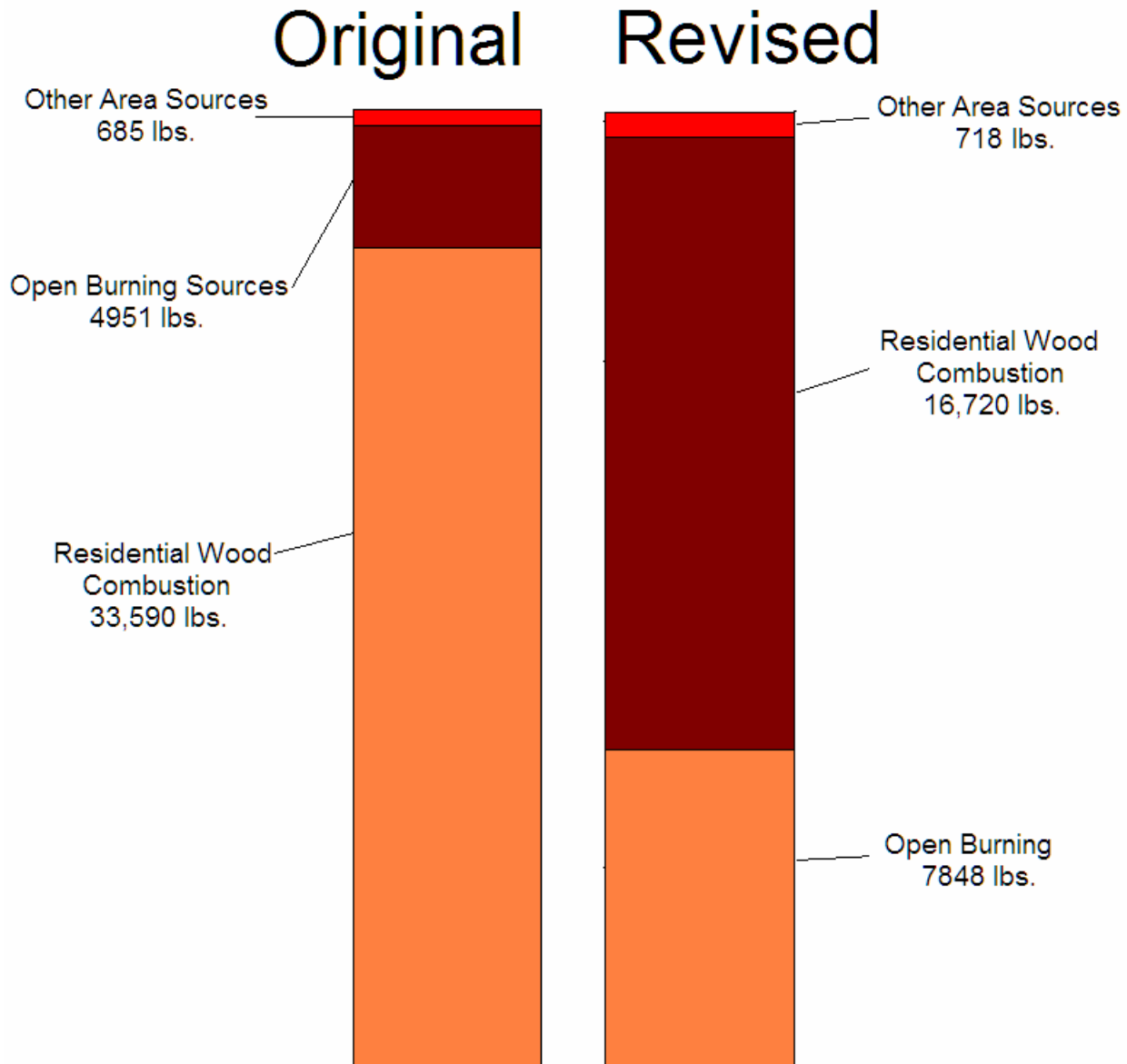
Revised



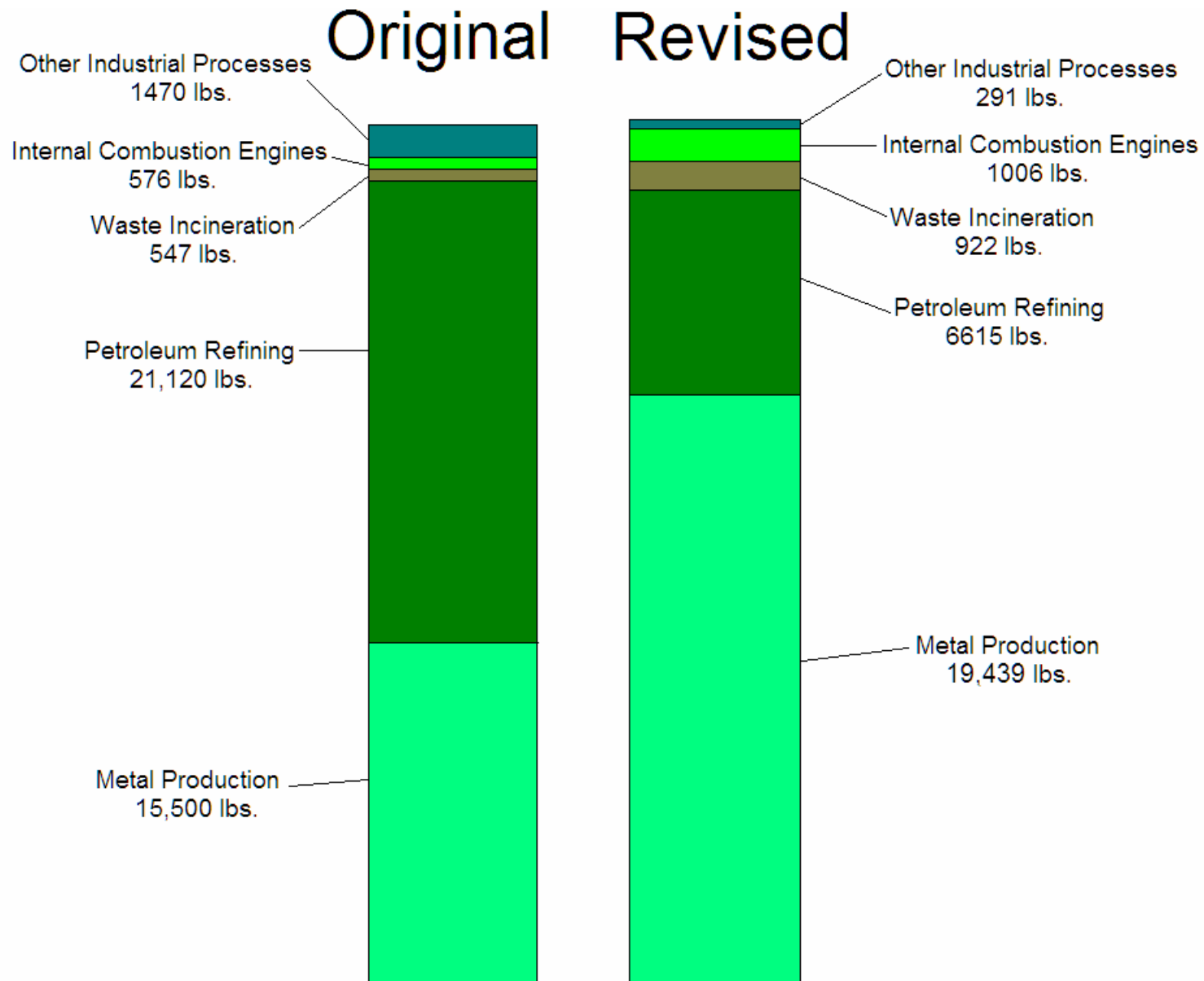
Mobile Sources



Area Sources



Point Sources



Major Decreasing Categories

- Fluidized Catalytic Cracking Units (FCCUs)
- Residential Wood Burning
- Non-road Sources

FCCUs

- Down 14,500 lbs. (70%) to 6520 lbs.
- Several states decreasing facility estimates based on control factors
- Several states retaining previous estimates
- Inclusion of Illinois (<1 lb)

Residential Wood Burning

- Down 16,870 lbs. (50%) to 16,720 lbs.
- Substantial decrease in New York
- Inclusion of Pennsylvania
- Changes in other states, especially inclusion of “conventional” fireplaces

Mobile Sources

- Down 3130 lbs. (36%) to 5543 lbs.
- Inclusion of MN on-road data
- Correction of errors in OH non-road data
- Total mobile contribution ~10%
- Gasoline >> Diesel

Other Decreasing Categories

- Non-point, stationary source combustion
 - Down 195 lbs (84%) to 37 lbs
 - Changes in NY Electric Utility estimate
- Pulp, paper and wood product mfg.
 - Down 1160 lbs (97%) to 41 lbs
 - Correction to an IN facility

Major Increasing Categories

- Open Burning
 - Household waste, wildfires and prescribed burns
- Metal Production
- Internal Combustion Engines
- Waste Incineration
- Commercial Cooking

Open Burning

- Increased 2900 lbs (59%) to 10,770 lbs
 - Res. waste burning increased 3085 lbs (95%) to 6339 lbs
 - Estimates from 6 states up from 4
 - Wildfires decreased 220 lbs (20%) to 973 lbs
 - Inclusion of Ontario; adjustment of other states
 - Prescribed burning increased 33 lbs (7%) to 533 lbs.
 - Estimates from 6 states up from 4
 - Some states (e.g., NY) have ban in place

