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

New Jersey Clean Air Council
Public Hearing April 21, 2021

STATE OF NEW JERSEY
CLEAN AIR COUNCIL

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***Editor's note**: Supporting documents for this report can be found at the following URL: https://www.nj.gov/dep/cleanair/cac-past-public-hearings.html*

EXECUTIVE SUMMARY

New Jersey is the most densely populated state and, as a result, is experiencing continuous change to its landscape, undergoing roadway construction, commercial and residential land development and agricultural activities, all of which have the potential to produce health effects from the generation of dust that is not always adequately controlled. Dust generated from these activities is termed "fugitive" because it is not discharged to the atmosphere in a confined or regulated stream. Common sources of fugitive dust include unpaved roads, mining, agricultural tilling operations, and heavy construction operations. The impact of a fugitive dust source on public health due to air quality depends on the size, quantity, and drift of the dust particles injected into the atmosphere. Large dust particles that settle out near the source may be simply considered a nuisance, but fine particles also are emitted and dispersed over much greater distances from the source. The smallest particles pose the greatest health problems because they can be inhaled into the respiratory tract, affecting the nasal passages, sinuses, and more deeply into the lungs. Excessive fugitive dust and particulate matter emissions can have significant impacts on human health including irritation to the eyes, nose and throat, sinuses, respiratory distress, increased severity of bronchitis, asthma and emphysema, heart attacks and aggravated heart disease, and premature death in individuals with serious lung or heart disease. Fugitive dust can also reduce visibility (i.e., cause hazy conditions) which can result in driving or work-site accidents.

Based upon the testimony received at the April public hearing, it has been determined that fugitive dust is primarily a local issue that can affect the environment and health of residents downwind of the generation site. While the Clean Air Council is not advocating for the creation of new regulations to abate offsite dust migration, we have determined that NJDEP should use existing regulations, permitting and enforcement guidelines to improve air quality impacting local residents. Certain categories of facilities identified at this public hearing should work with NJDEP to develop and implement best management practices that mitigate or reduce dust emissions and these efforts should focus on overburdened and environmental justice communities where these particular facilities are having disproportionate impacts. Partnerships among the NJDEP, community groups and academic institutions are encouraged as part of a stakeholder process to identify the most heavily impacted communities and develop an educational outreach campaign to inform residents of their exposure potential, air quality monitoring initiatives being undertaken, and potential health and environmental impacts that can occur until mitigation strategies are implemented and enforced.

RECOMMENDATIONS

- Dust generation has been identified by testimony at this hearing as primarily a local issue that is not only a nuisance but can also have adverse health impacts on residents of neighboring communities. In particular, dust generation affects certain overburdened and environmental justice communities with disproportionate impacts, such as reported in the testimony (e.g., Camden, Lake Hopatcong).

- With regard to fugitive dust emissions, NJDEP must balance the need between improving air quality through use of existing regulations, permitting and enforcement, and the need to allow source facilities, which provide both environmental and economic benefits.

- Where feasible, NJDEP should develop and implement Best Management Practices (BMPs) that mitigate or reduce dust emissions that are generated at certain categories of facilities which have been identified as significant contributors to dust generation (*see BMP examples in the sections below*). DEP enforceable BMPs should focus on specific industries such as quarries, recycling facilities, and classes of facilities with processes that generate dust emissions in unconfined areas of their facility that can migrate into neighboring communities. In light of the local nature of fugitive dust issues, NJDEP should focus its efforts on overburdened and environmental justice communities where these particular facilities are having disproportionate impacts.

- The testimony from NJDEP indicates that there are a variety of regulatory programs that address the impacts of the migration of offsite dust, albeit for different environmental media and different reasons (e.g., the Industrial Stormwater Permitting Program and Soil Erosion and Sediment Control). Prior to the implementation of BMPs, NJDEP should coordinate with the administrators in those regulatory programs, both within NJDEP and other agencies (i.e., the New Jersey Department of Agriculture) to avoid the imposition of duplicative regulatory programs.

- NJDEP should attempt to increase the quality and quantity of data related to fugitive dust.
    - The current metric to gauge success of mitigation strategies is frequency of public complaints with limited data available showing how well mitigation strategies work.

- Increase the identification of facilities in overburdened communities with the potential for offsite fugitive dust.
    - Develop and share targeted advisories and information with particular overburdened and environmental justice communities and regulated entities.
    - Conduct enforcement sweeps to identify unpermitted facilities.

- Increase collaborations between NJDEP agencies to address fugitive dust emission concerns.
    - Increase collaborations between NJDEP, NJDOH, NJ Department of Agriculture and local and county agencies for education and outreach.
    - Develop partnerships between overburdened and environmental justice communities and academic institutions for planning and implementing air quality monitoring in communities.
    - NJDEP should support local citizen science through funding and expertise to increase localized air quality data.
    - NJDEP should share a compendium of BMPs that can reduce fugitive dust with the local and county agencies, and with particular industry groups and their industry representatives.
    - Educate local communities on how to NJDEP responds to citizen complaints (through county environmental health agencies, where applicable).

- In order for these health-based recommendations to be realized, increase funding to enhance existing and build new infrastructure and capacity in the NJDEP, NJDOH, and county environmental health agencies to accomplish these recommendations.

- NJDEP should permit temporary recycling facilities, as they appear unregulated and emit uncontrolled dust into local areas.

Best Management Practices for Industrial Sites That Should Be Implemented Where Feasible

- NJDEP should share a compendium of best management practices, currently implemented by facilities within the state, that can reduce fugitive dust with the local and county agencies.

- Comprehensive dust management plans should be required and enforced by DEP for any facility that generates fugitive dust.
    - A stakeholder process for input on BMPs should be required for all new permit applications (e.g., quarries, recycling centers).
    - A dust management plan should be added to all facility permit applications that also require a stormwater permit.

- The most practical way to address fugitive dust emissions is through the requirement to implement BMPs at all industrial processing sites. BMPs include, but are not limited to the following:
    - Wetting surfaces prior to and during demolition activities and cutting/grinding.
    - Watering, treating, sweeping, sealing, or paving roadways.
    - Maintaining stockpiles to include watering, reducing drop distance between discharge point and top of stockpile, covering, or enclosing.
    - Constructing windbreaks, vegetative control, embankment construction, or topographic controls.
    - Enclosing crushers, screens or other material transfer points, wetting, and dust collection equipment. If enclosed, further collection and treatment is possible.
    - Controlling the loading and movement of vehicles throughout the site, such as reducing speed, under unfavorable conditions.

    - Utilization of effective dust controls should be enforced.
        - Prepare roadways to avoid dust from vehicles.
        - Cover trucks when moving on and off site.
        - Promote anti-tracking & wheel wash practices prior to site exit.
        - Utilize water trucks and other means to wet dry soil.
        - Cover soil piles when not in use.

- A Conceptual Site Model should be used as a framework for the development of BMPs.
    - Need to determine historic site use before using land.
    - Identify chemicals of concern in all fugitive emissions.
    - Identify transport mechanisms of fugitive dusts.

- Each BMP should examine potential impact to off-site receptors; need to develop a perimeter monitoring plan.

- Permitting processes and development of BMPs should focus on inhalation exposure route and toxicity factors.

- There should be a preference for real-time monitoring.

- NJDEP needs to address both dust and odor complaints from these facilities.

Best Management Practices for Agricultural Sites That Should Be Implemented Where Feasible

- Follow no-till and cover crop guidance.

- Use cover crops.

- Vegetation barriers can be helpful to reduce emission spreading.

- Sources of agricultural fugitive dust
    - Windblown dust
        - maintain ground cover
        - reduce tillage
        - have windbreaks/vegetative barriers
    - Unpaved roads
        - apply dust suppressants
        - minimize vehicle traffic and speeds
    - Tillage/harvesting/field operations
        - timing of operations (e.g., higher humidity or at time of lower windspeeds)
        - alternative harvesting techniques
        - windbreaks
    - Animal activity in open lots or pens
        - Keep soils within open lots and pens moist

Citizen Science and Academic Partnerships

- NJDEP should encourage and support community based or fence line monitoring (saturation monitoring program in targeted areas).

- NJDEP should partner with local colleges and universities for planning and monitoring.

