PUBLIC HEALTH

CHAPTER 20

Public health is the organized effort of society to protect and improve the health and well-being of the population through monitoring; assessment and surveillance; health promotion; prevention of disease, injury, disorder, disability and premature death; and reducing inequalities in health status. The goal of CEQR with respect to public health is to determine whether adverse impacts on public health may occur as a result of a proposed project, and if so, to identify measures to mitigate such effects.

Scientific understanding of the links between human health and the environment is an evolving and expanding field of research. Some well established associations include the influence of poor air quality on human health and human exposure to hazardous materials, noise, and contaminants in soil and water. These topics are discussed in other chapters of this Manual, and should be considered in conjunction with any public health assessment.

As with each technical area assessed under CEQR, it is important for an applicant to work closely with the lead agency throughout the environmental review process. In addition, a lead agency should consult, as appropriate, with the City's expert technical agencies early in the process to ensure that the proposed methodologies are appropriate for assessing a particular project. For this technical area, the expert technical agency is the New York City Department of Health and Mental Hygiene (DOHMH).

100. DEFINITIONS

The following terms are helpful when considering potential public health impacts.

ENVIRONMENTAL HAZARDS. Chemical agents, physical agents, biochemical stressors, and biologic toxins that may be found in air, water, soil, food, or other environmental media.

ENVIRONMENTAL MEDIA. Environmental media that, as a result of a proposed project, may serve to transport contaminants, sound or radiation from the source(s) to possible points of human exposure. Affected media may include groundwater, surface and subsurface soils, sediment, surface water, air, soil gas, food chain, sludge/leachate/waste materials.

EPIDEMIOLOGY. The study of the distribution and determinants of health or disease in a population and the application of such study to control health problems.

EPIDEMIOLOGIST. A masters- or doctoral-level public health professional trained in epidemiologic analysis.

EXPOSURE. Contact by swallowing, breathing, hearing, radiation energy absorption, or dermal contact. Exposure may be short-term, of intermediate duration, or long-term.

EXPOSURE PATHWAY. The route a substance takes from its source (where it began) to its end point, and how people may come into contact with it. An exposure pathway has five parts: a source of contamination; an environmental media and transport mechanism; a point of exposure; a route of exposure (eating, drinking, breathing, or touching), and a receptor population (people potentially or actually exposed).

EXPOSURE ASSESSMENT. A process that estimates the amount of a contaminant, sound or radiation that enters or comes into contact with people. An exposure assessment also describes how often and for how long an exposure occurred, and the nature and size of a population exposed.

HEALTH OUTCOME. A disease or health problem, such as asthma or gastroenteric illness (see Table 20-1).

LITERATURE REVIEW. A comprehensive examination of peer-reviewed, published, scientific literature on a subject that includes a critical examination of the scientific validity of study findings by assessing the quality of the study methods and generalizability of study findings.

MORBIDITY RATE. The relative frequency, or incidence, of a non-fatal disease or other health conditions.

MORTALITY RATE. The relative frequency, or incidence, of deaths generally or attributable to particular causes.

POTENTIALLY EXPOSED POPULATION. Populations to consider include residents, those engaged in recreational activities, workers, transients, potential "sensitive or vulnerable" populations.

PUBLIC HEALTH ASSESSMENT. An analysis and statement of the public health implications posed by activities, a facility, release, or contaminated site under consideration. The public health assessment is an evaluation of relevant environmental data and health outcome data associated with a proposed project where environmental exposures may occur.

SENSITIVE OR VULNERABLE POPULATION. A population vulnerable to the potential for health impacts by virtue of their financial circumstance, health, age, functional or developmental status, ability to communicate effectively, presence of chronic disease or disability, or other personal characteristics.

200. DETERMINING WHETHER AN ASSESSMENT IS APPROPRIATE

For most proposed projects, a public health analysis is not necessary. Where no significant unmitigated adverse impact is found in other CEQR analysis areas, such as air quality, water quality, hazardous materials, or noise, no public health analysis is warranted. If, however, an unmitigated significant adverse impact is identified in other CEQR analysis areas, such as air quality, water quality, hazardous materials, or noise, the lead agency may determine that a public health assessment is warranted for that specific technical area. For example, if an unmitigated impact on the quality of the city's drinking water was identified, a public health analysis of water quality would be appropriate.