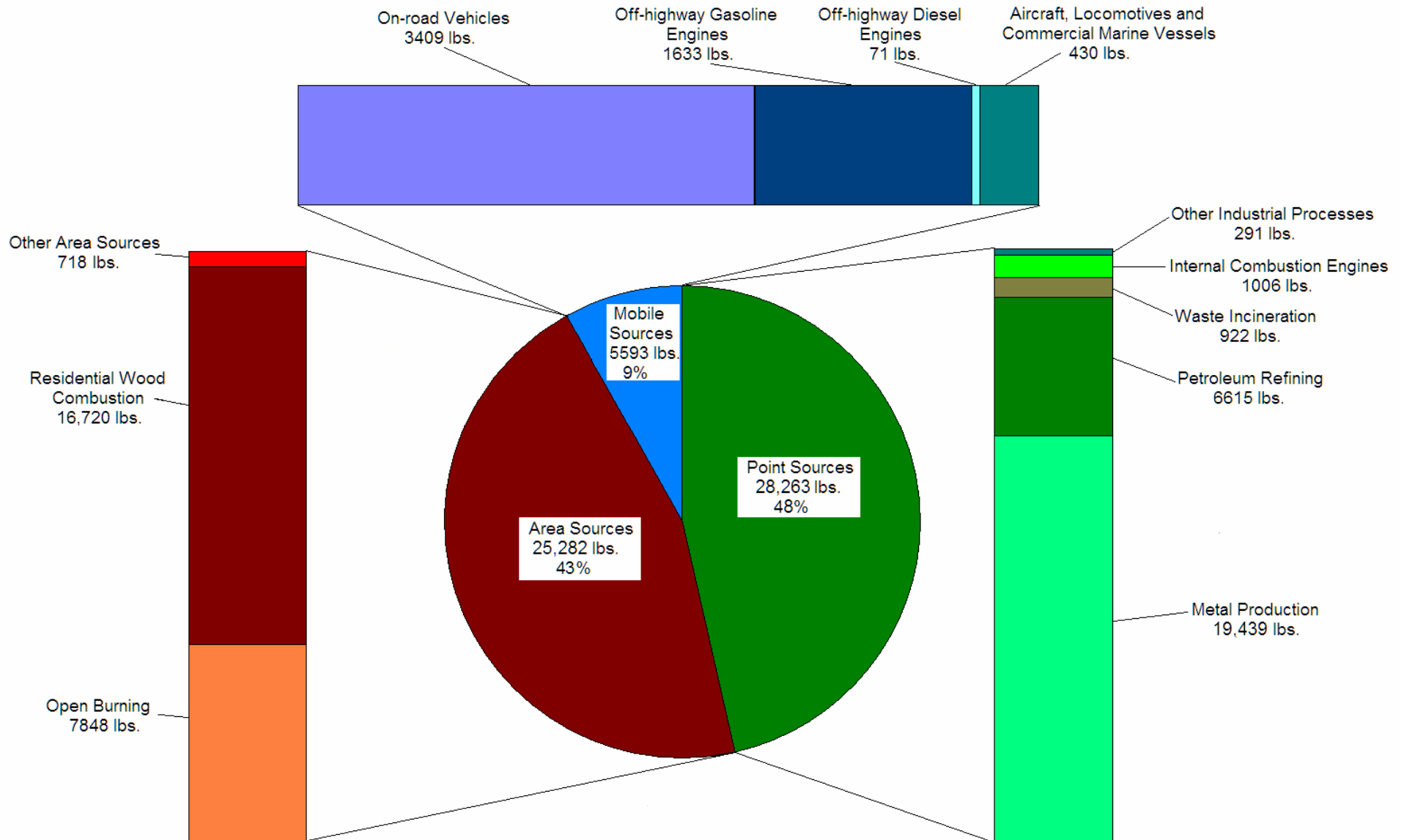
Metal Production

- Increase 3930 lbs (25%) to 19,430 lbs
 - Includes: Aluminum ore reduction
Coke oven operation
Electric arc furnaces
Other steel manufacturing processes
 - Decrease in estimates from Indiana
 - Inclusion of estimates from New York
 - “Coke Oven Gas” estimate of 1,360,000 lbs in 2002