BACKGROUND

As far back as 1975, the USEPA began to examine fugitive emissions and differentiate them from fugitive dust emissions (Lillis and Young, 1975). Fugitive emissions were defined to include both gaseous and particulate emissions resulting from industrial operations and which escape to the atmosphere through windows, doors, vents, etc., but not through a primary exhaust system, such as a stack, flue, or control system. Fugitive emissions often have a greater effect on air quality in the immediate vicinity of a source than do stack emissions, since stack emissions are released well above ground level, are more readily dispersed, and therefore have less of an impact on nearby residents. Fugitive emissions, by their very nature, occur at or near ground level and remain there, where the impact on people working and living in the area is greatest. Fugitive dust emissions, on the other hand, are generally related to natural or man-associated dusts that become airborne due to the forces of wind, man-made mechanical actions, or both. Fugitive dust emissions may include windblown particulate matter from unpaved dirt roads, paved roads, agricultural activities (e.g., tilling), open fields, construction sites, exposed surface areas at construction sites, etc. (Watson et., al., 2000). Natural dusts that become airborne during dust storms are also included as fugitive dusts. On average, fugitive dust emissions contribute between 40%-60% of PM_{10} and 5%-20% of $PM_{2.5}$ measured in the atmosphere (Watson et., al., 2000). In total, paved and unpaved roads, construction site activities, and wind erosion comprise more than 80% PM_{10} and 75% $PM_{2.5}$ fugitive dust emissions (Watson et., al., 2000) . A source apportionment pie chart for both $PM_{2.5}$ and PM_{10} can be found in Figure 1 and Figure 2, respectively. It should be noted, however, that fugitive dust emissions estimates can vary widely dependent upon meteorological factors and chemical and physical characteristics of the particles being observed.

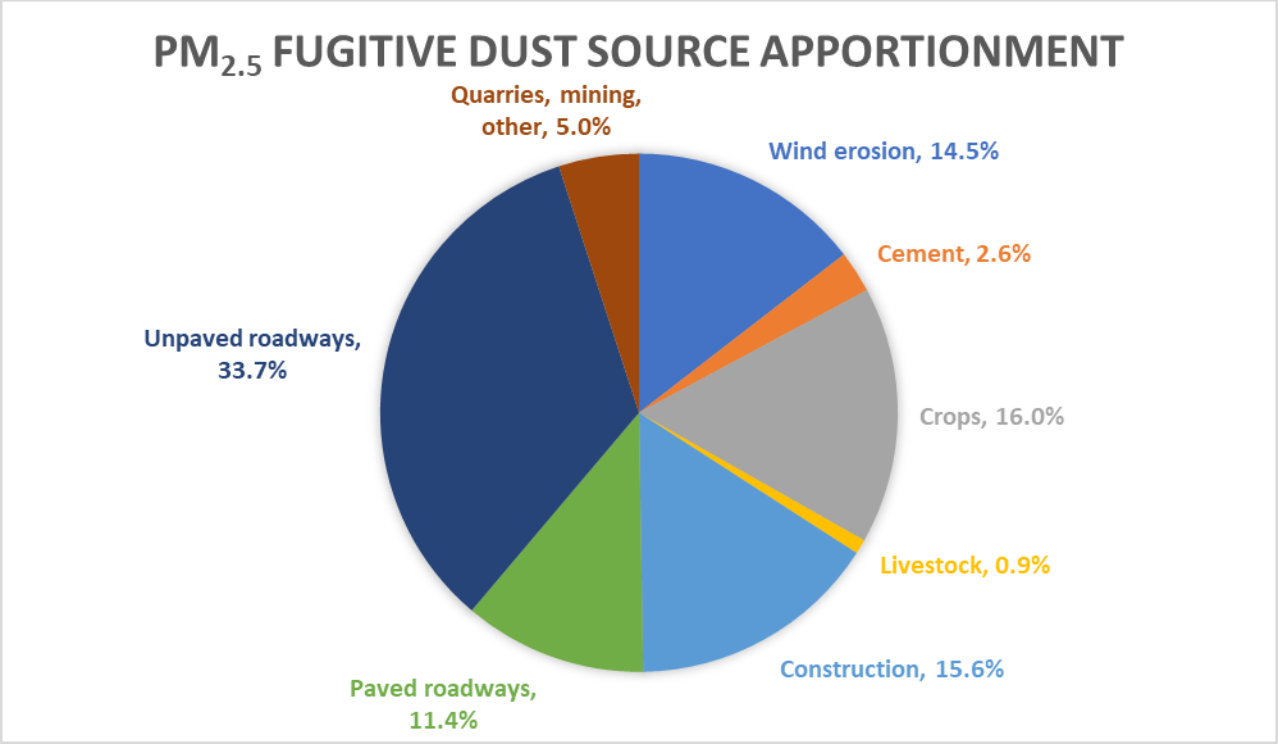

Figure 1 - Fugitive Dust $PM_{2.5}$ Source Apportionment, taken from: Watson, JG., Chow, JC., Pace, TG. (2000). Fugitive Dust Emissions. Air Pollution Engineering Manual, 2nd edition. Air and Waste Management Association. p. 118.

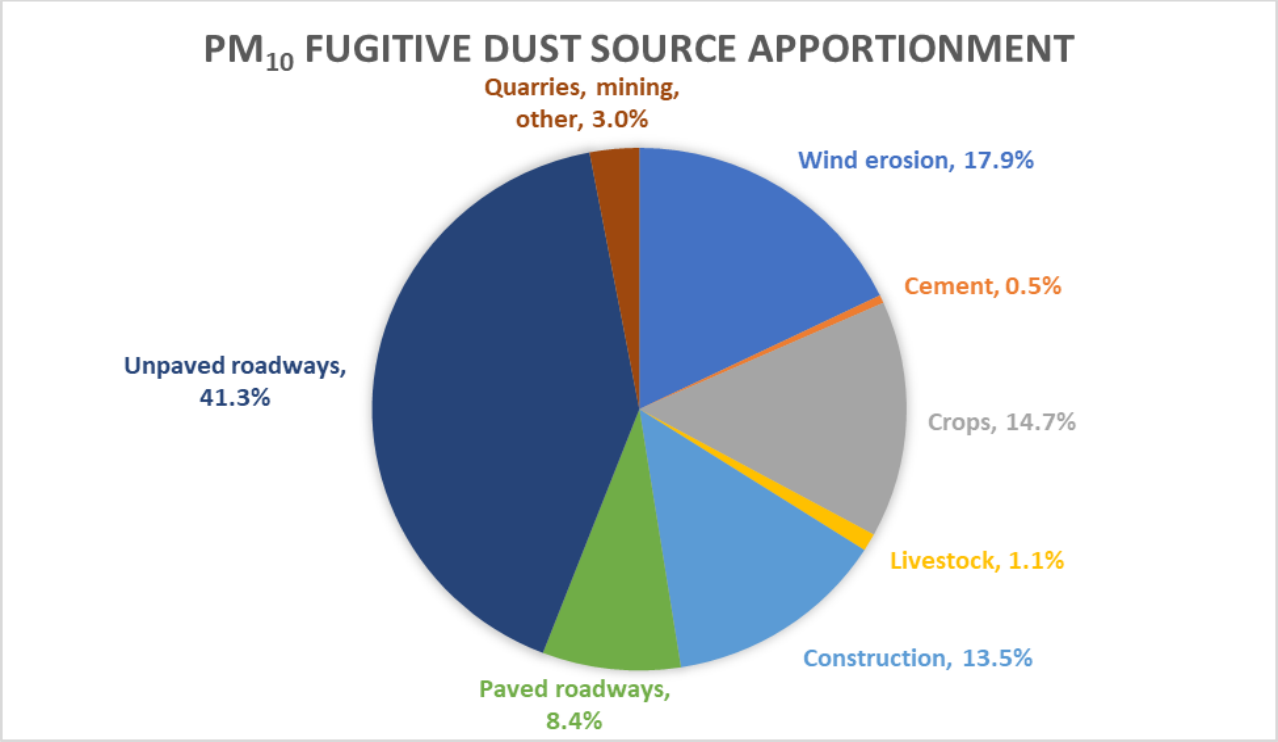

Figure 2 - Fugitive Dust PM_{10} Source Apportionment, taken from: Watson, JG., Chow, JC., Pace, TG. (2000). Fugitive Dust Emissions. Air Pollution Engineering Manual, 2nd edition. Air and Waste Management Association. p. 118.

In addition to understanding source apportionment of particles, it is necessary to understand the size distribution of particles being emitted from certain processes. Figure 3 shows the size distribution of particles from several select emissions. It should be noted that particles sized 10 µm and greater dominate in road and soil dust, as well as from construction activities. Pollen spores also exist in the coarse size fraction.

