

S U S T A I N A B L E J E R S E Y
SUSTAINABILITY SUMMIT

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Sustainability Brief: Air Quality

Ambient (outdoor) air quality affects public health both directly and indirectly, and it also affects natural and built resources. Direct health effects relate to the impacts of air pollution on lungs, eyes and other sensitive organs. Indirect health effects can occur in several ways, such as mercury contamination of streams resulting in contaminated fish, or dry deposition on surfaces that then come in contact with people. Air pollutants damage the natural environment through such impacts as acid rain, nitrogen oxide deposition in estuaries, and deposition of toxic materials. Buildings, vehicles and other built materials can be damaged by corrosive air pollutants. Breathing is essential, and so air quality is a fundamental aspect of sustainability.

1 Background

1.1 Clean Air Legislation

The Federal Clean Air Act required USEPA to establish ambient air quality standards and to regulate pollutant sources, including both stationary and mobile sources. Stationary sources such as industries, fossil fuel power plants and incinerators are regulated through a permitting process, while mobile sources are controlled through vehicle emission standards and inspections. “The Federal Clean Air Act establishes two types of national air quality standards. Primary standards set limits to protect public health, including the health of ‘sensitive’ populations such as asthmatics, children, and the elderly. Secondary standards set limits to protect public welfare, including protection against decreased visibility, damage to animals, crops, vegetation, and buildings.” (NJDEP, n.d.)

USEPA established six national primary standards for “criteria” air pollutants: carbon monoxide (a combustion product); lead (previously used in gasoline); nitrogen dioxide (a combustion product); ground-level or tropospheric ozone (as distinct from ozone in the stratosphere, the upper atmosphere), created through photochemical processes involving ozone precursors such as nitrogen oxides (NO_x); particulate pollution (such as dust and products of fossil fuel combustion); and sulfur dioxide (SO₂, primarily a fossil fuel combustion product). As noted, all of these pollutants are associated with combustion, directly or indirectly.

In addition, the 1990 Clean Air Act requires regulation of major hazardous air pollutant sources; these pollutants are not addressed by health-based criteria, but by regulation of the sources themselves to achieve “maximum achievable control technology” standards. New Jersey’s Air Pollution Control Act was first adopted in 1954 and subsequently amended; it provides the necessary statutory basis for the New Jersey Department of Environmental Protection (NJDEP) to develop a State Implementation Plan (SIP) and to regulate air pollutant sources, including as state lead under the Clean Air Act.

1.2 Air Quality and Transportation

Transportation systems are a ubiquitous aspect of life in the developed world, with a range of health threats ranging from excessive noise to pollutant exposure. “Some 35 million people live within 300 feet of a major roadway, placing them at higher risk for asthma and other respiratory illnesses, cardiovascular disease, pre-term births, and premature death.” (RWJF, 2012) The physical form and function of transportation affects health both directly and indirectly. “...childhood asthma, birth outcomes, and cardiovascular risk have all been shown to be associated with transportation and planning decisions that shape exposure to air pollution, including airborne particulate matter and toxic gases generated by traffic and other sources.” (NRC, 2011) As such, transportation is a significant concern under the Clean Air Act and more, at both regional and local levels.

1.3 Neighborhood Air Quality

USEPA and many others have documented that poor or disenfranchised communities and neighborhoods tend to include a disproportionate share of pollutant sources and polluted environmental conditions that damage health. In some cases, this connection is the legacy of early urban manufacturing that spurred construction of worker residences nearby, so that workers could walk to their jobs. In other cases, pollution sources were located very deliberately in communities that lacked the power to challenge those decisions. The result is a concentration of pollutant sources within concentrations of poverty, in many cases dominated by air quality concerns. “Often, urban areas are polluted because of neglect of the simple basics of sanitation, siting of facilities such as coal- and oil-burning generating stations in close proximity to housing, sewage treatment, and abandonment of factories containing hazardous materials.” (Hanna and Coussens, 2001) Even with progress in pollution control over the last decades, the net result is a much heavier pollution burden in those communities; correction of these problems is part of initiatives termed “environmental justice.”

Of major concern is the potential for damage to the health of children, as these health problems can continue throughout their lives. Neurotoxicity can damage a child’s intelligence potential for life, such as from lead and mercury (Hanna and Coussens, 2001). Asthma likewise can severely limit a child’s ability to play, interact positively with others, and build self-esteem. “A child’s health is powerfully shaped by the environment in which he or she lives, learns and plays. ... Many—although not all—modifiable factors known to influence children’s health are shaped in significant ways by family income and/or education. ... Medical care is important for children’s health. ... But many experts have concluded that medical care and genes actually play a relatively minor role compared with the influence of the physical and social conditions in which children grow up. Children continue to develop not only physically but also cognitively and behaviorally through adolescence, but the first five years of life are particularly crucial.” (RWJF, 2008)

2 Sustainability Issues

2.1 Unsustainable Air Quality

An industrialized society will inevitably cause some level of air quality degradation. However, the sustainability of our society is compromised when air quality poses a significant risk of health damage to the general or susceptible populations, such as the young, elderly, pregnant or immunocompromised, or causes significant degradation of natural resources or the built environment. Poor air quality can also harm economic competitiveness. Workforce health impairment damages productivity and obvious air pollution problems limit the ability to attract desirable economic activity. The recent episodes of poor air quality in

China are an example. The scale of the pollution is a critical social issue. Neighborhoods can expose residents to far higher ambient and indoor pollutant levels than average conditions for a state or the nation, with health and productivity implications that can cascade down through generations. Entire regions of the country are affected by pollutants such as acid rain, while other pollutants are very localized – often in the poorest neighborhoods.

