New York State Department of Health

Center for Environmental Health

Public Health Consultation

Respiratory Hospitalizations in Areas Surrounding the AES Greenidge Power Plant

Town of Torrey, Yates County, New York

August 15, 2008

Prepared by:
The New York State Department of Health
Center for Environmental Health
Troy, New York
Under a Cooperative Agreement with
The U.S. Department of Health & Human Services
Agency for Toxic Substances and Disease Registry
Division of Health Assessment and Consultation
Superfund and Program Assessment Branch
Atlanta, Georgia

For additional information about this document, you may contact the:

New York State Department of Health
Center for Environmental Health

547 River Street
Flanigan Square, Room 300
Troy, New York 12180-2216
1-800-458-1158, extension 2-7950
E-mail beoe@health.state.ny.us

INTRODUCTION

The New York State Department of Health (NYS DOH) has a cooperative agreement with the Agency for Toxic Substances and Disease Registry (ATSDR) to perform health assessments, conduct health statistics reviews, and perform epidemiological studies of populations in New York State which may have been exposed to environmental contaminants. In December 2005, Senator Hillary Clinton requested that ATSDR conduct a Public Health Assessment for the area around the AES Greenidge power station in Torrey, New York due to concerns about respiratory illness in the area (Appendix A). Her request was prompted by an informal statistical summary prepared by Dr. David Carpenter, Director of the University at Albany's Institute for Health and the Environment, which found statistically significant elevations of several respiratory diseases in six ZIP codes near the facility (Appendix B). In response, NYS DOH agreed to conduct a health statistics review of respiratory related hospitalizations among residents of the communities surrounding the coal-fired power plant which lies in Yates County, in the Finger Lakes region of Central New York. The link between the air pollutants commonly associated with coal-fired power plants and adverse respiratory health has been well documented in the scientific literature (Brunekreef and Holgate, 2002; Pope, 2000; Brook et al., 2003). While many other health effects have also been associated with some of these same pollutants, the current review focused only on non-cancer respiratory illnesses.

Health statistics reviews are descriptive epidemiologic studies which analyze existing health information from sources such as vital records, disease registries or hospital admissions to compare rates of adverse health outcomes in a local community to national, statewide, or other reference population rates. The purpose of this type of investigation is to serve as a pilot investigation to explore the relationships between available respiratory health indicators and past emissions from the AES Greenidge power plant. While this health statistics review cannot prove that emissions from AES Greenidge are causing respiratory disease in the area, it can generate hypotheses and may indicate whether further detailed health investigations are warranted.

BACKGROUND

AES Greenidge is a coal-fired electricity generating plant located on the western shore of Seneca Lake in the town of Torrey, New York, just south of the village of Dresden in Yates County (Figure 1). The plant property occupies 153 acres on the western shore of Seneca Lake. Immediately to the north of the property is the Keuka Lake Outlet, a small stream. The surrounding land use is a mixture of agricultural, commercial, and residential, but is predominantly rural. The larger city of Geneva, population 13,600 according to the 2000 Census, is located 15 miles north of the power plant on the northern tip of Seneca Lake.

The Greenidge power plant was built in the 1930s for the New York State Electric and Gas Corporation (NYSEG), and was bought in 1999 by the AES Corporation. The generating units currently in operation were built in the 1950s and have a combined generating output of 161 megawatts (MW). The boilers burn pulverized coal as their primary fuel. They are also permitted to burn clean (untreated) wood, waste wood product from a furniture manufacturer, #2 fuel oil, diesel oil, waste oil, and natural gas. The units are equipped with electrostatic precipitators to remove particulate matter. Under an agreement with the State of New York, announced in January 2005, AES Greenidge will install innovative clean coal technology, which will greatly reduce nitrogen oxides (NO_x) and sulfur dioxide (SO_2) emissions from this facility. For a more detailed description of the history of the facility and its pollution controls see Appendix C.

Public health concerns about coal-fired power plants:

Pollutants commonly associated with coal-fired power plants include particulate matter (PM), ozone (O_3), SO_2, NO_x, carbon monoxide (CO), metals and volatile organic compounds (VOCs). As mandated by the 1990 Clean Air Act the USEPA conducted a study detailing air pollutant emissions from electric generating stations (USEPA, 1998). While the link between these air pollutants and adverse health events has been well documented in the scientific literature, it is important to note that the human response to air pollution exists along a spectrum. This relationship, which was described in a statement by the American Thoracic Society in 2000, has been characterized as “a pyramid, with the most common consequences of exposure (increased prevalence and incidence of respiratory symptoms/diseases, reduction of lung function) at the base and mortality, the least common but most severe consequence, at the tip” (Viega et al., 2006). Pollutants associated with power plant emissions have been linked to a variety of respiratory problems including irritation of the airways, difficulty breathing and decreased lung function. In general, the effect of pollutants is more severe among persons with preexisting respiratory diseases such as asthma and chronic obstructive pulmonary disease (COPD); persons with cardiovascular disease; and among older adults and children. Exposure to pollutants may lead to exacerbation and increased hospitalizations for respiratory illnesses among persons in these groups (NALBOH, n.d.; Gauderman, 2006).