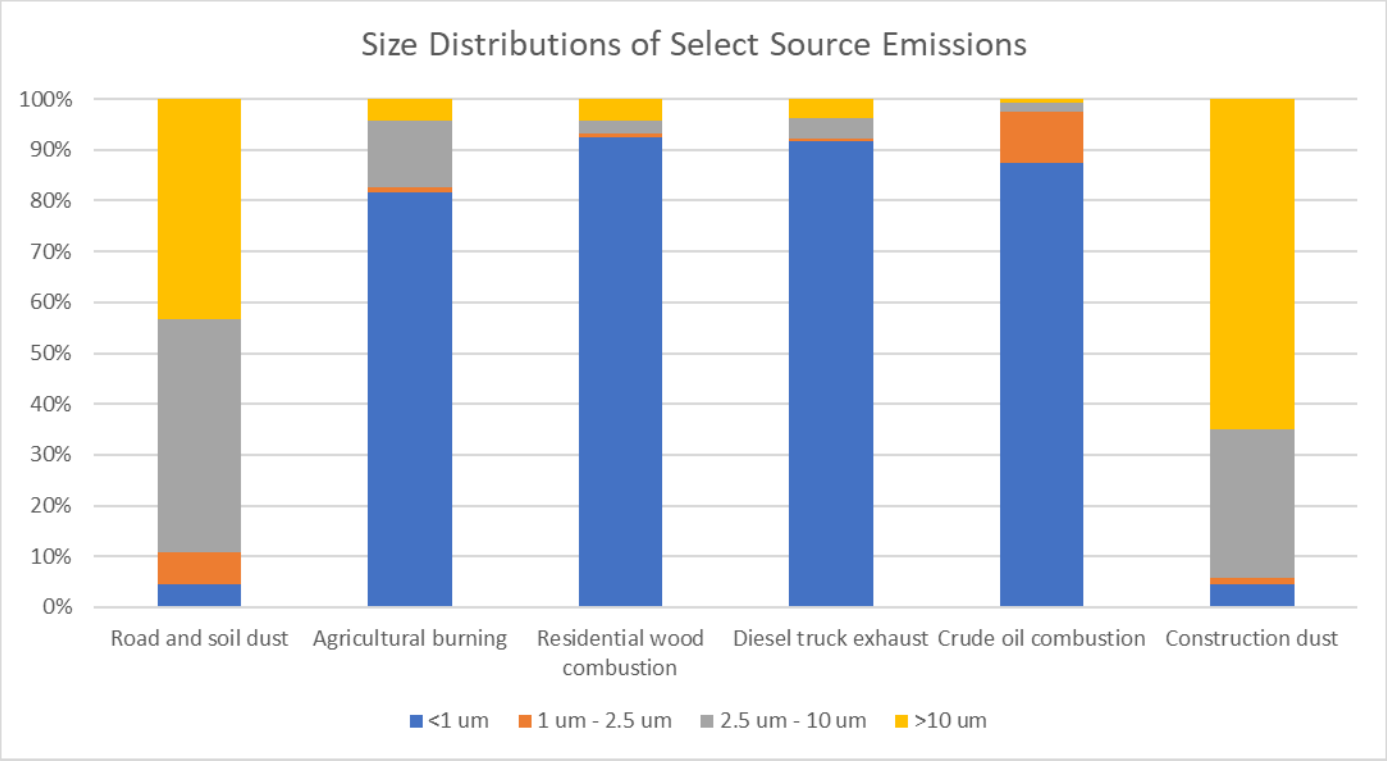

Figure 3 - Size Distribution of Select Source Emissions, adapted from: Watson, JG., Chow, JC., Pace, TG. (2000). Fugitive Dust Emissions. Air Pollution Engineering Manual, 2nd edition. Air and Waste Management Association. p. 119.

Numerous environmental conditions are known to be involved in particle dispersion. Watson et. al. (2000) listed these factors to include surface loading, surface conditions, wind speed, moisture content of the particles, movement of vehicles, industrial processes, and construction activities. Since most soil areas are limited in area, suspendable dust will be depleted in a short period of time without continued abrasive forces. Surface conditions are related to the shape of the landscape and height of nearby obstructions (e.g., buildings, tree lines, etc.). Landscapers and farmers typically orient furrows perpendicular to prevailing winds or plant rows of trees upwind of fields to minimize loss of soil from wind. Higher wind speeds, those in excess of 7 m/sec. have been shown to be necessary to increase the movement of PM_{10} particles. Much lower wind speeds are required to suspend and disperse the $PM_{2.5}$ fraction of particles. Studies by both Chepil and Woodruff (1963) and Gillette and Hanson (1989) determined that the amount of dust particles suspended in wind not only depends upon the size fraction of the particles, but also windspeed and the surface of the dust area, roughness of the surface, the relative fraction of erodible and nonerodable material, and cohesion of the particles with each other. Moisture content also plays a role in particle ejection/suspension from vehicular movement. When moisture content on the road surface exceeds 2%, there is an 80% reduction of PM_{10} particles (Rosbury and Zimmer, 1983).

Caution, however, should be taken not to have excessive moisture on dust and soil surfaces since overly moist soils can adhere to vehicles moving in and out of a construction zone or unpaved roadway and then redeposited further away from a site as it dries and is then available for resuspension and redistribution. Vehicle shape, speed, weight, and number of wheels all determine how much soil and dust can adhere to a vehicle and be carried away (Watson, et. al, 2000). While many dust control agents are either under development or already on the market, care needs to be taken to verify the compatibility of the solution with the soil(s), soil contamination, water quality, amount of rainfall in the area. Effectiveness of these "wetting agents" is usually short-term since they not only lose their effectiveness following rainfall but can break down quickly under the weight of heavy machinery. Industrial processes that involve digging, dozing, grading, scraping, and blasting are also responsible for injecting dust particles into the atmosphere. In addition, landfill dust emissions (Botsford et. al, 1996) can range from less than one ton per year for a small landfill (650,000 m^2 area handling approximately 1,150 m^3 material) to a large landfill handling nearly forty tons per year (5,120,000 m^2 area handling approximately 6,1000 m^3 material per day). It should be noted, however, that emission inventories tend to treat fugitive dust emissions as a continuous process, whereas these emissions are intermitted processes that depend on the factors discussed above.

According to a regulatory analysis paper by Probst and Becker (1981), particles from mining operations typically range in size between 10 and 35 microns. These particles are usually quite coarse and are respirable, but not inhalable and are readily cleared from the upper airways by coughing, sneezing or mucocilliary removal within a few days. Fugitive dust particles from these operations are composed primarily of crustal minerals-oxides of silicon, aluminum, calcium, iron, and others. The fraction of each element varies from location to location. In addition, most coarse particles are basic (i.e., pH >7.0) and are not thought to contribute much to acid rain conditions. Conversely, particles less than 2.5 microns are more acidic and contain most organic compounds, SO_4^{2-}, NO_3^-, NH_4^+, H^+, ions, volatile elements, heavy metals, and other toxic trace materials. In surface mining operations, however, large haul trucks are used to move material around the property. These trucks generate the vast majority of dust from surface mining sites, accounting for approximately 78%-97% of total dust emissions (Reed and Organisack, 2007). On average, research demonstrated that 14.5% of the airborne dust generated from haul trucks consists of material <10 µm, and 3.5% is material <3.5 µm. The majority (85.5%) of the airborne dust consists of larger particles that do not pose a respirable threat to the truck operator but may be a visibility hazard (Reed and Organisack, 2007). Their results showed that dust concentrations drop off rapidly at 50 feet away from the haul road, and at 100 ft away from the road the concentrations were at or below background levels.

Luo (2017) and colleagues studied the relationship between building construction dust and meteorological factors. Their study concluded that building construction dust was significantly positively correlated with wind speed and relative humidity, and weakly correlated with temperature. Kinsey and colleagues (2004) found that vehicles driving out of the construction site can carry a large amount of dust and sediment to nearby roads, causing secondary dust to rise under external force. A more recent study by Yan and colleagues (2019) supported the theory that construction vehicles were one of the main influencing factors of building construction dust and that dust-proofing measures, such as cleaning construction vehicles as they depart a construction

site and watering the construction access roadway and entranceways should be routinely performed.

