Chapter 20: Public Health

A. INTRODUCTION

Public health is defined by the *City Environmental Quality Review (CEQR) Technical Manual* as "the activities that society undertakes to create and maintain conditions in which people can be healthy." The proposed action would support public health through continued treatment of wastewater and additional nitrogen removal from the plant's effluent. This chapter reviews the potential effects on public health from the construction and operation of the proposed action.

This chapter presents an assessment of the potential health concerns related to air quality, noise, traffic[1], and hazardous materials impacts during the construction and operational phases of the proposed action. Potential health effects during operations are related to pollutant emissions from process and combustion sources, and potential exposure to wastewater aerosols. During construction, potential health impacts due to air and noise pollutant emissions can stem from construction equipment and construction vehicles. Of particular concern is the potential for diesel emissions from construction-related activities to impact public health (such as increasing asthma rates). In response to those concerns, the City has recently adopted Local Law 77, which will result in significant reductions in air pollution from construction equipment throughout New York City. Therefore, this chapter also provides an overview of health concerns related to traffic and construction equipment, particulate matter (PM) emissions, and a discussion of asthma, its prevalence in New York City and the area most likely affected by the proposed action.

As noted in Chapter 8, "Criteria Air Pollutants," between the issuance of the Draft Environmental Impact Statement (DEIS) and the Final EIS (FEIS), NYCDEP has committed to the use of ultra low sulfur diesel (ULSD) fuel in the generators that are being installed under the Phase II Upgrade and the new emergency generator associated with the Phase III Upgrade. NYCDEP has also agreed to reduce the maximum number of emergency generators participating in a Peak Load Management (PLM) program to five of the six 2,000 kw generators that are being installed under the Phase II Upgrade. The commitment to use ULSD allowed the analyses to be updated to reflect the lower $PM_{2.5}$ emissions from these units. The air quality modeling analysis for the $PM_{2.5}$ 24-hour averaging period was updated, and these results were included in the public health assessment for the FEIS.

In addition, as note in Chapter 9, "Non-Criteria Air Pollutants," these analyses were updated to reflect that 10 out of 12 sludge thickeners would normally operate with the proposed action.

---

[1] Traffic impacts related to public health are primarily the potential for increased congestion and increased air pollution from vehicle emissions.

B. METHODOLOGY

For determining whether a public health assessment is appropriate, the *CEQR Technical Manual* lists the following as public health concerns for which a public health assessment may be warranted:

- Increased vehicular traffic or emissions from stationary sources resulting in significant adverse air quality impacts;
- Increased exposure to heavy metals (e.g., lead) and other contaminants in soil/dust resulting in significant adverse impacts;
- The presence of contamination from historic spills or releases of substances that might have affected or might affect groundwater to be used as a source of drinking water;
- Solid waste management practices that could attract vermin and result in an increase in pest populations (e.g., rats, mice, cockroaches, and mosquitoes);
- Potentially significant adverse impacts to sensitive receptors from noise or odors;
- Vapor infiltration from contaminants within a building or underlying soil (e.g., contamination originating from gasoline stations or dry cleaners) that may result in significant adverse hazardous materials or air quality impacts;
- Actions for which the potential impact(s) result in an exceedance of accepted federal, state, or local standards; or
- Other actions, which might not exceed the preceding thresholds, but might, nonetheless result in significant public health concerns.

A public health impact analysis was undertaken, since urban public health issues require special attention with regard to the construction and operation of the proposed action. In general, these concerns are closely related to air quality, noise, traffic and transportation, and hazardous materials.

Potential localized impacts on public health were analyzed to determine if the construction and operation of the proposed action would adversely impact the human populations near such activities. To make these determinations, predicted exposure levels considered relevant local, state, and federal regulations, guidelines, and action levels.

AIR QUALITY

Given the concern over higher than national asthma prevalence and hospitalization rates in New York City and that exposure to PM emissions could aggravate or induce asthma episodes in an individual, and concern relating to the potential health effects from exposure to wastewater aerosols and volatile organic compounds (VOCs), this chapter provides an assessment of the potential health concerns related to air quality during the construction and operation of the proposed action.

Pollutants of concern relating to air quality and the applicable standards and thresholds to which potential emissions from construction and operational activities were associated with the proposed action were compared. A description of the sources of air pollutants during construction and operation are presented, followed by a literature review of the health effects associated with diesel engine exhaust and emissions of PM in particular.

This chapter then provides an in-depth review of relevant asthma-related studies, provides an overview of the prevalence of asthma in New York City, and presents current asthma hospitalization data for neighborhoods representing the potentially affected population surrounding the proposed action.

This chapter also provides a discussion of the health effects related to microbial aerosol emissions from wastewater treatment plants.

Potential public health impacts associated with vehicular traffic included the potential for increased congestion, and increased pollution from vehicle emissions as a result of such construction.

Details for the potential air quality impacts identified from modeling are described in Chapters 8, “Criteria Air Pollutants,” 9, “Non-Criteria Air Pollutants,” and 17, “Construction.” The potential for increases in air quality levels that could cause public health impacts were evaluated.

NOISE

As described in Chapter 11, “Noise,” and 17, “Construction,” baseline noise levels were monitored and future levels during operation and construction of the proposed action were determined. Established thresholds were used to determine the potential significance of such predicted impacts on local populations. Details of noise monitoring and modeling to evaluate potential noise impacts from operation and construction of the proposed action are described in Chapters 11, “Noise,” and 17, “Construction.” The potential for increases in ambient noise levels that could cause public health impacts were evaluated.

HAZARDOUS MATERIALS

Hazardous materials are of concern due to their potential to cause environmental and human harm. Chapter 14, “Hazardous Materials,” describes the methodology employed to evaluate potential impacts from construction and operation of the proposed action. This included a determination of the potential presence of hazardous materials and the testing and other protective measures that will be undertaken prior to and during construction to protect workers and the surrounding population. In addition, potential hazardous materials that would be used on-site during operation of the Phase III upgrade were identified and protective measures that would be employed were addressed. All chemicals being used would have safety and handling issues evaluated before use. Right-To-Know regulations that identify hazardous wastes and inform the public of hazardous waste being produced in the vicinity of their residences would be followed. Compliance with other local, federal and state regulations would help protect local citizens and reduce risks to the public.

C. EXISTING CONDITIONS

The analysis of existing conditions for the Study Areas of concern included the identification of special local populations that may be particularly sensitive to the health effects of environmental impacts. Existing conditions for traffic, air quality, noise and hazardous materials are discussed within their respective chapters of the EIS (i.e., Chapters 8, “Criteria Air Pollutants,” 9, “Non-Criteria Air Pollutants,” 11, “Noise,” 14, “Hazardous Materials,” and 17, “Construction”).

In addition, regulations promulgated by the federal, state, or local governments serve as the basis for the identification and classification of potential public health issues. The following apply:

FEDERAL

- U.S. Environmental Protection Agency (EPA): EPA's Federal Clean Air Act (CAA) regulates the National Ambient Air Quality Standards (NAAQS), and Section 304(a) of the Clean Water Act (CWA) regulates water quality (www.epa.gov). Resource Conservation and Recovery Act (RCRA): This federal act regulates the generation, treatment, storage, disposal, and transport of hazardous wastes. Under RCRA, hazardous wastes are substances that are chemically reactive, ignitable, corrosive, or toxic as measured by the Toxicity Characteristic Leaching Procedure. Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA): More commonly known as Superfund, this federal act established prohibitions and requirements concerning closed and abandoned hazardous waste sites. The act provided for liability of persons responsible for releases of hazardous waste at these sites, and established a trust fund to provide for cleanup when no responsible party could be identified. The law authorizes two kinds of response actions: 1) short-term removals, where actions may be taken to address releases or threatened releases requiring prompt response; and 2) long-term remedial response actions that permanently and significantly reduce the dangers associated with releases or threats of releases of hazardous substances that are serious, but not immediately life threatening. These actions can be conducted only at sites listed on EPA's National Priorities List (NPL).
- Occupational Safety and Health Administration (OSHA) Regulations: This agency was created by Congress in 1970 and promulgates regulations and standards to protect workers' safety and health.
- U.S. Department of Transportation (USDOT): USDOT relates to public health through its mission of ensuring that various modes of transportation operate safely on an individual basis and together as an interlinked transportation system. The USDOT provides numerous transportation safety organizations and programs to protect public health (http://www.dot.gov/safety.html).

STATE

- New York State Department of Transportation (NYSDOT): The NYSDOT provides an Environmental Procedure Manual (http://www.dot.state.ny.us/eab/epm.html) to support its mission that those who live, work and travel in New York State are entitled to a safe, efficient, balanced and environmentally sound transportation system. NYSDOT can provide important environmental enhancements through close coordination with municipalities and state and federal resource agencies (i.e., NYSDEC and EPA). However, their initiative is to encourage construction and maintain practices above and beyond permit and mitigation requirements.
- New York State Department of Health (NYSDOH): The NYSDOH maintains public and human health standards (www.health.state.ny.us/home.html). NYSDOH also regulates drinking water. While EPA distinguishes between health-based (primary) and aesthetic (secondary) water standards, the NYSDOH considers them equally.
- New York State Department of Environmental Conservation (NYSDEC). NYSDEC is responsible for protecting and enforcing air quality laws and regulations for New York State. NYSDEC has implemented numerous programs to maintain or improve existing air quality on both a local and regional level. New or modified sources of emissions are issued permits and registrations by NYSDEC.

LOCAL

- New York City Department of Environmental Protection (NYCDEP): NYCDEP is responsible for the installation and maintenance of the water and sewer system for the City of New York. Through numerous programs, NYCDEP protects the quality of the City's waterbodies and drinking water supply watershed.
- New York City Department of Health and Mental Hygiene (NYCDOHMH): NYCDOHMH's mission is to protect and promote the health of New York City residents. NYCDOHMH has taken the lead in developing programs to reduce asthma-related hospitalizations and deaths in New York City by undertaking initiatives, and providing public health information for doctors and the public on asthma treatments and effects on health.

D. BENCHMARKS FOR DETERMINING THE SIGNIFICANCE OF PUBLIC HEALTH IMPACTS

The *CEQR Technical Manual* suggests evaluating compliance with applicable standards and guidelines protecting public health to help determine the significance of potential adverse impacts on public health from a proposed action. The following discussion presents the applicable standards and thresholds to which the results of the air quality and noise modeling are compared in determining the significance of public health impacts. From a public health perspective, traffic impacts are evaluated in context of their potential to impacts air quality, and hazardous material impacts are examined within the context of potential exposure from remediation during construction and chemicals used during operation. The potential public health impacts due to the proposed action are based on the results of the impact assessments presented in Chapters 8, "Criteria Air Pollutants," 9, "Non-Criteria Air Pollutants," 14, "Hazardous Materials" and 17, "Construction."

AIR QUALITY

Any action predicted to increase the concentration of a criteria air pollutant to a level that would exceed the concentrations defined by the NAAQS would generally be deemed to have a potential significant adverse impact. In addition, to maintain concentrations lower than the NAAQS in attainment areas, or to ensure that concentrations will not be significantly increased in non-attainment areas, threshold levels have been defined for certain pollutants. Any action predicted to increase the concentrations of these pollutants above the thresholds would be deemed to have a potential significant adverse air quality impact, even in cases where violations of the NAAQS are not predicted, requiring a detailed analysis of air quality impacts for that pollutant. The evaluation of public health impacts considered the potential for air quality impacts on a community wide basis.

