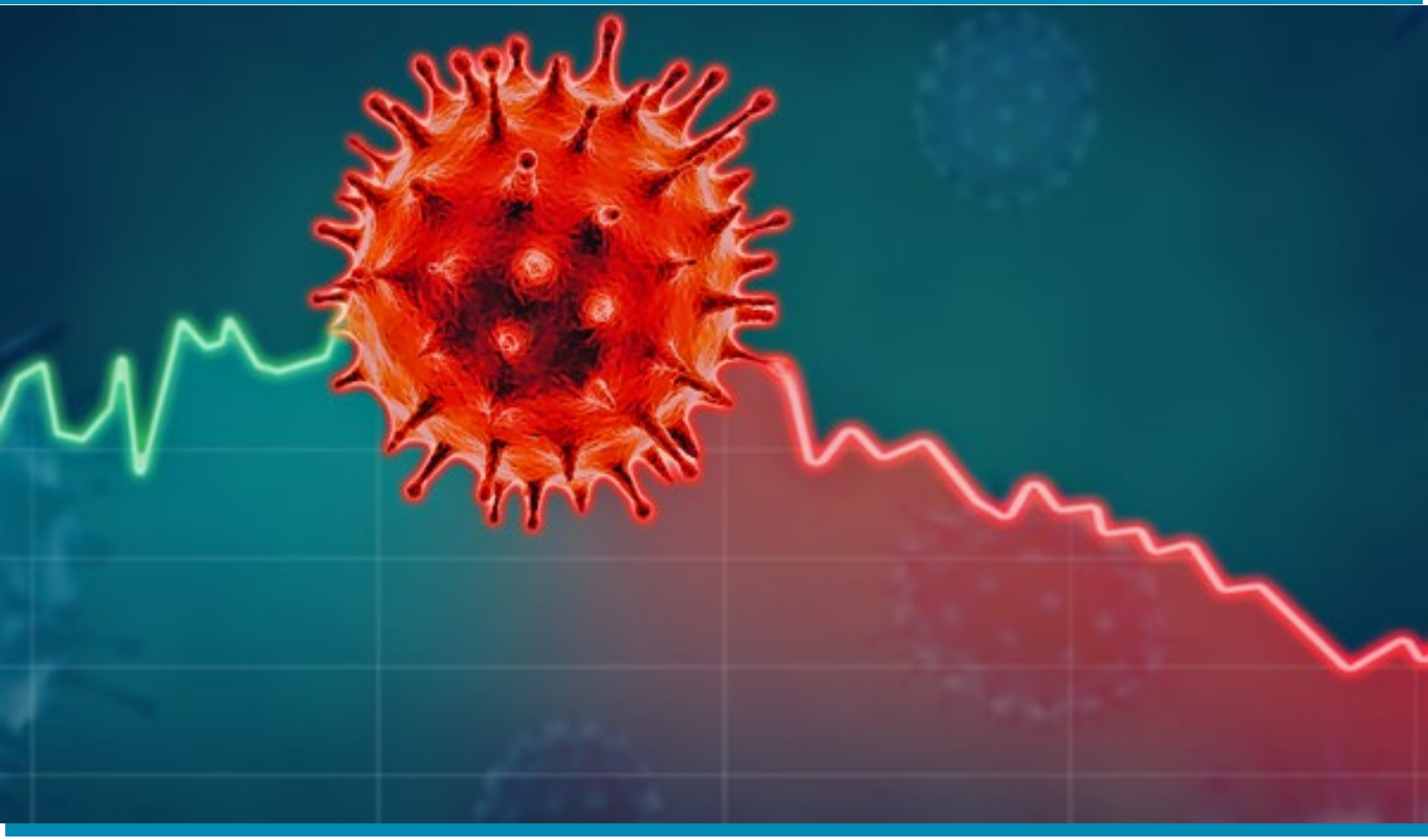
Declining Trends During the Pandemic: Vehicle Miles Traveled and Air Pollutants



STATE OF NEW JERSEY
CLEAN AIR COUNCIL

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New Jersey Clean Air Council's website
nj.gov/dep/cleanair

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***Editor's note**: See supporting documents for this report:*
nj.gov/dep/cleanair/cac-past-public-hearings.html

EXECUTIVE SUMMARY

Since March 2020, the world has been subject to a pandemic that changed the behaviors of New Jersey citizens, including the way they worked, and carried on their lives. In essence, the world, and particularly New Jersey citizens, were asked to stay at home, except for certain essential businesses. These dramatic changes in lifestyle had a demonstrated impacts on travel. Remote work, which was once the province of those requiring alternative work arrangements, became the norm. As a result, air quality in New Jersey significantly changed, particularly air quality impacts from mobile sources, the largest contributor of air pollution in New Jersey. In addition, exposure to COVID-19 pathways also heightened concerns about the quality of both indoor and outdoor air. It is well known that air pollution is known to be a cause of health problems, like heart attacks, strokes, diabetes, and high blood pressure, that have been identified as the pre-existing medical conditions (International Journal of Infectious Diseases 94 (2020) 91–95) that are also known to be linked to death from COVID-19 infection.

With the advent of vaccines, and the understanding of how COVID-19 can be prevented, lifestyles are beginning to return to normal. Although the pandemic is ongoing, after over two years of our changed lifestyle, the Clean Air Council conducted what we believe will be one of the first of many analyses of the impacts of the pandemic on air quality. The Council received testimony from the NJDEP on air quality data during the pandemic, which showed direct correlations to the reduction of vehicle mile travelled (VMT) and improved air quality. The Council also received expert presentations on the impact of pollution on COVID-19. Given the positive impacts on air quality, the Council also received information from transportation experts, including New Jersey Transit, as well as local government, transit experts and the development community to solicit information and ideas to develop recommendations on maintaining the air quality benefits that New Jersey obtained during the pandemic. The Council also heard from public health experts regarding the impacts of COVID-19 on indoor air as this will be a continuing concern as we proceed through what will hopefully be the end of the pandemic and beyond.

Although the Council believes that the analyses we initiated will need to be the subject of further study, particularly as more data are obtained, the Council has made the following recommendations that we believe will continue and perhaps enhance the improvements to air quality in New Jersey. Most importantly, the Council's recommendations focus on reducing VMT, including encouraging continued remote work; supporting land use and mode change policies to enhance reduction of VMT; enhancing ridership on public transportation; improving efficiencies of private and commercial transportation; and catalyzing the electrification vehicles (consistent with prior Council reports). In addition, the Council has also made recommendations on targeting impacts to improve air quality, and conduct continuing assessments, monitoring and mitigation strategies for impacts on vulnerable populations and overburdened communities.