Adverse health outcomes from fugitive dust exposure are not based solely on the abundance, size, and shape of particulate matter, but also on the chemical composition of the PM. According to a review article by Davidson, et. al. (2005), the most abundant chemical species in PM in the eastern United States are SO_4^{2-} and organic material, while the most abundant species in the western part of the U.S. are NO_3^- and organic material (see Figure 4), both which are subject to seasonal variation. Elemental carbon (EC) and crustal material comprise varying fractions depending on location, but usually each contributes less than 10–15% of the $PM_{2.5}$, with higher EC levels in urban areas and higher soil dust in the western United States. More individuals in cities become ill when airborne concentrations of $PM_{2.5}$ mass and $PM_{2.5}$ SO_4^{2-} increase (e.g., Thurston et al. 1994; Schwartz et al. 1996; Pope 2000). Examples of associated illnesses include respiratory problems, changes in heart rhythms, heart attacks, and severe respiratory and heart malfunctions leading to death. There also are more absences at work and at school when airborne concentrations increase. In the Harvard six-cities study, Dockery et al. (1993) show that increases in $PM_{2.5}$ mass and $PM_{2.5}$ SO_4^{2-} are associated with increases in death rates. This includes death rates from all causes and death specifically from respiratory and heart problems, as well as from lung cancer.

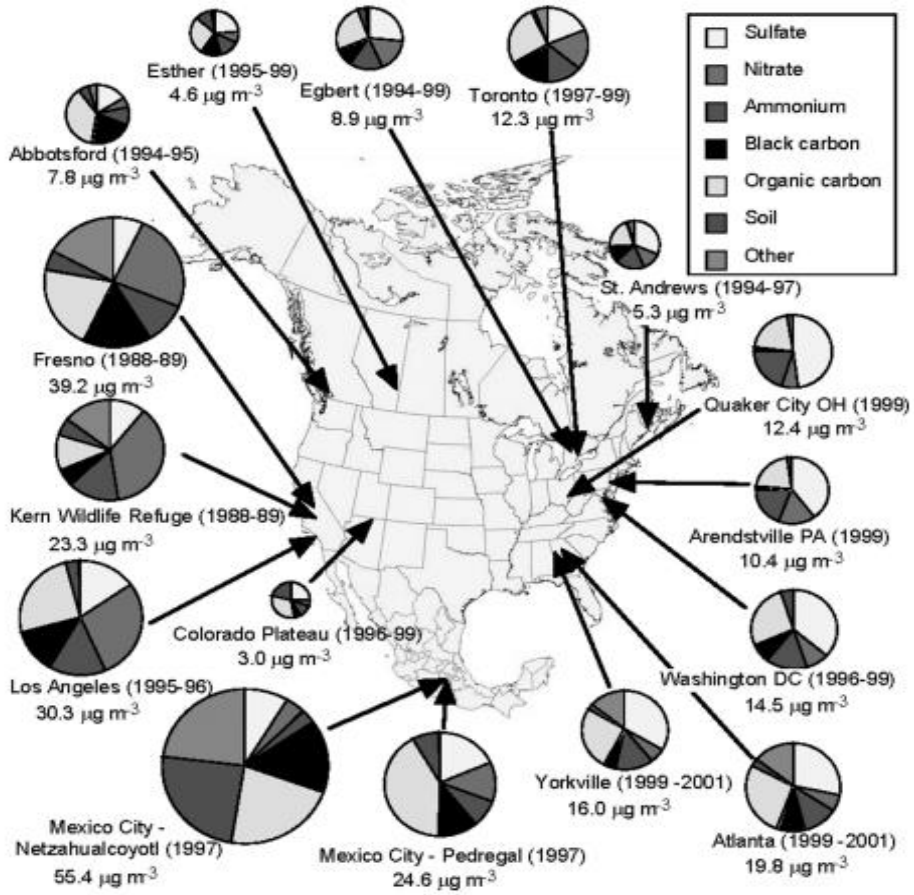

Figure 4 – taken from: Cliff I. Davidson , Robert F. Phalen & Paul A. Solomon (2005) Airborne Particulate Matter and Human Health: A Review, Aerosol Science and Technology, 39:8, 737-749.

Numerous studies have examined the adverse health effects associated with compounds found in road dusts. Potgieter-Vermaak et al. (2012) found that lead and chromium compounds in road dust were present in human body fluids. Chromium dust is a pulmonary irritant that can exacerbate asthma, bronchitis, and other respiratory symptoms. Lead in dust is known to be responsible for cognitive and neurobehavioral deficits in children (Rosen, 1995) Bell et al. (2014) found a significant positive association between $PM_{2.5}$ in road dust and hospital admissions from adverse cardiovascular and respiratory events. A study by Gent et al. (2009) found a higher rate of inhaler usage due to increased symptoms among children with asthma who were exposed to fine road dust particles. Kioumourtzoglou et al. (2014) found an association between increased cardiovascular-related hospital admissions and $PM_{2.5}$ in road dust. Mar et al. (2004) found a strong association between respiratory symptoms in children and $PM_{2.5}$ exposure. Franklin et al. (2008) established an association between $PM_{2.5}$ exposure by season and cardiovascular mortality. Bell et al. (2010) found that $PM_{2.5}$ road dust particles containing aluminum and silicon were associated with low birth weight. Colombo et al. (2008) established an association between respiratory tract diseases and platinum in road dust. Li et al. (2015) measured the health risks of road dust and found that a higher risk of adverse health outcomes in children living near industrial areas was associated with the presence of lead, chromium. The main route of exposure, however, was via ingestion and not inhalation of dust particles. Liu et al. (2014) found that non-carcinogenic health risks were associated with the presence of higher concentration of barium, lead, and copper in road dust in high-traffic areas. Jiang et al. (2014) found higher levels of polyaromatic hydrocarbons (PAHs) than of other compounds in road dust. However, the cancer risk of PAH in road dust was higher through the dermal contact and ingestion rather than through inhalation, specifically in children.

SUMMARY OF TESTIMONY

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

Shawn LaTourette, Acting Commissioner, NJDEP - Welcome and Opening Remarks

Good morning. Let me begin by thanking everyone for joining us today. I am encouraged to see so many representatives of New Jersey's municipalities and state agencies, as well as those from universities, planning organizations, research institutes and the business community.

I would like to extend my gratitude to Council Chairman John Valeri, Vice Chair Allen Weston, Hearing Chair Mayor Bob Campbell (Downe Township) and Hearing Vice Chair Dr Leonard Bielory for conducting this public hearing.

Before we get to our discussion, I'd like to take a moment to say that I consider it an incredible honor – and a humbling responsibility – to be nominated by Governor Murphy to be the Commissioner of the Department Environmental Protection. I am grateful for the Governor's confidence in my leadership and for the opportunity to work side-by-side with the outstanding people of the DEP – nearly 3,000 environmental professionals who have made the protection of our environment and public health the cause of their lives. Their work impresses and moves me every single day.

Over the years, the Clean Air Council has advised my predecessors on a wide range of important and emerging air quality issues, including power plant pollution, interstate transport, air toxins, mobile sources, cumulative impacts and climate change. Today, I look forward to hearing your advice and thoughts on the timely issue of fugitive dust emissions and the impact on the health of NJ residents, particularly the disproportional effects on environmental justice communities.

Clean air is public health issue, an environmental quality issue, a justice issue.

We already know that the cumulative effect of pollution from too many facilities concentrated in marginalized neighborhoods contributes to significantly higher incidences of asthma and other respiratory illness among residents of such communities.

What we have learned in the past year is that those same communities – with higher numbers of residents who have underlying health conditions (in part, the result of environmental stressors) – have been inordinately impacted by COVID-19. It is our responsibility to do a better job at protecting the most vulnerable among us. Alleviating the environmental challenges of one community strengthens our statewide community.

The issue of fugitive dust emissions has been a particular concern in EJ communities such as Camden, where –along the Waterfront South neighborhood – industrial sources ranging from recycling centers to large materials storage piles are considered a source of this pollutant.

I ask you to keep all of our communities in mind throughout this hearing, while paying special attention to those who have shouldered more than their fair share of pollution and environmental hazards. At bottom, an environmental threat to any one of our community, is a threat to our entire New Jersey community. Let's do all we can to ease the environmental burdens for all of our residents.

Key Areas for Council's Consideration for Hearing

I know you have a lot of ground to cover during this session, but as you focus on fugitive emissions, I would ask that you consider the following questions:

- What are the major activities contributing to fugitive dust emissions in New Jersey?
- What are the best dust mitigation strategies that can be implemented for each dust-generating process or activity, whether industrial, commercial, agricultural or residential?
- How can fugitive dust emissions be monitored, and regulations enforced?
- Should fugitive dust emissions have to be included in permit applications?
- Should we be doing more to recognize the potential adverse health outcomes resulting from widespread and uncontrolled dust exposure across the state?