THE NATIONAL AMBIENT AIR QUALITY STANDARD FOR $PM_{2.5}$

Section 108 of the CAA directs the EPA to identify criteria pollutants that may reasonably be anticipated to endanger public health and welfare. Section 109 of the CAA requires the EPA to establish NAAQS and periodically revise them for such criteria pollutants. Primary NAAQS are mandated to protect public health with an adequate margin of safety. In setting the NAAQS, EPA must account for uncertainties associated with inconclusive scientific and technical information, and potential hazards not yet identified. The standard must also be adequate to protect the health of any sensitive group of the population. Secondary NAAQS are defined as standards that are necessary to prevent adverse impacts on public welfare, such as impacts to crops, soils, water, vegetation, wildlife, weather, visibility, and climate.

Beginning in 1994, EPA conducted a five-year review of the NAAQS for PM, which included an in-depth examination of epidemiologic and toxicological studies. EPA also held public meetings across the nation and received over 50,000 oral and written comments regarding these studies, particularly as to whether $PM_{2.5}$ is correlated with adverse health effects, and at what ambient air concentrations of $PM_{2.5}$ these correlations hold. The studies are summarized in EPA's Criteria Document for Particulates, Chapters 10-13 (1996); EPA's Staff Papers on Particulates, in particular Chapter V[1]; and EPA's proposed NAAQS for particulates, found in the December 13, 1996 Federal Register on page 65638. Based on this extensive analysis, in June of 1997, EPA revised the NAAQS for PM and proposed a new standard for $PM_{2.5}$ consisting of both a long-term (annual) limit of 15 $\mu g/m^3$ and a short-term (24-hour) limit of 65 $\mu g/m^3$.[2]

In establishing the NAAQS for $PM_{2.5}$ in 1997, EPA conservatively assumed that moderate levels of airborne PM of any chemical, physical, or biological form might harm public health. In setting the value of the annual average NAAQS for $PM_{2.5}$, EPA found that an annual average $PM_{2.5}$ concentration of 15$\mu g/m^3$ is below the range of data most strongly associated with both short- and long-term exposure effects. The EPA Administrator concluded that an annual NAAQS of 15$\mu g/m^3$ "would provide an adequate margin of safety against the effects observed in the epidemiological studies."[3] The annual standard was supplemented by the 24-hour standard of 65 $\mu g/m^3$ to protect against short-term exposures in areas with strong local or seasonal sources.

EPA has revised the NAAQS for PM, effective December 18, 2006. The revision included lowering the level of the 24-hour $PM_{2.5}$ standard from 65 micrograms per cubic meter ($\mu g/m^3$) to 35 $\mu g/m^3$ and retaining the level of the annual standard at 15 $\mu g/m^3$. The PM_{10} 24-hour average standard was retained and the annual average PM_{10} standard was revoked.

INTERIM GUIDANCE CRITERIA (THRESHOLD LEVELS) REGARDING $PM_{2.5}$ IMPACTS

In addition to the NAAQS, NYCDEP has promulgated an interim guidance for $PM_{2.5}$, a threshold value that is used for comparison when determining potential significance of air quality and public health impacts.[4] The interim guidance requires a $PM_{2.5}$ neighborhood analysis for actions that have

[1] Many of the studies are found on EPA's website at http://www.epa.gov/ttn/oarpg/t1sp.html.

[2] 62 Federal Register 38652 (July 18, 1997).

[3] 62 Federal Register 28652, 38676 (July 18, 1997).

[4] NYSDEC has also published a policy to provide interim direction for evaluating $PM_{2.5}$ impacts. This policy would apply only to facilities applying for permits or major permit modification under the State Environmental Quality Review Act (SEQRA) that emit 15 tons of PM_{10} or more annually. All of the air emission sources combined at the Hunts Point WPCP in the future with and without the proposed action result in PM_{10} emissions much less than 15 tons per year. The policy states that such a project will be deemed to have a potential significant adverse impact if the project's maximum impacts are predicted to increase $PM_{2.5}$ concentrations by more than 0.3 $\mu g/m^3$ averaged annually, or more than 5 $\mu g/m^3$ on a 24-hour basis. Projects that exceed either the annual or 24-hour threshold will be required to prepare an Environmental Impact Statement (EIS) to assess the severity of the impacts, to evaluate alternatives, and to employ reasonable and necessary mitigation measures to minimize the $PM_{2.5}$ impacts of the source to the maximum extent practicable. The NYCDEP community-based threshold of 0.1$\mu g/m^3$ is considered more relevant and appropriate when determining potential public health impacts than the above-

potential for a significant impact. In the neighborhood analysis, the annual increase in concentration representing the average over an area of approximately 1 square kilometer, centered on the location where the maximum ground-level impact is predicted for stationary sources; or at a distance from a roadway corridor similar to the minimum distance defined for locating neighborhood scale monitoring stations, is considered a significant adverse impact. According to the interim guidance, actions should not exceed an average annual $PM_{2.5}$ concentration increment of 0.1 μg/m^3 within the 1 km^2 area considered. To put this value in perspective, 0.1 μg/m^3 constitutes less than one percent of the annual NAAQS for $PM_{2.5}$. A concentration increment that is lower than the incremental neighborhood guidance concentration would be statistically insignificant due to normal variations in the ambient concentrations and would not be shown by the ambient air monitor reports. $PM_{2.5}$ impacts below this threshold are not considered to be significant with regards to public health impacts.

The NYSDEC and NYCDEP interim guidance criteria have been used for the purpose of evaluating the significance of predicted impacts of the proposed action on $PM_{2.5}$ concentrations and to determine the need to minimize PM emissions from the proposed action.

RECOMMENDED GUIDELINE CONCENTRATIONS FOR NON-CRITERIA POLLUTANTS

New York State also seeks to control the ambient levels of air toxics through the use of recommended guideline concentrations in the New York Code, Rules and Regulations (6 NYCRR Part 212). These “non-criteria pollutants” include carcinogens, as well as non-carcinogenic compounds and irritants. NYSDEC provides 1-hour and annual average guideline concentrations called Short-Term Guideline Concentrations (SGCs) and Annual Guideline Concentrations (AGCs), respectively, for these compounds and describes the methodology for assessing the impact due to air toxic emissions in Air Guide-1: Guidelines for the Control of Toxic Air Contaminants (DAR-1, NYSDEC, 1991). (See Chapter 9, “Non-Criteria Air Pollutants,” for a detailed discussion regarding NYSDEC’s Guideline Concentrations).

NOISE

As discussed in Chapters 11, “Noise,” and 17, “Construction,” noise levels associated with the construction of the proposed action would be subject to the emission source provisions of the New York City Noise Control Code. Construction equipment is also regulated by the Noise Control Act of 1972. In addition, the New York City Noise Control Code specifies maximum sound pressure levels at receiving properties (designated by octave band levels). The *CEQR Technical Manual* also provides guidance for examining the incremental noise impacts, and comparisons with NYCDEP’s external Noise Exposure Guidelines. Finally, the City of New York’s Zoning Resolution sets octave band limits for the lot line of a property.

E. AIR QUALITY POLLUTANTS OF CONCERN

The assessment of potential air quality impacts from the proposed action are reported in Chapters 8, “Criteria Air Pollutants,” 9, “Non-Criteria Air Pollutants,” and 17, “Construction.”

---

mentioned NYSDEC thresholds, since it represents the effect on public health over a larger population evaluated over a “neighborhood-scale” area.

PARTICULATE MATTER

Particulate matter (PM) is a broad class of air pollutants that exist as liquid droplets or solids, with a wide range of sizes and chemical composition. Generally, airborne concentrations of PM are expressed as the total mass of all material (often smaller than a specified aerodynamic diameter) per volume of air (in micrograms per cubic meter, $\mu g/m^3$). Thus, PM_{10} refers to suspended particles with diameters less than 10 μm, and $PM_{2.5}$ to suspended particles with diameters less than 2.5 μm.

PM is emitted by a variety of natural and man-made sources. Natural sources include the condensed and reacted forms of natural organic vapors, salt particles resulting from the evaporation of sea spray; wind-borne pollen, fungi, molds, algae, yeasts, rusts, bacteria; debris from live and decaying plant and animal life; particles eroded from beaches, desert, soil and rock; particles from volcanic and geothermal eruptions; and, forest fires.

Major man-made sources of PM include the combustion of fossil fuels, such as vehicular exhaust, power generation and home heating, chemical and manufacturing processes, all types of construction, agricultural activities and wood-burning fireplaces. Since the chemical and physical properties of PM vary widely, the assessment of the public health effects of the airborne pollutants in ambient air is extremely complicated.

$PM_{2.5}$

As mentioned above, PM is a byproduct of fossil fuel combustion. It is also derived from mechanical breakdown of coarse particulate matter such as pollen fragments. $PM_{2.5}$ does not refer to a single homogeneous pollutant, but to an array of fine inhalable materials. There are, for example, thousands of forms of natural ambient $PM_{2.5}$ and perhaps as many forms of man-made $PM_{2.5}$, which include the products of fossil fuel combustion (such as diesel fuel), chemical/industrial processing, and burning of vegetation. While all the disparate forms of $PM_{2.5}$ can be inhaled, their toxicological properties can differ. Some PM is emitted directly to the atmosphere (i.e., primary PM), while other types of PM are formed in the atmosphere through various chemical reactions and physical transformations (i.e., secondary PM). The formation of secondary $PM_{2.5}$ is one determinant of ambient air quality and is, thus far, extremely difficult to model.

The major constituents of $PM_{2.5}$ are typically sulfates, nitrates, organic carbon, elemental carbon (soot), ammonium, and metallic elements (not including sulfur). Secondary sulfates and nitrates are formed from their precursor gaseous pollutants, SO_2, and NO_x at some distance from the source due to the time needed for the chemical conversion within the atmosphere. Elemental carbon and metallic elements are components of primary PM, while organic carbon can be either emitted directly from a source or formed as a secondary pollutant in the atmosphere. Due to the influence of these "secondary" pollutants from distant or regional sources, regional ambient levels of $PM_{2.5}$ are typically more evenly distributed than their related class of pollutants PM_{10}, which is more highly influenced by local sources. Diesel exhaust is a substantial component of $PM_{2.5}$ in New York City, and recent research has demonstrated that variations in diesel exhaust are more strongly associated with changes in respiratory function than is $PM_{2.5}$ overall[1]. Data

---

[1] Citations include:

Ito K., Christensen W.F., Eatough D.J., Henry R.C., Kim E., Laden F., Lall R., Larson T.V., Neas L., Hopke P.K., Thurston G.D.. PM source apportionment and health effects: 2. An investigation of from the Botanical Gardens in the Bronx and Queens College in Queens, New York City indicate that the greatest contributors to ambient $PM_{2.5}$ concentrations are sulfates and organic carbon (approximately two thirds of the total $PM_{2.5}$ mass). Studies confirming the contribution of long-range transport to ambient $PM_{2.5}$ levels compared the data from New York City monitors to monitors from a remote site within the state, downwind from other states. These data show that high levels of sulfate and other pollutants come into New York State from areas to the west and south of New York. The data also indicate that urban sites are more likely to experience increased nitrate and carbon levels than rural sites.[1]

F. SUMMARY OF AIR AND NOISE POLLUTION SOURCES

CONSTRUCTION

AIR QUALITY

Construction activities have the potential to impact public health as a consequence of emissions from on-site construction engines as well as emissions from mobile construction related vehicles and their impact on traffic conditions. In general, most construction engines are diesel powered, and produce relatively high levels of PM. Construction activities also emit fugitive dust. Impacts on traffic could also increase mobile source-related emissions.

The construction of the proposed action would be subject to Local Law 77, thus, the potential PM emissions would be reduced due to the implementation of required emission controls and ultra-low sulfur diesel (ULSD) fuel (See Chapter 17, "Construction").

