

DIESEL EXHAUST GASES

WHAT IS DIESEL EXHAUST?

Diesel exhaust is composed of a mixture of many different toxic chemicals. Diesel engines rely on heat, generated during the compression cycle, for ignition rather than an electrical spark as in gasoline engines. Because of this needed compression, diesel engines are heavier and bulkier than gasoline engines. They operate with less highly refined fuel and consume less fuel per horsepower per hour. Gasoline engines emit fewer particulates in their exhaust than diesel engines, so the exhaust looks "cleaner." However, gasoline engines still emit toxic chemicals similar to those in diesel exhaust, but in different concentrations.

WHAT TOXIC CHEMICALS ARE IN DIESEL EXHAUST?

The toxic chemicals of most concern in diesel exhaust are the oxides of nitrogen (nitric oxide, nitrogen dioxide), sulfur dioxide, aldehydes, primarily formaldehyde, acetaldehyde and acrolein, and various hydrocarbons particles. Carbon monoxide is also present. The higher average temperature of combustion of diesel engines generates more oxides of nitrogen than gasoline engines.

WHAT ARE THE HEALTH EFFECTS OF DIESEL EXHAUST?

These toxic chemicals can cause health effects, some of which are immediate and others which take years of exposure. High concentrations of the oxides of nitrogen can cause headache, dizziness and loss of consciousness as well as respiratory irritation. Sulfur dioxide, a pungent gas, may cause immediate respiratory distress. The aldehydes are also pungent and cause eye, nose and throat irritation. Prolonged exposure to diesel exhaust can increase the risk of cardiovascular, cardiopulmonary and respiratory disease and lung cancer. In June, 2012, the International Agency for Cancer Research (IARC) classified diesel exhaust (including diesel particulate matter) as a known human carcinogen (Group 1).

ARE THERE LEGAL STANDARDS REGULATING DIESEL EXHAUST?

Although there is no single standard regulating employee exposure to diesel exhaust, the individual chemicals are regulated by exposure limits. For General Industry, the primary limit is a Time-Weighted Average (TWA). Other limits are a Short Term Exposure Limit (STEL) and a Ceiling limit (See R 325.51101 - R 325.51108.) For Construction, the primary limit is the Maximum Allowable Concentration (MAC) (See R 325.2411 - R 325.2413). The exposure limits for diesel exhaust chemicals are listed in the Table below. Formaldehyde is an expanded standard and the TWA and STEL apply to both general industry and construction.

TABLE 1
(ppm is parts of chemical per million parts air)

	General Industry			Construction
	<u>TWA</u>	<u>STEL</u>	<u>C</u>	<u>MAC</u>
Acetaldehyde	100 ppm	150 ppm	---	200 ppm
Acrolein	0.1 ppm	0.3 ppm	---	0.1 ppm
Carbon monoxide	35 ppm	---	200 ppm	50 ppm
Formaldehyde*	0.75 ppm	2 ppm	---	---
Nitric oxide	25 ppm	---	---	25 ppm
Nitrogen dioxide	---	1 ppm	---	5 ppm
Sulfur dioxide	2 ppm	5 ppm	---	5 ppm

* Also applies to construction.

Specific sampling equipment is necessary to test the air and determine an employee's exposure to these chemicals. Concentrations of nitric oxide, nitrogen dioxide, sulfur dioxide and formaldehyde can also be measured by using detector tubes.

WHAT IF SAMPLING ANALYSES SHOW EXPOSURE CONCENTRATIONS ABOVE THE LEGAL EXPOSURE LIMITS?

The exposure limits listed above must not be exceeded. If they are exceeded, control measures must be implemented to reduce employee exposure. Although not typically feasible, a solution is replacing diesel engines with electric motors or other fuel powered engines that don't exceed limits. However, a well-tuned diesel engine will produce a minimal amount of toxic chemicals, thus reducing employee exposures. Adequate general or local exhaust ventilation in the work place should minimize employee exposure.

If you have additional questions or concerns on diesel exhaust, contact MIOSHA, Consultation Education and Training Division, 530 W. Allegan Street, P.O. Box 30643, Lansing, Michigan 48909-8143 or call (517) 284-7720.