In unusual circumstances, a project may have potential public health consequences that may not be related to the issues already addressed in other technical analysis areas in CEQR reviews. The lead agency, therefore, may determine that a public health assessment is warranted. Examples of these unusual public health analyses have included the potential public health impact of pesticide application for the control of West Nile Virus infected mosquitoes and the potential for gastrointestinal illness associated with the installation of devices that aerosolized water in public areas.

300. THE PUBLIC HEALTH ASSESSMENT PROCESS

If a public health assessment is determined to be appropriate under Section 200 above, the assessment process involves evaluating whether and how exposure to environmental contaminants may occur and the extent of that exposure; characterizing the relationship between exposures and health risks; and applying that relationship to the population exposed. This assessment should be conducted in consultation with an environmental epidemiologist, a professional exposure or risk assessor, or similarly trained person. The public health assessment is a step-wise process consisting of:

STEP ONE: Identifying the extent of potential environmental exposures to the public as a result of a proposed project. This may already have been determined in analyses conducted of other CEQR technical areas such as water quality, air quality, hazardous materials, *etc.*, where an unmitigated significant adverse impact was identified. (Section 310).

STEP TWO: If necessary, identifying potential health impacts as a result of identified exposure pathways (See Section 320 and Table 20-1).

STEP THREE: If necessary, determining the potential significance of the impact (Section 400).

STEP FOUR: Recommending steps to reduce and prevent exposures (Section 500).

Examples of how this public health analytic framework has been utilized in the past include the following scenarios:

- Estimating the number of asthma hospitalizations in a neighborhood that may occur from an increase in $PM_{2.5}$ that is identified as an unmitigated significant impact in Chapter 17, "Air Quality."
- Estimating the number of poisonings and asthma hospitalizations that may result from the spraying of a pesticide for a mosquito control program.
- Estimating the total bacterial dose that may result from proximity to a project that involved spraying river and estuary water.

310. STEP ONE: IDENTIFYING POTENTIAL ENVIRONMENTAL HAZARD EXPOSURES

If an analysis is required and contaminants/substances of concern are identified, a public health analysis should first consider:

- The levels (or "concentrations") of hazardous substances and contaminants likely to result from the proposed project; and
- Whether people may be exposed to contamination and how people may be exposed (for example, through "exposure pathways" such as breathing air, drinking or contacting water, contacting or eating soil, or eating food).

Depending on the proposed project, some of this information may already be available as a result of CEQR technical analyses that identified an unmitigated significant impact.

Exposure pathways are used to evaluate the specific ways in which people may come into contact with environmental contamination or hazards. An exposure pathway evaluation, therefore, determines if project-related contaminants have been, are, or may be in contact with local populations. In other words, it answers the key question: Could people be exposed to project-related hazards? Past, current, and future exposure conditions need to be considered because the elements of an exposure pathway typically change with time.

Potentially exposed populations may include:

- Residential populations - those living in the area that may be impacted by the proposed project.
- Recreational populations - people who may reasonably be anticipated to recreate near, or on, a site of a proposed project.
- Worker populations - On- and off-site workers who may be impacted by the proposed project.
- Transient population – populations that may visit the area of the proposed project.
- Vulnerable populations - *e.g.*, children, elderly, those with pre-existing health conditions.

When characterizing potentially exposed populations, it is important to determine:

- Who is exposed?
- What activities are occurring?
- Where are activities occurring?
- When has exposure occurred (past current, future)? For how long?
- How are people exposed?

If the exposure assessment does not find potential environmental hazard exposures to the public as a result of a proposed project, then no further analysis is necessary.

320. STEP TWO: IDENTIFYING POTENTIAL IMPACTS OF EXPOSURES

If a public health assessment for a particular topic has been determined in Section 200 to be appropriate, and potential hazardous exposures to the public were identified in Section 310, then additional analysis is warranted. Further analysis of potential health impacts is appropriate when exposures are known, qualitatively or quantitatively estimable, and may potentially occur for periods of time, over geographic areas, or to a population large enough that one may not reasonably rule out the possibility of significant impact. The next step in the process considers whether hazardous substances might harm people, whether working or living nearby might affect their health, or whether the proposed project may result in other dangers, such as physical hazards. Health impacts may involve short-term, or acute, effects, including burns, injuries, poisonings, and exacerbations of asthma and other respiratory or cardiovascular diseases. Health impacts may also involve long-term or chronic impacts, including increased incidence of heart disease, respiratory illness, cancers, diabetes, and obesity.

