[redacted]

[redacted]

Q7. **Do you support the proposed workplace exposure standard (WES) for diesel particulate matter (DPM) to protect workers from the adverse health effects of exposure to diesel engine emissions (DEE)?**

No

Q8. **What are your reasons for your response to Question 1? Please provide evidence or information to support your response.**

Detailed evidence and information is provided in our attached submission.

Q9. **Is there an alternative WES to DPM as respirable elemental carbon, or additional WES that should be considered to protect workers from DEE? Please provide evidence or information to support your response.**

10ug/m3 reducing to 1ug/m3, over three years.

Q10. **What changes would you need to make in your workplace (over and above any controls currently in place) to ensure workers and others at the workplace are not exposed to levels of DPM above the proposed WES? Please include in your response: i. a description of the control measures currently in place at your workplace(s) to minimise exposure of workers and others to DEE.ii. details of any costs to implement the WES for DPM (e.g., upgrade of ventilation systems in area X, costing approximately $XXX).**

Ineffective administrative controls, that are often unable to be used. Detailed information from Fire and Rescue NSW documents is provided in our written submission.

Q11. **Is there additional evidence or information that you think should be considered?**

Yes, there is detailed evidence and information is provided in our attached submission.

Q12. **Are there any additional comments you would like to make?**

not answered

Q13. **Upload your submission here: (PDF,DOC or DOCX)**

[redacted]

Preamble.

Fire Brigade Employee's Union of New South Wales (FBEU) Submission to the Safe Work Australia, Consultation on a proposed workplace exposure standard for diesel particulate matter (DPM).

Details.

[redacted]
Fire Brigade Employees' Union of New South Wales.
Email: office@fbeu.net .
[redacted]
Industry: Emergency Services NSW.

Publish our submission online.

I have read and understand the terms and conditions for making this submission.

Introduction

The FBEU's membership of approximately 6500 Firefighters, represents over 99% of the Firefighters employed by Fire and Rescue NSW (FRNSW). The FBEU is pleased to have the opportunity to make our Submission to this important Consultation.

Questionnaire

1. Do you support the proposed workplace exposure standard (WES) for diesel particulate matter (DPM) to protect workers from the adverse health effects of exposure to diesel engine emissions (DEE)? No.

2. What are your reasons for your response to Question 1? Please provide evidence or information to support your response.

   i. The FBEU supports the Australian Council of Trade Unions Submission, that recommends;

   Recommendations.

   Recommendation 1
   Immediate adoption of WES for DEE, based on elemental carbon of

   a. Mining industry: 0.05mgm/m3. (5ug/m3).
   b. All other industries: 0.01mgm/m3. (10ug/m3).

   Recommendation 2

It is essential to acknowledge that based on latest evidence presented by Van Vermeulen[1], the proposal in the report by SLR and that being submitted by the ACTU for immediate adoption, is not a health-based WES and may be deviating from a health-based standard by a factor of ten[2].

Recommendation 3
The ACTU proposes that the WES is progressively reduced over three years to a health-based standard, of 0.001mgm/m3 (1ug/m3), as submitted by the Cancer Council of Australia in 2020.[3]

Recommendation 4
The ACTU supports the adoption of the following recommendations from the SLR report:

- A 'Carcinogenicity Category 1A' notation is recommended for DPM based on the weight of evidence from both human and animal studies indicating DEE is a lung carcinogen.
- In addition, it is recommended the candidate WES for DPM be applied in conjunction with appropriate management measures to control and/or minimise exposures to other indicators of potential concern within DEE including NO2, PAHs, and aldehydes to ensure the risk of health effects from the mixture as a whole is adequately controlled.

b. The FBEU supports the Submission from *Cancer Council Australia, Occupational & Environmental Cancer Committee* to the February 2020 *Safe Work Australia Workplace Exposure Standard Review – Release 10: Diesel Engine Emissions***;**

Work by Vermeulen and co-workers 2 [4] provides good evidence that the current 'working limit' of 0.1 mg/m3 is much too high and results in an unacceptable risk to exposed workers. Based on their work, a strong argument can be made to have an exposure level of 0.01 mg/m3 (or lower) and a strict application of their work would suggest 0.001 mg/m3 would be more appropriate.