NOISE

Incremental community noise levels during construction of the proposed action can result from construction equipment operation and from construction vehicles and delivery vehicles traveling to and from the site. Noise levels caused by construction activities would vary depending on the phase of construction and the location of the construction relative to receptor locations.

PROJECT OPERATIONS

Potential stationary source emissions associated with operation of the proposed action would primarily be from the boilers and emergency generators as upgraded under Phases I and II and from the replacement waste gas burners and the 500 kW emergency generator proposed for the Phase III Upgrade. NYCDEP has committed to the use of ULSD fuel in the generators that are being installed under the Phase II Upgrade and the new emergency generator associated with the Phase III Upgrade. Uncovered aeration basins or trickling filters associated with the wastewater

intermethod variability in associations between source-apportioned fine particle mass and daily mortality in Washington, DC. J Expo Sci Environ Epidemiol. 2006 Jul;16(4):300-10. Epub 2005 Nov 23.

Lena T.S., Ochieng V., Carter M., Holguin-Veras J., Kinney P.L.. Elemental carbon and $PM_{2.5}$ levels in an urban community heavily impacted by truck traffic. Environ Health Perspect. 2002 Oct;110(10):1009-15

[1] New York State Department of Environmental Conservation (NYSDEC), Report to the Examiners on Consolidated Edison's East River Article X Project, Case No. 99-F-1314, February, 2002.

treatment process may also be an airborne source of microbial aerosol and non-criteria airborne wastewater emissions during operation of the proposed action.

G. AIR QUALITY-RELATED HEALTH EFFECTS

Scientists have been studying possible links between various health effects, particularly respiratory diseases or symptoms, such as cough, asthma, and bronchitis, and traffic sources of air pollution. The toxic effects of diesel engine exhaust, in particular, have been evaluated in numerous studies. Increases in airborne particle matter (PM) emitted by such sources may account for potential impacts on public health. The following section provides a general discussion of the health effects from traffic and construction equipment sources of air pollution, such as engine exhaust, then focuses specifically on the characteristics of PM, especially $PM_{2.5}$ (suspended particles with diameters less than 2.5 μm) and the public health effects related to human exposure to airborne concentrations of $PM_{2.5}$. Because New York City, and the project area in particular, are considered high density areas with asthma rates that are generally higher than in less urban areas, a detailed discussion of asthma is presented, including its prevalence in New York City and the area most likely to be affected by the proposed action. A review of the health effects related to microbial aerosol emissions from wastewater treatment plants is also provided.

DIESEL ENGINE EXHAUST

EPA's *Health Assessment Document for Diesel Engine Exhaust, 2002,* evaluates available evidence of the health hazards associated with exposure to diesel engine exhaust (DE).[1] The assessment categorizes the possible health hazards as either acute (short-term exposure) effects, chronic (long-term exposure) non-cancer respiratory effects, or chronic (long-term exposure) carcinogenic effects.

EPA's assessment notes that there is available, but limited, human and animal evidence to suggest that exposure to diesel exhaust can cause acute irritation (e.g., eye, throat, and bronchial), neurophysiological symptoms (e.g., lightheadedness and nausea), and respiratory symptoms (e.g., cough, and phlegm). There is also evidence of the exacerbation of allergenic responses to known allergens and asthma-like symptoms.

Toxicological information from human studies does not provide a definitive evaluation of possible non-cancer health effects; however, there is extensive animal evidence. Based on the available animal evidence, EPA has concluded that diesel exhaust exposure may pose a chronic respiratory hazard to humans. In several animal species, including rats, mice, hamsters and monkeys, chronic-exposure animal inhalation studies show a range of dose-dependent inflammation and histopathological changes in the lungs.

Based on the evaluation of evidence from human, animal, and other supporting studies, EPA has concluded that diesel engine exhaust is "likely to be carcinogenic to humans by inhalation" and that this hazard applies to environmental exposures. EPA's assessment states that:

---

[1] EPA National Center for Environmental Assessment, 2002, *Health Assessment Document for Diesel Engine Exhaust*, EPA/600/8-90/057F.

Although the available human evidence shows a lung cancer hazard to be present at occupational exposures that are generally higher than environmental levels, it is reasonable to presume that the hazard extends to environmental exposure levels.

Given a carcinogenicity hazard, EPA typically performs a dose-response assessment of the human or animal data to develop a cancer unit risk estimate that can be used with exposure information to characterize the potential cancer disease impact on an exposed population. The DE human exposure-response data are considered too uncertain to derive a confident quantitative estimate of cancer unit risk, and with the chronic rat inhalation studies not being predictive for environmental levels of exposure, EPA has not developed a quantitative estimate of cancer unit risk.

Although there is convincing evidence for potential human health hazards related to diesel engine exhaust, EPA's assessment acknowledges that uncertainties exist because of the use of assumptions to bridge data and knowledge gaps about human exposures to DE and the underlying mechanisms by which DE may cause the observed toxicities in humans and animals:

A notable uncertainty of this assessment is how the physical and chemical nature of DE emissions has changed over the years because the toxicological and epidemiologic observations are based on older engines and their emissions, yet the desire is to focus on the potential health hazards related to exposure from present-day or future emissions.

Other uncertainties include the assumptions that health effects observed at high doses may be applicable to low doses, and that toxicologic findings in laboratory animals are predictive of human responses. Also, the available data are not sufficient to demonstrate the absence or presence of an exposure/dose-response threshold in humans from DE toxicity at environmental exposures.

As mentioned in the above, the results of the EPA study are based on data for older engines. Ultra-low sulfur diesel (ULSD) fuel would be used exclusively for diesel engines throughout the site during construction. This would enable the use of tailpipe reduction technologies required by Local Law 77, and would directly reduce additional diesel PM emissions, which would reduce their aggregate potential for public health impacts had ULSD not been used. The PM emitted from combusting ULSD consists primarily of organic products of incomplete combustion, and is very low in metal content.[1] Further, this PM contains no biological material. Small amounts of nitrates and sulfates may be present in this PM and NO_x, SO_2, and ammonia emissions may lead to further (but much more diffuse) formation of secondary particulate matter in the region, although chemical reactions that result in secondary PM are typically too slow to cause an increase in secondary PM near the source. Many toxicological studies have shown that concentrations of hundreds of micrograms of sulfate or nitrate per cubic meter of air are required before even minimal changes in respiratory or other functions can be observed, even in asthmatic subjects or in sensitive laboratory rodents.[2]

---

[1] *AP42*, Section 1.3, September, 1998 and Section 3.1, April, 2000.

[2] Concentrations of at least 100 micrograms of sulfate or nitrate per cubic meter of air are required before even minimal changes in respiratory function can be observed, even in asthmatic subjects or in sensitive laboratory rodents. See EPA's 2004 PM Criteria Document for extended discussion and references.

$PM_{2.5}$

Short- and long-term exposure to $PM_{2.}$ is associated with a variety of effects on human health. Since particulate matter in the ambient air is comprised of a combination of discrete compounds or elements, its possible public health effects could vary depending on the specific components of particulate matter in a region. Acid aerosols such as sulfuric acid may trigger reactions in pulmonary lung function, while bioaerosols, such as mold spores, may result in allergic reactions related to increased incidences of asthma, for example. The EPA 2004 Criteria Document acknowledged the uncertainty regarding the shapes of particulate matter exposure-response relationships; magnitude and variability of risk assessments for particulate matter; the ability to attribute observed health effects to specific particulate matter constituents; the time intervals over which particulate matter health effects are manifested; the extent to which findings in one location can be generalized to other locations and the nature and magnitude of the overall public health risk imposed by ambient particulate matter exposure.

At the Hunts Point WPCP, the primary sources of particulate matter are, during construction, from the combustion of diesel fuel in road and non-road vehicles and heavy duty equipment, and during operation, from natural gas or digester gas, and diesel fuel. The digester gas, which is generated by the treatment process, is either flared or re-utilized in the boilers. Diesel fuel and natural gas are used by the boilers, while the emergency generators operate on diesel fuel. As discussed in Chapter 9, "Criteria Air Pollutants," NYSDEC has published a policy to provide interim direction for evaluating $PM_{2.5}$ impacts[1]. This policy would apply only to facilities applying for permits or major permit modifications under SEQRA that emit 15 or more tons of PM_{10} annually. The policy states that such a project will be deemed to have a potential for significant adverse impacts if the project's maximum impacts are predicted to increase $PM_{2.5}$ concentrations by more than 0.3 $\mu g/m^3$ averaged annually or more than 5 $\mu g/m^3$ on a 24-hour basis. Projects that exceed either the annual or 24-hour threshold will be required to prepare an Environmental Impact Statement (EIS) to assess the severity of the impacts, to evaluate alternatives, and to employ reasonable and necessary mitigation measures to minimize the $PM_{2.5}$ impacts of the source to the maximum extent practicable. Although the proposed action's annual emissions of PM_{10} were estimated to be well below the 15 ton per year threshold that would trigger review under DEC's $PM_{2.5}$ policy guidance, the maximum impacts of the proposed action are compared with the NYSDEC threshold concentrations.

In addition, NYCDEP is currently recommending updated interim guidance criteria for evaluating the potential $PM_{2.5}$ impacts from NYCDEP projects subject to CEQR. NYSDEC is reviewing its 24-hour interim guidance criteria of 5 $\mu g/m^3$ and is expected to lower this threshold in the future. The updated interim guidance currently employed by NYCDEP for determination of potential significant adverse $PM_{2.5}$ impacts under CEQR are as follows:

- 24-hour average $PM_{2.5}$ concentration increments which are predicted to be greater than 5 $\mu g/m^3$ at a discrete receptor location would be considered a significant adverse impact on air quality under operational conditions (i.e., a permanent condition predicted to exist for many years regardless of the frequency of occurrence);
- 24-hour average $PM_{2.5}$ concentration increments which are predicted to be greater than 2 $\mu g/m^3$ but no greater than 5 $\mu g/m^3$ would be considered a significant adverse impact on air

1 CP-33, Assessing and Mitigating Impacts of Fine Particulate Matter Emissions, NYSDEC, December 29, 2003.

quality based on the magnitude, frequency, duration, location, and size of the area of the predicted concentrations;

- Predicted annual average $PM_{2.5}$ concentration increments greater than 0.1 μg/m^3 at ground-level on a neighborhood scale (i.e., the annual increase in concentration representing the average over an area of approximately 1 square kilometer, centered on the location where the maximum ground-level impact is predicted for stationary sources; or at a distance from a roadway corridor similar to the minimum distance defined for locating neighborhood scale monitoring stations) is considered a significant adverse impact; or
- Predicted annual average $PM_{2.5}$ concentration increments greater than 0.3 μg/m^3 at a discrete or ground level receptor location is considered a significant adverse impact.

The thresholds are used to help address the potential impacts of all forms of $PM_{2.5}$.

Studies have shown the importance of separating total personal exposure to $PM_{2.5}$ into its two major components.[2] Ambient (or outdoor) exposure includes the ambient PM concentration while outdoors, usually estimated by measurements at local air monitoring stations. Non-ambient exposure is the result of indoor sources (cooking, cleaning) and personal sources (smoking, hobby). Non-ambient exposure levels are independent of outdoor ambient PM concentrations. Among subjects of a large study of three cities, personal exposures to $PM_{2.5}$ were significantly higher than outdoor $PM_{2.5}$ concentrations.[3] The fact that personal PM exposures were higher than outdoor concentrations indicates that indoor sources of $PM_{2.5}$ would significantly contribute to, and in some cases, dominate ambient exposures.