Depending on the known information, the potential for impacts may be quantitatively or qualitatively discussed, as appropriate. For instance, where concentration-response functions or attributable risks are available in peer-reviewed literature, regulations and/or guidelines, the potential for public health impacts should be quantified. However, when quantitative relationships between exposures and health outcomes are not well-established, but where peer-reviewed literature indicates effects may occur, a qualitative assessment is appropriate for determining the likely direction and significance of impact.

321. Environmental Media-Specific Guidance

If further assessment is appropriate and potential health exposures are identified for a particular environmental media, then that specific area should be further examined to determine potential public health impacts. The following sections describe examples of hazards, exposures, potential health effects and measurable outcomes that may be utilized when conducting a public health assessment for specific environmental media. Because the field of environmental health is constantly evolving as new research becomes available, consultants with expertise in environmental epidemiology and toxicology may be critically important when more detailed health assessments are warranted. Health impacts may be directly discerned in some cases, but others may require more complex modeling.

AIR QUALITY

Fine particles and ozone are both found in New York City's airshed at levels that, as of 2009, exceed federal Clean Air Act standards. Road and non-road vehicle emissions and stationary combustion sources contribute to these pollutants. Stationary sources may emit volatile organic compounds (VOCs) (*e.g.* drycleaners and perchloroethylene), metals, or other chemicals.

When significant adverse air quality impacts are identified pursuant to the methodologies of Chapter 17, "Air Quality," and may not be fully mitigated, the increments in the concentrations of air pollutants should be evaluated for their potential impact on an affected area's health.

Route of exposure: Inhalation

Health effects: Two air pollutants, fine particles ($PM_{2.5}$) and ozone, are of particular concern since these air pollutants exacerbate asthma symptoms and are known to contribute to emergency department visits, hospitalizations for respiratory and cardiovascular conditions, and to overall mortality. Of these two, ambient levels of $PM_{2.5}$ tend to be localized and analyzable and are more likely to be influenced by proposed projects. Health effects may also occur from exposure to pollutants from combustion and process emissions such as VOCs.

Analysis: For a public health assessment of air quality impacts, analyses frequently include epidemiologic modeling or the impacts of exposures on affected populations. Data that contribute to such analyses may include the increment in a pollutant's concentration, a concentration-response function, age, underlying illness bur-

dens in affected populations, and the number of people affected. Much of this information may have been collected as a result of the analysis in Chapter 17, "Air Quality."

WATER QUALITY (POTABLE, NON-POTABLE, AND RECREATIONAL)

When significant adverse water quality impacts are identified pursuant to the methodologies of Chapter 11, "Natural Resources," or Chapter 13, "Water and Sewer Infrastructure," and may not be fully mitigated, the project's impact on water quality should be evaluated for its potential impact on the health of the potentially affected population.

Route of exposure: Exposure may be by direct ingestion, contamination of cooking water and/or food supply, or secondary exposure from hand-to-mouth contact with affected surfaces.

Health effects: Water contaminated with infectious organisms may cause mild or serious infectious diseases. Chemical contamination of water may result in increased risk for acute and chronic conditions including neurologic effects, kidney or other organ system effects, and cancers.

Analysis: The potential effects of a project's unmitigated impact on water contamination may be analyzed in terms of potential impacts on beach closings and frequency of potential contact with waters. The potential increase in the risks of, or anticipated numbers of occurrences of, water- and food-borne illnesses should be examined and, if feasible, quantified.

SOIL AND DUST CONTAMINANTS

Soil contaminants may include environmental contaminants such as lead or other metals, asbestos, volatile organic compounds, other hazardous materials, or, in some cases, infectious agents. Soil contaminants are a concern particularly with projects having unmitigated significant impacts where the public would have access to previously restricted areas that have unknown quality of fill materials, where disturbance of topsoil is possible during construction or operational project phases, or where ongoing soil erosion is likely. Soil vapor intrusion is a concern in areas where VOCs may have been used as solvents or where compounds have spilled or leaked into soil or groundwater. These compounds may subsequently become a source of soil gas that may enter nearby buildings.

When significant adverse hazardous materials impacts are identified pursuant to the methodologies of Chapter 12, "Hazardous Materials," and may not be fully mitigated, that hazardous materials impact should be evaluated for its potential impact on the health of the potentially affected population.

Routes of exposure: Ingestion, inhalation, dermal contact

Health effects: Dust exposure may exacerbate asthma, cause gastroenteric illnesses, and elevate risks for health effects from toxic exposures, such as lead poisoning. Unmitigated significant soil gas exposures may increase risks of fires and explosions, and may increase risks of a variety of chronic illnesses associated with VOCs.