A major concern is the inhalation of particulate matter. Airborne PM is made up of a mixture of solid and liquid particles suspended in air. Two types of PM are associated with the coal burning process. Primary PM is emitted directly into the air during combustion processes, whereas secondary PM is formed from complex reactions between gaseous emissions (primarily SO_2 and NO_X) and moisture and/or sunlight in the atmosphere (EPA, 2002). PM is further categorized by size. Particles larger than 2.5 micrometers (µm) are often referred to as “coarse” PM, and can include crustal dusts, pollen and spores. Upon inhalation, coarse particulates >10 µm are generally deposited in upper respiratory tract where they are cleared. PMcoarse refers to coarse particles between 2.5 and 10 µm which may penetrate into the thoracic cavity and lead to adverse health effects. Fine PM, or $PM_{2.5}$, refers to particles 2.5 µm and smaller. These are comprised of residual fly ash emissions generated by the combustion process and nitrates, sulfates, and their acid aerosols formed through atmospheric reactions following combustion (Brook et al., 2004; EPA, 2002). In the Eastern United States sulfates (which are formed from SO_2 released into the atmosphere) make up the largest component of $PM_{2.5}$ (USEPA, 2004). Power plants are responsible for about two thirds of SO_2 released (USEPA 2000). Because coal burning power plants account for approximately 90% of SO_2 emissions they are responsible for a large percentage of $PM_{2.5}$ pollution.

Epidemiological studies have consistently found a correlation between ambient $PM_{2.5}$ concentrations and increased morbidity and mortality (Dockery et al., 1993; Burnett et al., 1995; Schwartz and Morris, 1995; Lippmann et al., 2000; Samet et al., 2000; Schwarze et al., 2006). $PM_{2.5}$ has been linked specifically to increases in hospitalizations for asthma (Sheppard et al., 1999) and other respiratory outcomes (Dominici et al., 2006). However, several studies have also provided evidence that the coarse fraction of PM_{10} to have as strong an effect as fine particles on hospital admissions for asthma, COPD and total respiratory hospital admissions (see review by Brunekreef and Forsberg, 2005).

Another concern is ozone caused by coal burning power plants. Ozone, the principal component of "smog", is formed through the reaction of sunlight on NO_x and VOCs in the atmosphere. Ozone levels are most likely to be elevated on hot, sunny afternoons and during episodes of stagnant air. About half of all NO_x emissions are from motor vehicles, while power plants are responsible for about 25% of NO_x (USEPA, 2007).

Respiratory health effects of ozone have been observed in a substantial number of investigations, including human clinical, animal toxicological and epidemiologic studies. Short term ambient ozone exposure is associated with decrements in lung function and respiratory symptoms such as eye, nose, and throat irritation, coughing, wheezing, and shortness of breath. Long term exposure may cause permanent lung damage. People with preexisting pulmonary disease such as asthma, COPD, and chronic bronchitis are most sensitive to the effects of ozone. In the northeastern United States, summer ozone pollution has been associated with 10-20% of summertime respiratory hospital visits and admissions (USEPA, 2006).

In addition to O_3, and PM, other pollutants associated with coal plant emissions have been linked to respiratory health effects. These include: VOCs , NO_x, CO, and SO_2. In one study involving over one million junior high students in Taiwan, females exposed to higher levels of CO were found to be 2 times more likely to have asthma and males were found to be 1.8 times more likely to have asthma (Ho et al., 2007). The same study also found that monthly asthma attack rates increased as the concentration of NO_x, O_3, PM, CO and SO_2 increased. Anderson et al., (1997), found that, for all ages, the risk for COPD hospital admissions increased with increases in the daily mean levels of CO, black smoke, total suspended particulates, NO_2, and O_3. However, it is often difficult to distinguish between the roles that specific pollutants have on respiratory health since exposures occur together.

Information on respiratory disease in communities near the AES Greenidge power plant:
In 2005, Dr. David Carpenter prepared a one-page statistical summary of hospitalization rates for respiratory diseases in six ZIP codes on the western shore of Seneca Lake, near the facility (14441, 14527, 14415, 14891, 14837 and 14878). In this six ZIP Code area, Dr. Carpenter reported a 41% higher than expected hospitalization rate for chronic bronchitis and chronic obstructive pulmonary disease (COPD) as well as a 37% higher than expected rate for all forms of infectious respiratory disease (not defined in the summary). See Appendix B for the complete statistical summary.

OBJECTIVES

The objectives of this health consultation were to:

- Determine areas most likely impacted by emissions from the AES Greenidge coal-fired power station.
- Conduct a health statistics review of the rates of hospitalizations due to respiratory illness in the area(s) determined to be most likely to be impacted by pollutants from the AES Greenidge power plant. Illnesses reviewed included acute bronchitis; asthma; and COPD; including chronic bronchitis
- Compare these rates to rates of respiratory hospitalizations in other areas of the State and compare the findings to those of the previous analysis.

METHODS

Study areas:

Emissions from the facility were modeled by NYS DOH in consultation with staff from the New York State Department of Environmental Conservation to predict the area most likely affected by emissions from the AES Greenidge facility. The model accounted for meteorological conditions (such as wind direction and wind speed), local topography and facility characteristics (such as stack height). Within the area thought most likely to be affected by emissions from the facility, three areas (higher, moderate and lower potential exposure) were delineated to further stratify potential exposure levels. These areas, described in more detail in Appendix D, served as our three study areas. Additionally, we combined all three study areas in our evaluation.

ZIP codes were selected if the *population-weighted* centroid fell within the boundary of one of the three study areas. The higher potential exposure study area contained 5 ZIP codes: 14441, 14842, 14860, 14521, and 14541. The moderate potential exposure study area contained only ZIP code 14456; and the lower potential exposure study area contained ZIP codes 13165 and 13148. The ZIP code containing the facility, 14527, was not included in the study since the majority of its population resides in the city of Penn Yan which lies outside the area estimated to be most likely impacted by the facility emissions and thus the population weighted centroid of the ZIP code was not within any study area. Figure 2 shows the ZIP codes selected for the three study areas.