RECOMMENDATIONS

Encourage the Adoption of Telework

- NJDEP, in cooperation with the State Civil Service Commission and state worker unions, should continue to work to develop, advocate for, and expand, statewide work from home policies to reduce vehicle miles traveled (VMT) by state, county and municipal employees.
- NJDEP, in collaboration with other State agencies, can encourage the development of guidance documents for businesses to adopt telework options to help reduce VMT, with the associated improvement in air quality.
- NJDEP should consider collaborating with NJDOT and NJDOH to update the State's Pandemic Response Plan to facilitate the reduction in unnecessary vehicular movement throughout the State as part of the State's pandemic response plan to protect public health and respiratory health by lowering traffic emissions during public health emergencies and surge events.

Target Impacts to Priority Population

- NJDEP should work with NJDOH, local health departments, and healthcare providers to focus on improving air quality in areas with historically higher levels of air pollutants to better prepare for impacts of future pandemics and mitigate their effects.
- NJDEP should collect more real time and near time data to better understand pollution patterns and impacts in these affected areas. Analysis of air monitoring data during the height of the pandemic suggested that pollution reduction impacts were less in these areas than in other areas of the state.
- NJDEP Division of Air Monitoring, in collaboration with the NJDEP Office of Environmental Justice and the NJDEP Office of Environmental Health and Safety, should undertake development of a plan to identify overburdened communities and communities of color that are disproportionately impacted by air pollution emissions to reduce impacts in these communities.
- NJDEP should encourage NJDOH and local health agencies to monitor and develop mitigation strategies to protect vulnerable populations (e.g., children, elderly, those with compromised immune systems, and cardiopulmonary disorders) from air pollutants.

Support Land Use and Mode Change Policies

- Similar to adjacent states including Pennsylvania, New Jersey should consider having the Motor Vehicle Commission (MVC) plan for collection of annual odometer readings. Requesting residents to report annual mileage will allow the state to develop a consistent baseline from which to measure progress and provide data to help shape state transportation policy and develop inevitable funding models. This work needs to begin now to overcome challenges such as the five-year inspection grace period for new cars and questionability of self-reported data. While New Jersey's vehicle registration law (NJSA § 39:3-4) currently requires some information from vehicle owners, such as address, name and make of the vehicle and manufacturer's number, it does; however,

provide the Chief Administrator with the ability to require "any other statement", giving leeway for the collection of odometer readings.

- Even as direct emissions from vehicles are reduced through electrification, New Jersey should consider adopting a statewide target for the reduction of VMT. Establishing a target would compel New Jersey state agencies to take action and adopt VMT as one Transportation Performance Measure. Transportation Performance Measures predict, evaluate, and monitor the degree to which the transportation system accomplishes adopted public objectives. By establishing VMT reduction as a public objective, decision-makers will be obligated to determine the effects on VMT from proposed transportation plans and projects and to monitor trends in the transportation system performance over time.
- NJDEP, should encourage municipal governments to develop plans encouraging more mixed-use development near train stations and other public transportation hubs and transit villages.
- NJDEP should continue to partner with state agencies and local government to institute a cohesive regional strategy to institute Complete Streets policies throughout the State by providing or expanding technical planning assistance.
    - Proof of concept for this already exists in eight NJ counties and over 160 municipalities that have adopted Complete Streets policies as of March 2021
    - NJDEP, NJDOT and NJT should collaborate to encourage more transit-oriented development across all of the state's municipalities and provide access to more mobility options (e.g., bicycle rentals, scooter rentals, rideshare programs, etc.) with a focus on VMT reduction.
    - NJDEP should coordinate with NJDOT and the MPOs to collect and share activity data from micro mobility, pedestrian and other non-vehicular transportation (bike and e-scooter) programs to inform a statewide program.
- NJDEP should coordinate with NJDOT and the MPO's to study lifestyle changes in correlation to the pandemic, including increased work from home, fuel price change and more. This information can be used to determine the most useful techniques, incentives and disincentives for convincing single passenger vehicle users to move to other modes of transportation.
- The state should put a greater emphasis on expanding use of existing land use tools and developing new tools which will lead to a reduction in VMT and more sustainable development patterns. While state agencies have developed and implemented many of these tools, the regulatory or incentive environments have not been sufficiently leveraged to achieve more significant adoption of the tools. These tools range from transit-oriented development (TOD), complete streets, technical assistance, accessory use dwellings, form-based zoning, in-fill development, and state planning which encourages and enhances multi-model development and reduces vehicular dependency.
- New Jersey should expand on the work done for the Eastern Transportation Coalition Mile-based user fee pilot and research study. This would allow the state to explore alternative funding options for road and transportation infrastructure, options which could include congestion charges and other road pricing techniques and/or updated vehicle registration and real-time pricing based on weight and configuration. Study should include incentives for lower life-cycle GHG VMT and disincentives for higher life-cycle GHG VMT.

Enhance Ridership on Public Transportation

- NJDEP should work with NJDOT and the MPOs to develop first mile/last mile transportation solutions to improve connections, encouraging the use of transit solutions, and improve job access and safety within the context of reducing overall VMT.
    - Identify priority areas for public investment in first/last mile solutions using regional analyses conducted through the NJTPA's congestion management process.
    - Identify gaps in bike and pedestrian infrastructure based on existing facilities and demand for bike and pedestrian access.
    - Identify performance measures for first/last mile solutions and incorporate these metrics into any operational plans or vendor contracts.
    - Develop incentives for private sector investment in first/last mile services – by employers, property developers and managers through tax credits and other financial incentives.
- In an effort to encourage and expand use of mass transit, NJDOT should work in cooperation with NJT and private transportation entities to make mass transit/multi-rider (e.g., ride share) transportation more reliable and more frequent.
- NJDEP should partner with other state agencies, advocacy groups, and stakeholders to develop, standardize, and expand a transit stakeholder engagement process to develop a robust and sustainable transit use and modernization plan.
- In order to overcome hesitancy to use mass transit during a pandemic, NJDEP should encourage NJT to continue following protocols of the International Association of Public Transportation (UITP) and the Global Biorisk Advisory Council (GBAC) on surface cleaning standards.

Private and Commercial Transportation

- State transportation agencies along with port and other transportation infrastructure operators should collaborate to identify techniques to increase the efficiency of every part of the commercial freight transportation system. This examination should include addressing empty miles, reduced-idle freight transport and transfer, improved design of multi-model hubs, and many more.

Catalyze Vehicle Electrification

- New Jersey state agencies should develop a plan to transition to a green economy with renewable energy resources. To promote sustain long-term post-pandemic vehicle pollution reduction, state agencies should promote the use of electric vehicle (EV) technology powered by a "clean energy" electrical grid.
- The BPU and New Jersey's electric distribution companies should develop a plan to invest in substantial upgrades to the electrical grid to support widespread electric vehicle charging infrastructure.
- NJDEP should encourage NJT to make clean energy transportation as available as possible with a priority to electrify buses and trains throughout the system.

    - NJDEP should continue to support and assist NJT with its plan to have a 100% zero emission bus fleet by 2040.
- NJDEP should promote expansion of the program for school bus and ferry electrification.
- In order to continue seeing the benefits of vehicle-related pollution reduction that occurred during the COVID-19 pandemic, state transportation agencies should continue to develop and expand identification of the EV charging corridor to encourage use of electric vehicles.
- NJDEP should encourage multi-rider EV use when possible to reduce overall VMT throughout the state, as well as to reduce mobile source pollution.