Conclusion

Pursuing environmental justice continues to be a priority of Governor Murphy and the DEP. More than 50 years of implementing environmental laws also has uncovered shortcomings; the DEP must deliver on promise of environmental justice for all.

Fugitive dust may not necessarily be unique to EJ communities; however, it is a major nuisance and environmental concern to the residents of these neighborhoods.

That is why we are here today. We are working to listen to and amplify voices of people of color, and to do better in furthering the promise of equality for all as part of our mission to protect the environment and public health.

So, again, thank you for your service this past year and for your willingness to work with the DEP toward this goal. I look forward to hearing to your recommendations and seeing your report this summer.

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Kenneth Ratzman, Asst. Director Air Quality Regulation and Regional Planning, NJDEP – Fugitive Dust Update

Overview of Talk

The Division of Air Quality presented to the Council an overview of the challenges associated with regulating "fugitive" dust. The presentation clearly showed that fugitive dust is clearly a nuisance issue and more than likely a health-related issue based on particle size distribution. It is also clear that EJ areas are disproportionally impacted by the fugitive dust issues as they are generally in closer

proximity to the source/facility in question. Lastly, it was established that there is a clear need for cross discipline interactions for Department staff, particularly between staff in the air program and staff within water, waste, and enforcement.

Recommendations

Clarify in regulation that piles and the transfer of material from one pile to another area (even if being performed by an off-road mobile source) should be required to obtain a permit and be evaluated for particulate control and application of best management practices. Specific requirements of when BMPs or Dust Mitigation Plans should be defined in air permit.

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Daniel Kuti, Environmental Specialist, NJDEP - Industrial Stormwater Permitting Overview

An overview of the New Jersey Industrial Stormwater Permitting program's history, regulated universe, and the variety of permits it issues and how dust control is handled in each of these permit types. This includes detailed information on the constituents of each permit type, examples of best management practices (BMPs) utilized in the permits, and the number of permits issued throughout the state. Also discussed are the industries of higher concern when considering fugitive dust generation from a stormwater perspective as well as the challenges the permitting program faces in developing management strategies in the permits.

Recommendations:

The Stormwater permitting groups recommends a closer working relationship with the Air permitting group, within the Department, to develop BMP strategies that can address both stormwater and air quality issues when dealing with dust control at regulated industrial sites.

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Raihan Khan, Instructor, Dept. of Health Sciences, James Madison University - Fugitive Dust and Health

- Road dust is not one thing but a combination of dusts.
- Composition depends on type and source
    - Lead, aluminum, zinc, vanadium, iron, silicon cadmium, arsenic
    - Platinum group derivatives (Pt, Pd, Rh); PAHs
    - Minerals: zeolites: erionite, offertite
- Known health effects from fugitive dust exposures
    - Respiratory distress,
    - Asthma
    - COPD
    - Pneumoconiosis
    - Fungal infection
    - Cancers
    - Low birth weight and premature deaths

- Use hazard index to determine health effects of certain dust components
- Best management practices will vary by materials, processes, jurisdiction of the site
    - Water is used in some areas for dust control and soybean oils in others

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Dr. Robert Laumbach, Associate Professor, Department of Environmental and Occupational Health and Justice, Rutgers School of Public Health – Health Effects of Fugitive Dusts with an Emphasis on Urban Road Dust

Fugitive dust emissions are very heterogeneous and complex mixtures of particles ranging widely in size, shape, chemical composition, and other chemical and physical properties that influence their toxicity and potential public health impacts. Fugitive dusts contribute to total exposures to $PM_{2.5}$ and PM_{10}, which have been associated with a variety of respiratory and non-respiratory health effects, including asthma and COPD exacerbation, heart disease and stroke, neurodegenerative disorders, and adverse pregnancy outcomes. Among the fugitive dust emissions in New Jersey, there is little doubt that fugitive urban road dust, in the form of non-exhaust particulate matter emissions and resuspended road dust, presents the largest public health burden. Non-exhaust transportation emissions include degradation products of brakes, clutches, tires, and road surfaces, as well as resuspended road dust. These emissions are particularly rich in metals and organics that cause increased oxidative stress and inflammation. Non-exhaust PM emissions are also concentrated in the most densely populated areas of the state, which also tend to be home to more vulnerable and susceptible populations. Non-exhaust PM emissions related to transportation already exceed tailpipe emissions in New Jersey. This gap will grow as further reductions in exhaust PM with zero and low emission vehicles will do little to improve non-exhaust emissions. In fact, increases in vehicle miles traveled and the increased weight of longer range EVs are likely to increase non-exhaust emissions. Therefore, the NJDEP should start to consider policies to mitigate non-exhaust transportation PM emissions such as incentivizing fewer vehicle miles traveled, light-weighting of vehicles, and restricting metal content of brake materials.

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Mike Morgan, Administrative Assistant & Britani Nestel Morgan, Youth Coordinator, Rutgers School of Nursing-Camden & Center for Environmental Transformation - Fugitive Dust in Waterfront South Neighborhood in Camden

- In a neighborhood surrounded by many industries, fugitive dust is a common occurrence in Waterfront South.
- Despite many efforts, the sources of fugitive dust haven't been identified yet.
- Recommendations:
    - Reinstate NJDEP monitoring station at CCMUA, a location closer to Waterfront South that could more accurately monitor air quality.
    - When a neighborhood industry is fined by NJDEP, allocate this money toward a local Supplemental Environmental Project (SEP) in coordination with neighborhood agencies.

- Support local citizen science through funding and knowledge to increase available data on local air quality issues.

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Joann Held, Air Toxics Analysis Service - Routine Fugitive Dust Controls are Essential to Protect Overburdened Communities

Fugitive dust may have a significant fraction of large particles which are not inhalable and will settle out quickly. But dust is still a problem in New Jersey for two reasons. First, part of some dust may still be composed of particles that are small enough to be inhaled, with the potential to contribute significantly to human exposure. And second, since it is common to find homes built extremely close to industrial sites in New Jersey, any settling that would normally happen on the operator's own property - if they own a large site - will be deposited at the neighboring residences instead in these densely populated areas. This is of special concern in Environmental Justice (EJ) communities. In EJ communities the source operations of concern include scrapyard operations and raw material piles, among others. So far, the effort to control fugitive dust has been on a case-by-case basis. This approach was helpful in the Waterfront South neighborhood of Camden after an extensive cumulative impact assessment and significant investment of time and effort on the part of the NJDEP. But New Jersey really needs to have routine procedures in place if they are to address the vast number of sites in the state that have fugitive dust emissions. These procedures could take the form of new regulations, but other options exist as well, beginning with better enforcement of existing rules. For example, the Compliance Advisory issued on 2/17/21 reminding Scrap Metal Handling and Recycling businesses of their responsibility to apply for an air permit, coupled with compliance investigations. Collaboration with the NJDEP Solid Waste and Water Quality programs could also provide a means of requiring better management practices at smaller air pollution generating sources that are not currently required to obtain an air permit. Collaboration with local and county agencies may also be expedient, especially if a compendium of best management practices could be developed and shared. These practices could then be readily adopted at the municipal and county level where local sources may be more easily identified.

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Eric Raes, President & Bruce Groves President & CEO, Engineering & Land Planning Associates, Inc. & Emilcott Associates, Inc. – Controlling Dust on Construction Sites and When Air Monitoring Should Be Conducted

- Dust Control is Integral to Responsible Construction.
- Implement Work Practices to avoid dust emissions.
- Utilize effective dust controls.
    - Prepare roadways to avoid dust from vehicles.
    - Cover trucks when moving on and off site.
    - Utilize water trucks and other means to wet dry soil.
    - Cover soil piles when not in use.
- Conceptual Site Model:

- Need to determine historic site use before using land.
- Identify chemicals of concern.
- Identify transport mechanisms.
- Focus on inhalation exposure route and toxicity factors.
- Look at potential impact to off-site receptors; need to develop a perimeter monitoring plan.
- There should be a preference for real-time monitoring.
- Need to address both dust and odors.

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Kyle England, Legislative Associate, NJ Concrete and Aggregate Association, Concrete & Clean Air

- Existing State and Federal permitting appear sufficient.
- Better education of permittees and regulators with regards to visible emissions (opacity) testing (by USEPA protocols) and relevance to operations.
- Greater latitude in use of fugitive dust controls such as roadway surfacing agents.
- Better coordination between NJDEP air quality and water quality divisions (so that air control practices involving the use of water do not automatically become prohibitive water quality concerns).
- Promote use of water sprays, material enclosures, covers, screening buffers, wheel washes, etc.
- Promote use of material enclosures (remove wind), e.g., aggregate bins.
- Promote use of screening buffers (vegetation – remove wind).
- Promote roadway watering.
- Promote anti-tracking & wheel wash practices prior to site exit.