The potential for $PM_{2.5}$ to affect public health is dependent on the composition and the amount of PM in the atmosphere (i.e., the higher the ambient $PM_{2.5}$ concentration, the more likely that it would have an effect). The evidence cited by EPA in establishing the NAAQS for $PM_{2.5}$ is derived from epidemiologic studies that found, at typical ambient levels, a statistical correlation of PM and increased levels of morbidity and mortality.[1,2] It is unclear what forms of PM and what physiological mechanisms are responsible for the observed health effects, as these studies generally depend on ambient air monitoring of total PM that does not speciate (i.e., identify individual) components. However, the extent of any adverse public health effect related to an increase in PM concentrations is anticipated to be proportional in some way to the concentration increase. A small increase in PM concentrations can lead to a small increase in PM related public health effects. The size of the increase in public health effects is a function of several factors appropriate to this discussion: the concentration of PM, the duration of exposure, the

---

[1] Krewski et al (2000); Dockery et al. N. Engl. J. Med. 329, 1753-1759 (1995); Pope et al Am. J. Respir. Crit. Care Med., 151:669-674 (1995), Burnett et al, JAMA 287(9), 1132-41 (2002); Dominici et al, Am. J. Epidemiol. 157 (12), 1055-1065 (2003).

[2] Some analysts doubt that PM concentrations and these health effects are causal. Compare. Pope, III, C. A. (2000), "Epidemiology of fine particulate air pollution and human health: Biologic mechanisms and who's at risk?" *Environ Health Perspect*, 108(4), 713-23; and Samet, J. M., Dominici, F., Curriero, F., C., Coursac, I., & Zeger. S. L. (2000), "Fine particulate air pollution and mortality in 20 U.S. cities, 1987-1994," *N Engl J Med*, 343(24), 1742-1749; with Lipfert, F.W., Perry, Jr., H. M., Miller, J. P., Baty, J. D. Wyzga, R. E., & Carmody, S. E. (2000), The Washington University-EPRI Veteran's "Cohort Mortality Study: Preliminary Results," *Inhalation Toxicology*, 12(4), 41-73; and Gamble, J. F. (1998). "$PM_{2.5}$ and mortality in long-term prospective cohort studies: Cause-effect or statistical associations?" *Environ. Health Perspect*. 106, 535-549.

extent of the peaks of exposure, the susceptibility of individuals that comprise the population exposed, and overall number of people exposed and therefore susceptible to the effects of exposure.

Although the NAAQS for $PM_{2.5}$ is based on the measurement of particle mass concentrations (i.e., total $\mu g/m^3$), the EPA recognized the need for further research into the relationships between PM composition and PM-related health effects. Indeed, a major requirement of 40 CFR Part 58 (Ambient Air Quality Surveillance for Particulate Matter, Final Rule) is the chemical speciation of $PM_{2.5}$ at 50 monitoring sites across the country. A great deal of current PM research, including studies conducted under the EPA's Office of Research and Development,[1] is focused on attempting to better understand the biological, chemical, and physical characteristics of PM underlying its potentially toxic effects. A basic finding among these studies is that different forms of $PM_{2.5}$ may differ substantially in their toxicologic significance.

The principal health acute effects of airborne particulate matter are on the respiratory system, although recent research has demonstrated association between particulate matter pollution and cardiovascular disease and overall mortality.[2]

Respiratory

General Respiratory Effects of $PM_{2.5}$

Numerous studies have correlated increased rates of hospital admissions for respiratory conditions, small decreases in lung function in children with or without asthma, and absences from school with changes in PM concentrations.[3] As a result, EPA stated that these statistical associations reflect cause and effect and established the NAAQS for PM primarily on the basis of the associations.[4] The $PM_{2.5}$ standard was established to address the shortcomings of the PM_{10} standard and to protect public health.

Asthma

High-density populations, such as those in New York City, are generally considered to have higher asthma rates than non-urban populations.[5] Given the concern that exposure to particulate matter emissions, especially $PM_{2.5}$, from activities associated with the proposed action could either aggravate pre-existing asthma or induce asthma in an individual with no prior history of the disease, the potential for emissions of $PM_{2.5}$ to precipitate the onset or exacerbation of asthma is examined in the following discussion. The discussion includes a review of the risk factors for asthma development and exacerbation; current prevalence, morbidity and mortality estimates of

---

[1] EPA Office of Research and Development, Research and Development, Fiscal Years 1997-1998 Research Accomplishments, EPA 60-R-99-106.

[2] Künzli, N., Tager I.B. 2005. Air pollution: from lung to heart. Swiss Med Wkly 135:697-702. Available at http://www.smw.ch/docs/pdf200x/2005/47/smw-11025.pdf (accessed July 2006).

[3] CEPA/FPAC Working Group on Air Quality Objectives and Guidelines. National Ambient Air Quality Objectives for Particulate Matter. Part 1: Science Assessment Document.

[4] EPA (2004) Air Quality Criteria for Particulate Matter (Vols. I and II); EPA/600/P-99/002af.Washington, DC: Office of Research and Development (1997); National Ambient Air Quality Standards for Particulate Matter, Final Rule, Federal Registry: July 18, EPA 2003.

[5] Aligne C.A., Auinger P., Byrd R.S. 2000. Risk factors for pediatric asthma: contributions of poverty, race, and urban residence. Am J Resp Crit Care Med 162:873-877.

asthma, and a survey of the scientific literature that discusses the relationship between truck traffic and the occurrence of asthma.

Background. Asthma is a complex disease with multiple causes and substantial inter-individual variation in the severity of symptoms. It is a chronic inflammatory disorder of the airways characterized by variable airflow obstruction and airway hyper-responsiveness in which prominent clinical manifestations include wheezing and shortness of breath.[1] During an asthma "attack," an individual experiences difficulty breathing which, if severe enough, and treatment is not rendered, may be fatal in rare instances.[2] Asthmatic episodes may be triggered by specific substances, environmental conditions, and stress, as discussed below.

Although somewhat of a simplification, asthma can be categorized as having either an allergic or a non-allergic basis.[3,4,5] Allergic asthma is usually associated with a family history of allergic disease, increased levels of certain immune system proteins, and/or positive responses to specific diagnostic tests. Although exercise, cold air, and respiratory infections may also exacerbate asthma for allergic asthmatics, allergen exposure may be most important for eliciting airway inflammation and hyper-responsiveness. About 75 percent of people suffering from asthma have allergic asthma.[6] In contrast, people suffering from non-allergic asthma experience symptoms in their airways when confronted with such conditions as exercise, breathing cold air, or respiratory infections.[7]

Studies have demonstrated an increase in daily mortality, hospitalizations and emergency department utilization for asthma, attributable to air quality diminution from increased levels of sulfur dioxide, ozone and particulate matter. However, in children living in 24 US and Canadian communities, significant associations were reported between exposure to fine particles and their acidity and reduced lung function, symptoms of bronchitis, but not asthma. Children relocating from high to low pollution areas (or vice versa) were shown to experience changes in lung function growth that mirrored changes in exposure to particulate matter. The relationship between variations in asthma prevalence to air pollution has been difficult; although, prospective studies in California have suggested that some incident asthma cases could be related to ozone.[8]

---

[1] Sheffer, A.L., and V.S. Taggart. 1993. The National Asthma Education Program: expert panel report guidelines for the diagnosis and management of asthma. Med Care 1993:31 (suppl):MS20-MS28.

[2] McFadden, Jr. E.R. 2004. Asthma. In Harrison's Principles of Internal Medicine. (Eds: D.L. Kasper, E. Braunwald, A. Fauci, S. Hauser, D. Longo, J.L. Jameson), McGraw-Hill, New York, pp. 1508-1516.

[3] Scadding, J.G. 1993. "Chapter 1: Definition and clinical categorization." In *Bronchial Asthma: Mechanisms and Therapeutics*. Second Edition (Eds: Weiss, E.B, M.S. Segal, and M. Stein), Little, Brown, and Company, Boston, MA, pp. 3-13.

[4] McFadden, 2004.

[5] Sears, M.R. 1997. "Epidemiology of childhood asthma." *Lancet* 350:1015-1020.

[6] Centers for Disease Control (CDC). 2002. "Surveillance for Asthma – United States, 1980-1999." *Morbidity and Mortality Weekly Report* 51(SS01): 1-13. Available at http://www.cdc.gov/mmwr/preview/mmwrhtml/ss5101a1.htm (accessed July 2006).

[7] McFadden, 2004.

[8] The Lancet, Vol 360, October 19, 2002.

Prevalence of Asthma. In the US, approximately 6.4 million children (8.8 percent of children under age 18) have asthma. Asthma prevalence in New York State is estimated at approximately 9.9 percent.[1] According to the CDC, over the last two decades the self-reported prevalence of asthma increased 75 percent in all age groups and 160 percent in children between 0 and 4 years of age. The rate of asthma is increasing most rapidly in children under age 5. Additionally, it is estimated that asthma prevalence in Western countries doubled between 1977 and 1997.[2] Other parts of the world have also reported an increase in asthma prevalence in urban areas. In addition to changes in ambient air quality, changes in infectious disease patterns,[3] decreased physical activity, increasing prevalence of obesity,[4] and increased time spent indoors are hypothesized to be contributing factors to the increase in the prevalence of asthma and the subject is one of continuing research. In New York City, the prevalence of asthma among children and adults exceeds that of the nation as a whole. NYCDOHMH reported that the prevalence of asthma among children 4-5 years old in 1999 was 9.1 percent. There exists a strong income gradient -- children residing in zip codes with the lowest family income have a prevalence rate of 13.9 percent, compared to children in the zipcodes with the highest family income having a rate of just 6.4 percent. Hunts Point had among the highest prevalence of asthma among 4-5 years olds; 17.1 percent, just a bit lower than High Bridge-Morrisania, Bronx (17.2 percent) and East Harlem (18.5 percent). The prevalence of asthma among adults in New York City is also higher than that of the U.S. as a whole, and the Bronx overall had a higher rate than all other boroughs (6.2 percent). The South Bronx had a prevalence rate somewhat higher than the City as a whole, with 7.1 percent of adults having asthma. Unlike childhood asthma, adult asthma is not strongly associated with neighborhood poverty. [5]

Asthma Morbidity and Mortality. Asthma morbidity and mortality rates have been rising throughout the US over the last few decades,[6] with New York City experiencing a disproportionate increase in the early 1990s[7]. However, hospitalization rates in New York City have been gradually declining since the peak rates in the mid-1990s. Between 1997 and 2004, asthma hospitalization rates among children aged 0-14 years decreased in most New York City boroughs.[8] Asthma mortality rates between 1990 and 2000 also declined for all age groups.[1]

---

[1] American Lung Association, May 2005. "Trends in Asthma Morbidity and Mortality."

[2] Cookson, W.O.C.M., and M.F. Moffatt. 1997. "Asthma: an epidemic in the absence of infection?" *Science* 275:41-42.

[3] Ibid.

[4] Platts-Mills, T.A.E., R.B. Sporik, M.D. Chapman, and P.W. Heymann. 1997. "The role of domestic allergens." In: *The Rising Trends in Asthma.* Ciba Foundation Symposium 206. John Wiley and Sons, New York, NY, pp. 173-189.

[5] NYCDOHMH, Asthma Facts, Second Edition. Available at Garg, R., Karpati, A., Leighton, J., Perrin, M., Shah, M., 2003. *Asthma Facts, Second Edition*. New York City Department of Health and Mental Hygiene.

[6] CDC, 2002.

[7] Garg et al., 2003,

[8] New York City Department of Health and Mental Hygiene. *Updated Asthma Hospitalization Data by NYC Neighborhood* from website http://www.nyc.gov/html/doh/downloads/pdf/asthma/asthma-hosprates-children.pdf. Site accessed June, 2006.