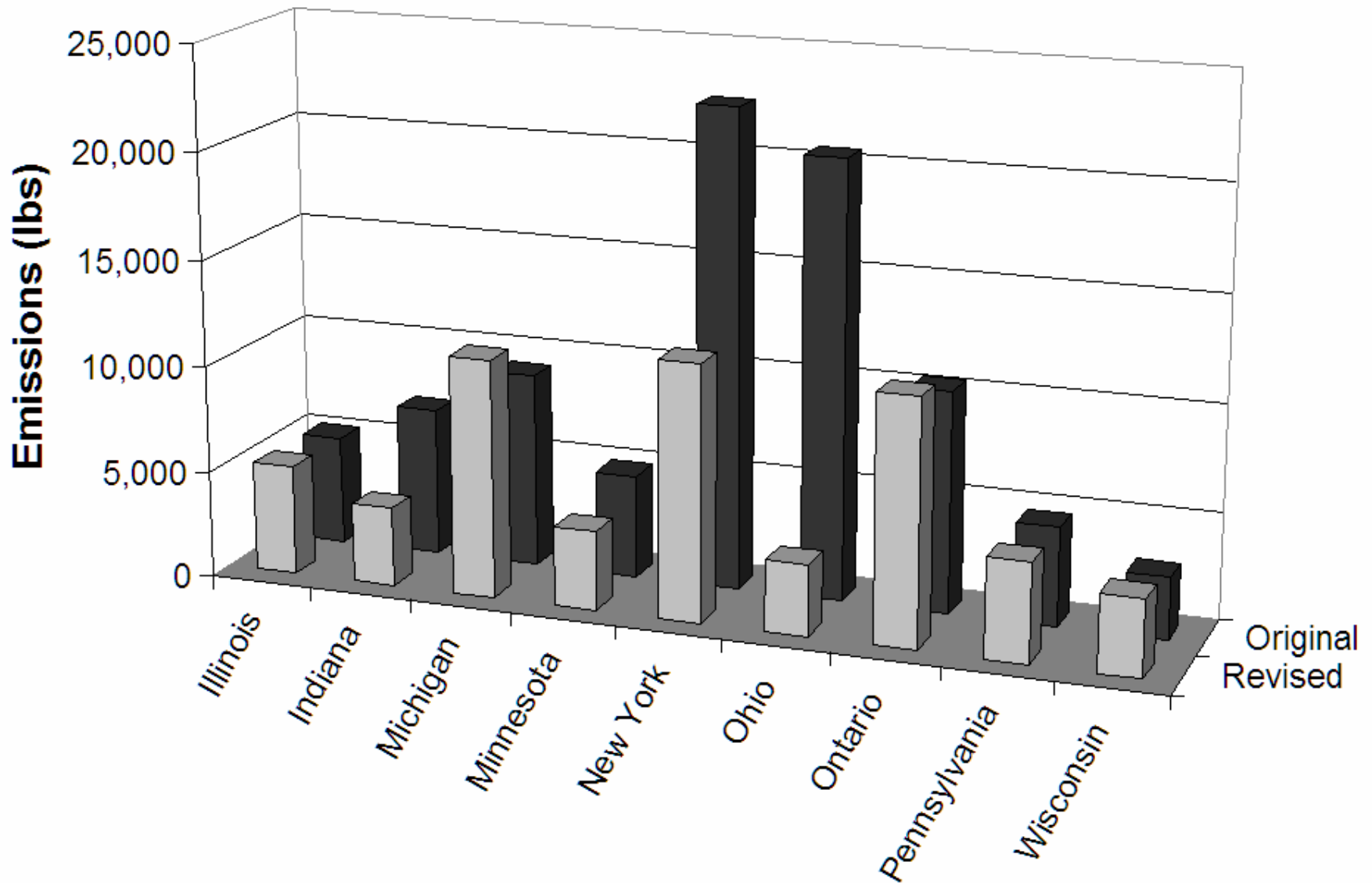
Other Increasing Sources

- Internal Combustion Engines
 - Increased 430 lbs (75%) to 1006 lbs
- Waste Incineration
 - Increased 375 lbs (69%) to 922 lbs
- Commercial Cooking
 - Increased 226 lbs (211%) to 333 lbs
 - Estimates from 6 states up from 3

Revised Inventory



Emissions by State/Province



Revised Inventory Improvements

- Decreased many large outlier sources
- Included previously omitted sources
- Improved inter-jurisdictional consistency of sources estimated
- Much improved overall quality
- Pointed out remaining needs and uncertainties

Sources Needing Investigation

- Uncertainty in methods and factors:
 - Residential waste burning
 - Wildfires and prescribed burning
- Evaluate facility estimate accuracy:
 - Metal production and FCCUs
- Other likely sources:
 - Outdoor wood boilers
 - Agricultural waste burning

Inventory may be useful for . . .

- Identifying key sources
- Determining potential control options
- Estimating exposure levels / risk
- Modeling local vs long-range contribution
- Problematic to use in tracking trends
 - Emphasis on improvements, not inter-annual consistency
 - Reductions can feed back to inventory slowly

Next Steps

- Prepare 2005 inventory, continue improvements where possible
- Conduct fate and exposure modeling using b(a)p inventory
- Could compare receptor modeling results for PAH to emission inventory results

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