Analyses: The potential health impacts may be evaluated in terms of expected airborne concentrations of soil or soil vapors, potential for vapor buildup in interior spaces, or levels and quantities of anticipated dust deposition and their attendant health and safety risks. Many of these data may have been collected as a result of the analysis in Chapter 12, "Hazardous Materials."

NOISE

Noise, or unwanted sound, is a leading cause of public complaints in New York City. When significant adverse noise impacts are identified pursuant to the methodologies of Chapter 19, "Noise," and may not be fully mitigated, that noise impact should be evaluated for its potential impact on the health of the potentially affected population.

Route of exposure: Soundwave absorption.

Health effects: Noise in and around homes may disturb quality-of-life by disrupting sleep or interfering with conversations, Chronic noise exposure may raise blood pressure and has been suggested to contribute to myocardial infarctions, as well as to interfere with language development in children. Prolonged exposure to levels above 85 a-weighted decibels (dB(A) will eventually harm hearing. Episodic and unpredictable exposure to short-term impact noise at high decibel levels may also affect health.

Analyses: Noise modeling results and allowable city noise levels based on proposed use (residential, open space, *etc.*) data can be used for quantitative analyses for unmitigated significant noise impacts. Much of this information may have been collected as a result of the analysis in Chapter 19, "Noise."

PESTS (RODENTS, INSECT VECTORS, AND ANIMAL-BORNE DISEASE)

Projects that modify the built and natural environment may result in increased wild animal – human interaction, or conditions conducive to insect and animal breeding, and subsequently an increase in animal bites, or vector-borne disease. Examples of vectors include mosquitoes, rats, ticks and fleas.

Routes of exposure: Inhalation of allergens; insect and animal bites.

Health effects: Contact with animals may lead to infectious diseases, rabies exposures, injuries, and other health problems. The increased presence of indoor pests may contribute, in sensitive persons, to asthma symptoms and exacerbations. Inappropriate pest control may increase exposures to pesticides and their health effects.

Analyses: The need for inclusion of a pest analysis in this chapter occurs only when it cannot be determined that standard practices/protocols would adequately address a potential problem. Projects should be evaluated for their potential to shift or increase pest or wild animal populations in or around a project area, for the potential impact of pesticide-based mitigation, and for the potential to increase the risks of animal bites and vector-borne diseases. Analyses may also include an evaluation of potential impacts on rodent complaints, seasonal mosquito pool counts, and on animal populations.

NON-EXPOSURE FACTORS

When conducting a public health assessment, there are certain non-exposure factors that may influence the likelihood and magnitude of a public health impact. For instance, if an air quality analysis conducted pursuant to Chapter 17, "Air Quality," determines that a proposed project may have the potential to result in an unmitigated significant adverse impact with respect to $PM_{2.5}$ and the increase in $PM_{2.5}$ exposure would occur in an area with a relatively healthy population, the potential for this exposure to be considered a significant adverse public health impact may be lower than if the same increase in $PM_{2.5}$ were to occur in an area where the population exhibits more signs of vulnerability. The following questions help to identify the factors that may influence the potential for public health impacts based upon the vulnerability of the area's population:

- Based on existing health data for the affected community, what are the leading causes of morbidity and/or mortality? Does the proposed project have the potential to contribute to an existing health burden? Does the existing health status of the population in the affected area make it vulnerable to the potential exposure(s)? Health issues of particular concern include:

  - Asthma
  - Cardiovascular disease and its consequences
  - Immuno-compromised conditions (diabetes, HIV/AIDS, *etc.*)
  - Adult and infant mortality.

- Does the affected population have characteristics that may place it at greater risk of exposure to urban health stressors or environmental hazards? Depending on the exposure, vulnerability may be evaluated in terms of a population's relative age, institutional status, or other vulnerability.
- Are the characteristics of the population in the affected area such that there are many people potentially affected by the project? Population characteristics to consider include:
  - Population size. In calculating the total burden of a health outcome that is associated with exposure to a contaminant, the total number of cases is estimated as a function of the background rate of this particular health outcome in the population and the size of the population. A condition that has a high background rate in a relatively small population may produce the same number of cases as a larger population with a smaller background rate.
  - Population density (residential, occupational) in proximity to sources of exposure.