The authors looked at excess lifetime risk of lung cancer from DEE exposure at a range of exposure levels, assuming working lifetime exposures (45 years - from age 20 to age 65 years). Typically in risk assessment, maximum exposure levels are set so the excess risk for workers would be no more than about one case in 1,000. Their study estimated that at 0.025 mg/m3, there would be an extra 69 cases per 1,000 workers. At 0.01 mg/m3, the estimate was 20 cases per 1,000 workers and at 0.001 mg/m3, there would be an extra 1.7 cases per 1,000 workers. There has been criticism of aspects of

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[1] Vermeulen R, Portengen L. Occup Environ Med 2022;79:540–542. doi:10.1136/oemed-2021-107752

[2] Due to time of publication, the latest estimates by Vermeulen were not considered by the SLR report.

[3] *Work by Vermeulen and co-workers [3] provides good evidence that the current 'working limit' of 0.1 mg/m3 is much too high and results in an unacceptable risk to exposed workers. Based on their work, a strong argument can be made to have an exposure level of 0.01 mg/m3 (or lower) and a strict application of their work would suggest 0.001 mg/m3 would be more appropriate*.

[4] Vermeulen R, Silverman DT, Garshick E, Vlaanderen J, Portengen L, Steenland K. Exposure-response estimates for diesel engine exhaust and lung cancer mortality based on data from three occupational cohorts. *Environmental Health Perspectives*. 2014:122(2):172-177. doi: 10.1289/ehp.1306880.

the study [5] but sensitivity analyses and subsequent review and analysis of the study data strongly support these estimates [6], [7].

3. What changes would you need to make in your workplace (over and above any controls currently in place) to ensure workers and others at the workplace are not exposed to levels of DPM above the proposed WES?

Context:
Firefighters are regularly exposed to hazardous levels of DPM, in numerous ways;

i. Firefighters very often will stay in their profession for their working life, which means their exposure to carcinogens at work is a long-term hazard.

ii. At Firegrounds and other emergency incidents, as Fire Trucks' diesel engines are used during Firefighters' work at firegrounds and other emergency incidents.

iii. When attending structural fires and motor vehicle incidents, Firefighters are regularly exposed to a toxic smog of thousands of hazardous carcinogenic chemicals. These are formed when petroleum-based furniture products catch fire. While firefighters wear Personal Protective Clothing (PPC) to protect them mainly from the radiant heat, the toxic smog will enter the PPC set and can then enter the Firefighter's body through their skin, which becomes ever more porous as the temperature increases.

iv. In Fire Station Engine Bays, when performing daily water pump safety checks on Fire Trucks. This requires their engines to be running for an average of 300 seconds and involves revving the engine, to ensure all the seals are working properly.

v. In Fire Station Engine Bays, when Fire Trucks are started up to attend an incident. This can be for as little as 30 – 120 seconds for functioning Fire Trucks. Where a Fire Truck is malfunctioning, this decision-making process can take up to 300 seconds.

vi. Fire Truck maintenance will deteriorate over time, which requires additional revving of engines to enable the optimal operation of their brakes, before leaving the Engine Bay to attend to a fire alarm or 'Turn Out'.

vii. New Fire Trucks provided by FRNSW, are still only compliant with the old Euro V Standard.

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[5] Morfeld P, Spallek M. Diesel engine exhaust and lung cancer risks - evaluation of the meta-analysis by Vermeulen et al. 2014. *Journal of Occupational Medicine and Toxicology* 2015:12(10):31. doi: 10.1186/s12995-015-0073-6. eCollection 2015.
[6] Vermeulen R, Portengen L. Is diesel equipment in the workplace safe or not? *Occupational and Environmental Medicine* 2016:73(12):846-848. doi: 10.1136/oemed-2016-103977.
[7] Vermeulen R, Portengen L, Lubin J, Stewart P, Blair A, Attfield MD, Silverman DT. The impact of alternative historical extrapolations of diesel exhaust exposure and radon in the diesel exhaust in miners study (DEMS). *International Journal of Epidemiology* 2019:pii: dyz189. doi: 10.1093/ije/dyz189.

