TUC
Changing the world of work for good

# Diesel exhaust in the workplace

## A TUC guide for trade union activists

## Section one

# Introduction

Diesel Exhaust Emissions are a major workplace hazard. Although most of us are exposed to diesel exhaust during our journeys to work, some groups of people have very high exposures and it is becoming a significant health problem.

Emissions from diesel vehicles are far more harmful than those from petrol vehicles and diesel exhaust is now one of the biggest workplace killers after asbestos.

The Health and Safety Executive have a free to download booklet on diesel exhaust that every employer should use.

This guidance is intended to help union health and safety representatives get the health risks from diesel exhaust exposure to be controlled in the workplace.

It contains information on

- What and where diesel exhaust is
- What the health risks are
- What the law says
- What your employers should be doing
- Monitoring
- A simple checklist for workplace representatives.

## Section two

# What and where is diesel exhaust

Diesel engine exhaust emissions are a mixture of hundreds of different compounds produced by engines using diesel as fuel. Over 20 chemicals known or suspected of causing cancer have been found in diesel exhaust.

Some of these emissions are a gas and others are tiny dust particles. The gases include common ones you can find in ordinary air like carbon dioxide, nitrogen and oxygen but also more toxic ones such as formaldehyde, benzene and toluene. The main component of the dust particles is two kinds of carbon (organic and elemental, also known as black carbon) although there are lots of other very tiny particles.

The exact composition of diesel exhaust varies considerably depending on the engine type, the operating conditions, the fuel used and any emission control systems. Older engines are also likely to have far higher levels of particles than newer ones. The newer diesel engines are therefore considered to be much safer than older ones but that is not necessarily the case.

Although the levels of elemental carbon are only 13% of the particles in diesel exhaust from a new diesel engine (as compared to 75% from an older engine), they are likely to have a higher proportion of organic carbon, nitrogen oxides, and sulphate.

Diesel exhaust is not only produced by motor vehicles but also by ships, many trains, and anywhere there is a diesel engine, such as a generator or pump.

Most of the publicity given to the dangers of diesel exhaust is about the levels in towns and cities caused by traffic and the effect that it has on people who live near busy roads or people who commute to and from work but but many workers can face additional high exposure because of their occupation.

Those most at risk include professional drivers, including buses, trains, lorries, fork lifts, tractors and cars, those who work in warehouses, garages, construction workers, seafarers, underground workers, maintenance workers, and anyone who is in an enclosed space near a diesel engine, such as administrative staff. People who work outdoors on busy streets or in buildings next to a road or railway may also be at risk.

## Section three

# Health problems

Diesel Exhaust is a carcinogen. That is a chemical known to cause cancer. The international body that classed it as a carcinogen said that people such as bus drivers who are regularly exposed to diesel exhaust fumes at work can be up to 40 per cent more likely to develop lung cancer.

Even the most conservative estimates show that prolonged exposure to diesel exhaust is responsible for around 800 cases of bladder and lung cancer every year leading to 650 deaths, although the total may be even higher. However cancer is not the only risk as diesel exhaust can also increase the risk of other lung diseases and heart failure. The very small particles penetrate deeply into lung tissue and damage it, causing premature death in extreme cases. Inhalation of such particles may also cause or worsen respiratory diseases, such as emphysema or bronchitis, or may aggravate existing heart disease. This means the actual death toll is likely to be considerably higher from that reported. Among the other long-term health problems is decreased cognitive function in older men.

Short-term exposure to high concentrations of diesel exhaust and diesel particulate matter can result in dizziness; headaches; breathing problems and eye, nose and throat irritation.