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Gary Sondermeyer, Vice President of Operations, Bayshore Family of Companies - Fugitive Emission Control in the Recycling Industry

Class B recycling facilities in New Jersey, many of which operate on-site concrete crushing equipment, are heavily regulated. Facilities receive General "Recycling Center Approvals" from the NJDEP Division of Solid & Hazardous Waste Management which contain 40 "General Provisions" and 45 "Additional Conditions" applicable to all Class B operations. From an air quality regulation standpoint, Title V or Preconstruction Permits are applicable for each piece of equipment (sources). NJDEP Stormwater Management requirements are also applicable and relevant and, in the case of Bayshore, we operate under a "Facility-wide Stormwater Pollution Prevention Plan" which deals with mud and dust as a surrogate for fugitive emissions control. Finally, Federal OSHA requirements are applicable from a worker safety standpoint. Strict monitoring and reporting requirements are already in place and regular compliance inspections conducted by NJDEP DSHW, Air, Stormwater Compliance & Enforcement as well as Middlesex County CEHA in the case of Bayshore. From a societal benefit standpoint, construction & demolition (C&D) materials are the

most effectively recycled in the entire disposal stream in the United States (74% recycling rate nationally). From a sustainable materials management standpoint, C&D recycling provides substantial environmental, GHG emissions reduction, economic and jobs creation benefits. At the same time, the C&D recycling industry is highly competitive with challenging markets for recovered products, particularly given the global pandemic and impacts to construction activity. As a conclusion, we do not feel that additional fugitive dust emissions controls are needed or warranted at Class B Recycling Centers as the industry is already very highly regulated.

- Select hours of operation for processing and crushing.
- Use water sprayers and misters on conveyor belts.
- Implement on-site mud management.
- Implement continuous water truck misting.
- Sweep nearby public roads.
- Use on-site bounce house or rumble strip to remove mud and dusts.

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Greg Zwicke, Air Quality Engineer, USDA Natural Resource Conservation Service - Sources and Mitigation of Agricultural Fugitive Dust

- Sources of agricultural fugitive dust
    - Windblown dust
        - maintain ground cover
        - reduce tillage
        - have windbreaks/vegetative barriers
    - Unpaved roads
        - apply dust suppressants
        - minimize vehicle traffic and speeds
    - Tillage/harvesting/field operations
        - Timing of operations (e.g., higher humidity or at time of lower windspeeds)
        - alternative harvesting techniques
        - windbreaks
    - animal activity in open lots or pens
        - Keep soils within open lots and pens moist

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Laura Tessieri, Executive Director, North Jersey Resource Conservation and Development Council - Current Soil Health and Agricultural Conservation Efforts in NJ

North Jersey Resource Conservation & Development (RC&D) is a regional 501(c)(3) non-profit

organization that supports programming in northern NJ in areas of water resource protection, soil health and sustainable agriculture. Through partnerships with county, state and federal agencies, as well as private entities, North Jersey RC&D develops and manages programs and projects that promote conservation of the region's resources.

Programs include working with NJ Farmers and providing both technical and financial assistance to aid in implementation of soil and water conservation practices. These practices include reduced tillage, no-till seeding, planting of cover crops, residue management, nutrient and manure management, as well as erosion control practices such as grassed and lined waterways. In a classic northeastern corn/soybean farm, crops are often harvested in the late fall and fields can be left bare for 5-7 months. Without living roots to anchor the soil, the topsoil and nutrients are lost during intense rainfall or wind events, reducing a soil's fertility and polluting local waterways.

North Jersey RC&D has a long-standing, strong partnership with the USDA Natural Resources Conservation Service (NRCS) which includes a Contribution Agreement for partner employees and also, an Aerial Seeding Multi-Species Cover Crop Initiative. With the combined support of farmers, the USDA-NRCS, the National Fish and Wildlife Foundation, and the William Penn Foundation through the Delaware River Watershed Initiative (DRWI), the aerial seeding initiative is a successful public-private partnership that benefits the region by building healthy and resilient soils while protecting water quality.

In addition to cover crops, many farmers are now managing their fields with no-till or reduced till. No-till adoption reduces soil erosion, increases soil biological activity and increases soil organic matter. These benefits can lead to increased water holding capacity, as well as, additional economic gains for farmers over time.

There is an economic cost for farmers to transition to no-till and cover crops which often includes decreased yield and equipment costs. To assist farmers in overcoming these barriers to implementation:

- North Jersey RC&D captured technical assistance from leading crop consultants and agronomists and produced an implementation manual, "A Practical Guide to No-till and Cover Crops". North Jersey RC&D also led a series of training classes for agricultural service providers in the Summer of 2020 through a Northeast Sustainable Agriculture Research and Education Professional Development Grant.
- Through a USDA-NRCS On Farm Trial Soil Health Demonstration Conservation Innovation Grant, North Jersey RC&D is currently working with 25 farmers in northern NJ to implement innovative approaches of cover crop management. This opportunity assists with equipment costs and includes research on methods that include roller crimping, planting green and grazing with cover crops.

Increased opportunities for conservation funding are needed, both to fund increased technical and financial assistance. Specifically, funding is needed that supports more widespread adoption of innovative approaches, practices and systems on working lands. Increased adoption of cover crops and no-till management benefits include soil erosion protection, carbon sequestration,

reduced nutrient leaching, reduced inputs and carbon sequestration. This results in healthier, more resilient soils and improved water quality.

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Ed Wengryn, Research Associate, NJ Farm Bureau – Dust and Agriculture

NJ Agriculture has come a long way from the dust bowl days of plowing everything up. Practice from windbreaks and small field design, to no till agriculture, and cover crop plantings, are all part of how NJ farms help keep soil dust where it is needed, on the farm.

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PUBLIC COMMENTS

Barbara Pfeiffer

Don't let other permits pass in Waterfront Camden.

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Martin Kane, Chairman, Lake Hopatcong Foundation and H. Ronald Smith, Chairman, Lake Hopatcong Commission

Thank you for conducting the "Dust In The Wind" public hearing on 4/21/21. Unfortunately, the Lake Hopatcong Commission (Commission) was not able to participate because of time constraints, however the Lake Hopatcong Foundation (Foundation) was present and provided comment during the hearing.

The Commission and Foundation share the responsibility of protecting an important natural resource, Lake Hopatcong, the largest freshwater water body in New Jersey. The importance of this resource cannot be overstated and its future will affect the socio-economic well-being of the region in which it is located.

The responsibilities and interests of our two groups are many, but for the purpose of the aforementioned public hearing our comments will focus on a specific land use – the quarrying of rock material and related activities, such as the processing and the transport of that material, well beyond the locations of the quarries themselves. While there are almost 200 operating quarries in the state, our specific concern is the Weldon Quarry which operates off the northern shore of Lake Hopatcong on the border of the municipalities of Hopatcong, Sparta, and Jefferson Township. It is our expectation that future studies will reveal conclusively that quarry operations have a varying degree of negative impacts on air quality and water quality. The studies and observations that we have made in connection with the Weldon Quarry points us in that direction.

For a significant period of time there have been complaints about the dust and runoff generated from Weldon Quarry's operations. Fugitive dust has covered cars, houses, and boats in this area

for decades. A 2015 Bathymetric Survey by Princeton Hydro showed that the cove closest in proximity to Weldon Quarry has the highest rate of infilling of any cove on Lake Hopatcong. Turbidity is also notably higher. Local fishing clubs have raised concerns about degradation of fish habitat and the reduction in fish compared to the rest of the lake. In addition to the common fugitive dust emissions, several times a year stone dust from large blasts at the quarry blanket the area around State Route 181. One can easily imagine the human health and ecological impacts of these emissions. The most egregious in recent memory occurred on September 22, 2020. The amount of rock dust in the air was calculable, but without on- or off-site monitoring Weldon will not be held accountable. We recognize that quarries are an important economic resource (and legally protected to a certain extent), but they cannot, at this point in the 21st century, be considered more important than important natural resources like Lake Hopatcong and the people who live in close proximity of the continuous extraction activities associated with quarry operations. Given that the Weldon Quarry, as well as many other quarry operations, have anticipated life spans of 100 years or more, this is an issue that is not going away anytime soon. The Commission and Foundation therefore recommend the following:

- It essential that the state revisit the compliance and enforcement regulations related to reporting nuisance dust and air quality issues. It is the experience of the Lake Hopatcong Commission, Foundation and our residents that the protocol for issuing citations in which an inspector must be physically present to witness dust migrating from a facility to a complainant's property hinders the process of holding polluters responsible. So much so that many of our residents have given up reporting issues to the DEP because nothing is ever accomplished. A quarry related air quality monitoring program must be established at the state level to ensure protection of our citizens.