viii. Fire Station Engine Bays are adjacent to the Living Areas of a Fire Station, often there is no Transition Corridor, and / or the seals around the relevant doors are either non-existent or insufficient to filter out fine DPM particles. Many Firefighters work shift work and longer shifts. So, the exposure is over a longer period than for many other workers.

ix. Often Firefighters' Personal Protective Clothing are stored in the Engine Bay, with sticky DPM particles adhering to them. These can then off gas into Fire Truck Cabs, when Fire Station Platoons are en route to an incident.

x. When returning from emergency incidents, DPM exposed Self Contained Breathing Apparatus can off gas DPM in the Fire Truck Cab.

xi. Many Fire Stations currently lack the necessary, changing rooms and showers to allow Firefighters to quickly wash themselves to remove DPM. FRNSW Policy requires Firefighters to 'Shower within the hour', in these circumstances this is often not possible. As well, many Fire Stations lack the necessary laundry facilities as per FRNSW Policy. With the result that Firefighters are forced to shower at home and take their DPM infused undergarments to launder at home. So, spreading the hazard through off gassing into the domestic vehicle and home environments.

xii. Historically based on a NSW Mineral Council recommendation, FRNSW have been using the outdated unendorsed standard of 0.1mg/m3 for DPM, on the rare occasions when they have carried out air monitoring in Fire Stations. This has resulted in FRNSW downplaying legitimate concerns of the FBEU and its' members.

xiii. In the absence of using higher order engineering controls, such as Local Exhaust Ventilation (see below point xiv), FRNSW relies on lower administrative controls in Engine Bays.

Such as the whole 4 person Platoon must be in the Fire Truck when the engine is started. This is often illegal where a Standard Pumper Fire Truck is reversing from an Engine Bay, which has a Platoon of 4 riding in it. As National Heavy Vehicle Regulations requires one of these Firefighters to be a spotter while reversing.

Some Engine Bay doors are not automated requiring a Firefighter to shut the roller door manually.

FRNSW recommend leaving Engine Bay doors open for ventilation. However, there is a contradictory Order to keep these doors shut for security purposes. Also, many Engine Bays only have one entrance minimising the ad hoc natural ventilation mandated by FRNSW administrative controls.

Fire Stations can be located near main roads, railway stations and industrial zones. All of these will have their own inherent levels of DPM and other pollutants, that

reduce the utility of these administrative controls, even where they can be implemented legally and safely.

xiv. What changes would you need to make in your workplace?

The overwhelming majority of the 340 odd NSW Fire Stations are not provided with any form of mechanical Local Exhaust Ventilation. So, to minimise DPM hazards as far as reasonably practical, they must be fitted with both forms of them. As per, the 2015 SafeWork Australia *Guide To Managing Risks Of Exposure To Diesel Exhaust In The Workplace*, Page 4-5 Local exhaust ventilation. See diagrams below.

Figure 1 Fixed length flexible hose with tailpipe.

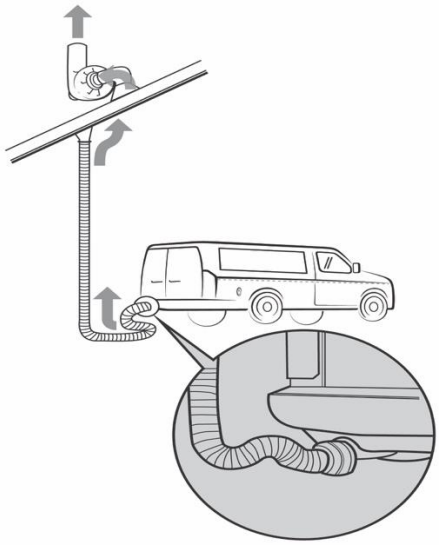
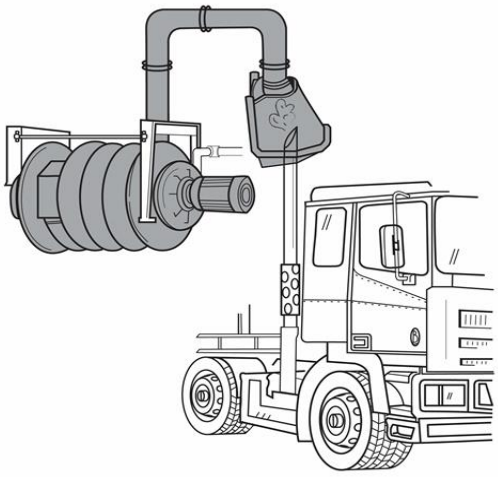


Figure 2 Fixed hose and funnel-type exhaust extraction system.