Study population:
The study populations consisted of individuals residing within the ZIP codes that fell within the areas described above between 1986 and 2005. Population estimates for the study areas were tabulated from the 1990 and 2000 US Census block data. For the years 1986-1995, the 1990 Census data were used to estimate population, while for 1996-2005 the 2000 Census data were used. For census blocks that fell completely within a study area the entire population was included. For those blocks that fell partially within a study area, only the proportion of the population equal to the proportions of the block's area within the study area boundary was included.

Health outcomes studied:
NYS DOH evaluated hospitalization discharge rates, within the ZIP codes selected for each of the study areas, for respiratory illnesses previously linked to air quality. This included acute bronchitis; asthma; and COPD; including chronic bronchitis and emphysema for the years 1986-2005. Table 1 lists the ICD-9-CM codes evaluated for each respiratory outcome.

The source of the hospitalization data was the NYS DOH Statewide Planning and Research Cooperative System (SPARCS), established in 1979 to collect detailed records on discharges from hospitals located in New York State. Only persons admitted to the hospital are included in this dataset. Persons seen in the Emergency Room but not admitted are not included in this dataset and thus were not included as part of this analysis. We obtained data for individuals admitted to the hospital between 1986 and 2005 with one of the primary diagnoses listed in Table 1. The primary diagnosis represents the illness for which the person was admitted to the hospital.

Selecting a reference population:
A reference population was used to generate expected rates of respiratory disease hospitalizations to compare to those in the study population. The reference population was selected from an area thought to be similar demographically, socioeconomically and in urbanicity to the study population. Since the study areas are predominantly rural we excluded counties with major urban areas. Census demographics for the study and reference populations are given in Tables 2 and 3. The reference population was defined as individuals residing in New York State, excluding those counties which included urban areas of 100,000 or more as defined by the 2000 US Census in this analysis. Excluded were counties which contained the New York City (NYC) metropolitan area (Bronx, Kings, New York, Queens, Richmond, Nassau, Suffolk, Westchester, Rockland and Putnam); the Newburg-Poughkeepsie area (Orange and Dutchess); the Albany area (Albany, Schenectady, Rensselear and Saratoga); Utica (Onedia); Syracuse (Onondaga); Binghamton (Broome); Rochester (Monroe) and the Buffalo area (Erie and Niagara). Population estimates for the 40 counties that made up the reference population were obtained from the 1990 and 2000 US Census in a manner similar to that used for the study population.

Calculating expected number of cases:
Eighteen, five-year age groups (0-4 through 80-85 and 85 and older) were used to calculate the expected number of cases. The rates of respiratory illness in the reference population were then multiplied by the study area populations for each age group. A single expected number for each respiratory disease was then generated by summing the age specific strata. Expected numbers of respiratory hospitalizations were used to calculate age-adjusted standardized rate ratios (SRR) described below. The expected number of respiratory illness was estimated for individuals of all ages combined as well as for seven specific age group categories (0-4, 5-14, 15-24, 25-54, 55-64, 65-74, 75+). Calculation of rates for these specific age groups was done primarily to evaluate the rates of respiratory disease among children as well as older residents who may be more susceptible to the effects of air pollution.

Statistical analysis:
NYS DOH compared hospitalization discharge rates for respiratory illnesses among persons living in the study areas to those of the reference population using indirect standardization. Age-adjusted standardized rate ratios (SRR) were calculated by dividing the observed number of respiratory disease hospitalizations by the expected number of respiratory disease hospitalizations. If the SRR was greater than one then there was an excess of respiratory disease in the study population compared to the reference population. If the SRR was less than one then there was a deficit of respiratory disease in the study population. The magnitude of the excess or deficit can also be determined from the SRR. For instance, if twice as many cases are observed as expected, it would result in an SRR of 2.0, while a 50% excess in cases observed, compared to the number expected, would result in an SRR of 1.5. On the other hand, if only half the expected number of cases were observed, this would result in an SRR of 0.5. The Poisson probability distribution, which is used to describe the occurrence of rare events, was used to calculate 95% confidence intervals (95% CI). The 95% CI is the range in which there is a 95% chance that the true SRR is between the lower and upper confidence limits. In addition, if the 95% CI does not include 1.0 we conclude that the SRR is significantly higher or lower than expected. Average annual age-adjusted hospitalization discharge rates per 100,000 persons are also shown for comparative purposes. SRRs and hospitalization discharge rates were calculated for both the entire population as well as the 7 age groups described above for each of the study areas.

RESULTS

Tables 2 and 3 present demographic and socioeconomic characteristics three study areas and the reference area. The total population of the lower potential exposure area was about 7,000 – 8,000 while the population of the other two areas was slightly more than 20,000. Overall the study areas had similar demographic and racial/ethnic make up as compared to the reference area. In general, the study areas (including the combined) and the reference area were somewhat less diverse than the state as a whole but compared favorably to each other. In addition, the median household income of the study areas, although somewhat more modest than that of New York State was nearly identical to that of the reference population in both 1990 and 2000. Poverty rates between the reference area and the study areas were similar as well.

Age-adjusted SRRs of the respiratory hospitalizations are shown in Tables 4-7. For simplicity of the report age-stratum specific rates of respiratory disease are not shown here, however they are available by request from the author (see contact information included in the fact sheet.). Almost all of the age-adjusted respiratory hospitalization outcomes evaluated were lower than expected in all three study areas and many of these were significantly lower than expected. In fact only COPD (NOS) in the lower potential exposure area had a hospitalization rate higher than expected.