- In conversations with DEP regarding the February 2019 surface water discharge to Lake Hopatcong and ongoing air quality issues with Weldon Quarry, we understand that quarries are not required to analyze on-site rock for silica or other compounds that are known to cause human health issues. For residents who see, feel, and inhale the quarry "fugitive dust" and other particulates on a continuous basis it is crucial that quarries be required to analyze the rock on their property so that preventative measures can be implemented to protect our communities.

- Although quarries are already subject to some monitoring and regulation, it is not enough with respect to air quality, water quality and health issues. Grandfathering quarries under old regulations, self-monitoring and self-regulation, especially, cannot provide the protection that state level scrutiny can. We can't say for certain what additional regulation may be needed to better protect residents of New Jersey, until more data is assembled and analyzed, but it is our expectation that additional more conservative regulation will be needed, which only the state government can provide.

- Further studies also need to be completed in connection with the impacts that affect important natural resources like Lake Hopatcong, particularly with respect to water quality, sedimentation, infilling and other related matters. The Commission has compiled relevant information about how the Weldon Quarry is impacting the lake. We have photos, reports

(such as from our consultant Princeton Hydro) emails from affected residents, containers full of dust etc. that document where the fugitive dust from Weldon lands. It can be found on windows, in roof gutters, in marine engines, on the lake bottom and in countless other locations. However, rather than burden the public hearing record with all of our documentation, we would prefer to meet with representatives of the Clean Air Council – either in person or virtually - so that we can review that information together and directly assist with the necessary next steps. Nevertheless, we are including with this letter two of those documents for your files – 1) An aerial photo that depicts the proximity of Weldon Quarry to Lake Hopatcong 2) A letter sent to former DEP Commissioner McCabe on 8/17/20 regarding air quality and quarries.

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Benjamin Saracco, Member of Camden Shade Tree Commission

Examples of fugitive dust materials in Camden include but are not limited to uncovered Cement aggregate piles, automotive shredder residue piles, contaminated soil, illegal fill dumping, plaster wallboard manufacturing operations, waste being trucked back and forth from the incinerator. Many more. Also, get more black and brown people on the Council.

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Jonathan Latko, Cooper Grant Neighborhood Association Member

We need to look more at cumulative dust impacts. How do we deal with pollution coming across from Philadelphia? Residents have black soot on their windowsills Need to spend money locally to reduce dust issues. NJDEP fines and funding sources should be used to handle problems locally.

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L.M. Davis, Jackson, New Jersey Resident

I would like to take a minute to thank you for your invitation to attend your annual public meeting this year and as always it was quite thought provoking. I found myself thinking about a meeting where I first heard the phrase "onion skin" applied to a remediation project of some lagoons and the multiple layers of complexity that can lie just below the surface of any endeavor. Therefore, please see the following comments:

- The use of a control device employing a water suppression spray will help to capture the wind driven fugitive emissions associated with open air storage of certain manufacturing operations that employ stockpiling of aggregate / debris. The particulate captured in the mist with a specific gravity of 2 or better will fallout of the runoff relatively close to the shadow of the pile being sprayed but, it's the colloidal particulate entrained in the runoff that is more problematic. The colloidal laden runoff could cause pooling in spots across the yard which eventually evaporate and become released back into the outdoor atmosphere through foot traffic or eventually find its way into the nearest waterway. It's not unusual to see as a condition added to a permitted wet

scrubber or a leachate collection system, stating where the contaminated solution will be sent for treatment off site and should be considered when permitting these types of air pollution control devices in the future.

- Recently, I have started to hear mention of windblown micro plastics becoming entrained into the atmosphere. Apparently, the alleged source of the micro plastic particulate is road dust. I have not heard an explanation as to how this occurs. I am assuming that plastic litter along the curbside is being ground to a powder under the tires of the vehicles as they roll over the plastic trash. While I have heard mentioned that the micro plastic particles are traveling high into the atmosphere, it sounds like they are passing through the neighborhoods abutting these roadways on their way. Therefore, it might be prudent to include micro plastic as part of wind driven road dust discussion in the future.

- The planting of windbreaks has been a common solution to wind driven soil erosion in rural areas since the dust bowel and I have even heard of them being used to minimize the spray coming off WTPs. However, recently I have heard that a secondary condition has come to light regarding the selection of shade trees in urban areas. Apparently, with the loss of most of our Elm trees due to the Dutch Elm disease, there was a push to find a suitable replacement and strains of cultivars were propagated with an eye towards hardiness and ease of maintenance. One of these criteria was to be fruitless for easy clean up. What this led to was the planting of millions of male trees in metropolitan areas and when the trees matured, they produced pollen at higher rates than would normally be expected. It's kind of a double whammy for allergic people who live in areas with high particulate loading or a compromised respiratory system to also be exposed to higher pollen levels. Therefore, if the planting of natural windbreaks does come into consideration as a possible recommendation for dust in the wind, consideration of the gender of the planting should be included in the discussion. I have included a link below for possible consideration at your leisure.

Keith F. Voos, Chair, Health, Education, Environmental and Pollution Subcommittee, Environmental Justice Committee, NJ State Conference, The National Association for the Advancement of Colored People

The purpose of this statement is to make clear the position of the Environmental and Climate Justice Committee of the NJ State Conference of the NAACP, of which Marcus Sibley is Chair and Richard Smith the State President. We wish to state in the strongest possible terms our support of legislative and/or regulatory activity to address the problem of fugitive dust degrading the state's air quality and comprising a contributing factor to poor respiratory health among NJ's adults and children.

In this statement, I will speak especially to the issue of asthma. As was made clear in testimony by several speakers at your public hearing of April 21, 2021, it is an established fact that densely populated areas of the state, home to many of the constituents and members of the NAACP, have higher asthma rates than other areas of the state. On the NJ Health Department website, it is stated that 9% of NJ's adults and 8.7% of NJ's children suffer from continuing asthma symptoms. But in the city of Newark, for example, 25% of children suffer from asthma, a rate three times higher than the state average.

Some contributors to this high rate are transportation-related pollutants such as carbon monoxide, lead, sulfur dioxide, and nitrogen dioxide as well as industrial pollutants including but not limited to oxides such as aluminum, iron, potassium and silicon. A substance closely related to silicon, silica, is one of the commonest natural elements on earth. Common construction materials containing silica include asphalt, brick, cement, concrete, dry wall, grout, mortar, stone, sand and tile.

It is now scientifically established that continued exposure to combinations of pollutants have a cumulative impact on respiratory health. Groundbreaking research on this topic is an important result of the many years of study by the NJ Environmental Justice Alliance and, as we all know, contributed to the recent passage of NJ's first-in-the-nation cumulative impacts law, also known as the Environmental Justice Law.

Given these irrefutable facts concerning cumulative impacts of multiple pollutants and the tragically above-average asthma rates in NJ's urban communities, we as informed citizens cannot allow fugitive dust to be a cumulative factor in the poor health of NJ's children, especially those in over-burdened urban neighborhoods. It is imperative that the NJ CAC strongly recommend legislation and/or regulatory activity to address the suppression of fugitive dust caused by, among other activities, residential, commercial, industrial and transportation-related construction as well as industrial scale recycling operations and routine farming operations not currently covered by air monitoring regulations.

The remediation of this problem is neither technically difficult nor, contrary to some testimony heard on April 21, prohibitively burdensome, especially compared to the financial and emotional burdens placed on our families and health-care systems by leaving the problem unaddressed.

The ECJ Committee of the NJSC of the NAACP strongly endorses immediate legislation and/or regulatory action to address this issue.

APPENDIX

REFERENCES

Bell ML., Belanger K., Ebisu K., Gent JF., Lee HJ., Koutrakis P., Leaderer BP. (2010). Prenatal exposure to fine particulate matter and birth weight: variations by particulate constituents and sources. Epidemiology 21: 884-891.