According to FRNSW's 2020 Project 6 Healthier Buildings: Recommendations for New Fire Stations Design Costings;

- Mechanical Exhaust Ducted System Double Engine Bay $50,000

- Transition Zone (Hallway) – 12sqm $54,000
- Clean Equipment Store 12sqm $48,000
- Clean Clothes Laundry 9sqm $40,500
- Clean PPC Store (Turn Out Gear) 18 sqm $72,000
- Transition Zone (Hallway) 12sqm $54,000
- 2 x Decontamination Bathrooms – 18sqm $81,000

Compared to the overall infrastructure budget of the NSW Government, these changes are not prohibitively expensive, even with higher costs of retrofitting these control measures. These costs are certainly not grossly disproportionate to the risk, as per the NSW Work Health and Safety Act (WHS Act) Section 18 (e). Especially in the context that Firefighters conduct work that the rest of the community would usually flee from.

The regular exposure of Firefighters to carcinogens at emergency incidents, which are harder to control. Makes FRNSW's historical lack of interest in controlling the carcinogens they can in Fire Stations, of fatal concern to many Firefighters and their loved ones.

4. Is there additional evidence or information that you think should be considered?

i. A Firefighter's Lung Cancer Experience.

Retired [redacted] - 38 years in the job.

"I joined the NSW Fire Brigades on the [redacted] and retired in [redacted]. I enjoyed going to work, everyday was an adventure. The Fire Brigade was my second family, I loved working with Firefighters and I loved responding to emergencies. I was stationed at a number of inner-city locations in the early 80's then moved out to [redacted] where I served for around 30 years as a Firefighter, Station Officer and Duty Commander.

In my last few years as [redacted] Duty Commander [redacted] I responded to a number of large building fires which I will never forget. [redacted] which ended up as a 16th alarm. Life was good, it was a privilege to serve my community with my mates.

I'm married to [redacted] for 36 years, my lifelong friend and companion. We've 4 kids & almost 2 grandchildren. My youngest son is a firefighter and my son-in-law as well. So, I still feel a part of Fire & Rescue as well as having a vested interest in cleaning up our stations & trucks. I've been a surfer since I was 16 years old as well as a keen bush walker, canyoner and fisherman.

Six months after I retired, I was diagnosed with lung cancer. I was fortunate we found it by accident. A colleague was having some heart issues. It prompted me to get my heart checked as well. It saved my life. I should be dead around now. Part of the heart check-up included a PET scan. This showed my cardiac health was good but in the top left lung was cancer.

The radiologists normally only scan the heart, but for some reason this guy scanned from the top of my chest to my groin. The cancer only just got into the scan. Because it was found so early they could do something about it. Two weeks later I was in surgery and had my upper left lung removed.

Lung cancer sucks, the biopsy was horrible with no anaesthetic, surgery hurts, post-surgery I had a pneumothorax and couldn't breathe and I'm short of breath for the rest of my life. When I swim, I feel like I'm drowning and walking up any hill is hard work. But everyday I thank God I'm alive. One of the worst experiences was gathering my family and telling them I had a disease that has an 85% fatality rate. Ongoing I'm subject to ongoing scans & check-ups. So far I'm all clear.

How did I develop lung cancer? I've never smoked a cigarette in my life (number one cause of lung cancer). I believe a likely cause was my ongoing exposure to diesel exhaust particulate. Towards the end of the 1980's Fire & Rescue NSW fleet

was converted to diesel powered fire trucks. There were no clean/dirty areas in stations, our engine bays were coated in a layer of black dust - with no extraction/ventilation, and I stood in the exhaust plume at the rear of the Duty Commander's car when working as the Incident Commander at fires, drills and Hazard Reductions.

I'm convinced this directly contributed to my cancer. I know five other firefighters who have developed lung cancer in the last few years and I'm worried there will be more.

Fire & Rescue NSW need to do something about this, there are solutions, let's fix our fire stations so that no one has to go through this nightmare."