2.2 Assessment of Air Quality

NJDEP operated around 40 air quality monitoring stations in 2011 at a variety of (mostly urbanized) locations within the state; these stations are used to determine compliance with ambient air quality standards, to evaluate migration of pollutants from other states into New Jersey, and to estimate the potential for air deposition to the land surface or waters. NJDEP and USEPA have developed and implement an Air Quality Index (AQI) that provides a composite indicator of health effects from short-term air pollutant levels (ground-level ozone, particle pollution, carbon monoxide, sulfur dioxide, and nitrogen dioxide). NJDEP provides daily AQI results, and also publishes annual reports on air quality conditions. However, it should be noted that even with a concentration of these sites in more urban areas, there aren't sufficient sites to measure air quality in specific neighborhoods on a routine basis.

The effects of mercury air deposition into New Jersey streams are monitored indirectly, through fish tissue sampling; results are used in fish consumption advisories. Indoor residential air quality is not monitored by any agency, as routine monitoring would have three major flaws: extremely high expense; high level of intrusiveness for residents, with major privacy concerns; and lack of broad applicability as each station would have little or no relevance to other stations. Indoor air quality is monitored to a certain extent in manufacturing locations (e.g., OSHA requirements), schools and large employment areas to foster a healthful environment.

2.3 Challenges in New Jersey

The greatest air quality challenges for New Jersey come from cross-state migration of air pollutants, concentrated air pollution at the neighborhood level, indoor air quality, and poor integration of land development practices with air quality objectives. Significant improvements have been achieved in ambient air quality since 1970 through controls of both stationary and mobile sources. However, non-attainment areas still exist and ongoing research has elevated concerns about fine particulate matter and the health impacts of neighborhood air quality, especially with regard to childhood asthma. The relative impacts of neighborhood and indoor air quality also are being researched. Indoor air quality lacks a strong regulatory framework, which would more likely require modification of landlord obligations (for residences) and large-building HVAC requirements than implementation of permit programs through NJDEP.

3 Sustainability Responses

The major sustainability issues regarding air quality revolve around the common questions: How good is good enough to be sustainable? Implementation methods then are necessary to achieve those levels. The national system is a proven framework for establishing ambient air quality standards as a definition of sustainability for regional air quality, if the political will exists to address issues such as cross-state pollutant transport. However, the industry-specific technology-based controls are not health-based and therefore do not provide an indicator of sustainability.

4 Implications

Clearly, the two sustainability statements below pose an immense challenge for both the public and private sector. Significant advancements in pollution control would need to be made throughout many sectors of the economy. However, the statements do not anticipate perfect air quality, but rather are focused at the population level, with the expectation that some individuals may still experience negative outcomes due to individual attributes, highly localized air quality issues, etc.

5 Defining & Tracking Sustainability

Based on the issues, the following general sustainability statements are offered:

- **Ambient Air Quality** is sustainable when National Ambient Air Quality Standards are achieved throughout New Jersey, and ambient air quality and the migration and deposition of air pollutants pose no significant direct or indirect health threats to sensitive populations and natural resources.
- **Neighborhood Air Quality** is sustainable when children and other sensitive populations in urban neighborhoods have health effects related to outside air quality that are comparable to those in other areas of New Jersey.

Table 1 provides a preliminary set of indicators and target for each of the two sustainability statements below. Municipal action will be feasible primarily for certain aspects of the neighborhood level and indoor air quality.

Table 1 Preliminary Air Quality Sustainability Indicators and Targets

Sustainability Definition	Preliminary Sustainability Indicators	Preliminary Targets	Scale of Analysis	Availability and Period of Data
<p>Ambient Air Quality is sustainable when National Ambient Air Quality Standards are achieved throughout New Jersey, and ambient air quality and the migration and deposition of air pollutants pose no significant direct or indirect health threats to sensitive populations and natural resources.</p>	<p>Achievement of National Ambient Air Quality Standards</p>	<p>Concentrations of “criteria” pollutants</p>	<p>Statewide and county</p>	<p>Long-term data sets from NJDEP ambient air quality monitoring network</p>
	<p>Watersheds are not toxic to aquatic life</p> <p>Fish consumption advisories and bans are no longer required in New Jersey waters</p>	<p>Aquatic life morphologic aberrations due to toxicity</p> <p>Bioaccumulation of toxic substances in fish</p>	<p>Watersheds and estuaries</p>	<p>NJDEP Index of Biotic Indicators and Ambient Macroinvertebrate Monitoring (AMNET) Networks</p>
<p>Neighborhood Air Quality is sustainable when children and other sensitive populations in urban neighborhoods have health effects related to outside air quality that are comparable to those in other areas of New Jersey.</p>	<p>Health outcome comparison of urban and nonurban neighborhoods</p>	<p>Asthma rates in children by neighborhood category and socioeconomic group</p> <p>Asthma rates in sensitive adult populations by neighborhood category and socioeconomic group</p>	<p>Neighborhood categories, municipalities and counties</p>	<p>Health outcome data compiled by NJDOH</p>

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