In the higher potential exposure area, age-adjusted rates of hospital admissions for all respiratory conditions examined were lower than or similar to what was expected. Overall, acute bronchitis was significantly lower than expected (SRR = 0.86). For age specific rates, almost all age groups examined showed lower than expected acute bronchitis rates with the 0-4 age group having significantly lower than expected rates (SRR = 0.65). One age group (65-74) did, however, experience a 40% higher than expected rate of acute bronchitis which was statically significant. Asthma rates were significantly lower than expected in all age groups in this study area and the overall age-adjusted asthma rate for the area was less than half of what was expected (SRR = 0.42). Total COPD, chronic bronchitis and emphysema were all slightly lower than expected although none significantly so. When broken down by age group a significant deficit was noted for emphysema among the 65-74 age group (SRR = 0.26). In addition, there was a statistically significant deficit of chronic bronchitis among the 65-74 age group (SRRs = 0.73) while a significant excess was observed among 25-54 year olds (SRR = 2.42). These rates tended to offset each other resulting in an overall age-adjusted rate for chronic bronchitis which was similar to expected. Rates of total COPD followed a similar pattern as chronic bronchitis rates across the age categories.

Hospitalization rates among residents in the moderate potential exposure study area are given in Table 5. As was the case with the closer study area, total age-adjusted hospitalizations for acute bronchitis were significantly lower than expected (SRR = 0.82). Again almost all age groups had lower than expected rates with 0-4 year olds and 25-54 year olds having significantly lower than expected rates (SRRs = 0.49 and 0.68 respectively). However, those in the 55-64 age group had significantly elevated rates of acute bronchitis (SRR = 1.59). The overall age-adjusted asthma hospitalization rate was significantly lower than expected (SRR = 0.74). Rates of asthma among those 0-4 and 65 and older were also significantly lower than expected. The age-adjusted overall rates of chronic bronchitis (SRR = 0.87), emphysema (SRR = 0.38) and total COPD (SRR = 0.89) were also all significantly lower than expected. Significant deficits of chronic bronchitis and emphysema were seen among those 65-74 and 75 and older, which are the ages where the highest numbers of these types of respiratory illness occur. A significant excesses of COPD NOS (SRR = 1.42) among those 55-64 was also observed.

In the lower potential exposure area hospitalization rates of all groups of respiratory illnesses examined except for COPD (NOS) were significantly lower than expected.

Hospitalizations for acute bronchitis (SRR = 0.62), asthma (SRR = 0.51), total COPD (SRR = 0.81) chronic bronchitis (SRR = 0.66) and emphysema (SRR = 0.54) were all significantly lower than expected. Acute bronchitis was significantly lower than expected in all age groups except for 15-24 year olds where it was still about half the expected rate. Asthma hospitalizations were significantly lower than expected among all age groups. Chronic bronchitis hospitalizations were significantly lower than expected in all age groups above 25 which accounted for all but two hospitalizations. Emphysema was significantly lower than expected among those 65-74 and 75 and older. Only COPD (NOS) was higher than expected (overall SRR = 1.42; 95% CI 1.27 – 1.58) and all age groups over 25 showed significant elevations (there were no cases below 25). However, when COPD (NOS) was combined with chronic bronchitis and emphysema to calculate total COPD, the rates of total COPD were significantly lower than expected, as noted above. Among the 65-74 and 75 and older age groups total COPD hospitalizations were significantly lower than expected and none of the individual age group categories showed significant elevations.

When all areas were combined and rates of respiratory hospitalizations were analyzed, patterns generally followed those observed among the three individual areas. Overall hospitalization rates for acute bronchitis (SRR = 0.74), asthma (SRR = 0.59) total COPD (SRR = 0.87) chronic bronchitis (SRR = 0.80) and emphysema (SRR = 0.49) were all significantly lower than expected. Only COPD (NOS) was higher than expected (overall SRR = 1.21) and this was driven entirely by the excess observed in the lower potential exposure area.

DISCUSSION

The respiratory illnesses examined in the current analysis all fall under the broad category of obstructive lung diseases, meaning conditions exist such as obstructions or blockages of the airways, which affect the rate of air flow in the lungs. Acute bronchitis is an inflammation of the airways in the lungs, lasting up to 2-3 weeks, and is usually caused by a viral or bacterial infection. It was included in the current review because it is thought that exposure to pollutants may make individuals more susceptible to respiratory infections resulting in acute bronchitis. Asthma is an inflammation of the airways caused by a reaction to various triggers which leads to a constriction of the airways. Asthma attacks can be caused by a number of environmental factors including cigarette smoke; allergens such as pollen, mold and animal dander; as well as air pollution. COPD includes two diseases chronic bronchitis, a chronic inflammation of the airways; and emphysema, the destruction of the alveoli. Smoking is the primary cause of COPD accounting for 80-90% of COPD mortality; however, air pollution is also a risk factor for COPD.

The results of the study show a general pattern of lower than expected rates of respiratory hospital admissions across all three study areas examined. Among the three study areas only COPD (NOS) in the lower potential exposure area was higher than expected. COPD (NOS) is a classification that is used for coding purposes when physicians don’t specify which form of COPD a patient has. All other respiratory conditions examined were lower than expected and in most cases they were significantly lower. When examined by increasing distance from the facility to the study area, age-adjusted rates for both chronic and acute bronchitis fell with increasing distance. While this could be suggestive of a dose response, it should be noted that the differences in rates between the first two areas were relatively small. However, both chronic and acute bronchitis were much lower in furthest study area (lower potential exposure area).