Retired [redacted]

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ii. The following table drawn from; *How serious are we about protecting workers health? The case of diesel engine exhaust. Vermeulen R, Portengen L. Occup Environ Med, 2022;79:540–542. Page 541;* clearly shows the risks of lung cancer posed by DPM.

This updates the papers by Vermeulen et al, referred to above and concisely sets out the lung cancer risks of DPM exposure. And why the WES should eventually be set at 1ug/m3.

This is also the lower limit of DPM detectable in the current Occupational Hygienist testing standard; NIOSH METHOD: 5040: Issue 3.

Table 1 *Excess risks of lung cancer (LC), number of LC cases and population attributable fraction (PAF) according to different regulatory standards (ie, 1, 10 and 50 ug/m^3) in the EU.*

Table 1 Excess risks of lung cancer (LC), number of LC cases and population attributable fraction (PAF) according to different regulatory standards (ie, 1, 10 and 50 ug/m^3) in the EU

	No limit	50 ug/m^3	10 ug/m^3	1 ug/m^3
Prev (ever diesel exposure)=37%				
Excess lifetime risk of LC (per 10 000)	341	268	166	26
Expected excess cases of LC in EU#	779891	614567	380099	59524
PAF of LC	8.8%	7.1%	4.5%	0.73%
Prev (ever diesel exposure)=5%				
Excess lifetime risk of LC (per 10 000)	46	36	22	3
Expected excess cases of LC in EU*	104995	82738	51172	8014
PAF of LC	1.3%	1.0%	0.63%	0.10%

*The number of subjects out of the present EU working population (229 million) that is expected to ever die from LC due to diesel exposure.
EU, European Union; LC, lung cancer.

iii. The FBEU notes that the UN's International Agency for Research on Cancer (IARC), in 2012 published its' *Monograph 105, Diesel and gasoline engine exhausts and some nitroarenes* / IARC Working Group on the Evaluation of Carcinogenic Risks to Humans (2012: Lyon, France). Finding in Chapter 6 Evaluation, Section 6.1 Cancer in humans;

There is sufficient evidence in humans for the carcinogenity of diesel engine exhaust. Diesel engine exhaust causes cancer of the lung. A positive association has been observed between exposure to diesel engine exhaust and cancer of the urinary bladder.

Following this authoritative finding, PCBUs including FRNSW, had a proactive and systematic duty under Sections 18, 19, 20, 21 and 27 of the NSW WHS Act, to reasonably know about this hazard and its' risks and ensure the health and safety of Firefighters, as far as reasonably practical. They did not.

xv. Further in 2012 WHS Regulation 40 (e) '*ventilation enables workers to carry out work without risk to health or safety',* came into force.

Sitting under this Regulation is the *Managing the Work Environment & Facilities Code of Practice. Section 2.7 Ventilation,* which states;

Workplaces must be ventilated to allow work to be carried out without risk to health and safety. Fresh, clean air should be drawn from outside the workplace, uncontaminated by discharge from flumes or other outlets, and be circulated through the workplace.

The Managing the Work Environment & Facilities Code of Practice. Section 2.7 refers to the 2012 Australian Standard AS 1668.2–2002: *The use of ventilation and air conditioning in buildings*: *Part 2 Mechanical ventilation in buildings Section 4 Ventilation of Enclosures Used by Vehicles with Combustion Engines*.

This Standard recommends various methods to ensure PCBUs operate in accordance with WHS Regulation 40 (e). They are yet to be applied in a proactive and systematic manner by FRNSW, as per its' WHS Act Section 18, 19, 20, 21 and 27 Duties.

xvi. The FBEU notes that despite 11 years passing with overwhelming evidence of the carcinogenic hazard posed by DPM and its' associated gases, FRNSW has only just commenced a pilot DPM Testing Programme across an initial 12 Fire Stations.

xvii. The FBEU notes, the *Safety and Health Considerations for the Design of Fire and Emergency Medical Services Stations, April 2018*, authored by the US Federal Emergency Management Agency / US Fire Administration, pages 96 & 97.

Preventive design methods

Various methods have been suggested for reducing diesel exhaust emissions at fire stations. These possible solutions take two different forms: filtration and source capture.