BACKGROUND

The past two years of the COVID-19 Pandemic have significantly disrupted the behaviors of New Jersey citizens including use of mass transit, goods and vehicle movement, building occupancy, and economic growth, all of which impacted air quality throughout the state. The Clean Air Council (CAC) has chosen to take this opportunity to examine the resulting changes to air quality during this time period. COVID-19 belongs to the coronavirus, a family of respiratory viruses that can cause mild to severe disease, from the common cold to respiratory syndromes such as MERS (Middle East respiratory syndrome) and SARS (severe acute respiratory syndrome). This family of viruses has three routes of transmission: 21% spread by aerosol, 29% droplet spread by close contact between individual, and 50% through surface contact.[1]

New Jersey is a very densely populated state that also serves as a major port and transportation corridor for the Northeast United Sates, leading to high volumes of vehicular traffic, movement of goods, and congestion. However, there is evidence that lockdown strategies during early stages of the pandemic significantly changed traffic-related air pollution. Changes were also observed in other activities, such as energy production and manufacturing.

During the pandemic, indoor air quality and confined space issues were less well understood. Due to the inability of people to socially distance in close quarters, there was hesitancy in the use of public transportation (e.g., trains, buses, and subways).

The COVID-19 pandemic and associated lockdown measures to control the spread of infection across the globe resulted in reports of reductions in air pollution from mobile sources. In Europe, lockdowns in the early part of 2020 resulted in significant reductions in air pollutants from vehicular emissions within days and weeks of officials curtailing movement of residents.[2] Nitrogen dioxide (NO_2) showed one of the largest reductions in monthly averages of up to 70% as observed at traffic monitoring stations in Spain and Italy. Background concentrations of NO_2 ranged from an average of 20% in the Czech Republic to 61% in Spain. In some cities, NO_2 levels remained relatively low after lockdown measures were lifted (Milan, Italy), while in others (Athens, Greece) NO_2 levels rapidly returned to pre-lockdown levels.[2] For $PM_{2.5}$, reduction in background concentrations ranged from 9% in the Czech Republic to 30% in Spain. These $PM_{2.5}$ reductions were smaller than those for NO_2 due to the more varied sources of $PM_{2.5}$, especially in urban areas, including the combustion of fossil fuel for heating, industrial activities, long-range transportation of particles, road traffic, and secondary particle formation.

Air pollution is a complex mixture of gases and particles that vary both spatially and temporally. The gases include carbon monoxide (CO), nitrogen oxides (NOx), ozone (O_3), sulfur dioxides (SO_2), ammonia (NH_3), and volatile organic compounds (VOCs). Particulate matter (PM) includes a mixture of compounds that can be grouped into five major categories: sulphates, nitrates, elemental carbon, organic carbon, and crustal material. COVID-19-related epidemiological studies have mostly examined health impacts based on particulate matter (PM), both PM_{10} and $PM_{2.5}$.

Particle size is important in determining transport and deposition (i.e., whether respirable or inspirable). Carbonaceous PM from coal, fuel or wood combustion is the most harmful and is a contributor to chronic disease outcomes, including cardiopulmonary diseases, neurodegenerative conditions, cancer and low birthweight.[3,4] Gaseous pollutants mainly studied at the population level related to transmissibility of COVID-19 and other respiratory viruses include nitrogen oxides (NOx) and ozone (O_3). NO_2 is a major air pollutant in urban environments, primarily arising from traffic, and has been associated with asthma, COPD, and cardiovascular diseases.[5] NOx and VOCs have been associated with excess morbidity and morbidity.[6] Exposure to air pollution has shown to increase severity of viral respiratory infections.[7] In addition, several studies have demonstrated that increases in air pollutant concentrations were associated with an increased occurrence of respiratory viral diseases among children and adults, particularly when the viral infection was concomitant to a short-term increase in exposure to air pollution.[8,9]

When it comes to a link between pollution exposure and COVID-19 specific morbidity and mortality, confirmed case identification, pollution exposure misclassification, and lack of pollution monitoring stations cast doubt on the association between pollutant exposure and exacerbation of disease. Furthermore, the majority of the epidemiologic studies of COVID-19 exposure and air pollution to date have been ecological with aggregated population level assessments, limiting their utility as they do not take into account individual exposures to a specific individual or confounders. However, Zhu et al.[10] analyzed the relationship between concentrations of six daily measured air pollutants (PM_{10}, $PM_{2.5}$, sulfur dioxide, carbon monoxide, nitrogen dioxide, and ozone) and confirmed COVID-19 cases in 120 cities in China between January 23, 2020 and February 9, 2020 and found significant positive associations among $PM_{2.5}$, PM_{10}, CO, NO_2 and O_3 with confirmed COVID-19 cases. There was a negative association with SO_2.