These results are in contrast to those in Dr. David Carpenter's statistical summary (Appendix B). Our results showed consistently lower than expected rates of hospital admissions for most respiratory illnesses evaluated, whereas the statistical summary reported higher than expected rates of chronic bronchitis and COPD (combined) as well as all forms of infectious respiratory disease. While definitions (i.e., ICD codes) of diagnoses examined in the previous study were not provided in the summary, making comparison of individual disease rates difficult, the overall trends in respiratory hospitalizations were not similar. For the diagnoses reported, the previous analysis showed a 41% increase in chronic bronchitis and COPD combined, while we found 15% fewer than expected cases of chronic bronchitis and COPD (NOS) combined among all study areas, a result that was also statistically significant. The previous analysis also reported a 37% increase in all forms of infectious respiratory disease. While we did not look at these diagnoses as a group, we did find that acute bronchitis, which is generally caused by infectious agents, was 29% lower than expected among all study areas.

Although the similar study designs were employed and the source of the health data was the same (SPARCS hospitalization data) for our health statistics review and the statistical summary done by Dr. Carpenter in 2005, there were several methodological differences between the two investigations that may have lead to the differences in findings. We attempted to improve on the previous analysis in several areas where additional data and resources were available. For example, we used an air model to identify the population most likely to be impacted by emissions from the facility. The result was that different ZIP codes were used to define each study area leading to different populations being evaluated. Different comparison populations were also used to generate age-stratified rates which were used to calculate the expected hospitalization rates. In addition, the current statistical review used 20 years worth of data, whereas Dr Carpenter's review looked at 8 years of data. In general, a longer time period would provide a greater number of cases for evaluation, which would lead to more stable estimates of hospitalization rates. Finally, somewhat different respiratory outcomes were evaluated, and the methodology used to select individuals with respiratory conditions was different in each analysis. A detailed description of these methodological differences is provided in Appendix E. Because of these differences we might not expect to see similar results between these two statistical analyses.

Age-adjusted rates of COPD (NOS), however, increased with increasing distance from the facility. While these results seem counter intuitive if the facility was in fact contributing to respiratory illness in the area, several possible explanations exist. Other studies of public health impacts of power plant emissions which used a more complex modeling programs have found that concentrations of primary pollutants (SO_2, NO_x and primary PM) were highest within 5 miles of the plant while concentrations of secondary pollutants (O_3 and secondary PM) peaked about 20 miles from the plant (Levy et al., 2004). While dispersion of pollutants from no two plants is exactly alike, this shows that concentrations of certain pollutants may not necessarily be highest closest to the facility. Because the AES facility has tall stacks (250 feet) the estimated impacts of stack emissions very close to the facility are relatively limited under most conditions.

Another possible explanation for the patterns of COPD (NOS) hospitalizations observed could be related to the reporting of COPD (NOS) by hospitals that serve those in the lower potential exposure area. It is possible that some of the cases recorded as COPD (NOS) should have been classified as either chronic bronchitis or emphysema, the two conditions that make up the majority of COPD. Both of the latter conditions were significantly lower than expected in this study area. Biologically it does not seem plausible that some forms of COPD would be significantly elevated while others were significantly lower than expected. It should also be noted that when all three conditions were combined, total COPD was still significantly lower than expected in the area.

Overall there were 115 age-specific tests conducted on individual diseases in the three study areas (7 age categories x 5 diseases x 3 study areas). Because we used 95% confidence intervals to determine statistical significance we would expect to see about six of the tests to show significant excesses or deficits of disease. Eight of the age-specific tests were significantly higher than expected which is slightly more than we would expect. However, there were no patterns across the study areas in any age group nor were there any consistent elevations within any study area. On the other hand, there were significant deficits in 43 of the age-specific individual tests. Acute bronchitis among children age 0-4; asthma among ages 0-4 and those over 65; chronic bronchitis, emphysema and overall COPD among those 65-74 were all significantly lower than expected across the three study areas.

It is not surprising to see asthma rates significantly lower than expected in every age group in all three study areas. Asthma rates in general are lower in this part of the state than in other areas of upstate New York. According to data published on the NYS DOH website, there were approximately 6.9 asthma hospitalizations per 10,000 persons for the years 2003-2005 in the 8 ZIP codes that made up the two study areas and there were 8.0 asthma hospitalizations per 10,000 persons in the three counties that the study area ZIP codes were in (NYS DOH, 2007). Asthma rates in the reference counties of upstate New York were approximately 60% higher than in the study area for the same period. This may be due to the large percentage of the population of the study area residing in rural areas compared to the population of some counties of the reference areas. Less traffic and related pollution may result in better air quality overall than in urban areas. However, we attempted to control for this by choosing 40 upstate counties that had no major urban areas as our reference area. The counties chosen were very similar to the study area in terms of urbanicity as well as sociodemographic characteristics.

Limitations
The study design employed is known as an ecological study. This study design does not prove or disprove hypotheses regarding the relationships between power plant emissions and respiratory health, but rather can suggest whether further more rigorous study may be warranted. Because this type of study evaluates the risk of disease within a population, it is not possible to link the occurrence of a disease in a particular individual to an exposure.

No measures of individual exposure were used nor were daily behaviors or activities of individuals in the area known. Personal activities such as the amount of time that someone spends outdoors could affect the amount of actual exposure that a person received. In addition, if a person spends a significant amount of time at another location such as work, this would not be taken into account by the study design. Additionally, the area thought most likely to be impacted by emissions from the power plant was identified through the use of a model. Although the model did take factors into account such as wind patterns, local topography and facility characteristics, actual measured or monitoring data were not available to verify the model selection of areas impacted. Nor were any monitoring data or other environmental measurements used to determine actual levels of pollutants in the area. While the New York State Department of Environmental Conservation does maintain a statewide network of air monitors that provide daily and weekly information on air pollutants such as particulate matter, O_3, SO_2 and NOx, none of these monitors are located in the three county area included in the study.