Filtration

Filtration uses forced air that filters the air in the station (see Figure 6.11). The filtration system units typically hang from the ceiling in the apparatus bay area. They typically have multiple stages of filtration within the units.
Automate the apparatus bay exhaust fan systems to work in conjunction with the opening and closing of the bay doors.

Source capture (hose connection)

Source capture is the best solution to capture diesel exhaust. This method captures the emissions from the vehicle exhaust system before they are expelled into the apparatus bay ***(see Figure 6.12).*** *The source capture system is designed as follows:*

An automatic disconnect nozzle allowing vehicles to drive into and out of the fire station with the hoses still attached to the exhaust system. (The hose disconnects from the vehicle and retracts into the building allowing automatic doors to close.)

Automatic activation via an in-line pressure switch when the apparatus engine is started or when apparatus bay doors open (ensuring consistent use).
Timers to run exhaust fans until all residual gases have been removed from the system (manual operation is also provided).

Figure 6.11 —
A forced-air filtration system.

Figure 6.12 — A typical source capture exhaust filtration system.

Special note: *For best results in achieving a healthy air environment for the bay, both a source capture and a filtration system should be used. The ventilation system will capture off-gassing of other contaminated equipment brought into the*

fire stations, such as fire hose, salvage covers and PPE that cannot be captured by a source capture.

Again, FRNSW had a duty to know and implement this best practice advice in 2018, with respect to WHS Act Sections, 18, 19, 20, 21, 27 & WHS Regulation 40 (e). They did not.

xviii. City of Sydney & Crows Nest Fire Stations

Both these Fire Stations have mechanical exhaust systems, but not direct source capture devices, in their Engine Bays. Which puts them in the minority, with respect to the other 330 odd Fire Stations across the FRNSW Fire Station network.

However, notwithstanding these systems there is clearly evidence of DPM build up in both Stations, as the photos below make clear.

a. City of Sydney Fire Station.

This Station is better ventilated compared to an average Fire Station. With a large atrium at the back of the Engine Bay and larger than normal Engine Bay entry/exit doors. Which emphasises the persistent nature of this hazard, shown below.

The yellow plant visible in two of the pictures is the existing mechanical exhaust system. This is automatically engaged when the Station receives a Turn Out call to a fire or emergency incident.

b. Crows Nest Fire Station.

This Station came to attention when FRNSW recently decided to repaint part of the Engine Bay ceiling black. Which makes acting in accordance with Safe Work Australia's, 2015 - *Guide To Managing Risks Of Exposure To Diesel Exhaust In The Workplace (Page 4),* more difficult to undertake. If the ceiling is white, then the element of the risk assessment process set out below, is much easier to enact.

2. Assess the risks if necessary – Dot point 5

- *Are there soot deposits in the workplace; how significant are they? What can be done to avoid them? What methods are in place for regularly cleaning the workplace?*

The photos below show the extent of DPM build up at the Station.

Photo above, is six months after this portion of the ceiling was painted white.

Photo above is DPM build up above an upward facing exhaust, from a Fire Truck.

The photo above, is the portion of the ceiling painted black. The photo below is of a simple wipe of the black portion of the Engine Bay roof, six months after the painting was completed.

xix. Since 2002, along with the rest of the public sector, under the last and current Australian WHS Strategy, FRNSW were expected to model best practice. Most recently in 2018, the NSW Government published its *NSW Government Work Health and Safety Sector Plan*, with the following opening Statement from the relevant Minister;

This NSW Government Work Health and Safety Sector Plan renews our commitment to provide safe and healthy workplaces for all workers under our care.

The NSW Government sector will do this by becoming role models in work health and safety; improving employee engagement and productivity; creating real solutions for safer working conditions...

Clearly, this did not happen either, at Fire and Rescue NSW.

Conclusion

As there is no lower limit to hazardous DPM exposure. Whatever level the DPM Exposure Standard is set at, it must not be regarded as a healthy and safe level by PCBUs. Only a maximum level that must not be exceeded.

The US National Institute for Occupational Safety and Health DPM Testing *METHOD: 5040: Issue 3,* also used in Australia, tests down to 1ug/m3. Given the data in the 2022 Vermeulen article, testing results that indicate 1ug and above must be used to trigger a consultative PCBU review of the DPM control measures in place.

FBEU members and their families, deserve nothing less.
