Freight and Air Quality

Current and projected growth in freight traffic volumes will continue to congest our highways. Operational and physical capacity improvements are being made to address this growth so air quality does not continue to be adversely affected.

All internal combustion engines emit pollutants, but a recent Federal Highway Administration (FHWA) study, *Assessing the Effects of Freight Movement on Air Quality at the National and Regional Level,* reports that the contribution of diesel engines, which power most freight trucks, locomotives, and ships, are a major source of two particularly troublesome emissions—nitrogen oxides (NO_x) and particular matter 10 microns in diameter (PM-10).

NO_x emissions contribute to the formation of ground-level ozone, a major constituent of smog. Particulate matter, which consists of dust, dirt, soot, and smoke, also contributes to smog and causes low visibility in many parts of the United States. Heightened concerns about the environmental effects of increasing freight volumes have prompted public agencies and businesses to focus on ways to control these and other emissions from freight transportation sources, particularly diesel engines.

National Emissions

Heavy-duty vehicles are by far the largest contributors to U.S. freight-related NO_x and PM-10 emissions. Marine vessels are the next largest source, followed by railroads. Air freight contributes less than 1 percent of freight NO_x and PM-10 emissions.

As shown in Table 1, freight movement accounts for approximately half of all NO_x emissions from mobile sources and 27 percent of all NO_x emissions. Freight movement also produces 36 percent of all PM-10 emissions from mobile sources but less than 1 percent of total U.S. PM-10 emissions. Agricultural fields, wildfires, and road dust are the chief sources of PM-10 emissions.

Regional Emissions

The FHWA study also reports that freight movement is a major source of NO_x and PM-10 emissions at the regional level, based on analysis of the Baltimore, Chicago, Dallas-Fort Worth, Detroit, Houston, and Los Angeles areas. Across the six study areas, freight produced 40 percent to 52 percent of NO_x emissions from mobile sources and 29 percent to 39 percent of *all* NO_x emissions (Table 2). These regional percentages are significantly higher than the national freight share of NO_x emissions (27 percent).

Freight movement also produced 22 percent to 47 percent of PM-10 emissions from mobile sources and 1 percent to nearly 6 percent of PM-10 from all sources in the six study regions. Again, these regional shares are higher than the national freight share for PM-10 discussed earlier. It is important to note that PM-10 emissions in the six regions, and the share attributable to freight movement, are affected by the amount of undeveloped land in a particular area.

Trucking is the largest contributor to both NO_x and PM-10 emissions from mobile sources in the regions analyzed. Not surprising, marine freight accounts for a significant share of freight PM-10 emissions in regions with large seaports—Houston, Los Angeles, and Baltimore. This reflects the high PM emissions rates of large marine vessels that burn residual fuel and have little or no emission controls (Table 3).

The Future

Strict new U.S. Environmental Protection Agency (EPA) emissions standards for heavy-duty trucks and off-road equipment (such as port cargo handling equipment) will dramatically reduce NO_x and PM emissions from these sources starting in 2007. Similarly, the expected adoption of strict standards for locomotives and U.S. commercial vessels will also decrease emissions, but slow fleet turnover means the full effect of these standards will not be felt for several decades. Thus, by 2020, the commercial marine and rail sectors will account for a larger share of freight NO_x and PM-10 emissions than they do today.

In addition to standards, technological and operational strategies are used to mitigate emissions, particularly in metropolitan areas. Technological strategies focus on reducing emissions by modifying equipment or fuel. They include diesel oxidation and NO_x catalysts that breakdown pollutants into less harmful components and diesel particulate filters that collect particulate matter in the exhaust. Operational strategies change the way equipment is used. They include reducing idling at trucks stops or other roadside areas and railyards and increasing load.

Additional information on mitigation strategies, research needs, and other topics is discussed in the FHWA report. Please contact Diane Turchetta in FHWA's Office of Natural and Human Environment at 202-493-0158 or Diane.Turchetta@fhwa.dot.gov for a copy of the report.

Table 1. U.S. Freight Transportation NO_x and PM-10 Emissions by Mode, 2002

Mode	NO_x Emissions: Tons	NO_x Emissions: Percent	NO_x As a percent of: All Mobile Sources	NO_x As a percent of: All Sources	PM-10 Emissions: Tons	PM-10 Emissions: Percent	PM-10 As a percent of: All Mobile Sources	PM-10 As a percent of: All Sources
Heavy-duty Vehicles	3,782,000	66.8	33.0	17.9	120,000	64.7	23.3	0.5
Freight Railroads	857,200	15.1	7.5	4.1	21,300	11.5	4.1	0.1
Marine Vessels	1,011,000	17.9	8.8	4.8	44,000	23.7	8.5	0.2
Air Freight	8,200	0.1	0.1	0.0	300	0.2	0.1	0.0
Total	5,658,400	100.0	49.4	26.8	185,600	100.0	36.0	0.8

Source: U.S. Environmental Protection Agency, National Emission Inventory; total mobile source emissions and total emissions obtained from state air quality agencies. Freight railroad emissions estimated as 96.4% of total railroad NO_x emissions and 96.7% of total railroad PM-10 emissions, based on passenger locomotive fraction in U.S. Environmental Protection Agency, *Locomotive Emissions Standards, Regulatory Support Document,* April 1998; freight emissions estimated as 10.1% of total aircraft emissions, based on estimated aircraft departures attributable to air freight.

Table 2. Total Regional NO_x and PM-10 Emissions from Freight, 2002

Region	NO_x Emissions: Tons	NO_x As a percent of: All Mobile Sources	NO_x As a percent of: All Sources	PM-10 Emissions: Tons	PM-10 As a percent of: All Mobile Sources	PM-10 As a percent of: All Sources
Baltimore	35,078	N/A	N/A	996	N/A	N/A
Chicago	122,164	50.6	34.1	3,616	39.9	5.8
Dallas-Ft. Worth	58,030	40.5	34.9	1,002	22.3	1.0
Detroit	100,809	51.2	30.8	2,469	41.5	2.2
Houston	84,189	52.1	28.9	2,314	47.2	1.7
Los Angeles	166,564	43.4	39.1	4,091	26.9	1.8

Source: Compiled and calculated by ICF Consulting, based primarily on data provided by state and regional air quality agencies, metropolitan planning organizations, and ports. Note: Total emissions data were not available for Baltimore.

Table 3. Regional NO_x and PM-10 Emissions from Freight by Mode, 2002

Region	Trucking: NO_x Tons	Trucking: PM-10 Tons	Freight Rail: NO_x Tons	Freight Rail: PM-10 Tons	Marine Freight: NO_x Tons	Marine Freight: PM-10 Tons	Air Freight: NO_x Tons	Air Freight: PM-10 Tons
Baltimore	29,081	734	2,655	71	3,315	190	26	1
Chicago	96,291	2,641	23,212	792	2,199	173	462	10
Dallas-Ft. Worth	53,718	884	4,157	113	0	0	155	4
Detroit	98,195	2,382	2,106	58	468	27	40	2
Houston	64,590	1,256	5,163	141	14,351	915	85	2
Los Angeles	130,341	2,210	12,744	346	22,610	1,521	870	14

Source: Compiled and calculated by ICF Consulting, based primarily on data provided by state and regional air quality agencies, metropolitan planning organizations, and ports.

May 2005
FHWA-HOP-05-052

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