Other factors that can affect the rates of rates of respiratory disease were not taken into account in this study. These include risk factors such as medical history, dietary and lifestyle choices such as smoking, and other environmental or occupational exposures to pollutants, dusts and other respiratory irritants. Smoking is the major risk factor for COPD accounting for up to 85% of all cases. If smoking rates among the study population were significantly different than the reference population then a valid comparison of underlying respiratory disease rates is not be possible. A review of county level smoking rates from the CDC's Behavioral Risk Factor Surveillance System showed that the three counties that parts of the study area fell into had similar smoking rates compared to the 40 county reference area. This lends some reassurance that differences in smoking rates did not confound the results, although the population of the study area made up only about 30% of population of these three counties.

In addition, differences in certain demographic and socioeconomic status characteristics that may have existed between the study area population and the reference population were not taken into account. Only age at time of admission was adjusted for in this study. Certain respiratory diseases such as asthma have been shown to vary by race, income levels and urbanicity. Demographics of the study area and the reference area were evaluated prior to the start of the study to assure that they were similar (see Tables 2 and 3), however this is not as rigorous as controlling for these variables at the individual level. While the SPARCS databases do contain information on race and ethnicity that could be used in an analysis, it contains no information on income, education or other indicators of socioeconomic status other than type of medical insurance.

The selection of the reference area was based on the lack of metropolitan areas greater than 100,000 in the counties selected. While certain factors such as traffic density and socioeconomic differences may have been controlled by this selection, it did not take into account whether or not another power plant or other industrial facility with similar emissions may have been present in the reference area.

In the study we evaluated 20 years of hospitalization data, from 1986-2005. The facility characteristics have changed somewhat over the course of the study period. Certain measures were taken to reduce air emissions of pollutants (see Appendix C). However, no attempt was made, in the current study, to look at any temporal trends that may have existed in respiratory hospitalizations in the area over the 20 year period.

It is important to realize that the measures available for use in this study, hospitalizations for several respiratory diseases, represent a severe endpoint. These represent neither the incidence nor prevalence of asthma, COPD or bronchitis within this community. Cases of these respiratory diseases seen by a family physician, clinic or even in the emergency department would not be counted in these totals. Only when a case becomes severe enough to require inpatient hospitalization, would it be registered in this database. Because of this, it is likely that most cases reported, especially in adults, represent not the onset of the disease but rather a severe exacerbation of an existing respiratory condition.

Finally the data source itself, the SPARCS database of hospital admissions, has limitations in the way cases are reported. For confidentially reasons no personal identifiers such as name and address are included with the records. Because of this it is impossible to identify readmissions for the same disease. Thus, if an individual is admitted to the hospital many times over the course of the study period then that individual would be counted multiple times. However, there is no reason to believe that readmission rates among the study area population were any different than among the reference population.

Conclusion

We found that hospital discharge records for nearly all respiratory disease outcomes evaluated were lower in area thought most likely to be impacted by emissions from the AES power plant. This is reassuring, suggesting that an elevation in severe respiratory illnesses related to exposures from the AES facility did not occur. None the less, more subtle adverse respiratory effects may have occurred in the exposed population. Power plant emissions have been associated with decreased respiratory health and any reductions in emissions from power plants should benefit the public’s health.

While COPD (NOS) rates were elevated, this was driven by elevations in the lowest exposure area. Furthermore, rates of total COPD, which includes COPD (NOS) as well as chronic bronchitis and emphysema, were lower than expected in this study area.

Several limitations of this type of study described above may have prevented us from seeing an increase of respiratory disease in the study area if an effect truly did exist.

Most limiting perhaps is the lack of individual level smoking information on those in the study and reference populations since smoking is so closely related to many of the chronic respiratory diseases examined.

Recommendations

These findings are reassuring in that additional detailed health studies are probably not warranted at this time. This is also supported by the fact that additional efforts to reduce power plant emissions at AES Greenidge are underway. The NYSDOH will continue to monitor respiratory outcomes among the population through ongoing environmental health surveillance activities in these areas. In addition, we will continue to be vigilant in addressing health concerns for respiratory illness that may be related to power plant emissions.

Public health actions

The installation of state-of-the-art pollution control devices in response to the landmark agreement between AES and the State of New York in 2005 (see Appendix C) will substantially reduce emissions of SO_2 and NO_X from this facility. The new pollution control devices have been installed and are currently being tested. New York State will continue to be aggressive in its actions to limit emission from coal burning power plants throughout the state and remains committed in its efforts to obtain national emissions reductions from power plants.

REFERENCES

American Thoracic Society. 2000. What constitutes an adverse health effect of air pollution? *American journal of respiratory and critical care medicine*, 161: 665–673.

Anderson HR, Spix C, Medina S, Schouten JP, Castellsague J, Rossi G, et al. 1997. Air pollution and daily admissions for chronic obstructive pulmonary disease in six European cities: results from the APHEA project. *Eur Respir J*, 10:1064-71.

Brook RD, Brook JR, Rajagopalan S. 2003. Air pollution: the "heart" of the problem. *Curr Hypertens Rep*, 5:32-39.

Brook RD, Franklin B, Cascio W, Hong Y, Howard G, Lipsett M, et al. 2004. Air pollution and cardiovascular disease: a statement for healthcare professionals from the Expert Panel on Population and Prevention Science of the American Heart Association. *Circulation*, 109(21):2655-2671.

Brunekreef B, Hogate ST. 2002. Air pollution and health. *Lancet*, 360:1233-1242.