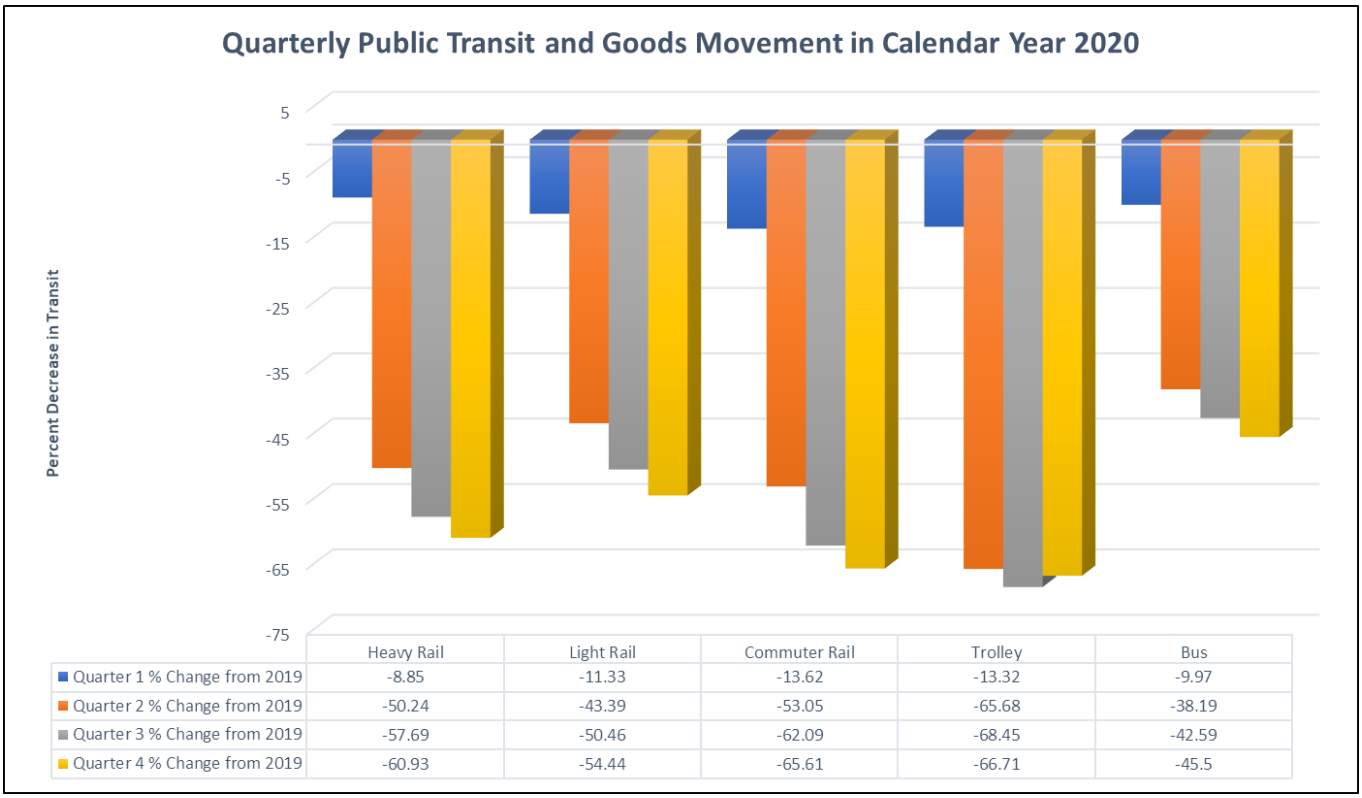
One of the most critical objectives in public health is to identify the key environmental factors that may contribute to the severity of an adverse health outcome among individuals exposed to COVID-19. Early pandemic data from both China and Italy indicated that the majority of deaths attributed to COVID-19 occurred in adults over 60 years of age with serious underlying health conditions.[11-13] Similarly, according to the CDC, early pandemic age-stratified COVID-19 mortality rates in the United States, suggested that persons aged 65 and over were at highest risk.[14] The comorbidities most often cited include hypertension, obesity, diabetes mellitus, cardiovascular disease, and chronic lung disease.[15-16] Relatedly, the association between $PM_{2.5}$ and health, including both infectious and chronic respiratory diseases, cardiovascular diseases, neurological disease, and pregnancy outcomes in the United States and worldwide is well established.[17-23] Therefore, since long-term exposure to $PM_{2.5}$ adversely affects the respiratory and cardiovascular systems and increases mortality risk,[24-26] it is generally agreed these particles

also exacerbate the severity of COVID-19 infection symptoms and worsens the prognosis of COVID-19 patients. Additionally, several experimental studies[18, 27-30] also suggest that exposure to pollution can suppress early immune responses to an infection, leading to a delayed severe inflammatory response.

There has been anecdotal reporting of particles in the air serving as carriers of SARS-CoV-2 virus-laden respiratory particles, thereby enhancing transmission in areas with higher levels of particulate matter pollution. There have been several studies published linking ambient air pollution ($PM_{2.5}$ or NO_2 concentrations) and the number of infection cases based on simple correlation analysis. However, without considering other critical factors driving the pandemic, and in particular severely limited human interactions during lockdowns (for the purpose of halting the spread of the pandemic), the relationships uncovered are likely proxies for other factors, in particular reduction in traffic and industrial activities, hence reduction in the emissions to the air, and in turn concentrations of pollutants in the cites where lockdowns where implemented. Thus, specific links between air pollution and severe acute respiratory syndrome-coronavirus-2 infection remain unclear.

In the early stages of the COVID-19 pandemic, personal travel was seen to decline, followed by goods movement throughout 2020. Figure 1 below, developed by the American Public Transportation Association (https://www.apta.com/research-technical-resources/transit-statistics/ridership-report/ridership-report-archives/) shows the national quarterly reduction in both public transit and goods movement on a quarterly basis throughout 2020 as compared to 2019 data. While decline in commuter rail, trolley, and bus ridership showed comparable declines during the first quarter of 2020, commuter rail and trolley ridership declined more steeply than bus ridership across second, third, and fourth quarters of the year. Goods movement by heavy rail also steadily declined throughout 2020.

Figure 1: Transit and Goods Movement



	Heavy Rail	Light Rail	Commuter Rail	Trolley	Bus
Quarter 1 % Change from 2019	-8.85	-11.33	-13.62	-13.32	-9.97
Quarter 2 % Change from 2019	-50.24	-43.39	-53.05	-65.68	-38.19
Quarter 3 % Change from 2019	-57.69	-50.46	-62.09	-68.45	-42.59
Quarter 4 % Change from 2019	-60.93	-54.44	-65.61	-66.71	-45.5

Vehicular emissions include carbon monoxide, particulate matter, hydrocarbons, nitrogen oxides, and greenhouse gases. These pollutants contribute to serious respiratory diseases, such as asthma and chronic obstructive pulmonary disease (COPD), myocardial infarctions, and can lead to premature death. Additionally, motor vehicle exhaust contains specific air toxics which include benzene, acetaldehyde, formaldehyde, and 1,3-butadiene.

According to a recent article in Earth System Science Data (2020) (https://essd.copernicus.org/articles/12/3269/2020/), global COVID-19 lockdowns caused fossil CO_2 emissions to decline by an estimated 2.4 billion tons in 2020. Carbon emissions from the burning of fossil fuels such as oil and gas are predicted to be approximately 34 gigatons CO_2, 7 percent lower than in 2019. Emissions from vehicle movement/good transport accounted for the largest share of the global decrease. By December 2020, emissions from vehicular traffic and aviation were still below their 2019 levels, 10 percent and 40 percent, respectively, due to continuing restrictions.

Following review of the aforementioned literature, the Council sought to have a public hearing to develop an understanding of the extent reduced vehicular traffic can improve statewide air quality, particularly during pandemic events. Additionally, the Council hoped invited subject matter experts could assist in developing guidance for safely returning to the use of mass transit where social distancing is not always practical or possible. The Council has attempted to gain a more detailed understanding of the air impacts seen throughout the pandemic and make recommendations to the Commissioner of the NJDEP on strategies to reduce vehicle miles travelled throughout NJ in order to sustain the positive air quality benefits seen during the pandemic.

SUMMARY of TESTIMONY

(Note: Summaries are listed in order of speaker testimony.)

Shawn LaTourette, Commissioner, NJDEP – Opening Remarks

Over the years, the Clean Air Council has addressed a wide range of important and emerging air quality issues, including power plant pollution, interstate transport, air toxins, mobile sources, cumulative impacts, climate change and fugitive dust emissions.

The latest topic, the "Impact of the COVID-19 Pandemic on Air Quality," is incredibly timely as we transition into a post-COVID world.

As all of you know, the transportation sector is the largest source of greenhouse gas emissions in New Jersey, accounting for 42 percent of those emissions. However, the pandemic gave us a unique glimpse into how air quality can improve simply because there are fewer cars on the road.

The impacts of the pandemic are many, but it is important that we not lose focus on the fact that fewer cars on the road have been a main contributor to improved air quality.