Asthma is the leading cause of hospitalization in New York City for children aged 0 to 14 and ranks among the leading causes of hospitalization for all age groups.[2,3] In 2000, the hospitalization rate for asthma among children aged 0 to 4 was 10.2 per 1,000 children in New York City, compared to 6.4 per 1,000 in the United States.[4] Asthma exacerbations resulting in hospitalizations appear to be particularly frequent and severe among minority, inner-city children. A recent study by investigators at the Mount Sinai School of Medicine found an enormous difference in the rate at which children living in poor New York City neighborhoods were hospitalized for asthma, compared to children in wealthy neighborhoods. Another recent study conducted in New York City found that children living in neighborhoods of low socioeconomic status had more than 70 percent increased risk of current asthma (diagnosis and symptoms during the previous 12 months), when compared to children of their same ethnicity and income level living in communities of greater economic affluence.[5] These findings suggest that characteristics of the urban environment, apart from the ethnicity and income level of the residents, contribute to high asthma prevalence. The study noted that areas with high asthma hospitalization rates are geographically clustered in low socioeconomic status areas. These areas tend to contain a number of potential pollution sources that could affect respiratory health, including designated truck routes and high traffic roads, waste transfer stations, manufacturing facilities and nearby power plants.

As such, there are striking differences in the number of hospitalizations among New York City boroughs and specific neighborhoods within each borough. On a borough level, hospitalization and death rates that are associated with asthma are highest in the Bronx. On a neighborhood scale, in 2004, the East Harlem area of Manhattan reported the highest rate of asthma hospitalizations among children 0-14 years old—approximately 13.1 hospitalizations per 1,000 children[6] and among adults 35 years and older, Hunts Point/Mott Haven had the highest rate, 12.6 per 1,000.

The borough of the Bronx as a whole has experienced close to a 40 percent decrease in child hospitalization rates between 1997 and 2004.[7] A comparison of asthma hospitalization rates in

---

[1] Garg et al., 2003.

[2] Ibid.

[3] It should be noted that although hospitalization data is useful in characterizing the population severely affected by asthma, it is not necessarily directly correlated with asthma prevalence in a community (e.g., individuals who seek private care or those who effectively self manage asthma symptoms would not appear in hospitalization data).

[4] Ibid.

[5] Claudio L, Stingone JA, Godbold J. Prevalence of Childhood Asthma in Urban Communities: The Impact of Ethnicity and Income. Ann Epidemiol 2006; 16: 332-340.

[6] New York City Department of Health and Mental Hygiene. *Updated Asthma Hospitalization Data by NYC Neighborhood* from website http://www.nyc.gov/html/doh/downloads/pdf/asthma/asthma-hosprates-children.pdf. Site accessed June, 2006.

[7] Under the direction of the New York City Department of Health and Mental Hygiene (DOHMH), an aggressive Asthma Initiative was begun in 1997, with goals of reducing illness and death from childhood asthma. Since its inception, major childhood asthma initiatives have been implemented in several low income neighborhoods with high hospitalization rates. Between 1997 and 2004, many of these neighborhoods have experienced substantial decreases in hospitalization rates, which may be an indication of success from extensive efforts by medical providers and community organizations participating in such initiatives.

1997 and 2004 among children ages 0-14 is presented in Table 20-1, for the Hunts Point/Mott Haven neighborhood, and for the Bronx and New York City as a whole.

Table 20-1
1997 and 2004 Hospitalization Rates per 1,000 Persons (Aged 0-14 and 35+)*

Location	Age 0-14 Years		Age 35+ Years	
	1997	2004	1997	2004
Hunts Point – Mott Haven (includes zip codes 10454, 10455, 10459, and 10474)	22.6	7.4	11.2	12.6
Borough of the Bronx	15.4	9.3	6.3	7.4
New York City	9.5	6.0	3.7	3.6

Note: * New York City Department of Health and Mental hygiene. *Updated Asthma Hospitalization Data by NYC Neighborhood* from website http://www.nyc.gov/html/doh/downloads/pdf/asthma/asthma-hosprates-children.pdf. Site accessed June, 2006.

The reasons for the borough and local disparities in asthma are not known, but may be due to differences in economic status and ethnicity; exposure to different asthma triggers; or access to medical care.[1,2]

NYCDOHMH is well aware of the epidemic of childhood asthma in the City's many boroughs and communities, and, under its direction, an aggressive Asthma Initiative was begun in 1997. The goals of the Asthma Initiative are to reduce illness and death from childhood asthma by 1) improving medical standards of care for children with asthma, 2) reducing asthma triggers in both homes and communities, 3) enhancing self-management support for individuals with asthma, 3) enhancing citywide asthma education standards and delivery 4) creating "asthma friendly" schools and daycare settings, 5) monitoring and tracking individuals with asthma, and 6) strengthening the ability of health care facilities, community organizations, schools, government agencies, and academic and research institutions to address asthma by facilitating the New York City Asthma Partnership.

NYCDOHMH promotes the following key messages for individuals with asthma (KICK Asthma):

- Know what worsens your asthma.
- Inform your doctor about frequent asthma symptoms (i.e., daytime symptoms more than 2 days per week or nighttime symptoms more than 2 times per month may be an indication of persistent asthma).
- Control frequent symptoms by using long-term control asthma medicines (inhaled corticosteroids are the most effective), and by avoiding tobacco smoke and other triggers.
- Keep regular doctor's visits, and ask your doctor for a written Asthma Action Plan.

In addition, NYCDOHMH recommends that medical providers:

- Assess each patient's asthma severity at every visit

---

[1] Weiss, K.B., P.J. Gergen, and E.F. Crain. 1992. Inner-city asthma: the epidemiology of an emerging U.S. public health concern. *Chest* 101:362S-367S.

[2] Platts-Mills, 1997.

- Prescribe long term control medicine for individuals with persistent asthma. (Inhaled corticosteroids are the most effective treatment for most patients with persistent asthma)
- Partner with patients and develop a written Asthma Action Plan. In addition, complete a school medication authorization form so that children with asthma can receive medication services at school.

Since NYCDOHMH's Asthma Initiative's inception, major childhood asthma initiatives have been implemented in several low income neighborhoods with high hospitalization rates. As mentioned above, between 1997 and 2004, many of these neighborhoods have experienced substantial decreases in hospitalization rates, which may be an indication of success from extensive efforts by medical providers and community organizations participating in such initiatives.

Causes and Triggers. The increase in asthma among children has spurred scientists and clinicians to search for causes and risk factors for the disease. The rapidity of the increase points away from a significant change in population genetics, which would evolve over a much longer time scale, and towards some characteristic(s) of modern life. Factors that have been investigated epidemiologically (and sometimes experimentally) include indoor air pollution, outdoor air pollution, behaviors, food and food additives, medical practices, and illness in infancy. The reasons for the dramatic increase in asthma prevalence are currently unknown, although a number of hypotheses have been developed and investigated. Current hypotheses tend to focus on three areas: (1) increases in individual sensitivity (possibly due to reduced respiratory infections); (2) increases in exposures to allergens (due to change in ambient air pollution and/or indoor air quality); and (3) increases in airway inflammation of sensitized individuals (due to factors such as viral infections). No single factor is likely to explain the increased rates of asthma, however, and different factors are likely to dominate in different areas, homes, and individuals.

In theory, one can distinguish between "causes" and "triggers" of asthma. Causes are those factors that make a person susceptible to asthmatic attacks in the first place, while triggers are those factors that elicit asthmatic symptoms at a particular time. Immunologists are increasingly coming to understand asthma as a genetic disorder. While genetic predisposition seems to be necessary for the onset of asthma, it is not sufficient. Asthma attacks typically occur when a genetically predisposed person encounters one or more environmental triggers.[1]

Triggers are more easily studied, but may not be the underlying causes of the disease. For example, although a genetic predisposition to allergy is an important risk factor for developing asthma, there may have been no real increase in the number of genetically susceptible children, but rather a growth in the prevalence of factors that promote asthma development or trigger an attack. For a person suffering from asthma, however, the identification and elimination of triggering factors is of greatest practical importance.

Allergens in the indoor environment are important triggers of asthma in the US. Organic materials that cause the immune system to overreact, such as cockroach antigens, dust mite antigens, molds, pet and rodent dander and urine, are the principal indoor air quality triggers of asthma attacks in children. Some of these antigens are probably more common in poor quality housing, which could explain, in part, why poor children suffer high rates of asthma. Other indoor pollutants, such as tobacco smoke and natural gas combustion from household appliances

[1] Gentile, D. A. J. Immunology, 65, 4, 347-351 (2004).

can also exacerbate asthma symptoms. "Improvements" in housing, such as increased insulation and reduced ventilation to save on energy costs, and increased amounts of wall-to-wall carpeting and stuffed furniture, may have the unintended effects of promoting growth of dust mites and molds, and of concentrating antigens, irritants, and particulate matter indoors. These changes in housing over recent decades could help explain the widespread increases in asthma rates. In addition, the effect of indoor pollutants may be increased by the growing amount of time that children spend indoors, which increases a child's exposure to antigens. The lack of exercise might also increase the respiratory system's sensitivity to allergens.

Some natural aspects of outdoor air, such as pollens, are capable of triggering asthma attacks. On a local scale, air pollution may be important as discussed in the next section. On a larger scale, it is possible that specific pollutants, such as ozone or diesel exhaust, enhance the effects of other factors, such as allergens, even if the pollutants themselves are not triggers of asthma. Though some epidemiologic studies have found an association between 24-hour average PM_{10} (particulate matter, less than 10 microns in diameter) levels and asthma hospitalizations and emergency room visits, others have not.[1] In addition, weather conditions, and cold air in particular, can elicit asthmatic symptoms independent of air pollution.

Asthma and Traffic and Construction Equipment Sources of Air Pollution. Most of the particles emitted by diesel engines are small enough to be counted as $PM_{2.5}$. Their small size makes them highly respirable and able to reach deep within the lung.

Certain experimental studies have evaluated the respiratory and systemic effect of diesel particles on laboratory animals.[2] These studies revealed that chronic and/or prolonged continuous exposures of the animals to large concentrations cause inflammation, fibrosis and functional changes in the respiratory system, and that very large concentrations cause premature death. The lowest observed adverse effect levels, as well as no observed adverse effect levels, occurred at concentrations that were considerably in excess of ambient concentrations. Specifically, the levels at which these effects were not observed ranged from 100 to 500 μg of diesel particulates per cubic meter, concentrations that are above allowable average daily values.

Epidemiologically, a few studies have addressed childhood asthma in relation to distance from roads and, hence, from vehicle exhaust. For example, young children in Birmingham, England admitted to hospitals with a diagnosis of asthma were more likely to live close to busy roads than children admitted for other reasons. The apparent risk of admission for asthma was increased by almost two-fold for children who live close to busy roads. Undercutting the significance of these findings was the lack of information about their socioeconomic status, family history of asthma, and the indoor environment. Other epidemiological studies have demonstrated an increase in daily mortality, hospitalizations, and emergency department utilization attributable to air quality diminution from increased levels of sulfur dioxide, ozone and PM.[3,4,1]

---

[1] Norris et al., 1999; Schwartz et al., 1993; Sheppard et al., 1999; Tolbert et al., 2000; Henry et al., 1991; Hiltermann et al., 1997; Roemer et al., 1998; Roemer et al., 1999; Roemer et al., 2000

[2] EPA (2002, 2003a) IRIS record for diesel engine exhaust, available at www.epa.gov/iris/subst/0642.htm.

