## FDM 22-1-1 General

*February 15, 1988*

Air pollutants are contaminants in the atmosphere. There are both man-made and natural sources of these pollutants. Many man-made air pollutants are a direct result of the incomplete combustion of fuels including coal, oil, natural gas, and gasoline. There are six major atmospheric pollutants from mobile sources:

1. Carbon Monoxide (CO): A colorless, odorless, poisonous gas produced most often during incomplete combustion of fuel in a poorly tuned automobile engine. Automobiles account for the majority of the CO produced, resulting in a problem in urban areas having heavy traffic. Concentrations of CO as found in an urban environment ( 30 ppm), reduce the oxygen carrying capacity of the blood and can affect an individual's health in various degrees, from impaired visual to mental acuity.

2. Hydrocarbons (HC): Those affecting air quality are for the most part colorless compounds of carbon and hydrogen. In urban areas, the majority of the HC emitted comes from vehicles. HC are not usually considered a problem in themselves, but rather as one of the precursors of photochemical smog. Chemically reactive HC react in the presence of sunlight and NOx to form photochemical oxidants, the major component of which is Ozone (03). The direct effects of HC on human and plant health are less important than the effects of oxidants.

3. Oxides of Nitrogen (Nox) This category includes two pollutants nitric oxide (NO), which is colorless, and nitrogen dioxide (NO2)which is reddish-brown and has a pungent odor. NO2 may be responsible for part of the reddish-brown color of photochemical smog. NO is formed when combustion takes place at high pressure; in urban areas the majority is emitted from automobile engines. NO2 formation is not directly related to transportation sources, but some NO2 is produced by the atmospheric oxidation of NO. Nox is presently not a problem in Wisconsin. NO does not appear to produce a health hazard. NO2 affects human health by producing nose and eye irritations; higher concentrations produce bronchiolitis and pneumonitis.

4. Total Suspended Particulates (TSP): This is any material that exists as a solid or liquid in the atmosphere under standard conditions of a temperature of pressure of 760 mm of mercury. In urban areas, automotive sources account for a minimal amount of the man-made particulate emissions. TSP in general are an irritant to the respiratory system. A specific TSP emitted by motor vehicles is lead. Lead particulates, produced by the combustion of leaded gasoline, affect the respiratory and nervous systems.

5. Sulfur Oxides (SOx): This category of pollutant includes sulfur dioxide (SOx)sulfur trioxide(SO3) sulfuric acid (H2SO4)and sulfur salts. Most SOx emitted is in the form of SO2a colorless gas with an irritating odor. Automobiles account for a minimal percent of the SO2 emissions because of the low levels of sulfur in gasoline. SO2 easily combines with moisture to form a corrosive acid that irritates lung tissues, damages vegetation, and disintegrates building materials, textiles, and paper.

6. Photochemical Oxidants: This is a large category that includes the products of the photochemical reaction of HC with the Nox.They are colorless, toxic gases, the most common of which are ozone(O3) formaldehyde (HCHO), peroxyacyl nitrate, acrolein, and peroxybenzoyl nitrate. Unlike the other pollutants described, photochemical oxidants are not emitted directly into the atmosphere; they are secondary pollutants formed through chemical reaction of primary pollutants. Adverse health effects of photochemical oxidants are chiefly related toO3. O3 reduces visibility and affects human health by producing eye irritations and a worsening of respiratory problems O3 also damages plants and trees, and cracks rubber products like automobile tires O3 is Wisconsin's most serious summertime pollutant.

The Environmental Protection Agency (EPA) regulates vehicle exhaust emission levels of CO, NO2 and HC. The EPA has set ambient air quality standards for allowable levels of five of the major pollutants. EPA in 1978, set standards for one specific type of suspended particulate, lead. In addition, EPA revoked the HC standard in January 1983.

The goal of all of the air quality actions is to ensure that the air quality levels of the various pollutants do not exceed the set standards in any part of the United States. In addition, for parts of the United States where the pollution levels presently are less than the standard, the goal is to prevent significant deterioration of the present

ambient air quality. Therefore, any changes in air quality, improvement or degradation, must be monitored.