### Just some of the chemicals found in diesel exhaust

*Acetaldehyde; acrolein; aniline; antimony compounds; arsenic; benzene; benzopyrene; beryllium compounds; biphenyl; bis(2-ethylhexyl) phthalate; 1,3-Butadiene; cadmium; carbon dioxide; carbon monoxide; chlorine; chlorobenzene; chromium compound; cobalt compounds; cresol; cyanide compounds; dibutyl phthalate; dioxins; dibenzofurans; 1,8-dinitropyrene; elemental carbon; ethylbenzene; fluoranthene; formaldehyde; inorganic lead; manganese compounds; mercury compounds; methanol; methyl ethyl ketone; naphthalene; nickel; 3-nitrobenzanthrone; 4-nitrobiphenyl; nitrogen oxides; organic carbon; phenol; phosphorus; polycyclic aromatic hydrocarbons; pyrene; propionaldehyde; selenium compounds; styrene; sulphur compounds; toluene; water; xylene.*

## Section four

# The law

The Health and Safety at Work Act says that all employers must make a "suitable and sufficient assessment" of the risks to health from anything in the workplace. After the risk assessment is done, the employer has to take any necessary steps to prevent or adequately control exposure to any hazards.

Diesel Exhaust is considered by the HSE to be a "substance hazardous to health" under the Control of Substances Hazardous to Health (COSHH) Regulations so the employer must include in any risk assessment the likelihood of exposure, who would be effected, and how it can be avoided.

The Approved Code of Practice to COSHH recommends an active precautionary policy of prevention and control for those substances that are suspected of being carcinogenic, and employers should have a system for identifying these substances.

For a lot of chemicals there are legally binding limit values, but there is no limit value for diesel exhaust. There are limits for some of the chemicals that are found in diesel exhaust, but usually these limits are at levels well above those likely to be found in diesel exhaust. This shows one of the problems with managing diesel exhaust in the workplace as it is the mixture of all the chemicals which is causing the health problems, but the current regulations only cover the individual chemicals on their own. However, the bottom line is that the employer must seek to remove the production of any diesel exhaust fumes in the workplace or, if that is not possible, to control it as far as is "reasonably practical".

UK and EU safety regulations still do not recognise diesel exhaust as a definite carcinogen, although the European Commission agreed to do so in 2018 and are proposing to add it to the chemicals covered by the Carcinogens and Mutagens Directive.

However, under COSHH, employers still have a legal duty to reduce exposure as far as is reasonably practical and should do that using what is called the "hierarchy of control".

This means they must start by looking at whether exposure can be prevented by not using the substance by changing the process or substituting it for something else.

Only if that is not possible should they look at things like engineering controls, ventilation and, as a last resort, personal protective equipment such as breathing apparatus.

COSHH also details the extra measures required to deal with carcinogens. Even if diesel exhaust is not yet considered a definite carcinogen yet in the UK, it is likely to contain chemicals that are listed as a carcinogen under the regulations, so employers should follow them the regulations.

Regulation 7(5) states that where it is not reasonably practicable to prevent exposure to a carcinogen the employer also has to take additional measures including:

- totally enclosing the process and handling systems, unless this is not reasonably practicable;
- the prohibition of eating, drinking and smoking in areas that may be contaminated;
- cleaning floors, walls and other surfaces at regular intervals and whenever necessary;

## Exposure limits

Some countries have legal exposure limits for diesel exhaust. These vary considerably and are complicated by the problem that they measure different things and the limits often use different measurements. In the USA there is a limit based on total carbon, while Switzerland has one for elemental carbon. Austria measures respirable particulates.

All these different particles are usually presented in milligrams per cubit metre (mg/ $m^3$) or micrograms per cubic metre (µg/$m^3$). One microgram is one thousandth of a milligram.

When they are used in exposure limits, there may be two figures, long term and short term. A TWA means a "Time Weighted Average" over an 8 hour exposure period or there is a Short Term Exposure Limit over 15 minutes for brief high exposures.

The UK does not have an exposure limit. The European Commission is considering one of 0.05 mg/$m^3$ for elemental carbon. This is certainly one that would continue to see people die through diesel exhaust. The EU's own scientific advisory panel, SCOEL, said that "although toxicological data supports a threshold (possibly….corresponding 0.015 mg EC/$m^3$), epidemiological data suggests significant cancer risks already at and below these exposure levels. Therefore, an occupational exposure limit that would be adequately protective for workers cannot be established on the basis of the current available data and analysis".

The Dutch Royal Health Council also looked at levels and said that 40 years exposure at 0.015 mg/$m^3$ for elemental carbon would lead to 4 deaths in every thousand workers. This death rate is at less than a third of the level being proposed by the European Commission.