[3] Kunzli, et al., Public health impact of outdoor and traffic-related air pollution: a European assessment, Lancet 2000 2:356 (9232); 795-801

[4] Schwela, D. Air Pollution and Health in Urban Areas. Rev Environ Health. 2000 Jan-Jun; 15(1-2): 13-42

In a study conducted in the Netherlands, researchers found that living near busy streets was associated, in children, but not adults, with a one and a half fold increase in wheezing symptoms in the past, with a 4.8 fold higher use of asthma medications among children after controlling for various socioeconomic and indoor environmental exposures.[2] Other studies have not found an association between asthma symptoms or hospitalizations and residence near heavy traffic.[3]

Most studies found associations between some indicator of traffic (distance to roads, traffic volumes, or truck traffic volumes) near a residence or school and some indicator of respiratory disease (allergic rhinitis, wheezing or cough), while a few found no evidence of an association.[4] Experiments in which non-asthmatic adults were exposed for an hour to diesel engine exhaust containing particles and gases found increased airways resistance[5] and some cellular indicators of inflammatory response;[6] however, these subjects did not experience asthma.

Recent unpublished studies conducted by New York University evaluated the links between truck exhaust and asthma on a sampling of schoolchildren from four public schools in the south Bronx. The children were monitored using instruments and filters attached to mobile backpacks. The study showed that only 5 to 10 percent of the fine particulate matter collected was from diesel exhaust, but it was that portion that appeared to have the largest effect on the children's asthma.[7]

Diesel particulates and ozone have been shown to increase the synthesis of the allergic antibody IgE in animals and humans, which would increase sensitization to common allergens. By interacting together and with other environmental factors, particulates and gaseous air pollutants can have an effect on allergic individuals.[8] An additional hypothesis described by Cookson and Moffatt suggests a link between the increase in asthma and the decline of respiratory infections in modern society, which could shift the balance of the immune system in favor of factors that predispose persons to asthma and allergy[9]. Infectious disease has been dramatically reduced in our society by the use of antibiotics and immunization programs.

---

[1] Edwards et al., (1994). Hospital Admissions for Asthma in Preschool Children; Relationship to Major Roads in Birmingham, United Kingdom. Arch. Environ. Health 49 (4); 223-227

[2] Oosterlee, A. et al., (1996). Chronic Respiratory Symptoms in Children and Adults Living Along Streets with High Traffic Density. Occup. Environ. Med. 53:241-247.

[3] Wilkinson, P. et al., (1999). Case-control Study of Hospital Admission with Asthma in Children Aged 5-14 Years: Relations with Road Traffic in North West London. Thorax. 54(12); 1070-1074.

[4] Brunekreef et al 1997, English et al (1999), Livingstone et al (1996).

[5] Rudell et al, Occup. Environ. Med. 53, 6480652, 1996.

[6] Slavi et al, Am. J. Respir. Crit. Care. Med. 159: 702-709, 1999.

[7] New York University Office of Public Affairs. Press Release: Asthma Symptoms Linked to Soot Particles From Diesel Trucks in South Bronx. Monday, Oct 16, 2006. http://www.nyu.edu/public.affairs/releases/detail/1263 [as retrieved on 13 Nov 2006]

[8] Fujieda et al Am J. Respir Cell Mol Biol, 19, 507-12, 1998; Nel et al.

[9] Cookson et al., 1997

Other Health Effects including Cardiovascular, Lung Cancer, and Premature Mortality

People with heart disease such as coronary artery disease and congestive heart failure are at risk of serious cardiac effects.[1] In people with heart disease, short-term exposures of one hour to elevated fine particulate matter concentrations have been linked to irregular heart beats and heart attacks. The odds of having a myocardial infarction among people susceptible to heart attacks increased by about 48 percent with an increase of 25 $\mu g/m^3$ in $PM_{2,5}$ during a 2-hour period before the onset, and increased about 69 percent for an increase of 20 $\mu g/m^3$ $PM_{2,5}$ in the 24-hour period one day before the onset. In practical terms, this means that the chance a heart attack goes up among susceptible people after exposure to very high increments in particulate matter. [2]

New epidemiological re-analyses of studies of long-term ambient PM exposure also show substantial evidence for increased lung cancer risk being associated with such PM exposures, especially exposure to fine PM or specific fine particles subcomponents.[3]

The elderly are at increased risk from fine particulate matter air pollution. Numerous community health studies have shown that when particle levels are high, senior citizens are more likely to be hospitalized for heart and lung problems, and some may die prematurely.[4]

Inhaling fine particulate matter has been attributed to increased hospital admissions, emergency room visits and premature death among sensitive populations with pre-existing heart or lung disease. Studies estimate that tens of thousands of elderly people die prematurely each year from exposure to ambient levels of fine particles.

MICROBIAL AEROSOL EMISSIONS

Numerous investigations have been conducted to determine whether or not municipal wastewater treatment plants pose any significant health risks to neighboring residential communities. In view of public concern over the potential transmission of infectious diseases, the primary focus of research efforts has been in the area of wastewater aerosols. It has been demonstrated in the literature that certain wastewater treatment processes can be sources of microbial aerosol emissions. Wastewater treatment facilities that include uncovered aeration basins or trickling filters may emit small droplets of wastewater into the atmosphere. These wastewater droplets evaporate rapidly to form minute droplet nuclei referred to as aerosols.

[1] Goldberg MS, Bailar JC 3rd, Burnett RT, Brook JR, Tamblyn R, Bonvalot Y, Ernst P, Flegel KM, Singh RK, Valois MF. Identifying subgroups of the general population that may be susceptible to short-term increases in particulate air pollution: a time-series study in Montreal, Quebec. Res Rep Health Eff Inst 2000 Oct;(97): 7-113; discussion 115-20; and Zanobetti A, Schwartz J. Cardiovascular damage by airborne particles: are diabetics more susceptible? Epidemiology 2002 Sep; 13(5):588-92.

[2] Peters A, Liu E, Verrier RL, Schwartz J, Gold DR, Mittleman M, Baliff J, Oh JA, Allen G, Monahan K, and Dockery DW. Air pollution and incidence of cardiac arrhythmia. Epidemiology 2000 Jan; 11(1):11-7; and Peters A, Dockery DW, Muller JE, and Mittleman MA. Increased particulate air pollution and the triggering of myocardial infarction. Circulation 2001 Jun 12; 103(23):2810-5.

[3] EPA Air Quality Criteria for Particulate Matter (Vols II); October 2004, EPA/600/P-99/002bf.

[4] Pope CA 3rd. Epidemiology of fine particulate air pollution and human health: biologic mechanisms and who's at risk? Environ Health Perspect 2000 Aug; 108 Suppl 4:713-23; and Samet JM, Zeger SL, Dominici F, Curriero F, Coursac I, Dockery DW, Schwartz J, and Zanobetti A. The National Morbidity, Mortality, and Air Pollution Study. Part II: Morbidity, Mortality and Air Pollution in the United States. Health Effects Institute Research Report 94, Part II, June 2000.

Aerosols generated in this matter may contain infectious agents commonly observed in sewage, such as enteropathogenic bacteria, viruses, protozoan, and parasites.

The microorganisms attached to the aerosols can travel passively with the wind and their concentrations will decrease with time and distance as a result of atmospheric dispersion, die-off, and deposition. Many factors contribute to biological die-off or decay, including ultraviolet radiation, temperature, and relative humidity. An additional die-off effect, which has been termed aerosol impact, occurs immediately after aerosolization. The rate at which microorganisms are aerosolized and emitted to the air from the aeration tanks of secondary treatment facilities is very low, and only a small proportion of these organisms are of the “indicator” type. (The presence and survival of indicator organisms indicates the potential presence of viable problem organisms. Indicator organisms are more in number and easier to grow and identify than the problem organisms.) They also survive in the environment as long as the problem organisms. In addition, it has been found that the concentration of microorganisms in the air decreases exponentially with height, at least within the first meter above the liquid surface in the aeration basins.

Sawyer, et al.[1] directly measured the source strength of bacterial emissions from the aeration tanks of a wastewater treatment plant in the greater Chicago area. Bacterial aerosol samples were collected within a walled tower positioned above the aeration tank liquid surface. The samples were analyzed for standard plate counts (SPC), total coliforms (TC), fecal coliforms, and fecal streptococci. The source emission rates for standard plate counts and total coliforms were estimated in the ranges of 0.66 to 2.66 SPC/m2/s and 0.02 to 0.53 TC/m2/s, respectively. The reported emission rates for fecal coliforms and fecal streptococci were proportionally less than those for SPC and TC because of the lower concentrations in the mixed liquor and higher aerosol impact factors.

Moreover, several epidemiology studies designed to investigate the potential health effects of aerosols on persons living in the vicinity of wastewater treatment plants have been conducted since 1975, as part of a nationwide research program sponsored by EPA. Johnson, et al.[2] performed a comprehensive environmental monitoring program and prospective epidemiology study in which the health of nearby residents was monitored before and after a new activated sludge treatment plant commenced operation. The viral serology tests and the examinations of clinical specimens for bacterial, parasitic, and viral isolates provided no evidence of infectious diseases originating from the operation of the plant. As a result, Johnson, et al. concluded that although the aeration basins at the wastewater treatment plant were a statistically significant source of microbial aerosols, the plant and its aerosols had no adverse health effects on the local residents. Johnson, et al also reported that the concentration of microorganisms in the air at the nearest residences (approximately 350 meters from the plant) were not distinguishable from the background levels.

---

[1] Sawyer, B.G. Elenbogen, K.C. Rao, P. O’Brien, D.R. Zenz, and C. Lue-Hing, 1993. Bacterial Aerosol Emission Rates from Municipal Wastewater Aeration Tanks. Applied and Environmental Microbiology. American Society for Microbiology, Vol. 59, No. 10, pp. 3183-3186.

[2] Johnson, D.E., D.E. Damann, K.T. Kimball, R.J. Prevost, and R.E. Thomas, 1980. Health Effects from Wastewater Aerosols at a New Activated Sludge Plant: John Egan Plant, Schaumberg, Illinois. In: Proc. National Symposium on Wastewater Aerosols and Disease. U.S. Environmental Protection Agency, Cincinnati, Ohio, September 19-21, 1979 EPA-600/9-80-028.

In another investigation, Northrop and coworkers[1] conducted an environmental health study of persons living within a 1-mile radius of a 292-mgd activated sludge plant (North Side Sewage Treatment Works, Skokie, Illinois). A retrospective questionnaire survey provided information on the types of diseases that had occurred in the previous 12 months. This was followed by an 8-month prospective study of self-reported illnesses as well as microbiological studies of throat and fecal specimen cultures. Concurrently, an environmental monitoring program was implemented to characterize the type and extent of exposure of individuals living in the vicinity of the plant. Analysis of the health information collected demonstrated that persons living in areas more highly exposed to aerosols generated at the plant site did not have different types or an increased frequency of health problems than persons living in low exposure areas.

Camann, et al.[2] investigated the possible health effects associated with the operation of an activated sludge plant located near an elementary school. The objective of the study was to determine whether the absentee rate at the nearby school was significantly different from the absentee rates at five control schools, which were located in the same area but not near a wastewater treatment facility. An evaluation was made of the microorganism concentrations in the wastewater aerosols transported into the school environment. The peak doses inhaled by the students due to wastewater aerosols was estimated to be on the order of 2 colony-forming units (cfu) of mycobacteria and 0.8 cfu of fecal streptococci. After the treatment plant commenced operation, attendance at the nearby school generally improved, relative both to the baseline school years and to the five control schools. Thus, Camann, et al. concluded that aerosols from the treatment did not have an adverse effect on the health of the school children.

Fannin, et al.[3] utilized data obtained as part of a comprehensive community health study conducted from 1965 to 1971 in Tecumseh, Michigan to determine whether there was a difference in the incidence of acute infectious diseases with distance from a secondary wastewater treatment plant. Study participants were classified according to how far the individual lived from the plant. The results from the study suggested that socio-demographic and personal variables were more important factors in the occurrence of infectious illnesses than proximity to the wastewater treatment plant. The interpretation of any observed health effects was complicated by the difficulties in identifying the probable route of infection because the ultimate source of pathogenic aerosols is infected individuals within the service area of the treatment plant.