This is where the transportation air quality analysis enters the picture. An air quality analysis is done on a mesoscale (or regional) and a microscale (or corridor) level. Only CO is analyzed on a corridor level. Several other pollutants are analyzed on a regional level, although this is not undertaken on every project. Various laws and regulations mandate the scope of the analysis that is to be accomplished. This chapter presents the background of the laws and regulations, prediction techniques, reporting techniques, and the indirect source review procedure for Construction or Modification and New Operation Permits. An overview of the procedures used in preparing a highway air quality analysis is contained in Attachment 1.1.

**LIST OF ATTACHMENTS**

Attachment 1.1 Procedures for Preparing a Highway Air Quality Analysis

## FDM 22-1-5 Glossary

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Ambient Air - The portion of the atmosphere, outside of buildings, to which the general public has access.

Average Route Speed - The vehicle volume related weighted average of the operating speeds for each direction (and/or lane) for two directional roadways.

CAA - The Clean Air Act as Amended, August 1977, PL 95-99 (see FDM 22-5-1).

CALINE3 - California Line Source Model--a quantitative computer model used to predict project level carbon monoxide concentrations (see FDM 22-35-10).

CO - Carbon Monoxide--an air pollutant previously defined in FDM 22-1-1.

Cold Start Mode - A phase of motor vehicle engine operation associated with the first 505 seconds of operation after the vehicle has been turned off for more than one hour for catalytic equipped vehicles (more than four hours for noncatalytic equipped vehicles).

CPHV - Critical peak hour volume--the traffic volume associated with the highest one-hour volume experienced in the year.

C8HV - Critical average eight hour volume--the traffic volume associated with one-eighth the sum of the eight highest consecutive hourly traffic volumes experienced in the year.

Construction or Modification and New Operation Permit - An authorization by the DNR to allow the DOT to construct, reconstruct, replace, relocate, modify or operate an "indirect air pollution source, i.e., highway." See FDM 22-50-1 through FDM 22-50-15 for further details.

Critical Average Eight Hour Volume - See C8HV.

Critical Peak Hour Volume - See CPHV.

Degradation - The numerical difference in air pollution concentration levels between the "build" alternate and the "no build" alternate for a given year.

Emf - See Emission Factor.

Emission Factor - The number of grams of a pollutant emitted per vehicle per mile of travel. It is based on an average emission rate for a given year for a particular category of vehicle (see LDGV, LDGT1, LDGT2, HDGV, LDDV, LDDT, HDDV and MC and FDM 22-20-1 through FDM 22-20-5).

Excess Emissions - Motor vehicle air pollution emissions in excess of those experienced during free flow conditions. These excess emissions are associated with the deceleration, idling, and acceleration of a vehicle making a stop at a signalized or stop signed intersection (see FDM 22-25-1).

FHPM 7-7-9 - Federal Aid Highway Program Manual, Volume 7, Chapter 7, Section 9.

G/C - The ratio of the number of seconds of the green phase to the total number of seconds in a traffic signal cycle.

GVW - Gross vehicle weight.

HC - Hydrocarbons--a broad category of air pollutants related to the photochemical production of ozone previously defined in FDM 22-1-1.

HDDV - Heavy duty, diesel powered trucks that exceed 8,500 pounds gross vehicle weight.

HDGV - Heavy duty, gasoline powered trucks that exceed 8,500 pounds gross vehicle weight.

I/M - The inspection/maintenance program for motor vehicles. This program, as implemented, requires periodic inspections of the affected vehicles to determine if the air pollutant emissions from the vehicles exceed the guidelines for the particular year and model of vehicle. If the guidelines are exceeded, maintenance will be required to lower the emissions to within the guidelines.

Indirect Source - A source that conveys motor vehicles or attracts, or may attract, mobile source activity and thus indirectly causes the emission of any air contaminant. Such indirect sources include highways; parking facilities; retail, commercial, and industrial facilities; recreation, amusement, sports, and entertainment facilities; airports; office buildings; apartment buildings; and education facilities.

LDDT - Light duty, diesel powered trucks.

LDDV - Light duty, diesel powered vehicles (automobiles).

LDGT1 - Light duty, gasoline powered trucks with a gross vehicle weight of less than 6,001 pounds.