As a society, we learned a lot about what we can do in a short period of time. Working from home for almost two years was not something that we could have predicted at the start of the pandemic, but we all managed that transition swiftly – some of us in a matter of days.

And now, we have data proving we can quickly make an impact on our air quality, if we make a concerted effort. That is why it is incumbent upon us to refocus our efforts on finding ways to reduce milage on the roads.

In early April, Governor Murphy established a pilot telework program for state employees. I am so very proud of New Jersey serving as an example of state government reducing its carbon footprint.

In situations where we cannot reduce vehicles miles traveled, we need to continue to promote electric vehicles.

As the Council has recommended, we are implementing a suite of strategies to increase the number of electric vehicles on the road and ensure sufficient electric vehicle charging infrastructure.

This will require a combination of efforts from towns, builders, and county, state and federal governments that range from policies to regulations, from educational resources to financial incentives.

Starting with financial incentives, DEP, BPU and EDA all offer funding to help with the transition to electric.

In fact, DEP has a $4 million funding opportunity open until Friday, May 13, to install chargers where people live and work, such as town centers, commercial areas, retail centers, tourist attractions and destinations, and near concentrations of multifamily dwellings.

BPU offers funding for local governments to purchase EVs and charging stations, and EDA has allocated nearly $45 million for electric trucks and buses in the greater Camden, Newark, New Brunswick and Shore areas.

And remember that New Jersey provides the most generous EV purchase incentives in the country – through a combination of the Charge *Up New Jersey* program and a sales tax exemption. Since launching in 2020, this program has reduced the upfront cost for the purchase of approximately 14,000 EVs.

The recently signed federal Infrastructure Investment and Jobs Act also allocates significant funding for electrification in New Jersey and throughout the nation.

- $15 to $20 million a year for 5 years will be coming directly to New Jersey for fast charging on corridors and in communities
- $500 million per year for 5 years is allocated for a national competition opening later this year to install fast chargers in communities.
- $1 billion per year for 5 years will be available for clean school buses, including electric buses.
- $1 billion in funding now available for electric transit/shuttle buses owned by government agencies; applications are due Tuesday, May 31.

This new funding builds off nearly $150 million in investments made during the last two years in clean, equitable transportation projects that will improve air quality and reduce the effects of climate change, while moving New Jersey toward 100 percent clean energy by 2050.

The Murphy Administration took a significant step toward electrifying New Jersey's transportation sector on Sept. 1, 2021, with the unveiling of a statewide ordinance that makes it easier for people to drive electric by streamlining the local approval process for installing convenient and cost-effective charging infrastructure.

The law also requires that developers of multi-unit dwellings, such as townhouses, and parking lots/garages install the infrastructure necessary for EV charging stations upfront, which is more cost effective than tearing up pavement and installing them down the road.

The Department adopted Advanced Clean Truck Rules intended to accelerate a large-scale transition to zero-emission medium- and heavy-duty vehicles, beginning with model year 2025 and delivered as of Jan. 1, 2025.

This supports our commitment in a 2020 MOU that Governor Murphy signed with 16 other states to have 30 percent of our truck and bus sales be electric by 2030 and 100 percent by 2050.

Progress

Are we making progress? Absolutely!

Over the last three years, New Jersey has doubled its EV ownership.

With more than $10 million in infrastructure investments, New Jersey is eliminating range anxiety through our *It Pay$ to Plug In* program. New Jersey already has 1,693 publicly accessible charging ports at 667 locations statewide and we continue to add more, putting – public charging within easy reach of most New Jerseyans.

We've already met one goal of the EV law and we're on track to meet the rest.

Clean transportation also must be available for residents of low- and moderate income communities. Earlier this year, DEP awarded money to several electric ride-sharing programs that will enable residents of these communities to have access to clean transportation.

We are moving with steady steps to a clean future.

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Luis Lim, Chief, Bureau of Air Monitoring, NJDEP

Analysis of the COVID-19 Impact on Air Quality in New Jersey

Based on an analysis of average concentrations of criteria pollutants from 2010 to 2021, the impact of COVID-19 on air quality in New Jersey was observed as a decrease in 2020 of average concentrations of nitrogen dioxide (NO_2) at all nine NO_2 monitoring stations, a decrease of ozone (O_3) levels at 14 of 16 monitoring stations and a decrease of fine particle ($PM_{2.5}$) levels at 10 of 12 monitoring stations. The impact of COVID-19 on carbon monoxide (CO) and sulfur dioxide (SO_2) was not evident in 2020 because concentrations of CO and SO_2 in New Jersey were already very low at all monitoring stations prior to 2020. Recommended actions are to use statistical analysis to determine if the impact of COVID-19 continued in 2021, obtain more detailed vehicle mix and traffic count data to determine if traffic counts in 2021 are correlated with air quality levels measured, and conduct more analysis of air quality data using the short-term averaging periods required in the National Ambient Air Quality Standards.

Comparing 2020 Criteria pollutants to 2019 and 2021

- Previous analyses showed reduction in light (50%) and heavy duty (30%) traffic, but traffic returned to normal volumes
    - As a result, Nitrogen Oxides and $PM_{2.5}$ were down significantly as well (30-40%), with ozone down less.
- Exceedance days were the lowest in 2020 probably since the Air Quality Index (AQI) was created, with only six days of exceedance
- In a new analysis, CO_2, SO_2, NO_2, O_3, and $PM_{2.5}$ were examined
    - CO and SO_2 minimal because already at detection limit

    - On NO_2, there seems to be a small enduring impact
    - O_3 did drop and recover, but during the pandemic its peak shifted either earlier or later depending on the monitoring station. There might have been a small enduring drop at many stations.
    - $PM_{2.5}$ dropped and recovered, but there is a lot of variation in the recovery, with probably an enduring small drop at some stations. Wildfires may have interfered with accurate measurement of $PM_{2.5}$.
- Further statistical, vehicle type relationship, and National Ambient Air Quality Standards (NAAQS) measurement and concentration analyses should be done.

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Kathryn Johnson, American University School of Public Affairs

The Effects of Increased Pollution on COVID-19 Cases and Deaths

During the early months of the COVID-19 pandemic, the Environmental Protection Agency advised industry that it would relax its enforcement of certain regulations. This led some counties in the U.S. to experience increased air pollution levels in the weeks following this announcement. These increased pollution levels were, in turn, associated with increased cases and deaths from COVID-19. We find that counties with more Toxic Release Inventory (TRI) sites saw a 11.8 percent increase in pollution on average following the EPA's rollback of enforcement, compared to counties with fewer TRI sites. We also find that the policy induced increases in pollution are associated with a 53 percent increase in cases and a 10.6 percent increase in deaths from COVID-19. These results underline the health costs of pollution, particularly in the context of the COVID-19 pandemic. They also reflect the importance of continuing enforcement of environmental regulations, even in difficult circumstances.