Many studies have also been conducted to determine the health effects, if any, associated with occupational exposure to microbial aerosols derived from municipal wastewater. For example, Clark and coworkers[4] performed a 4-year prospective epidemiology study of wastewater

---

[1] Northrop, R., B. Carnow, R. Wadden, S. Rosenberg, J. Holden, A. Neal, L. Sheaff, P. Scheff, and S. Meyer, 1979. *Health Effects of Aerosols from an Activated Sludge Plant.* EPA-600/1-79-019, U.S. Environmental Protection Agency, Cincinnati, Ohio.

[2] Camann, D.E., H.J. Harding, and D.E. Johnson. 1980. Wastewater Aerosol and School Attendance Monitoring at an Advanced Wastewater Treatment Facility. Durham Plant, Tigard, Oregon. In: Proc. National Symposium on Wastewater Aerosols and Disease. U.S. Environmental Protection Agency, Cincinnati, Ohio, September 19-21, 1979.

[3] Fannin, K.F., K.W. Cochran, H. Ross, and A.S. Monto. 1978. *Health Effects of a Wastewater Treatment System*. EPA/600/1-78-062, U.S. Environmental Protection Agency, Cincinnati, Ohio.

[4] Clark, C.S., G.L. Van Meer, C.C. Linnemann, Jr., A.B. Bjornson, P.S. Gartside, G.M. Schiff, S.E. Trimble, D. Alexander, E.J. Cleary, 1980 Health Effects of Occupational Exposure to Wastewater. In:

treatment plant and sewer maintenance workers in three metropolitan areas: Cincinnati, Ohio; Chicago, Illinois; and Memphis, Tennessee. The study method included laboratory analyses of blood specimens and throat and rectal swabs, annual health examinations and environmental monitoring at the work sites. The study group consisted of more than 100 activated sludge plant workers, 50 sewer maintenance workers, 50 primary wastewater treatment plant workers and 100 individuals serving as a control group. Aerosol sampling at the different work sites and subsequent analysis for respirable bacteria concentrations was used to categorize each worker according to his exposure level. Statistical analysis of the epidemiological data revealed that there was no relationship between exposure level and incidence of parasitic, bacterial or viral infection. Thus, the investigators concluded that there was no evidence of increased health risks to workers in the wastewater treatment and collection industry from occupational exposure to bacterial aerosols.

In a study conducted at two secondary wastewater treatment plants in Winnipeg, Canada, Sekla et al.[1] investigated the potential occupational health hazards to which employees working at these facilities might be exposed. The health of employees was assessed using questionnaires, clinical examinations, lung function tests, absenteeism records and comprehensive laboratory testing of blood and fecal specimens. The industrial hygiene of the work environment was evaluated from microbiological and chemical analyses of air samples collected at various locations throughout the plant sites. Again, the findings from the study showed that the health of the wastewater treatment plant employees, as a group, did not differ significantly from that of the control group despite the demonstrated presence of pathogenic aerosols in the work environment.

In addition to aerosols studies, the Nassau County DOH conducted a comprehensive air quality evaluation at the Cedar Creek and Bay Park Wicks and at three sewage pumping stations.[2] The purpose of the investigation was to determine whether or not employees working at the facilities were exposed to unacceptable health risks posed by toxic air contaminants. Health risk assessments were based on standards for 8-hour time weighted average (TWA) exposure limits established by the Occupational Safety and Health Administration. These standards represent the levels of toxic chemicals to which an essentially healthy industrial worker can be exposed to for eight hours a day, five days a week without risk of an adverse health effect.

Between October 1995 and January 1996, sets of samples were taken at each of the five selected test sites on four days. These were obtained by sampling for eight continuous hours during the time interval when the contaminant levels were expected to be at a maximum. The testing was conducted under normal operating conditions with all mechanical systems functioning properly and the facilities ventilated in accordance with design specifications. The samples were analyzed for four categories of air contaminants, namely vinyl chloride, volatile aromatic hydrocarbons, volatile halogenated hydrocarbons, and organosulfur compounds. Bag samples of air that were

---

Proc. National Symposium on Wastewater Aerosols and Disease. U.S. Environmental Protection Agency, Cincinnati, Ohio, September 19-21, 1979. EPA-600/9-80-028.

[1] Sekla, L., D. Gemmill, J. Manfreda, M. Lysyk, W. Stackiw, C. Kay, C. Hopper, L. VanBuckenhout, G. Eibisch, 1980. Sewage Treatment Plant Workers and Their Environment: A Health Study. In: Proc. National Symposium on Wastewater Aerosols and Disease. U.S. Environmental Protection Agency, Cincinnati, Ohio, September 19-21, 1979. EPA-600/9-80-028.

[2] Report of Evaluation of Air Quality in Cedar Creek and Bay Park Water Pollution Control Plants and Ancillary Facilities, Nassau County, New York, 1986.

analyzed for hydrogen sulfide, methane, and non-methane hydrocarbons were also collected on each sampling day.

The analyses of the 8-hour samples indicated that no air contaminant was present at a level exceeding approximately 1 percent of the 8-hour TWA standard. In addition, the results obtained from the bag samples did not reveal any air quality or occupational safety conditions that would be considered unsatisfactory. Therefore, the Nassau County DOH concluded that under normal operating conditions, the sewage pumping station and treatment plant personnel were not exposed to unacceptable health risks from toxic air contaminants. However, investigators have found that acute occupational exposure to toxic contaminants can occur under certain situations, such as illegal dumping and intermittent spikes of industrial waste discharges.[1, 2]

In a health hazard manual for wastewater treatment plant operators discussing the types of exposure to chemical hazards and biohazards and methods to reduce these exposures, N.J. Brown[3] reported that, overall, researchers have found that the risk of bacterial and viral diseases from wastewater treatment is low. However, heat-drying and composting of sludge may carry some risk of endotoxin exposure and its effects. In addition, acute health complaints, mostly involving irritation of the upper respiratory tract, have been associated with short-term exposure to volatile organic chemicals, but little evidence of adverse health effects from regular work exposure has been documented. Occupational exposure to toxic contaminants and viable biological agents can be diminished by such controls as rotation of plant personnel between various treatment plant processes, adequate ventilation for process areas located within buildings, and use of appropriate protective gear and test equipment. Likewise, a variety of design or operational features can be employed to reduce air-stripping of volatile compounds and aerosol emissions.

In sum, the literature review indicates that wastewater aerosols are inefficient means of transmitting infections and are unlikely to produce disease in the public at risk. The epidemiological case studies have shown little evidence of infection attributable to treatment plant aerosols and no convincing evidence of clinical illness. The exposure to pathogenic organisms from wastewater aerosols is probably not sufficient to increase the incidence of illnesses in the surrounding population. Therefore, wastewater treatment plants are not expected to expose the neighboring population to any additional health hazards from infectious disease transmission, nor are they expected to expose treatment plant personnel to unacceptable health risks from toxic air contaminants.

---

[1] Lucas, James B., 1980. Health Effects of Nonmicrobiologic Contaminants. In: Proc. National Symposium on Wastewater Aerosols and Disease. U.S. Environmental Protection Agency, Cincinnati, Ohio, September 19-21, 1979. EPA-600/9-80-028.

[2] Elia, V.J., C.S. Clark, V.A Majeti, T. Macdonald, N. Richdale, 1980. Worker Exposure to Organic Chemicals at a Activated Sludge Wastewater Treatment Plant. In: Proc. National Symposium on Wastewater Aerosols and Disease. U.S. Environmental Protection Agency, Cincinnati, Ohio, September 19-21, 1979. EPA-600/9-80-028.

[3] Brown, Nellie J. Health Hazard Manual for Water and Wastewater Treatment Plant Workers. Cornell University, Chemical Hazard Information Program. New York State Department of Labor Grant #COO5413.

H. THE FUTURE WITHOUT THE PROPOSED ACTION

In the future without the proposed action, air quality, traffic, noise and hazard materials conditions in the region are anticipated to be relatively similar to those described for existing conditions. A 2.75-acre area of the additional parcel consisting of Lots 100 and 105 of Block 2777 and the remaining 5.25-acre portion of the 8-acre site (Block 2777, Lot 600 and part of Lot 901, and Block 2779, part of Lot 1) will be remediated for hazardous materials in the future without the proposed action. Public health initiatives undertaken by the City, along with Federal, State and local regulations outlined above, are expected to continue. Land uses are expected to generally remain the same in this neighborhood.

Air quality regulations mandated by the CAA are anticipated to maintain or improve air quality in the region. As discussed in Chapter 8, "Criteria Air Pollutants," in the future without the proposed action, the criteria pollutant emission sources at the plant either being constructed under Phases II or already existing at the plant, include six 2000 kW emergency generators, five 750 hp boilers located in the main building, and two 400 horsepower (hp) boilers located in the dewatering building. To disclose the full impacts of previous plant upgrades and the proposed action, criteria pollutant impacts from the entire facility as upgraded under Phases I and II, and the proposed action were determined and compared to the NAAQS (see discussion below under the "Probable Impacts of the Proposed Action"). In addition, an analysis for $PM_{2.5}$ was performed, which also analyzed impacts from the entire plant as upgraded and compared them to the $PM_{2.5}$ interim guidance criteria. With the exception of $PM_{2.5}$ which is compared to NYSDEC and NYCDEP interim guidance criteria, for all criteria pollutants the modeling showed that there would be no exceedances of the NAAQS in the future without the proposed action.[1] The potential impacts from $PM_{2.5}$ on the surrounding community from the entire facility as upgraded under Phases I and II, and the proposed action are discussed below under "Probable Impacts of the Proposed Action".

Three non-criteria air pollutants three compounds had predicted exceedances of their corresponding Annual Guideline Concentrations (AGCs). 1,4-Dichlorobenzene was 2.15 times its Annual Guideline Concentration (AGC) of 0.09 $\mu g/m^3$, chloroform was 3.93 times its AGC of 0.043 $\mu g/m^3$, and dichlorobromoethane was 1.22 times its AGC of 0.02 $\mu g/m^3$. Based on guidance in NYSDEC's *Air-Guide 1*, potential air quality impacts that are greater than the AGC should consider controls to reduce emissions, and facility's emissions may still be permitted if the assessment of controls to reduce impacts is undertaken, and the off-site air impacts are less than 10 times the respective AGCs. As described in Chapter 9, "Non-Criteria Air Pollutants," a Best Available Control Technology (BACT) assessment of controls to reduce impacts from these contaminants was undertaken for the future without the proposed action. Based on the analyses conducted, BACT was determined to be "no control" due to technical and economical feasibility reasons. None of these compounds exceeded their respective AGCs by more than 10 times.

The main contributors to the offsite exceedances of chloroform, 1,4-dichlorobenzene, and dichlorobromomethane are the emissions from the aeration tanks, chlorine contact tanks, the primary influent channels, and the primary settling tanks. It is expected that chloroform, 1,4-dichlorobenzene, dichlorobromomethane, and other non-criteria pollutants would be adsorbed on

[1] Since monitored $PM_{2.5}$ concentrations are greater than the applicable standards, incremental modeled concentrations are compared to NYSDEC and NYCDEP interim guidance criteria.

the carbon, thereby reducing the levels emitted through these odor control stacks. However, these were modeled assuming no reductions in non-criteria air pollutant emissions, including chloroform, 1,4-dichlorobenzene, and dichlorobromomethane, from the carbon adsorbers in the odor control system at the primary influent channels. In addition, all chloroform, 1,4-dichlorobenene, and dichlorobromomethane emissions from the chlorine contact tanks were conservatively assumed to be emitted from the open portions of the tank.

