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DIESEL EXHAUST IN FIRE STATIONS

Public Employees Occupational Safety and Health Program

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INTRODUCTION

When diesel fire trucks idle inside the fire station, the exhaust generated can spread throughout the entire station, where it can darken walls and settle on food and clothing. Diesel exhaust can also effect the health of those who breath it. This bulletin will give information on these health effects and make recommendations for controlling exposure to diesel exhaust in fire stations.

WHAT ARE THE COMPONENTS OF DIESEL EXHAUST?

In considering the potential health effects arising from exposure to diesel exhaust, it is helpful to view the exhaust as being composed of two parts, gaseous and particulate. The gaseous phase of diesel exhaust is composed of carbon monoxide, oxides of sulfur and nitrogen, and unburned or partially burned hydrocarbons.

Diesel engines also emit particulates, in an amount 50 to 80 times greater than gasoline powered vehicles. These particulates are small in size, easily inhaled and contain many different chemicals. The chemicals gather on the surface of the particulates and represent 15-65% of the mass of the particles. The remainder of the particles are made of carbonaceous material. One group of chemicals found on diesel particulates is polynuclear aromatic hydrocarbons (PAH) which are potential health hazards.

WHAT EXPOSURE LEVELS ARE DANGEROUS?

A study about the exposure of firefighters to diesel exhaust has been conducted.¹ Personal sampling techniques were used to evaluate firefighter exposure to particulates from diesel engine exhaust. Fire stations in New York, Boston and Los Angeles were studied. The more alarms firefighters responded to, the higher their exposure to diesel exhaust particulates. When there were between 7 and 15 alarms during an 8 hour shift, the exposure levels of total airborne particulates from diesel exhaust ranged from 170-480 ug/m³ (micrograms per cubic meter of air) averaged over eight hours.

To understand this level it can be compared to outdoor air levels. In New York and Boston, air measurements for particulates during this study ranged from 30 to 60 ug/m³. These outdoor levels are expected to be composed of a variety of particulates. The particulate levels measured in fire stations would probably contain a higher percentage of particulates from diesel exhaust, and therefore a higher percentage of PAHs.

WHAT ARE THE HEALTH EFFECTS OF DIESEL EXHAUST EXPOSURE?

Exposure from diesel exhaust can cause a series of temporary symptoms including: headaches, eye irritation, nausea, vomiting, numbness, wheezing, heartburn and chest tightness.

¹Froines, J., W. Hinds, R. Duffy, E. LaFuente and L. Wen-Chen: Exposure of Firefighters to Diesel Emissions in Fire Stations. *American Industrial Hygiene Association Journal*. 48(3):202-207 (1987).

In August, 1988, the National Institute for Occupational Safety and Health (NIOSH) released Current Intelligence Bulletin 50, Carcinogenic Effects of Exposure to Diesel Exhaust. NIOSH concluded in this bulletin that the toxicologic and epidemiologic findings suggest a **“potential occupational carcinogenic hazard exists in human exposure to diesel exhaust.”**

WHAT CAN BE DONE TO CONTROL EXPOSURE?

Particulates from diesel exhaust in fire stations can exceed background (ambient) levels. Since diesel exhaust presents some carcinogenic risk, it is important to minimize the exposure of firefighters. The National Fire Protection Association (NFPA) Standard, Fire Department Occupational Safety and Health Program (NFPA 1500-1992) states, “Fire stations shall be designed and provided with provisions to ventilate exhaust emissions from fire apparatus to prevent exposure to firefighters and contamination of living and sleeping areas.”

The following methods may be used to control diesel exhaust emissions in fire stations. It may be necessary to use more than one method.

Work Practices And Procedures Should Be Established And Enforced To Ensure The Following:

1. Garage doors should be opened before engines are started and vehicles should not be allowed to idle in the fire station.
2. All drivers should be instructed to keep vehicular operation to an absolute minimum in the fire station.
3. Garage doors should be left open, when weather conditions permit, for at least 10 minutes following the operation of the vehicles.
4. Doors leading directly from the garage to other areas of the fire station should be kept closed whenever possible. Consideration should be given to installing an automatic door closing device.

5. All doors leading from the garage to stairwells, hose towers, living quarters, kitchen or offices should be modified by the addition of weather stripping (or similar material) in order to prevent diesel exhaust infiltration.
6. All pole holes that are not essential should be permanently sealed. Active pole holes should have flexible covers with air tight seals. An alternative is to install air tight booths around poles.

Engineering Controls Should Be Implemented To Ensure The Following:

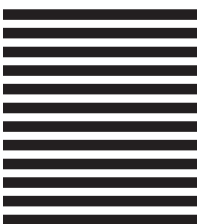
1. Diesel exhaust infiltration can be reduced by maintaining living quarters and office areas under positive pressure.
2. Ventilation systems should be installed to control vehicle exhaust. The two types of ventilation systems which may be used are dilution and local. Local exhaust is preferable because it removes the diesel exhaust at the source.

(a) Dilution Ventilation

- (1) Hot exhaust emissions rise, therefore, exhaust fans should be located near the ceiling and exhausted outside.
- (2) The volume of exhaust emissions generated is dependent on the number of trucks in operation in the firehouse and the horsepower of the trucks. The American Conference of Governmental Industrial Hygienists recommends dilution ventilation rates of 100 cubic feet per minute (cfm) per horsepower for diesel engines that are idling.
- (3) Make-up air must be supplied to replace exhausted air.
- (4) The exhaust opening should be situated to prevent re-entry of exhaust through windows or fresh air intakes.



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(b) Local Exhaust Ventilation

- (1) An exhaust filter hose system should be connected to the tail pipe of the truck. It should remain on the tail pipe until the truck has left the building.
 - (2) Make-up air must be supplied to replace exhausted air.
 - (3) The exhaust opening should be situated to prevent re-entry of exhaust through windows or fresh air intakes.
3. Commercially available high efficiency filter systems can be used to filter out particulates emitted from diesel engines. One system consists of a filter, a diverter unit, and an electronic control module, all of which are completely self-contained on the vehicle. This enables the filter system to be operated at anytime, regardless of the vehicle's location.

- 4. Follow these procedures when appropriate to reduce diesel apparatus emissions:
 - (a) Additives can be placed in diesel fuel tanks to combat water, sludge and algae.
 - (b) Injectors which are subject to continual problems, such as plugging and high emissions should be changed. This should be done after all sources of fuel contamination are eliminated.
 - (c) Both mechanical performance and emissions data should be included as primary criteria for engine selection.

Further information may be obtained by calling the Public Employees Occupational Safety and Health (PEOSH) Program at (609) 984-1863 or visit us at <http://www.state.nj.us/health/eoh/peoshweb>

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