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Re: Comments for consideration by the U.S. Environmental Protection Agency (EPA) Chartered Scientific Advisory Board (SAB) regarding COVID-19 research opportunities

POET is pleased to submit these comments for EPA's consideration regarding COVID-19 research opportunities. Our comments address research needs identified by the SAB COVID-19 Review Panel, with a specific focus on needs related to the role of fine particulate ($PM_{2.5}$) air pollution on COVID-19 susceptibility and severity.

Interests of POET

As one of largest producers of ethanol used in gasoline, POET is interested in relationships among motor vehicle fuel, air quality, and health. POET produces ethanol from plant starches and cellulose, primarily sourced from corn. Ethanol is added to gasoline to boost the octane of the fuel and, therefore, the performance of the engine. Ethanol displaces aromatic compounds, such as benzene, derived from oil that would otherwise be used to boost octane levels of gasoline. Said displacement is relevant to air quality in part because aromatic compounds are important precursors of secondary organic aerosol formation, a component of $PM_{2.5}$. In addition, the carbon intensity (CI) of typical corn starch ethanol is at least 40% lower than the CI for petroleum-based gasoline. Understanding relationships between air pollution, including $PM_{2.5}$, vehicle emissions, and COVID-19 is, therefore, of interest to POET.

Comments and Recommendations

The Review Panel identified several areas of research that may enhance and inform EPA's responses to COVID-19. Included in these research areas are environmental and human health risk factors affecting transmission and severity of COVID-19, as discussed by Review Panel in their April 21, 2020 report (USEPA 2020). Below we address several identified research questions in these areas.

- *Can particulate matter in the atmosphere serve as a vehicle for the transmission of SARS-CoV-2?*

  We support research investigating whether and how SARS-CoV-2 transmission is facilitated through particulate matter, and more specifically, $PM_{2.5}$. This research is central to EPA's mission, as it will provide important new information about the health risks posed by $PM_{2.5}$, a criteria air pollutant, and will directly impact the ability of EPA to mitigate and otherwise respond to COVID-19 and future viral infections.

  While our understanding of the role of $PM_{2.5}$ in SARS-CoV-2 transmission and severity is poor at present, results from several studies suggest that $PM_{2.5}$ may be a carrier of viruses, such as SARS-CoV-2, and other airborne pathogens and as a result, may allow these pathogens to deposit deep into the alveolar spaces of the human lung, thus increasing disease severity (Cambra-López et al. 2010, Zhao 2019). Consistent with this, recent studies from China show positive correlations between ambient $PM_{2.5}$ concentrations and virus-related infection rates (Ye et al. 2016, Chen et al. 2010) and higher relative risks for measles associated with increased Inhalable particle (PM_{10}) concentrations (Peng et al. 2020). While providing important preliminary evidence, these studies are too few and limited; additional measurement and epidemiological studies are needed to ascertain the role of $PM_{2.5}$ on SARS-CoV-2 transmission.

- *Does exposure to air pollutants, including wildland fire smoke or other air pollutants (e.g. ozone, particulate matter, diesel exhaust, pollen) increase the susceptibility to respiratory viruses like SARS-CoV-2? Or exacerbate existing COVID-19 infection?*

  We believe that addressing this research question is of critical importance to EPA's mission and its role in responding to SARS-CoV-2. As such, EPA is best suited to organize and synthesize research efforts that address this question, most likely in partnership with academic and other research organizations.

Long term exposures to $PM_{2.5}$ have been consistently associated with numerous and substantial adverse respiratory and cardiac outcomes, including pulmonary function deficits, asthma, myocardial infarctions, increased inflammation, and increased hospital admissions for respiratory and cardiac-related conditions (USEPA 2019). These outcomes have, in turn, been identified as key risk factors of COVID-19 severity.

Given this, it has been hypothesized that $PM_{2.5}$ may increase susceptibility to SARS-CoV-2 and/or exacerbate COVID-19 severity. Results from several non-peer-reviewed reports have been published that examine these hypotheses. In perhaps the most comprehensive of these studies, Wu et al. (2020) examined whether people who lived in counties with higher long-term $PM_{2.5}$ concentrations had higher risk of death from COVID-19 as compared to people who lived in counties with lower PM2.5 levels, adjusting for confounding factors related to county demographics, SARS-CoV-2 spread, and timing of governmental policies. The authors found that a 1 ug/m^3 increase in $PM_{2.5}$ is associated with an 8% increase in the COVID-19 death rate (95% confidence interval [CI]: 2%, 15%), suggesting that long-term exposures to $PM_{2.5}$ increases susceptibility to and the risk of death from COVID-19 (Wu, Nethery et al. 2020).

Findings from this and other recent studies of $PM_{2.5}$ and COVID-19 mortality, however, are preliminary. Better data, additional analyses, different study designs, and peer review are needed to assess the robustness of their findings. These additional steps are especially important given that their findings (as acknowledged by the authors) are based on an inaccurate accounting of the number of COVID-19 cases and deaths, with substantial under-reporting of both. As better data related to the SARS-CoV-2 pandemic become available, it will be important for these other analyses to be updated and peer-reviewed and for additional studies to be conducted.

- *Are there particular health risk factors (aside from preexisting conditions) that make certain individuals or subpopulations more sensitive or vulnerable to COVID-19, e.g. characteristics of the built environment, seasonal allergies, chronic exposure to aerosolized pollutants, demographic conditions, etc.?*

  We believe that EPA should make research aimed at identifying sensitive and vulnerable populations to COVID-19 a high priority, including the risk factors noted in this question. Because SARS-CoV-2 is an aerosol in the atmosphere, known risk factors for exposure to respirable particle matter may also be applicable to the virus. Such factors in the built environment include the type of ventilation for a building (natural or mechanical), air exchange rates, deposition velocities, and filtration of indoor air. Seasonal allergies could possibly influence the effects of COVID-19 given that early research

indicates the virus acts through immune-mediated pathways for many patients. The role of demographics on health impacts of the virus warrants consideration as well, especially factors such as residential and community population density that may influence transmission and viral loads for infected individuals. Given that this avenue of research would likely require consideration of a diverse array of risk factors, including socioeconomic, neighborhood, and environmental, it may be best for EPA to partner with other agencies to ensure a multi-disciplinary and coordinated approach to this work.

Sincerely,

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