As discussed in Chapter 9, "Non-Criteria Air Pollutants," an analysis of the chloroform impacts offsite demonstrated that maximum annual chloroform impacts occurred beyond the northern fence line along Ryawa Avenue extending less than 1 block to Viele Avenue and along the southern fenceline extending into the water. An analysis of the 1,4-dichlorobenzene impacts offsite also demonstrated maximum annual impacts occurring just beyond the northern fence line on Ryawa Avenue and just beyond the southern fence line in the water and maximum annual impacts of dichlorobromomethane occurred just beyond the northern fenceline along the street before Ryawa Avenue. There are no residences or other permanent or occupied locations between Ryawa Avenue and Viele Avenue and along the water past the southern fence line. The predicted exceedances of the AGCs from these three compounds do not extend to the nearest residence or nearest residential neighborhood, or the Vernon C. Bain Center, hence there would be no long-term, continuous exposure in these areas. The proposed South Bronx Greenway would be located in the area where these predicted exceedances of the AGCs would occur; however there would be no long term continuous exposure in these areas.

Therefore, it can be expected that public health conditions related to air quality, noise, traffic and hazardous materials conditions in the future without the proposed action would likely be no worse than those that presently exist.

I. PROBABLE IMPACTS OF THE PROPOSED ACTION

The following discussion summarizes the potential public health impacts related to air quality noise, traffic and hazardous materials from construction and operation of the proposed action (both the proposed action and the four-digester scenario). The determination of impacts was based on the analyses results reported in the other chapters of the EIS, including the updated analyses for the FEIS, and the *CEQR Technical Manual*.

CONSTRUCTION

AIR QUALITY

As discussed above and in Chapters 8, "Criteria Air Pollutants," and 17, "Construction," the discussion of significance of $PM_{2.5}$ air quality impacts is based on the NYSDEC and NYCDEP incremental threshold guidance levels. In addition to the NYSDEC annual threshold, NYCDEP has promulgated an interim guidance for $PM_{2.5}$, a neighborhood-scale threshold value that is used for comparison when determining potential significance of air quality and public health impacts.

As described in air quality impact assessment section of Chapter 17, "Construction," the results of the analyses showed no predicted exceedances of the NYCDEP or NYSDEC $PM_{2.5}$ short-term and annual thresholds at sensitive receptors. At the nearest residence and residential neighborhood, the maximum predicted $PM_{2.5}$ 24-hour incremental concentrations would be well below 2 $\mu g/m^3$. At Barretto Point Park and proposed South Bronx Greenway, levels would also be less than 2 $\mu g/m^3$

with shorter durations of exposure. In addition, the neighborhood-scale analysis resulted in no predicted exceedances of the $PM_{2.5}$ interim guidance threshold. The construction activities will be subject to New York City Local Law 77, which will require the use of Best Available Technology (BAT) for equipment at that time. [1] Potential cumulative $PM_{2.5}$ incremental impacts from construction and operational sources would be comparable to the impacts described below under "Project Operations." Therefore, no significant adverse impacts on air quality are predicted during the construction of the proposed action. Based on projected changes in air quality resulting from the construction of the proposed action, no potential significant adverse impacts on public health in the community would be expected as a result of the temporary increases in airborne emissions from construction activities.

Based on the analyses reported in Chapter 17, "Construction," the construction of the proposed action is not expected to result in any significant adverse impacts on air quality as a result of potential increased emissions from adverse traffic impacts. In addition, any increases in emission levels as a result of vehicular traffic would be transient. Therefore, there are no expected potential significant adverse impacts on public health from construction-related mobile source air quality for the proposed action.

NOISE

As described in Chapter 17, "Construction," the potential adverse noise impacts from the construction of the proposed action would occur in portions of the adjacent Barretto Point Park, but such noise levels should not interfere with park users' activities. Based on the noise modeling results, under these circumstances the resultant noise pollution exposure from construction activity would be for a limited area, and drop off rapidly with distance from the construction area. Consequently, there would be no adverse noise impacts at any of the nearby residences. The New York City Noise Control Code, as amended December 2005 and effective July 1, 2007, requires the adoption and implementation of a noise mitigation plan for each construction site, limits construction (absent special circumstances as described below) to weekdays between the hours of 7 AM and 6 PM, and sets noise limits for certain specific pieces of construction equipment. Thus, the construction associated with the proposed action would be subject to the conditions of the new Noise Code, and pursuant to the new Noise Code, the adoption and implementation of noise mitigation plans would be required for the construction of the proposed action. It is not anticipated that extended hours (7 AM through 6 PM would be needed for construction of the proposed action). Noise activities would largely not occur after 4 PM or on weekends, and no additional loss of sleep from noise activities would be expected at the nearest residential locations. The predicted off-site noise levels during construction are not expected to result in a potential significant adverse impact on public health.

[1] New York City Administrative Code § 24-163.3, adopted December 22, 2003, also known as Local Law 77, requires that any diesel-powered non-road engine with a power output of 50 hp or greater that is owned by, operated by or on behalf of, or leased by a city agency shall be powered by ultra low sulfur diesel fuel (ULSD), and utilize the best available technology (BAT) for reducing the emission of pollutants, primarily particulate matter and secondarily nitrogen oxides. NYCDEP is charged with defining and periodically updating the definition of BAT.

HAZARDOUS MATERIALS

As described in Chapter 14, "Hazardous Materials," during construction, subsurface soils would be excavated. The subsurface soils may contain contaminants resulting from a number of sources. Therefore, a number of preventive measures will be implemented to minimize exposure to potentially contaminated soils and groundwater during construction. With the proposed general procedures and protective measures in place, no potential significant adverse impact on public health from hazardous materials is expected.

PROJECT OPERATIONS

AIR QUALITY

Criteria Air Pollutants

As concluded in Chapter 8, "Criteria Air Pollutants," the results of the analysis showed that there would be no predicted exceedances of the NAAQS or of the applicable $PM_{2.5}$ interim guidance criteria at any residence resulting from the plant upgraded with the Phase I and II Upgrades and the proposed action. The results of the neighborhood-scale analysis demonstrated the maximum neighborhood-scale increment would be below the NYCDEP interim guidance criterion of 0.1 $\mu g/m^3$.

For the plant as upgraded under the Phase I and II Upgrades and the proposed action, the $PM_{2.5}$ 24-hour impacts would be less than 5 $\mu g/m^3$ at all places of public access. The only location where the $PM_{2.5}$ 24-hour criterion of 5 $\mu g/m^3$ would be exceeded is along the waterfront where there is no public access. In addition, this would only occur during participation in the Peak Load Management (PLM) program (assuming 5 generators at up to 6 hours), which could occur during the months of June to September for up to 15 days per year. During typical plant operations, the criterion would not be exceeded at this publicly inaccessible location.

The nearest sensitive receptor location with potential continual 24-hour exposure would be the closest residence. At this residence under typical conditions, the maximum predicted incremental $PM_{2.5}$ 24-hour concentration would be 0.63 $\mu g/m^3$. During PLM participation and emergency generator testing periods, the maximum predicted incremental $PM_{2.5}$ 24-hour concentration at the nearest residence would be 0.62 and 0.80 $\mu g/m^3$, respectively. These values are well below the 2 $\mu g/m^3$ criterion. Impacts would be lower in the residential neighborhood to the north of this residence.

Other nearby receptors include Barretto Point Park and the proposed South Bronx Greenway. At the park, under typical, yet conservative conditions, the maximum predicted incremental $PM_{2.5}$ 24 hour concentration would be 0.79 $\mu g/m^3$. During PLM participation and emergency generator testing periods, the incremental concentration would be 1.8 and 1.5 $\mu g/m^3$, respectively. At the proposed South Bronx Greenway, under typical, yet conservative, conditions, the maximum predicted incremental $PM_{2.5}$ 24 hour concentration would be 1.57 $\mu g/m^3$. During PLM participation and emergency generator testing periods, the incremental concentration would be 1.86 and 1.71 $\mu g/m^3$, respectively.

Operation of the proposed action is not expected to result in any significant adverse impacts on air quality as a result of potential increased emissions from incremental traffic associated with the proposed action. Therefore, there are no expected potential significant adverse impacts on public health from operation-related traffic for the proposed action.

Therefore, based on the air quality resulting from the operation of the proposed action, no potential significant adverse impacts on public health in the community would be expected as a result of the increases in airborne emissions from operational activities.

Non-Criteria Air Pollutants

Like the condition in the future without the proposed action, in the future with the proposed action, three compounds related to the wastewater process, chloroform, 1,4-dichlorobenzene, and dichlorobromomethane had exceedances of the AGC. AGCs are developed to protect the public health from the effects associated with long-term continuous, exposure to a contaminant. Under the proposed action the incremental levels of the 3 non-criteria air pollutants with predicted exceedances of the AGCs would be slightly reduced due to carbon addition, and predicted off-site levels would remain relatively unchanged compared to the future without the proposed action conditions. The predicted exceedances of the AGCs from these three compounds do not extend to the nearest residence or into the nearest residential neighborhood, or the Vernon C. Bain Center, hence there would be no long-term, continuous exposure in these areas.

The total air quality impacts from the addition of either methanol or ethanol, the additional odor control planned for the primary effluent channels, and non-criteria air pollutants from combustion sources under the proposed action would not result in predicted exceedances of the applicable SGCs or AGCs. Therefore, no potential significant adverse impacts on public health from non-criteria air pollutants are expected with the proposed action.

NOISE

Analyses of the potential off-site noise impacts associated with the proposed action are reported in Chapter 11, "Noise." The proposed action would not result in any predicted exceedances of the suggested incremental thresholds in the City's *CEQR Technical Manual* at nearby sensitive receptors, and would not create exceedances of the octave band limits contained in the New York City Noise Code or the performance standards of the New York Zoning Resolution. Therefore, no potential significant adverse impacts on public health from noise are expected with the proposed action.

HAZARDOUS MATERIALS

The Hunts Point WPCP would continue to comply with New York State Petroleum and Chemical Bulk Storage design criteria, including secondary containment and other requirements to minimize the potential impacts related to accidental spillage. Methanol and ethanol, which could be used under the proposed action, are considered hazardous because of their flammability and their storage and use are therefore strictly regulated by the New York City Fire Department (FDNY). Storage and handling facilities shall have fire suppression and prevention systems to maximize safety. Fire protection systems will include automated detection with thermal detectors and automated activation of fire fighting foam systems. Transport of these new chemicals, and the chemicals already used for operation of the plant, would be transported to and from the plant by licensed vendors and haulers, regulated by applicable New York City Department of Transportation (NYCDOT), NYSDOT, NYSDEC, and Federal regulations. With the continued implementation of these measures, no potential significant adverse public health impacts are expected from chemical storage and handling at the Hunts Point WPCP.

CONCLUSIONS

Based on the air quality assessments performed for the EIS, the operation and construction of the proposed action (for both two- and four-digesters) would not result in any new predicted exceedances of air quality standards and the predicted neighborhood average incremental concentration of $PM_{2.5}$ would be less than the applicable interim guideline concentration. The assessment also considered the type of sensitive receptors that could be affected, especially at locations where 24-hour exposure could occur. Additionally, any increased emission levels produced during the construction activity would be transient. The principal health effects of airborne particulate matter are on the respiratory system. Based on the project changes in air quality resulting from the operation and construction of the proposed action, no significant impacts on public health in the community would be expected. In addition, the potential impacts from non-criteria air pollutants, noise, traffic and hazardous materials are also not expected to result in a significant adverse impact on public health. Therefore, the construction and operation of the proposed action is not expected to result in a potential significant adverse impact on public health. ✷