LDGT2 - Light duty, gasoline powered trucks in the weight range of 6,001 through 8,500 pounds gross vehicle weight.

LDGV - Light duty, gasoline powered vehicles (automobiles).

Pb - Lead--an air pollutant in the suspended particulates category.

MC - Motorcycles.

Mesoscale Analysis - Regionwide air quality analysis.

Microscale Analysis - Project level air quality analysis. The area of influence for the microscale analysis includes the area from the highway out approximately 0.3 km (984 ft.).

MOBILE3 - A computer program for determining mobile source emission factors based on EPA's Compilation of Air Pollutant Emission Factors: Highway Sources, July 1984 (see FDM 22-20-5).

MOU - Memorandum of Understanding (see FDM 22-5-10).

MSA - Metropolitan Statistical Area--a United States Bureau of the Census designation. The following are the Wisconsin counties in a designated MSA:

1. Appleton-Oshkosh-Neenah MSA: Calumet, Outagamie, and Winnebago counties
2. Duluth MSA: Douglas County
3. Eau Claire MSA: Eau Claire and Chippewa Counties
4. Green Bay MSA: Brown County
5. Janesville-Beloit MSA: Rock County
6. Kenosha MSA: Kenosha County
7. La Crosse MSA: La Crosse County
8. Madison MSA: Dane County
9. Milwaukee MSA: Milwaukee, Ozaukee, Washington and Waukesha counties
10. Minneapolis-St. Paul MSA: St. Croix County
11. Racine MSA: Racine County
12. Sheboygan MSA: Sheboygan County
13. Wausau MSA: Marathon County

NAAQS - National Ambient Air Quality Standards (see FDM 22-5-5).

NO - Nitric oxide--an air pollutant in the nitrogen oxides category.

NOx Nitrogen oxides--a broad cateogry of air pollutants (previously defined in FDM 22-1-1).

NO2 Nitrogen dioxide--an air pollutant in the nitrogen oxides category.

Nonattainment Area - An area within which the ambient concentration of a given pollutant exceeds the NAAQS. This finding may be based on monitored data or estimated by an air quality model (see FDM 22-40-1).

O3 Ozone--an air pollutant produced through a photochemical reaction (previously defined in FDM 22-1-1).

PCCC - Percent of VMT in the cold start mode for catalyst equipped vehicles.

PCCN - Percent of VMT in the cold start mode for noncatalyst equipped vehicles.

PCHC - Percent of VMT in the hot start mode for catalyst equipped vehicles.

Persistence Factor - A factor used to account for the variability of meteorological conditions over an eight hour period.

PPM - Parts per million--parts of a contaminate per million parts of gas.

Queue - As it relates to motor vehicles, a line of awaiting vehicles. The line of vehicles may be caused by the red phase of a traffic signal or by a stop sign on a roadway approach.

Receptor - A residence, school, hospital, or other building along a highway project that is selected to have air pollution concentration levels predicted for it. The receptors selected are considered representative of the highest pollutant concentrations experienced along a project.

SIP - State Implementation Plan for air quality--a plan which will outline the state's strategy for achieving the air quality standards and complying with the other requirements of the 1977 Clean Air Act Amendments.

SOx Sulfur oxides--a broad category of air pollutant (previously defined in FDM 22-1-1).

SO2 Sulfur dioxide--an air pollutant in the sulfur oxides category.

Stability Class - The measure of the tendency of an exhaust plume to mix with surrounding air.

Stationary Source - Any facility, building, structure, equipment, or action that may directly or indirectly result in the emission of any air pollutant at a fixed location.

TEXIN - Texas Intersection Model--a quantitative computer model used to predict project level carbon monoxide concentrations (see FDM 22-35-5).

TSP - Total suspended particulates--a category of air pollutants (previously defined in FDM 22-1-1).

VMT - Vehicle miles traveled.

Worst Case - The meteorological conditions used in a project level air quality analysis include a wind velocity of one meter per second, a temperature of 20 (F a stability class of E for urban areas or F for rural areas with CALINE3 or TEXIN, and the angle of wind that produces the highest CO concentration.

Worst Wind Angle - The angle of wind relative to the highway that produces the highest concentration of pollutants.