- Some recent research suggests that some kinds of pollution decreased on average during the pandemic (Cicala et al., 2020), other studies find that pollution actually increased in some areas and overall (Bekbulat et al., 2020; NOAA, 2020; Schade, 2020).
    - Cicala and colleagues (2020) estimate that CO_2 and $PM_{2.5}$ emissions were projected to decline over this time period via estimates of electricity consumption and distance traveled, but they also find substantial heterogeneity in their estimates and do not make use of pollution monitor data from 2020.
    - Bekbulat and colleagues (2020) find that $PM_{2.5}$ concentrations are higher than expected across the United States based on long term seasonal trends.
    - Schade (2020) finds the pollution has increased in some parts of Texas, such as Houston, which has many TRI sites.
    - The NOAA (2020) reported that atmospheric carbon dioxide reached the highest monthly reading ever recorded in May 2020.
- The largest emitters of pollution are electricity generation, industry and agriculture, jointly accounting for more than 58% of the total pollution emissions in the U.S. (EPA 2020).

There were two primary reasons to be concerned about the impact pollution might have on COVID-19 outcomes.

- There is evidence that pollution can aggravate respiratory disease generally.
    - Pollution harms the immune system, leaving people more vulnerable to airborne diseases. (Beatty and Shimshack 2011; Miyashita et al. 2020).
    - Air pollution has been linked to respiratory illness in children. (Jans, Johansson, and Nilsson, 2014; Beaty and Shimshack, 2011).
    - There is also growing evidence that days of high air pollution can cause deaths (Anderson, 2019; Schwartz Bind and Koutrakis 2017; Deryugina et al. 2019).
- There was evidence that pollution could worsen COVID-19 outcomes specifically.
    - For example, there is evidence that pollution can increase inflammatory cytokines, which had been implicated in deaths from COVID-19 infections (Tay et al 2020).
    - Isphording and Pestel (2020) find days of increased pollution in German counties lead to increases in cases and deaths.

Pollution increased immediately after the announcement of a rollback of enforcement of environmental laws. This policy induced increases in pollution, resulting in an increase in COVID-19 cases and deaths. These results emphasize the importance of continuing enforcement of environmental regulations for the protection of health. Additionally, these results are in line with a growing literature emphasizing the damage air pollution can do to respiratory health.

- EPA reduced monitoring and enforcement of "routine" procedures.
- Johnson and colleagues studied health outcomes, gathering data from Toxic Release Inventory (TRI), County level data on COVID-19 deaths from John's Hopkins, and NOAA datasets and measured social and other measures, while attempting to control for various COVID-19 orders such as stay at home decrees.
    - Largest polluters are electrical generation, industry and agriculture accounting for almost 60% of total pollution as measured by EPA.
    - Study was statistically constrained to sites, size and pollution quantities to ensure that the study would be statistically valid and useful
    - Evidence shows that pollution decreased in some places, increased in others and something similar occurrences happened with pollution types.
- Previous studies have already shown that high air pollution days seem to aggravate respiratory conditions, and specifically seems to exacerbate COVID-19.
- Counties with high numbers of TRI sites showed increased pollution, and that pollution correlated to higher numbers of COVID-19 cases (53%) and deaths (10.6%).
- These results show the importance of ongoing enforcement.

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Kevin Corbett, President and CEO, NJ Transit

Transit's Critical Role in Improving Air Quality

- NJ TRANSIT reduces automobile vehicle miles in New Jersey by approximately 1.5 billion every year.
- An individual's carbon footprint can be reduced by 65 percent just from shifting from driving to commuter rail.
- In New Jersey – the densest state in the nation – the transportation sector accounts for about 40% of Greenhouse Gas emissions, yet NJ TRANSIT accounts for just 1.6 percent of that.
- Public transit is at its most efficient from an environmental perspective when it is maximizing ridership on the system.
- As a result, encouraging customers – both new and old – to come back to transit is one of our top priorities.
- Through our goal – already well underway – to achieve a 100% zero-emission bus fleet by 2040 and many other environmental initiatives, NJ TRANSIT is working to achieve the air quality we had during the height of the pandemic with the economic activity and the mobility we had before the pandemic.

Transit has a critical role in improving air quality.

- Lockdowns and work from home demonstrably improved air quality.
- NJ Transit continued running full service even as ridership dropped.
- Although 40% of GHG is from transportation, only 1.6% is transit
- While federal funding helped keep transit going, eventually it will run out
- Efforts will be needed to get people back on transit, not just to reduce pollutants and GHG, but to maintain a robust economy.
- Ridership dropped by almost 95% systemwide
- Transit ridership is up, from 50-80% depending on the part of the system and portion of the week, with only some weekend trains up to 100%.
- Vehicle traffic, however, is up or past pre-COVID-19 levels.
- How to get people back on transit:
    - Restore confidence
    - Make reliable and frequent enough
- Need to train and put in service new conductors and engineers
- NJ Transit is also creating new apps and programs such as better websites, FLEXPASS, NJIT Rewards program, contactless fare payment, etc.
- Introducing zero emission buses and completing new electric integrated bus garages, aiming for 100% zero-emission bus fleet by 2040.
- Launched a sustainability plan and continue to develop transit-oriented developments (TOD) which allow folks to live near transit to reduce or eliminate car usage.
- Advocacy for NJ Transit and budget support to continue to carry out mission.

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Donghai Liang, Assistant Professor, Gangarosa Department of Environmental Health, Rollins SPH, Emory University

Air Pollution and COVID-19

Since the pandemic, numerous environmental epidemiological studies and systematic reviews have demonstrated the positive associations between outdoor air pollution and the incidence and severity of COVID-19. Air pollution is a health equity issue, for example, the burden of air pollution is not evenly shared. Poorer people and people of color often face higher exposure to air pollutants and may experience greater impacts from air pollution, such as higher premature deaths, asthma attack rates, and increased risk of server COVID-19 outcomes. Swift and coordinated public health actions are needed to protect the vulnerable populations and disadvantaged communities who are experiencing double burden of COVID-19 and air pollution. The pandemic may end with high vaccination of the population or through herd immunity, however, there is no vaccination against air pollution and climate change. It is critical to continue and expand current efforts to lower traffic emissions and ambient air pollution to reduce population-level risk of COVID-19 case-fatality and mortality and to protect public health. Therefore, the transition towards a green economy with clean, renewable energy sources will further protect both environmental and public health.

