Chemicals and Materials

# Diesel Exhaust

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## What is diesel exhaust?

Diesel exhaust is produced by the combustion (burning) of diesel fuel. The exhaust is a complex mixture of gases, vapours, aerosols, and particulate substances. The exact nature of the exhaust depends on a number of factors including the type of engine, how well serviced/maintained the engine is, type of fuel, type of oil, speed and load on the engine, and emission control systems.

Diesel exhaust may contain:

- Carbon (soot)
- Carbon monoxide
- Carbon dioxide
- Oxygen
- Water vapour
- Ammonia
- Nitrogen
- Oxides of nitrogen (e.g., nitrogen oxide, nitrogen dioxide)
- Oxides of sulphur (e.g., sulphur dioxide)
- Alcohols

- Aldehydes
- Ketones
- Hydrocarbons
- Aromatic compounds such as benzene, toluene, and polycyclic aromatic hydrocarbons (PAHs)
- Diesel particulate matter (DPM)

Diesel particulate matter (DPM) is primarily made up of soot particles, carbon, ash, polycyclic aromatic hydrocarbons (PAHs), metallic abrasion particles, sulfates, and silicates. Almost all particulate emitted by diesel engines is respirable (PM <10 micron), with the majority of the particulates have diameters less than 1.0 micron.

## What are the main health concerns?

Short term exposure to diesel exhaust can cause coughing, and irritation of the eyes, nose, throat, and respiratory tract. Breathing in diesel exhaust can cause lung irritation and/or an allergic reaction causing asthma (wheezing and difficult breathing), or making pre-existing asthma worse.  Other symptoms may include feeling lightheaded, headache, or nausea.

Long term exposure may lead to serious health effects. The International Agency for Research on Cancer (IARC), which is part of the World Health Organization (WHO), classified diesel engine exhaust as carcinogenic to humans (Group 1), determining that exposure to diesel exhaust emissions increases the risk for lung cancer and possibly bladder cancer.

## Who is at risk of exposure to diesel exhaust?

The most common way individuals are exposed is by breathing air that contains the diesel particulate matter. The fine and ultra fine particles are respirable, which means that the particles can avoid many of the human respiratory system defense mechanisms and enter deeply into the lung.

Workers may be at risk:

- In areas where diesel powered vehicles are used repaired, or tested such as forklift trucks, railway locomotive, buses, trucks, construction vehicles, farm vehicles.
- Where diesel exhaust can accumulate, such as warehouses, car/bus depots, ferries/ships, garages, vehicle testing sites, fire stations, mines, or where diesel generators or winch motors are used.

- In occupations that work in areas where exhaust levels are high or can accumulate, such as police and traffic officers, custom officer/border control booths, ticket/toll booth operators, drivers of diesel vehicles (buses, subway/railway, truck, taxi, forklift, etc.), airline ground crew, farm workers, vehicle maintenance workers, dock/cargo/passenger ship workers, miners, tunnel construction workers, landscapers, etc.

## Is there an exposure limit for diesel exhaust in workplaces?

All jurisdictions in Canada have regulated occupational exposure limits . For diesel exhaust, these limits may apply to the specific component, or to diesel exhaust (as a whole), and/or may apply to specific industries (such as mining).

In the absence of such legislation, the "general duty clause" applies. This clause, common to all Canadian occupational health and safety legislation, states that an employer must provide a safe and healthy workplace. Making sure workers know the health effects of diesel exhaust, how to perform work safely, and precautions to take is, therefore, the employer’s duty.

In addition, as diesel exhaust is classified as a carcinogen, it is a good practice to keep exposures to carcinogens to a minimum.

## How do I know if exposure to diesel exhaust is an issue?

The workplace should have a competent person (such as an occupational/industrial hygienist, safety professional, or others) conduct a risk assessment to determine the health risks from exposure, and to identify the necessary steps needed to control these risks. See the OSH Answers for more information on how to do a risk assessment.

Questions to investigate include:

- How likely is exposure?
- How long is exposure?
- Who/how many are affected?
- Have health concerns been reported?
- Can engines be turned off or idling avoided? Can engines be operated outdoors only?
- Are the engines in good repair?
- How exhaust is currently ventilated or removed from the location?
- Is there visible smoke from the engine?
- Is soot accumulating in the workplace?
- What controls are currently in place?

- How can exposure be reduced or eliminated?

This checklist is not complete. Be sure to investigate all relevant issues for your workplace or situation.

## How can exposure to diesel exhaust be controlled?

Various measures can help lower exposure to diesel exhaust. Workplaces may investigate the measures that work best in their situation. Control measures may include:

- Eliminate by replacing diesel powered engines with electric or other types of power sources (remember to manage any risks introduced by alternative power sources).
- Use alternate fuels or cleaner sources of energy (such as propane, natural gas, low sulfur diesel, etc.) where possible.
- Use low-emission engines or fuel additives that will reduce emissions.
- Use exhaust treatment systems such as filters, catalysts and/or converters, and a corresponding maintenance program.
- Run engines outdoors (instead of indoors).
- Maintain the body of the vehicle to make sure that exhaust is not leaking into the cab or passenger area. Replace cabin air filters as required.
- Ventilate appropriately, such as providing positive pressure ventilation, exhaust extraction devices, inlet and exhaust general (dilution) ventilation, and/or local exhaust (such as tail pipe hose exhaust).  Place exhaust hoses so they exhaust outdoors, and not allow the emissions re-entre the workplace.
- Modify the layout of the work area to separate the area where people must work and areas where exhaust is generated, such as isolate the generator in a separate, ventilated space, or isolate the worker in a sealed, air conditioned cabin (air filtered) where possible.
- Keep openings for border, ticket, toll, or food booths as small as possible and closed as much as possible when there is exposure to exhaust. If booths are in a place where exhaust accumulates, ventilate the booth with fresh air appropriately.

- Use administrative controls such as:
  - Education and training to workers about the exposure to diesel exhaust and proper use of control measures.
  - Turning off engines whenever possible and/or opening doors and windows where possible.
  - Regularly maintaining engines, ventilation systems, and filters.
  - Reduce the hours of work exposed to exhaust through job rotation and scheduling.
- Use of personal protective equipment, such as respirators.

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