Brunekreef B, Forsberg B. 2005. Epidemiological evidence of effects of coarse airborne particles on health. Eur Respir J. Aug;26(2):309-18.

Burnett RT, Dales R, Krewski D, Vincent R, Dann T, Brook JR. 1995. Associations between ambient particulate sulfate and admissions to Ontario hospitals for cardiac and respiratory disease. *Am J Epidemiol*, 142: 15-22.

Dockery DW, Pope CA, Xu X, Spengler JD, Ware JH, Fay ME, et al. 1993. An Association between Air Pollution and Mortality in Six U.S. Cities. *New Eng J Med*, 329(24):1753-1759.

Dominici F, Peng RD, Bell ML, Pham L, McDermott A, Zeger SL, Samet JM. 2006. Fine particulate air pollution and hospital admission for cardiovascular and respiratory diseases. JAMA. Mar 8;295(10):1127-34.

Gauderman, JW. 2006. Air Pollution and Children – An Unhealthy Mix. *N Engl J Med*, 355(1):78-79.

Ho WC, Hartley WR, Myers L, Lin MH, Lin YS, Lien CH, Lin RS. 2007. Air pollution, weather, and associated risk factors related to asthma prevalence and attack rate. *Environm. Res*., doi:10.1016/j.envres.2007.01.007 (In Press).

Levy J, spengler JD, Hlinka D, Sullivan D. 2000. Estimated public health impacts of criteria air emissions from the Salem Harbor and Brayton Point power plants. Commissioned by Clean Air Task Force, 2000.

Lippmann M, Ito K, Nadas A, Burnett RT. 2000. *Association of particulate matter components with daily mortality and morbidity in urban populations. Health Effects Institute Report No. 95*. Health Effects Institute, Cambridge, MA.

National Association of Local Boards of Health (NALBOH). (n.d.) Environmental Health Primer: Air Quality. Retrieved March 8, 2007 from http://www.cdc.gov/nceh/ehs/Docs/NALBOH%20Web/NALBOH-2.pdf

New York State Department of Health (NYS DOH). 2007. Asthma Hospital Discharge Data in New York State by County and ZIP Code (2003-2005). Retrieved August 14, 2007 from http://www.health.state.ny.us/statistics/ny_asthma/

Pope CA. 2000. Epidemiology of fine particulate air pollution and human health: biologic mechanisms and who's at risk? *Environ Health Perspect*,108:713-723.

Samet JM, Zeger SL, Dominici F, Curriero F, Coursac I, Dockery DW, Schwartz J, Zanobetti A. 2000. *The national morbidity, mortality, and air pollution study, part II: morbidity, mortality, and air pollution in the United States. Health Effects Institute Report No. 94, Part II*. Health Effects Institute, Cambridge, MA.

Schwartz J, Morris R. 1995. Air pollution and hospital admissions for cardiovascular disease in Detroit, Michigan. *Am J Epidemiol*, 142:23-35.

Schwarze PE, Ovrevik J, Lag M, Refsnes M, Nafstad P, Hetland RB, Dybing E. 2006. Particulate matter properties and health effects: consistency of epidemiological and toxicological studies. *Hum Exp Toxicol*, 25:559-579.

Sheppard L, Levy D, Norris G, Larson TV, Koenig JQ. 1999. Effects of ambient air pollution on nonelderly asthma hospital admissions in Seattle, Washington, 1987-1994. Epidemiology. Jan;10(1):23-30.

US Environmental Protection Agency (US EPA). 1998. Study of Hazardous Air Pollutant Emissions from Electric Utility Steam Generating Units—Final Report to Congress. Volume 1. US EPA Office of Air Quality Planning and Standards. February 1998. Publication number: EPA 453/R98-004a.

US Environmental Protection Agency (US EPA). 2000. SO_2 - How sulfur dioxide affects the way we live and breathe. Office of Air Quality Planning and Standards. November 2000. Publication number: EPA- 456/F-99-005.

US Environmental Protection Agency (US EPA), Office of Research and Development. 2002. *Primary Particles Generated by the Combustion of Heavy Fuel Oil and Coal: Review of Research Results from EPA's National Risk Management Research Laboratory*. Retrieved March 6, 2007 from http://www.epa.gov/appcdwww/aptb/EPA-600-R-02-093.pdf

US Environmental Protection Agency (US EPA). 2004. The particle pollution report. Current understanding of air quality and emissions through 2003. US EPA Office of Air Quality Planning and Standards. December 2004. Publication number: EPA 454-R-04-002.

U.S. Environmental Protection Agency (US EPA). 2006. Air Quality Criteria for Ozone and Related Photochemical Oxidants. February, 2006. EPA/600/R-05/004aF.

US Environmental Protection Agency (US EPA). 2007. Review of the National Ambient Air Quality Standards for Ozone: Policy Assessment of Scientific and Technical Information OAQPS Staff Paper. January 2007. Publication number:EPA-452/R-07-003

Viegi G, Maio S, Pistelli F, Baldacci S, Carrozzi L. 2006. Epidemiology of chronic obstructive pulmonary disease: Health effects of air pollution. *Respirology*, 11:523-532.

PREPARERS OF THE REPORT

New York State Department of Health Authors

Steven Forand
Research Scientist
Bureau of Environmental and Occupational Epidemiology

Randi Walker
Research Scientist
Bureau of Toxic Substance Assessment

Gwen Babcock
Research Scientist
Bureau of Environmental and Occupational Epidemiology

Patricia Bessler
Research Scientist
Bureau of Environmental and Occupational Epidemiology

Acknowledgements

This study was supported, in part, by ATSDR and the Centers for Disease Control and Prevention through a Cooperative Agreement Grant to NYS DOH entitled "Program to Conduct and Coordinate Site-specific Activities" (U61/ATU200002-18 PA AA257 NY State DOH).