Potential link between urban air pollution and COVID-19 risk

- NO_2 levels associated with both county-level COVID-19 case-fatality rate and mortality rate
- Marginal association long-term $PM_{2.5}$ exposure and COVID-19 mortality rate
- Null associations were found for long-term O_3

NO_2 may be an important risk factor of COVID-19 death

- NO_2 may enhance biological susceptibility to server COVID 19 outcomes

Public health actions needed to protect vulnerable populations

- Strengthened enforcement on social distancing and facial masking
- Expanding healthcare capacity
- Continuation and expansion of current efforts to lower traffic emissions and ambient air pollution
- Actions needed to protect vulnerable populations and disadvantaged communities
- Transition towards a green economy with clean, renewable energy sources

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Peter Bilton, Principal Planner, TMA and Mobility Programs, North Jersey Transportation Planning Authority

Transportation Demand Management and Mobility Planning

The North Jersey Transportation Planning Authority recently completed a Transportation Demand Management (TDM) and Mobility Plan for northern New Jersey. TDM is a set of policies and strategies that increase traveler choices and help people meet their travel needs while also minimizing the air quality, congestion, and delay impacts of single-occupant vehicle travel. While TDM initiatives have traditionally focused on reducing vehicle travel, their scope has broadened to address bicycle and pedestrian safety, environmental education, and improving mobility for seniors, people with disabilities, low-income residents, and others who may lack access to personal transportation. New Jersey's eight Transportation Management Associations are important partners in implementing TDM. The six priority strategies developed for the plan have the potential to reduce Vehicle Miles Traveled (VMT) over the long term: Institutionalize Complete Streets, integrate sustainable and equitable transportation decisions into Local Land Use and Transportation Policy, provide more First/Last Mile Solutions, Support Telework and Teleservices, plan for Mobility on Demand, and Evaluate Rideshare Matching Service Options.

- Expand travel choices beyond driving alone: such as by using transit, carpooling, walking, biking, using micromobility services, or other emerging travel options.
- Shift travel to less congested times or routes: to reduce time spent in traffic.
- Avoid unnecessary trips: through teleworking, accessing teleservices, or connecting trips together.
- Dense urban centers in Hudson and Essex counties have much less average daily VMT estimates as compared to the sparsely populated rural areas of Hunterdon, Warren, Sussex, and Morris counties
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    - The census tracts along the rail lines tend to have lower VMT estimates as compared to neighboring census blocks, which generally indicates a higher transit mode share for residents for the census tracts with rail transit service
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Transportation Management Associations (TMAs) are important partners for the NJTPA and other state and regional agencies. They provide the public with assistance in finding ridesharing partners and accessing other commuting options. These non-profit organizations work with employers and governments throughout New Jersey. TMAs are supported with an annual program grant from the NJTPA. They also receive support from NJ TRANSIT, the NJDOT (for Safe Routes to School program) and other public and private sponsors.

The TDM & Mobility Plan addresses regional policies and strategies that increase traveler choices while also minimizing the negative impacts of single-occupant vehicles on congestion, air quality, and safety. The TDM and plan builds on the groundwork of existing TDM initiatives and planning goals identified in the region's long-range transportation plan, *Plan 2045: Connecting North Jersey*, as well as the comprehensive plan for sustainable development, *Together North Jersey.*

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Michael McGuiness, CEO, National Association for Industrial and Office Parks New Jersey

Commercial Real Estate's Role in Facilitating Reduced and Cleaner VMT

The commercial real estate (CRE) industry can play an integral role in facilitating reduced and cleaner vehicle miles travelled and better air quality. But CRE cannot play a meaningful role unless and until government agencies undertake strategic infrastructure investments to allow for a transition to electric power, provide incentives and adopt land use and zoning changes that accommodate infill distribution centers and live/work/play development patterns. Specifically, we can: (1) Locate smaller ecommerce fulfillment centers closer to consumers; (2) Improve our roads, railways and bridges and increase the reliability of mass transit options; (3) Use technology to reduce truck and vehicle pollution; and (4) Encourage and incentivize municipalities to revise their land use zoning and ordinances to permit mixed-use development adjacent to train stations and conversion of office to industrial use.

Commercial Real Estate's Role in Facilitating Reduced and Cleaner VMT

- Even during the recovery, working from home is used as a perk
- Home deliveries have gone up and stayed up
- Too soon for any mandate on electric trucks, say his organization's members, due to lack of availability of vehicles and infrastructure.

To get to electrification of transport, we need to:

- Invest in grid and distribution infrastructure
- Upgrade statewide charging infrastructure

- Encourage DEP to put some charging corridors in densely populated, goods movement areas
- Develop vehicle to grid charging
- Reduce idling by:
    - Coordinating departure and arrival times to match load and unload,
    - Create portal for container availability and,
    - Scheduling and RFID tagging of trucks and trailers to insure that studies can identify areas where reductions can occur e.g., PortPass, PrePass
- Locate fulfillment centers and smaller warehouses closer to buyers, in communities
- Edit ordinances to encourage mixed-used developments and infill
- Empty office buildings can be turned into (first and) last mile distribution centers
- Multi-modal infrastructure such as bike sheds

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Raymond Cantor, Vice President, Government Affairs, NJ Business and Industry Association

The Business Community's Response to COVID-19 and Its Impact on Future Air Emissions

The economic shutdowns mandated as a response to the COVID-19 pandemic had significant short term impacts on air emissions. As the limits on business and activities eased, more economic activities resumed resulting in much of the air pollution reductions being reversed. However, several trends that started pre-pandemic were accelerated and understanding these social and economic changes is important to predicting long term emissions and in setting policies to reduce air pollution and control CO_2.

Some of these trends include more people working from home, the rise of e-commerce, and the use of artificial intelligence (AI). These changes may impact mass transit, vehicle miles traveled, fleet turnover, and electrical needs. Types and locations of developments will also be impacted. Finally, the funds that came into New Jersey as a response to COVID-19 has left us with an unprecedented amount of money, some of which could be spent to address our clean energy needs, including the upgrade of transmission facilities.

- Four effects of COVID-19, government and business community response to it:
    - COVID-19 lockdowns had short-term impact, but will also have long-term impacts
    - As economy has recovered, emissions regained and came back to pre-pandemic levels
    - While business will come back, business and the economy are changing and will inform market and policy solutions.
    - With NJ government's budget surplus, including money from the federal government, we should consider policies to improve the business environment and meet our clean energy goals.
- Hybrid work will continue, with generational and other differences requiring government and business to respond.

- E-commerce, AI, and technology (robotics, automation) will shape the future of business, land use and the citizens of New Jersey.
- Possible effects and reactions include
    - Emptier larger cities but more full smaller cities
    - Changed or reduced use of public transportation
    - VMT changes to those sectors travelling less, but perhaps higher for those travelling more
- Can our grid system handle the growing load?

