—CO2 - Cognition [?] Environmental Justice

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November 22, 2022

Abstract

At least 37 studies demonstrate some degree of short-term influence of CO2 on human cognition, broadly considered, at CO2 concentrations frequently observed in buildings (>1000ppm). Ambient concentrations of CO2 in some cities can exceed global average values by several hundred ppm due to multiple large sources and idiosyncrasies of atmospheric transport, diffusion, and dispersion. In those few cities with extensive CO2 monitoring systems, local variations exceed 50ppm along transport corridors or close to point sources such as power plants. Scenarios of future CO2 concentrations project global average values up to 950ppm by 2100. Combining these various influences suggests that some locations in cities may regularly experience CO2 concentrations of 1300ppm by 2100. In occupied enclosed spaces such as schoolrooms, CO2 concentrations can rise several thousand ppm above ambient values. ASHRAE sets indoor air standards relative to ambient levels, not as absolute levels. Highly energy efficient buildings reduce air leakage and may have lower ventilation air exchange rates to reduce energy loss. LEED standards do not address effects of certification standards on CO2 concentrations. Cabs of vehicles and other enclosed spaces in the transport sector also can be several thousand ppm above ambient levels. Long-term exposure to elevated CO2 at these levels has not been studied in humans but limited studies of mouse models demonstrate respiratory impairments after three-month exposure to 890ppm CO2 for newborn mice. We are unaware of any studies of health impacts of CO2 on mice or humans that use pre-industrial concentrations of CO2 as baseline values. Thus, experimental methodologies must be reformed and standardized before we can fully appreciate how living in an elevated CO2 world is already affecting human health. Connecting the dots between these various influences suggests that exposure (particularly long-term exposure) to CO2 concentrations that affect cognition may vary significantly depending upon distance from active sources (power plants, roadways) and occupation (e.g. truck driver), such effects will grow to serious levels, may already exert a toll on human cognitive outcomes, and could implicate environmental justice concerns.

↑CO_2 - Cognition ≠ Environmental Justice

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Long-term exposure to elevated CO_2 at these levels has not been studied in humans but limited studies of mouse models demonstrate respiratory impairments after three-month exposure to 890ppm CO_2 for newborn mice. We are unaware of any studies of health impacts of CO_2 on mice or humans that use pre-industrial concentrations of CO_2 as baseline values. Thus, experimental methodologies must be reformed and standardized before we can fully appreciate how living in an elevated CO_2 world is already affecting human health.

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Plain language summary:

Carbon dioxide levels that you experience in your everyday life affect your ability to think and process information. Conditions in buildings and vehicles make this worse. As emissions of carbon dioxide increase, we will be exposed to more and more of these effects and may be unable to escape from the problem. The issue is worse near power plants and roadways so that people who live or work in such settings may suffer the most. We don't know much about how spending your whole life in such conditions will affect your thinking or health but what we do know is reason for worry.