The TUC welcomes the decision by the EU to list diesel exhaust as a carcinogen but we must remember that there are no safe levels of exposure to a carcinogen and a limit at the level proposed would lead to employers thinking that this is a safe level to have in the workplace, while instead they must by law get it down as low as is practical.

Section five

# What employers should be doing

## Prevention and control

If there is diesel exhaust in the workplace then the first step is risk assessment. If that shows there is a problem then the employer must act. Often the solutions are very simple.

The HSE has published good practical advice on removing diesel exhaust emissions in the workplace. It emphasises the importance of preventing exposure. This is best done by looking at safer alternatives such as battery powered vehicles or compressed natural gas. This is not always possible but there are other ways to prevent exposure. For example, often the engine or exhaust system does not need to be inside the workplace.

If removing exposure is not possible then it can be reduced. In many workplaces, very simple measures can make a major difference. Diesel exhaust can be reduced by replacing older engines with more efficient ones. Often just keeping doors and windows open help solve the problem, so long as it means workers are nor exposed to the cold in winter.

Also, little changes to working practices can help. For example, the employer can prohibit unnecessary idling or lugging of engines or designate strict off-limit areas for diesel engine operation.

However employers may also have to look at engineering controls like better preventive maintenance for machinery that uses diesel engines, using cleaner-burning engines, providing equipment that supply filtered air in cabs, or installing ventilation systems.

### Unions in action

The rail union TSSA surveyed its members at an engineering company who carry out tunnel examinations because of concern over the risk of health problems from prolonged exposure. After management refused to test air quality in the tunnels the union advised members also to use the close call reporting systems to log health and safety issues every time they suspected there was a problem and eventually testing was done.

The HSE has some useful ideas on how to control diesel exhaust is specific situations. Most of them are simple straight-forward common sense.

| Worksite | Control measures for diesel exhaust exposure |
|---|---|
| Mines and underground construction sites | - lower emission engines and/or (retrofit) exhaust after-treatment systems<br>- regular maintenance of engines<br>- efficient mechanical ventilation |
| Warehouses and production floors | - electric or gas fuelled forklift trucks<br>- switching of engines to avoid unnecessary idling<br>- regular maintenance of engines<br>- natural or mechanical ventilation |
| Motor vehicle repair shops and testing stations | - starting up engines only when required<br>- efficient natural or mechanical ventilation<br>- where appropriate, flexible hose extraction system or portable filters attached to tailpipes |
| Bus terminals and garages | - lower emission engines and/or (retrofit) exhaust after-treatment systems<br>- switching of engines to avoid unnecessary idling<br>- regular maintenance of engines<br>- efficient natural or mechanical ventilation |
| Ro-ro ferries | - starting up engines only when ready to move (doors open)<br>- natural or mechanical ventilation |
| Toll booths and car parks | - small ticket openings<br>- natural or mechanical ventilation<br>- in the case of continuously high emissions, fresh air supplied from an unpolluted source |
| Fire stations | - starting up engines only when ready to move (doors open)<br>- where appropriate, (automatically disconnecting) hose extraction or filter system attached to tailpipes |

In some circumstances the employer may ask workers to wear protective equipment such as dust masks. These must only be used as a last resort, but any masks must be fit for purpose and stop both the gases and dust while also being comfortable to wear. Most face masks do not protect against diesel exhaust. Further advice on this is available in the HSE guidance booklet "Respiratory protective equipment at work".

## Unions in action

Unite the union have launched a diesel exhaust register to allow members to log exposures to excessive diesel exhaust fumes.

# Monitoring

Once the control measures are in place the employer must ensure that they are working. That means regular checking of equipment and processes.

It may also involve monitoring diesel exhaust levels in the workplace. As the box below shows, this can be quite complicated, although monitoring the levels of carbon dioxide and soot may be sufficient in most workplaces.

Union health and safety representatives need to make sure that any monitoring is done in a way that reflects the real potential for exposure. That means ensuring that it is done in all places where people work, when equipment in fully running, and over a prolonged period, such as 8 hours.

## Measuring exposure

Because diesel exhaust is a whole range of chemicals that can vary depending of the situation, there is no one test that will tell you exactly what the levels are. This can make it difficult for union health and safety representatives to understand any figures their employer are giving them.