Bell ML., Ebisu K., Leaderer BP., Gent JF., Lee HJ., Koutrakis P., Wang, Y., Dominici, F., and Peng, RD. (2014). Associations of $PM_{2.5}$ constituents and sources with hospital admissions: analysis of four counties in Connecticut and Massachusetts (USA) for persons ≥ 65 years of age. Environmental Health Perspectives 122: 138-144.

Botsford, C., Lisoski, D., Blackman, W. (1996). Fugitive Dust Study Characterization of Uninventoried Sources. Report prepared for the South Coast Air Quality Management District.

Chepil, WS., Woodruff, NP. (1963). The Physics of Wind Erosion and Its Control. Advances in Agronomy, 15: 211-302.

Colombo C., Monhemius AJ., Plant JA. (2008). Platinum, palladium and rhodium release from vehicle exhaust catalysts and road dust exposed to simulated lung fluids. Ecotoxicology and Environmental Safety 71: 722-730.

Davidson, CI., Phalen RF., Solomon, PA. (2005). Airborne Particulate Matter and Human Health: A Review, Aerosol Science and Technology, 39(8): 737-749.

Dockery, DW., Pope III, CA., Xu, X., Spengler, JD., Ware, JH., Fay, ME., Ferris, BG., and Speizer, FE. (1993). Mortality Risks of Air Pollution: A Prospective Cohort Study, New England Journal of Medicine, 329: 1753–1759.

Franklin M., Koutrakis P., Schwartz P. (2008). The role of particle composition on the association between $PM_{2.5}$ and mortality. Epidemiology 19: 680-689.

Gent JF., Koutrakis P., Belanger K., Triche E., Holford TR., Bracken MB., and Leaderer, BP. (2009). Symptoms and medication use in children with asthma and traffic-related sources of fine particle pollution. Environmental Health Perspectives 117: 1168-1174.

Gillette, DA., Hanson, K. (1989). Spatial and Temporal Variability of Dust Production Caused by Wind Erosion in the United States. Journal of Geophysical. Research. 94(D2), 2197– 2206.

Jiang Y., Hu X., Yves UJ., Zhan H., Wu Y. (2014). Status, source and health risk assessment of polycyclic aromatic hydrocarbons in street dust of an industrial city, NW China. Ecotoxicology and Environmental Safety 106: 11-18.

Kinsey, JS., Linna, KJ., Squier, WC., Muleski, GE., Chatten, Jr., C. (2004). Characterization of the Fugitive Particulate Emissions from Construction Mud/Dirt Carry out. Journal of the Air and Waste Management Association, 54: 1394–1404.

Kioumourtzoglou MA., Coull BA., Dominici F., Koutrakis P., Schwartz J., Suh H., (2014). The impact of source contribution uncertainty on the effects of source specific $PM_{2.5}$ on hospital admissions: a case study in Boston, MA. Journal of Exposure Science and Environmental Epidemiology 24: 365- 371.

Liu E., Yan T., Birch G., Zhu Y. (2014). Pollution and health risk of potentially toxic metals in urban road dust in Nanjing, a mega-city of China. Science of the Total Environment 476-477: 522-531.

Li P., Xin J., Wang Y., Li G., Pan X., Wang S., Cheng, M., Wen, T., Wang, G., Liu, Z. (2015). Association between particulate matter and its chemical constituents of urban air pollution and daily mortality or morbidity in Beijing City. Environmental Science and Pollution Research International 22: 358-368.

Lillis, EJ., Young, D. (1975). EPA Looks At "Fugitive Emissions", Journal of the Air Pollution Control Association, 25(10): 1015-1018.

Luo, Y. (2017). Study on Dust Emission Characteristics of Typical Construction Site in Chong Qing; Southwest University: Chongqing, China.

Mar TF., Larson TV., Stier RA., Claiborn C., Koenig JQ. (2004). An analysis of the association between respiratory symptoms in subjects with asthma and daily air pollution in Spokane, Washington. Inhalation Toxicology 16: 809-815.

Pope III, CA. (2000). What Do Epidemiologic Findings Tell Us about Health Effects of Environmental Aerosols? Journal of Aerosol Medicine 13: 335–354

Potgieter-Vermaak S., Rotondo G., Novakovic V., Rollins S., Van Grieken R. (2012). Component-specific toxic concerns of the inhalable fraction of urban road dust. Environmental Geochemistry and Health 34: 689-696.

Probst, GL., Becker, Jr., RE. (1981). Escaping the regulatory dust bowl: Fugitive dust and the clean air act. Natural Resources Lawyer, 14(3): 541-566.

Reed, WR., Organisack, JA. (2007). Haul Road Dust Control: Fugitive dust characteristics from surface mine haul roads and methods of control. Coal Age 112: 34–37.

Rosbury, KD., Zimmer, RA. (1983). Cost Effectiveness of Dust Controls Used on Unpaved Haul Roads, Volume I – Results, Analysis and Conclusions. Report prepared for the Bureau of Mines, U.S. Department of the Interior by PEDCo Environmental, Inc.

Rosen JF. (1995). Adverse health effects of lead at low exposure levels: trends in the management of childhood lead poisoning. Toxicology 97: 11-17.

Schwartz, J., Dockery, DW., and Neas, LM. (1996). Is Daily Mortality Associated Specifically with Fine Particles? Journal of the Air and Waste Management Association, 46: 927–939.

Thurston, GD., Ito, K., Hayes, CG., Bates, DV., and Lippman, M. (1994). Respiratory Hospital Admissions and Summertime Haze Air Pollution in Toronto, Ontario: Consideration of the Role of Acid Aerosols. Environmental Research, 65: 271–290.

Watson, JG., Chow, JC., Pace, TG. (2000). Fugitive Dust Emissions. Air Pollution Engineering Manual, 2nd edition. Air and Waste Management Association. pp. 117-135.

Yan, H., Ding, G., Li, H., Wang, Y., Zhang, L., Shen, O., and Feng, K. (2019). Field Evaluation of the Dust Impacts from Construction Sites on the Surrounding Areas: A City Case Study in China, Sustainability 11: 1906, 1-19.

LIST OF ACRONYMS

BMP	-	Best Management Practices
C&D	-	Construction and demolition
CAC	-	Clean Air Council
CCMUA	-	Camden County Municipal Utilities Authority
CEHA	-	County Environmental Health Act
COPD	-	Chronic Obstructive Pulmonary Disease
COVID-19	-	Disease caused by the novel coronavirus
DRWI	-	Delaware River Watershed Initiative
DSHW	-	Department of Solid and Hazardous Waste
EC	-	Elemental carbon
ECJ	-	Environmental and Climate Justice
EJ	-	Environmental justice
EV	-	Electric vehicle
GHG	-	Greenhouse gas
H^+	-	Hydrogen ion
m^2	-	square meters
m^3	-	cubic meters
m/sec	-	meters per second
NAACP	-	National Association for the Advancement of Colored People
NH_4^+	-	Ammonium ion
NJDEP	-	New Jersey Department of Health
NJDOH	-	New Jersey Department of Health

NJSC	-	New Jersey State Conference
NO_3^-	-	Nitrate ion
NRCS	-	Natural Resource Conservation Service
OSHA	-	Occupational Safety and Health Administration
PAH	-	Polyaromatic hydrocarbons
Pd	-	Palladium
PM	-	Particulate matter
$PM_{2.5}$	-	Particulate matter with an aerodynamic diameter of 2.5 microns
PM_{10}	-	Particulate matter with an aerodynamic diameter of 10 microns
Pt	-	Platinum
RC&D	-	Resource conservation and development
Rh	-	Rhodium
SEP	-	Supplemental environmental project
SIC	-	Standard Industrial Classification
SO_4^{2-}	-	Sulfate ion
µm	-	micrometer
USDA	-	United States Department of Agriculture
USEPA	-	United States Environmental Protection Agency

HISTORY OF THE CLEAN AIR COUNCIL

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

1997 Particulate Matter: The proposed Standard and How it May Affect NJ

1996 Clearing the Air Communicating with the Public

1995 Strategies for Meeting Clean Air Goals

1994 Air Pollution in NJ: State Appropriations vs. Fees & Fines

1993 Enhanced Automobile Inspection and Maintenance Procedures

1992 Impact on the Public of the New Clean Air Act Requirements

1991 Air Pollution Emergencies

1990 Trucks, Buses, and Cars: Emissions and Inspections

1989 Risk Assessment - The Future of Environmental Quality

1988 The Waste Crisis, Disposal Without Air Pollution

1987 Ozone: New Jersey's Health Dilemma

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

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