Brief Update On Diesel Health Effects

Diesel Technology Workshop
Washington, DC
January 23, 2019

David N. Weissman, MD
Director, Respiratory Health Division
National Institute for Occupational Safety and Health

The findings and conclusions in this report are those of the author and do not necessarily represent the views of the National Institute for Occupational Safety and Health.
Outline of Presentation

• Overview of Diesel Health Effects

• IARC 2012 Evaluation of Carcinogenicity of Diesel Exhaust

• Follow-up to Diesel Exhaust in Miners Study (DEMS)
Health Canada’s Summary of Health Effects of Exposure to Diesel Exhaust

<table>
<thead>
<tr>
<th>Outcome</th>
<th>Acute/chronic DE exposure</th>
<th>Causality determination</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carcinogenicity</td>
<td>Chronic</td>
<td>Causal (lung cancer) Suggestive (bladder cancer) Inadequate (other cancers)</td>
</tr>
<tr>
<td>Respiratory effects</td>
<td>Acute</td>
<td>Causal</td>
</tr>
<tr>
<td>Chronic</td>
<td>Likely</td>
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<tr>
<td>Cardiovascular effects</td>
<td>Acute</td>
<td>Likely</td>
</tr>
<tr>
<td>Chronic</td>
<td>Suggestive</td>
<td></td>
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<tr>
<td>Immunological effects</td>
<td>–</td>
<td>Likely</td>
</tr>
<tr>
<td>Reproductive and developmental effects</td>
<td>–</td>
<td>Suggestive</td>
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<tr>
<td>Central nervous system effects</td>
<td>Acute</td>
<td>Suggestive</td>
</tr>
<tr>
<td>Chronic</td>
<td>Inadequate</td>
<td></td>
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</tbody>
</table>

6.1 Cancer in humans

There is sufficient evidence in humans for the carcinogenicity 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.

There is inadequate evidence in humans for the carcinogenicity of gasoline engine exhaust.

6.3 Overall evaluation

Diesel engine exhaust is carcinogenic to humans (Group 1).

Gasoline engine exhaust is possibly carcinogenic to humans (Group 2B).
Basis for IARC Determination


• Studies cited as most influential:


This report is a careful review by an independent scientific panel of two major epidemiological studies of historical exposures to diesel exhaust, the Diesel Exhaust in Miners Study (DEMS) and the Trucking Industry Particle Study (Truckers) to assess whether these studies could provide the basis for quantitative risk assessment.

In the Panel’s view, both the Truckers study and the DEMS were well-designed and well-conducted studies that each made considerable progress toward addressing a number of the major limitations that had been identified in previous epidemiological studies of diesel exhaust and lung cancer.

The Panel found that the studies have many strengths, but any effort at quantitative risk assessment will need to acknowledge some key uncertainties and limitations.

The Panel concluded that both the DEMS and the Truckers study provided results and data that provide a useful basis for quantitative risk assessments of exposures in particular to older diesel engine exhaust.
Follow-Up to the Diesel Exhaust in Miners Study

• Access to data underlying DEMS were made available to interested investigators, including a team funded by the Truck & Engine Manufacturers Association (EMA)

• EMA-supported publications raising criticisms of DEMS and presenting alternative data analyses:


• DEMS investigator responses:


Follow-Up to the Diesel Exhaust in Miners Study

- Ongoing studies based at NCI
- Suggested associations between ischemic heart disease and exposure to respirable elemental carbon and/or respirable dust


- Efforts underway to extend mortality follow-up of DEMS cohort and case-control studies from 1997 (original studies) to 2015
Health Effects Institute (HEI), 2015

• Published *The Advanced Collaborative Emissions Study (ACES)*

  • ACES set out to evaluate emissions and health effects from new-technology (MY 2007 and 2010) heavy-duty, on-road diesel engines.

  • The results show that the aftertreatment technologies used in such modern diesel engines are highly effective and that they meet — and exceed — the reductions mandated by U.S. regulations. The study reports the effectiveness of diesel particulate filters in greatly reducing PM emissions and of selective catalytic reduction systems in reducing NO\textsubscript{x} emissions; similarly, emissions of more than 300 other compounds — some with known carcinogenic and toxic properties — measured in the exhaust were also reduced relative to exhaust from traditional-technology diesel engines.

  • ACES results demonstrate, even after considering some inherent limitations in any such study, that diesel particulate filters greatly reduce the amount of PM from modern diesel engines and that the overall toxicity of exhaust from modern diesel engines is significantly decreased compared with the toxicity of emissions from traditional-technology diesel engines.

  • Exposure to new-technology diesel exhaust (NTDE) from a 2007 engine tested in Phase 3 of ACES was not carcinogenic in the rat, unlike traditional-technology diesel exhaust (TDE) from older engines, which is known to cause lung tumors under similar conditions. A few NTDE-associated effects in rat lungs in ACES were observed; however, these effects were consistent with exposure to NO\textsubscript{2}, a pollutant present in 2007 engine emissions that was further reduced in exhaust from MY 2010 engines, which deployed a selective catalytic reduction system.
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Thank you!