The simplest test is if you can see or smell diesel exhaust in the workplace then you have a problem. Diesel exhaust can be either blue, black or white depending on the situation, but if you can see blue or black fumes there is a problem with the exhaust or the ventilation system and your employer should get proper testing done.

The HSE simply say that monitoring $CO_2$, (carbon dioxide) can be a useful indicator of the overall adequacy of control measures. If there are CO2 levels above 1000 parts per million this can indicate problems with bad maintenance or faulty ventilation. While this is the simplest test, in many cases CO2 testing should be combined with other testing, especially as the levels of $CO_2$ vary considerably from diesel engines and do not necessarily reflect the levels of cancer-causing pollutants.

Another test for diesel exhaust exposure is done by measuring the amount of elemental carbon or total carbon in the air, but just comparing the mass of the particles may underestimate the health effects in modern biodiesel engines as they produce more ultrafine particles, which mean that you can get more particles with less overall mass.

Sometimes nitric oxide or nitrogen oxide are also measured to give an indication of levels of Diesel Exhaust. Tests may also be done for PAHs (Polycyclic Aromatic Compounds), VOCs (Volatile Organic Compounds), Aldehydes and Ketones, although these usually have to be done in a laboratory rather than at the workplace.

This means that employers can use very different measures, so if there is any doubt make sure that the employer is using someone who is competent such as an occupational hygienist.

Health and safety representatives may also consider asking for health surveillance of employees if there are concerns over members' health, such as several workers reporting breathing problems, headaches or eye, throat and nose irritation.

## *If you can see it or smell it – sort it!*

# Environmental exposure

For some workers the exposure happens outside the workplace. This is a particular problem for drivers, couriers and people who spend a lot of time on busy roads, such as parking control officers, toll collectors or street cleaners.

Employers often say that there is nothing they can do to prevent this exposure. That is not true. They can look at working practices to see if they can be altered to reduce levels of exposure.

Examples of simple adjustments are changing routes for drivers, so they do not have to travel on the most polluted roads, and ensuring that anyone working in a busy street only does it for a limited time. That can be done by changing rota systems.

Employers can also install air monitors in cars or cabs. Even when there are cab filters, if the door is frequently opened and closed, there can still be a lot of pollution inside the cab.

Teachers unions have been working with schools and local authorities to ensure that parents do not leave their cars idling outside school premises when dropping off or picking up their children.

### Unions in action

An old aircraft hangar in a Scottish council had been converted into a vehicle repair workshop. It had a large door towards the back of the building and the main double doors at the front through which trucks and other vehicles entered for repair or service, which meant there was an emission of diesel fumes while vehicles entered or left. Also, during the service process it was necessary to run the engines of plant vehicles, or in the case of trucks they needed to run the engine until air tanks were pumped up. This required a fume extraction process, which was simply the opening of both sets of large doors. This meant that fumes cleared almost instantly. That was until a partition from floor to ceiling was built all the way across the middle of the garage, which meant no air circulation and a big build-up of fumes. This was raised by the GMB safety representative and who eventually had to get the HSE involved. They spoke to the Council. The result was immediate action including an exhaust fumes extraction system which worked and was fit for purpose.

**Section six**

# Checklist for union representatives

- ✓ *Have you asked to see the employers risk assessments on diesel exhaust?*
- ✓ *Are the risk assessments adequate?*
- ✓ *Are the control measures proposed all in place and followed?*
- ✓ *Are there procedures in place for monitoring the effectiveness of the measures, and is there air monitoring in place?*
- ✓ *Do you receive reports from any monitoring?*
- ✓ *Is there a regular testing and maintenance regime for all engines and extraction equipment?*
- ✓ *Are staff given information and training on the risks of diesel fuel, including advice on not eating and smoking in areas where there may be exposure, washing hands and face before eating and changing clothes after work?*
- ✓ *Remember if you can see it or smell it – sort it!*

Follow the campaign on:
**TUC.org.uk/healthandsafety**
Follow the campaign on Facebook at:
**facebook.com/TUChealthandsafety**

The HSE guide to the control of diesel engine exhaust emissions in the workplace is at:

**http://www.hse.gov.uk/pubns/books/hsg187.htm**

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