

Re-assessment of Toxic Risks for Diesel Particulate Matter (DPM)

Summary of Deliberations

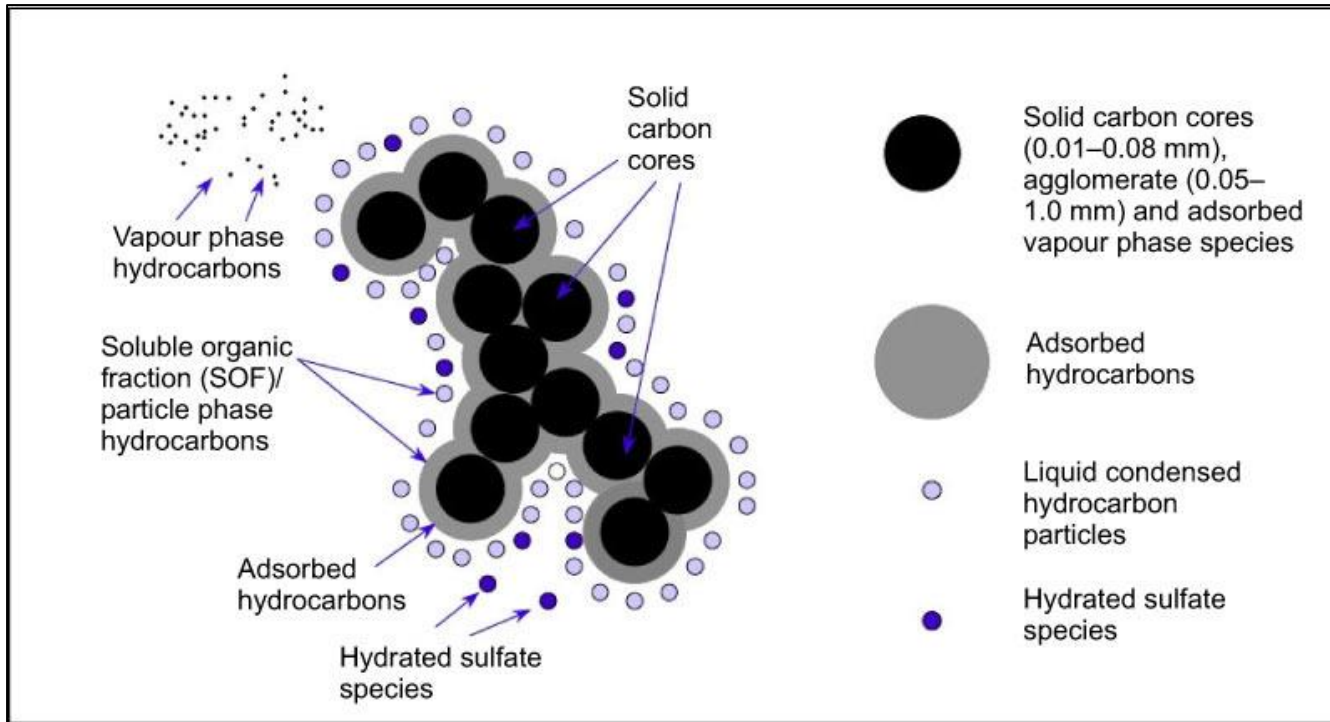
Oregon DEQ ATSAC

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ATSAC Meeting Record on Diesel

- May 20, 2015 Polycyclic aromatic hydrocarbons (PAHs) and DPM
- June 17, 2015 DPM, Elemental carbon, and epidemiologic evidence
- July 15, 2015 Alternative approaches for development of an ABC
- September 16, 2015 Alternative Approaches for development of an ABC

Diesel Exhaust



<http://www.technology.matthey.com/article/53/1/27-34/>

- Complex mixture of gases and ultrafine particles
- Toxic gases: NO_x, SO_x, VOCs, and PAHs
- Carbon particles: < 0.1 μm

The Health Issue

- Large and substantial diesel engine activity takes place in Oregon
- The statewide Air Emissions Inventory provides a general profile
- Most emissions are in metropolitan areas
 - particularly Portland
 - High population exposure potential
- Increasing trends due to growing truck/rail and off-road activity
- New engine technology (post-2007) has greatly reduced emissions and toxicity
- Diesel engine fleet is slow to turn-over due to durability of this engine type
 - Unknown but likely large old diesel engine use in metropolitan areas near populations

The Science Issue

CONSTITUENT APPROACH

- Standards and ABCs are not promulgated by source
- Wood smoke, industrial boiler, power plant, or gasoline engine
- Toxicological evidence for components provides quantitative evidence for selecting standard or ABC
- For many particulate matter and chemical pollutants, specific epidemiologic data exist
- For each constituent pollutant in ambient pollution, we apply uncertainty factors to account for its potential interaction with other pollutants

MARKER APPROACH

- No single chemical serves as a unique marker of exposure
- Poor or non-existent data from toxicological and animal models
- Best epidemiological studies use respirable EC as the measure of exposure
 - Old diesel engine technology
 - Miners and long-haul truck drivers (healthy men)
 - Exposures >> community
- No generally accepted method exists for the translation of relative risks from epidemiologic studies to unit risk estimates
- Direct measurement of EC in ambient air is analytically impractical for agencies – must be modelled from particulate matter measurements

The Policy Issue

CONSTITUENT APPROACH

- Protect population health via standards/ABCs of the constituent particulate matter and chemicals
- NAAQS for PM_{2.5}, NO_x, and SO_x
- ABCs for VOCs, particularly PAHs
- Addresses a range of potential endpoints associated with the mix of constituents

MARKER APPROACH

- Measure and model a component that serves as indicator of diesel exposure
- Elemental carbon (EC)
- Health endpoint limited to one outcome of concern: lung cancer

ATSAC Approach to Recommending ABCs

1. Assemble and evaluate existing UREs from U.S. EPA IRIS, IARC, ATSDR, and other trusted authorities
2. Evaluate documentation for application to unique aspects of protecting Oregon's population
 - Vulnerable groups (age, gender, race/ethnicity, SES)
 - Multiple pathway exposures
3. Recommend an ABC to the DEQ with scientific rationale and basis

Previously published UREs

- The U.S. EPA and the World Health Organization have withdrawn previously published unit risk estimates:
 - U.S. EPA IRIS (2003) RfC = 5×10^{-6} per $\mu\text{g}/\text{m}^3$
 - WHO (1996) URE 7.1×10^{-6} per $\mu\text{g}/\text{m}^3$
- Cal OEHHA (1998) URE 3×10^{-4} $\mu\text{g}/\text{m}^3$ remains published and used, but the documentation to support this choice is unclear and this URE was based on older evidence
- In 2005, the ATSAC recommended an ABC for DPM near the WHO URE

Most recent science

- Health Effects Institute (November 2015) reviewed most recently published epidemiologic studies of lung cancer risk for miners and truckers
- Expert panel endorsed quality and scientific validity of these epidemiologic studies
- The estimates for relative risk at the highest levels of these occupational exposures are statistically significant, but the excess risk is small
- However,
 - The HEI Expert Panel did not generate a URE
 - Extrapolation down to community ambient levels of exposure requires assumptions about the appropriate dose-response model
 - Choice of uncertainty factors to apply for vulnerable groups is not clear

Draft Consensus of ATSAC

- The available scientific evidence is insufficient to support a quantitative revision for the ABC
- Therefore, we cannot recommend a revision to the ABC for DPM at this time
- The combination of the NAAQS for PM_{2.5}, NO_x, and SO_x, and the ABCs for DPM and volatile organic compounds, specifically PAHs provides health protection for diesel exhaust in ambient air