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Matthew Watkins, Administrator and Director (Ret.), Local Government Services, NJ League of Municipalities Labor Consultant

Remote Work and Municipal Government

Three areas of local government in New Jersey are feeling the effects of COVID-19:

- Municipal employees and remote versus in-person future
    - Youth wants a virtual future; they do everything online anyway and would prefer online access to many government services.
    - It was clear that many employees were more productive working from home, and the return to the office, in many cases, is difficult.
    - Many government bodies are still operating in a virtual or hybrid space and have been working fine
    - State government and unions need to work together to develop policy to ensure work-from-home opportunity fairness since not all job categories align themselves to a work-from-home option
    - Civil Service Commission voted to allow a hybrid work-from-home pilot plan at the state government level
- Services demanded of local government
    - The change in culture is huge; many people want to come to City Hall. The public isn't ready for an all-virtual government.
    - While large governments can and will do more online, small towns may be financially and technically constrained in putting services online.
    - The State and unions need to work together to determine how to make it equitable for first responders and public works employees who have to come to work each day and do not have the option to work remotely
- Financial impact
    - Significant impact to local governments, with high vacancies and lowered traffic and thus lower assessments after challenges
    - Towns relying on parking deck fees to suffer, temporarily or permanently, from the reduced parking for mass transit use

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PUBLIC COMMENTS

Robert Rashkes, West Orange, NJ Resident

Throughout the pandemic, Mr. Rashkes has seen an increase in the number of woodburning stoves and firepits outdoors. Emissions from these sources are very toxic to health and the environment and have a very serious impact on the chronically ill, elderly, and children. Many of these individuals suffer from severe adverse health conditions when exposed to these emissions. The DEP and local agencies need to do something to curtail the use of these firepits and woodstoves especially during pandemic events that compromise respiratory health.

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APPENDIX
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LIST OF ACRONYMS

AI	-	Artificial Intelligence
AQI	-	Air Quality Index
BPU	-	(NJ) Board of Public Utilities
CAC	-	(NJ) Clean Air Council
CDC	-	Centers for Disease Control and Prevention
CO	-	Carbon Monoxide
CO_2	-	Carbon Dioxide
COVID-19	-	Coronavirus Disease
DCA	-	(NJ) Department of Community Affairs
DEP	-	(NJ) Department of Environmental Protection
DOH	-	(NJ) Department of Health
DOT	-	(NJ) Department of Transportation
EDA	-	(NJ) Economic Development Authority
EPA	-	(US) Environmental Protection Agency
EV	-	Electric Vehicle
GBAC	-	Global Biorisk Advisory Council
GHG	-	Greenhouse Gases
GIS	-	Geographic Information Systems
MERS	-	Middle Eastern Respiratory Syndrome
MOB	-	Mobility On Demand
MOU	-	Memorandum of Understanding
MPO	-	Metropolitan Planning Organization

MVC	-	Motor Vehicle Commission
NAAQS	-	National Ambient Air Quality Standards
NH_3	-	Ammonia
NJSA	-	New Jersey Statutes Annotated
NJT	-	New Jersey Transit
NJTPA	-	New Jersey Turnpike Authority
NO_2	-	Nitrogen Dioxide
NOx	-	Nitrogen Dioxides
NOAA	-	National Oceanographic and Atmospheric Administration
O_3	-	Ozone
PM	-	Particulate Matter
$PM_{2.5}$	-	Particulate Matter with a 2.5 micron aerodynamic diameter
SARS	-	Severe Acute Respiratory Syndrome
SARS-CoV-2	-	Severe Acute Respiratory Syndrome-Covid Variant 2
SO_2	-	Sulfur Dioxide
TDM	-	Transportation Demand Management
TMA	-	Transportation Management Association
TOD	-	Transit Oriented Development
TRI	-	Toxic Release Inventory
UITP	-	*Union Internationale des Transports Publics*; International Association of Public Transportation
VMT	-	Vehicle Miles Traveled
VOC	-	Volatile Organic Compound

HISTORY OF THE CLEAN AIR COUNCIL HEARINGS

2021 Dust in the Wind: Just a Nuisance or Something More?

2020 Past, Present, and Future: Air Quality Around Our Ports and Airports

2019 Global Warming Pollutants in New Jersey: Beyond Carbon Dioxide

2018 Zero Emission Vehicles: Clearing the Air

2017 What Can Be Learned from Low Cost Air Quality Monitors: Best Uses and the Current State of Technology

2016 The Clean Power Plan: Impact on New Jersey (not released)

2015 Air Pollution Knows No Bounds: Reducing Smog Regionally

2014 Reducing Air Emissions Through Alternative Transportation Strategies

2013 Addressing the Adverse Effects of Climate Change on Air Quality

2012 Transportation and Small Sources of Air Pollution: Challenges and Opportunities to Achieve Healthier Air Quality in New Jersey

2011 The Cumulative Health Impacts of Toxic Air Pollutants on Sensitive subpopulations and the General Public

2010 Vision for the Next Decade: Air Quality and Pollution Control in New Jersey

2009 Electricity Generation Alternatives for New Jersey's Future: What is the Right Mix for Improving Air Quality and Reducing Climate Change?

2008 Improving Air Quality at Our Ports & Airports—Setting an Agenda for a Cleaner Future

2007 Improving Air Quality through Energy Efficiency and Conservation: The Power of Government Policy and an Educated Public

2006 Indoor Air Quality

2005 Air Pollution—Effects on Public Health, Health Care Costs, and Health Insurance Costs

2004 Fine Particulate Matter in the Atmosphere
- Health Impacts in NJ
- Need for Control Measures

2003 Moving Transportation in the Right Direction

2002 Innovative Solutions for Clean Air

2001 Air Quality Needs Beyond 2000

2000 Air Toxics in New Jersey

1999 The Impact of Electric Utility Deregulation on New Jersey's Environment

1998 CLEAN AIR Complying with the Clean Air Act: Status, Problems, Impacts, and Strategies

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1986 Indoor Air Pollution

1985 Fifteen Years of Air Pollution Control in NJ: Unanswered Questions

1984 The Effects of Resource Recovery on Air Quality

1983 The Effects of Acid Rain in NJ

1981 How Can NJ Stimulate Car and Van Pooling to Improve Air Quality?

1980 (October) Ride Sharing, Car– and Vanpooling

1979 What Are the Roles of Municipal, County, and Regional Agencies in the New Jersey Air Pollution Program?

1978 How Can NJ meet its Energy Needs While Attaining and Maintaining Air Quality Standards?

1977 How Can NJ Grow While Attaining and Maintaining Air Quality Standards?

1976 Should NJ Change its Air Pollution Regulations?

1974 Photochemical Oxidants

1973 Clean Air and Transportation Alternatives to the Automobile and Will the Environmental Impact Statement Serve to Improve Air Quality in NJ?

1972 The Environmental Impact on Air Pollution: The Relationship between Air Quality, Public Health, and Economic Growth in NJ

1971 How Citizens of NJ Can Fight Air Pollution Most Effectively with Recommendations for Action

1970 Status of Air Pollution from Mobile Sources with Recommendations for Further Action

1969 Status of Air Pollution Control in NJ, with Recommendations for Further Actions

Special Acknowledgement:

The New Jersey Clean Air Council would like to acknowledge our DEP liaison, Ms. Heidi Jones, for over a decade of dedicated service. Heidi has worked tirelessly to secure meeting locations, coordinate presentations by outside speakers, maintain our meeting calendar and minutes, and coordinate all activities related to our annual public hearing. Her role in all aspects of Council meetings has made our work easier and a great success, and for this we would like to extend our heartfelt gratitude and wish her much success in her future endeavors. She has set a high standard of excellence that must continue for the future success of the Clean Air Council.

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