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TO: The Honorable Mitch Greenlick
House Committee on Health Care

FROM: David Farrer, Public Health Toxicologist
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SUBJECT: Health Effects of Diesel

Chair Greenlick and members of the committee; I am David Farrer, a Public Health Toxicologist with the Public Health Division of the Oregon Health Authority. I am also a member of DEQ's Air Toxics Science Advisory Committee that sets ambient benchmark concentrations for toxic air pollutants in Oregon.

I am here to talk about the negative health effects of diesel from a public health perspective and to provide additional details about the mechanism by which diesel exhaust causes these health effects.

Health Effects

Exposure to outdoor air pollution, including exposure to diesel exhaust, is linked to a number of health problems. Particle pollution from diesel can increase the risk of cancer, heart disease, asthma attacks, chronic obstructive pulmonary disease (COPD), and can interfere with the growth and work of the lungs.

Recent studies¹ indicate that carbon black particles (the core of particle pollution from diesel) can negatively affect cognitive abilities like speech and memory in children. Another recent study² found a link between proximity to major roadways and dementia in older adults.

¹ Suglia, S., Gryparis, A., Wright, R.O., Schwartz, J., & Wright, R.J. (2008). Association of black carbon with cognition among children in prospective birth cohort study. *American Journal of Epidemiology*, 167, 280-286.

² Chen, H. et. al., (2017). Living near major roads and the incidence of dementia, Parkinson's disease, and multiple sclerosis: a population-based cohort study. *The Lancet*, 389, 718-726.

The United States Environmental Protection Agency recently completed an assessment of benzo(a)pyrene, which is attached to the particles in diesel exhaust. The assessment found that, in animal studies, benzo(a)pyrene can cause fetal death when pregnant mothers are exposed and can decrease ovulation rates in female rats.

Where people live, work, learn and play matters in their risk of exposure to diesel exhaust. Exposures are highest where diesel traffic is heaviest, such as along major highways and in cities.

Inhaling particle pollution from diesel makes it harder to breathe, triggers heart attacks, causes greater use of asthma medication and causes emergency room visits and hospitalizations for children and adults.

Oregon Specific Information

Oregonians at greatest risk from particle pollution, including diesel exposure include:^{3,4}

- Infants, children and teens with growing lungs
- People over the age of 65: 488,099
- Children with asthma: 64,038
- People living with lung disease such as asthma or Chronic Obstructive Pulmonary Disease (COPD):
 - Asthma: 330,300 (10.4%)
 - COPD: 214,800 (6.0%)
- People living with heart disease or diabetes:
 - Cardiovascular disease: 272,500 (7.3%)
 - Diabetes: 307,800 (8.4%)

Mechanism of Toxicity

The exhaust from diesel engines is a mixture of gases and particles. Older diesel engines emit much larger quantities of both types of pollutants than newer diesel engines. This is why older diesel engines pose a much greater public health risk than newer diesel engines.

The gases in diesel exhaust include carbon monoxide, sulfur oxides, nitrogen oxides, alkenes, aromatic hydrocarbons, volatile organics, aldehydes and low molecular weight polycyclic aromatic hydrocarbons (PAHs). Several of these gases are carcinogenic.

³ American Lung Association State of the Air Report 2017 <http://www.lung.org/our-initiatives/healthy-air/sota/city-rankings/states/oregon/>

⁴ Oregon Health Authority, Public Health Division, Health Promotion and Chronic Disease Prevention section. Chronic diseases among adults, Oregon 2016. <http://public.health.oregon.gov/DiseasesConditions/ChronicDisease/DataReports/Pages/AdultData.aspx>. Accessed 2.5.2018.

PAHs, in particular, cause DNA mutation which is the first step in a cell becoming cancerous. Benzene targets bone marrow increasing the risk of various blood cancers (or leukemias). Other gases in diesel exhaust are respiratory irritants, and carbon monoxide decreases the blood's ability to carry and distribute oxygen throughout the body.

The particles in diesel exhaust cause health effects in two ways – the physical size of the particles and the contaminants that coat the outside of the particles. The particles are so small that they escape the natural filtering mechanisms we have in our noses and upper airways and so are able to penetrate all the way to our alveoli (the gas exchange sacs in our lungs). Once lodged there, the particles are difficult for our lungs to clear and inflammation occurs as result of the lung's efforts to clear the particles. This mechanism of action likely plays a large role in diesel exhaust's contribution to asthma and COPD. The particles are small enough that some enter the blood stream through the lungs, which is likely a part of the mechanism by which diesel exhaust can increase risk of heart attacks.

But it is not just the physicality of the diesel particles that are problematic. They are also coated with heavier PAHs that wouldn't normally exist in gas form. Heavier PAHs tend to be more carcinogenic than the lighter ones, and the size of the particles carries these more potent PAHs deep into the lungs. One of these heavier, potent, PAHs is benzo(a)pyrene, which I mentioned earlier in terms of potential fetal deaths and reproductive harm.

Summary/Closing

Diesel exhaust, which is emitted at much greater volumes from older diesel engines, contains several elements that are harmful to the health of Oregonians, especially the young and elderly among us and those with pre-existing health problems.

I would be happy to answer any questions you may have now or later on if you think of additional questions then. Thank you for the opportunity to testify.