400. Step Three: Determining Impact Significance

When a more detailed analysis is undertaken, it is important to gather as much project and site-specific data as possible. If these data are unavailable reasonable, but conservative, assumptions should be made. Literature reviews may be helpful in identifying concentration response functions and dose-response relationships. Data describing baseline conditions about neighborhoods (*e.g.* socio-economic factors such as education levels, median income, traffic volume and flow, *etc.*), its populations (census, other demographic data), and its health status and disease burdens (*e.g.*, self-reported health status, asthma and myocardial infarction hospitalization rates, mortality and birth rates, pedestrian injury rates, *etc.*) are important to consider when determining the significance of a public health impact.

Impacts may either be considered adverse (*i.e.*, increasing the frequency or severity of illness) or positive (*i.e.*, decreasing its incidence). In general, CEQR is predominantly concerned with disclosure of significant adverse impacts. However, in the event that a proposed project has the potential for both adverse effects and those that are positive, it is appropriate for the lead agency to disclose such information.

500. Developing Mitigation

A hierarchy of mitigations should be considered that prioritizes engineering or process controls that minimizes the presence of hazards first, reduces the potential for exposure second, and mitigates the effect of exposure only as a last resort.

600. Developing Alternatives

Alternatives that incorporate the potential mitigation discussed above may also reduce or avoid significant impacts associated with a project. In addition, depending on the impact, there may be alternatives available that could also reduce or eliminate significant public health impacts in these respective areas.

700. REGULATIONS AND COORDINATION

710. APPLICABLE COORDINATION

Coordination between the lead agency and DOHMH should be initiated when significant unmitigated impacts are found that may influence public health in ways described in this chapter. DOHMH should be notified if the public health analysis for CEQR projects determines there may be elevations in rates of illness, injury or mortality. DOHMH may also be consulted if questions arise with respect to appropriate methodology for public health analyses, or appropriate mitigation of potential public health impacts.

720. REGULATIONS, STANDARDS, AND GUIDELINES

City, state and federal standards and guidelines may be helpful when considering potential public health impacts. Examples of some standards/guidelines include:

- New York City Noise Control Code §24-232
- USEPA - National Ambient Air Quality Standards (NAAQS) promulgated under the Clean Air Act
- US EPA – Drinking Water Standards and Health Advisories promulgated under the Safe Drinking Water Act
- Agency for Toxic Substances and Disease Registry (ATSDR) - Minimal Risk Levels (MRL)
- US EPA – Reference Concentration Levels in Air
- NYSDEC Air Annual Guidance Criteria/ Short-term Guidance Criteria – (AGC/SGC)
- NYS DEC Soil Cleanup Objectives (currently 6NYCRR Part 375)
- NYS DOH – Soil Vapor Intrusion Guidelines
- Information may also be readily obtained from the websites of the following agencies: USEPA, ATSDR, NYSDEC, NYSDOH, DOHMH.
- In addition to the regulations and guidelines listed above, other laws and regulations pertaining specifically to public health may be relevant for assessment purposes. These may include, but not be limited to, the following:
    - New York State Public Health Law Section 570 *et seq*. and 10 NYCRR Part 58 (regulating clinical laboratories) and 42 CFR Part 72 (covering the handling of pathogenic organisms).
    - New York City Health Code

730. DATA AND RESOURCES

DOHMH publishes data describing neighborhood-specific demographic and socioeconomic characteristics, as well as mortality, morbidity, birth rates and outcomes, communicable, noninfectious and chronic disease burdens, environmentally related illnesses such as respiratory and cardiovascular disease burdens and their consequences, insect-borne disease, water-related infectious diseases, domestic and wild animal-related illnesses, pest burdens and pesticide use. The following resources are available here:

- Epi-Query
- Vital statistics publications
- Community Health Profiles
- NYC Health Disparities Reports
- Environmental Public Health Tracking Portal

731. Literature and Reference Sources

Peer-reviewed literature and toxicological references can be found at:

- Medline (PubMed) http://www.ncbi.nlm.nih.gov/pubmed/
- Toxnet (Toxicology Data Network) http://toxnet.nlm.nih.gov/

732. Epidemiologists

Epidemiologists study the frequency and distribution of health and diseases within human populations and environments. Specifically, they measure or estimate the incidence of disease occurrence and relate it to different characteristics of populations and environments; plan and develop methodology relating to risk assessments; analyze experimental data and interpret published literature; and interpret and evaluate environmental epidemiological data/studies. An Epidemiologist should have a masters or doctoral degree in epidemiology. A background or experience in Environmental Health (one area of specialization in Public Health) is also helpful.