The authors would like to thank the following people for their contribution to this project. Leon Sedefian, Chief, Impact Assessment and Meteorology Section, NYSDEC Division of Air Resources, who provided technical advice for the development of the model which was used to determine the areas of potential impact from the facility. Aubrey Stimola, who did much of the background research on the AES facility and the history of pollution control at the site. Shao Lin, Valerie Haley, Syni-An Hwang, Judy Abbott, Tony Grey and Dan Luttinger of NYSDOH and staff of ATSDR provided reviews and comments on the final report.

Agency for Toxic Substances and Disease Registry

ATSDR Regional Representative
Arthur Block
Senior Regional Representative
Region 2
Office of Regional Operations

ATSDR Technical Project Officer
Greg Ulirsch
Senior Environmental Health Scientist
Division of Health Assessment and Consultation

Table 1. Respiratory outcomes and ICD-9-CM codes examined in the study.

Respiratory Outcome Examined	**ICD-9-CM codes**
Acute Bronchitis	466.0, 466.1, 466.11, 466.19
Chronic Bronchitis	491.0, 491.1, 491.2, 491.20, 491.21, 491.8, 491.9
Emphysema	492.0, 492.8
Asthma	493.00, 493.01, 493.10, 493.11, 493.20, 493.21, 493.90, 493.91, 493.02, 493.12, 493.22, 493.92
COPD (NOS)*	496

* Chronic Obstructive Pulmonary Disease (Not Otherwise Specified)

Table 2: Demographics of the study areas and the reference area in 1990.					
	1990[1,2]				
Census Demographics	**Higher Potential Exposure Area (ZIP Codes 14441, 14842, 14860, 14521, 14541)**	**Moderate Potential Exposure Area (ZIP Code 14456)**	**Lower Potential Exposure Area (ZIP Codes 13165, 13148)**	**All Study Areas Combined**	**Reference Area 40 Predominantly Rural Counties in Upstate NY**
Total Population	8,129	20,435	21,788	50,352	2,654,479
Percent Male	50.7%	47.8%	48.4%	48.8%	49.4%
Percent Female	49.3%	52.1%	51.6%	51.2%	50.6%
Age Distribution					
<6 years	9.2%	8.2%	8.9%	8.6%	8.6%
6-19 years	20.6%	19.3%	19.5%	19.6%	20.7%
20-64 years	55.6%	56.6%	56.7%	56.5%	57.2%
>64 years	14.6%	15.9%	14.9%	15.2%	13.4%
Race/Ethnic Distribution					
White	93.2%	91.3%	98.6%	94.8%	95.5%
Black	4.4%	6.3%	<1%	3.5%	2.6%
Native American	<1%	<1%	<1%	<1%	<1%
Asian	1.2%	<1%	<1%	<1%	<1%
Pacific Islander	<1%	<1%	<1%	<1%	<1%
Other	<1%	1.4%	<1%	<1%	<1%
Multi-Racial	-	-	-	-	-
Percent Hispanic	2.3%	3.3%	<1%	2.0%	1.9%
Percent Minority*	8.1%	10.2%	1.9%	6.3%	5.5%
Economic Description					
Median household income	$26,695	$26,341	$28,905	$27,380	$27,220
Percent below poverty level	11.2%	13.8%	10.9%	12.2%	11.7%
Median house value	$52,800	$63,100	$57,300	$59,200	$65,100

* Minority includes Hispanics, African-Americans, Asian-Americans, Pacific Islanders and Native Americans.

1. US Bureau of the Census. *1990 Census of population and housing summary tape file 1 (STF1)*. US Department of Commerce. 1991.
2. US Bureau of the Census. *1990 Census of population and housing summary tape file 3 (STF3).* US Department of Commerce. 1992.

Table 3: Demographics of the study areas and the reference area in 2000.

Census Demographics	2000[3,4]				
	Higher Potential Exposure Area (ZIP Codes 14441, 14842, 14860, 14521, 14541)	**Moderate Potential Exposure Area (ZIP Code 14456)**	**Lower Potential Exposure Area (ZIP Codes 13165, 13148)**	**All Study Areas Combined**	**Reference Area 40 Predominantly Rural Counties in Upstate NY**
Total Population	7,612	20,287	21,885	49,754	2,692,704
Percent Male	53.9%	47.5%	48.8%	49.1%	49.8%
Percent Female	46.1%	52.5%	51.2%	50.9%	50.2%
Age Distribution					
<6 years	7.2%	7.2%	7.1%	7.1%	7%
6-19 years	20.7%	21.1%	19.5%	20.3%	21%
20-64 years	59.1%	55.9%	57.6%	57.1%	58.1%
>64 years	13.1%	15.8%	15.9%	15.4%	13.9%
Race/Ethnic Distribution					
White	88.6%	86.1%	96.8%	91.2%	93.5%
Black	7.3%	7.4%	<1%	4.5%	3%
Native American	<1%	<1%	<1%	<1%	<1%
Asian	<1%	1.2%	<1%	<1%	<1%
Pacific Islander	<1%	<1%	<1%	<1%	<1%
Other	2.0%	2.4%	<1%	<1%	1%
Multi-Racial	1.4%	2.7%	1.0%	1.8%	1.2%
Percent Hispanic	4.2%	6.2%	1.4%	3.8%	2.7%
Percent Minority*	13.2%	16.3%	4.1%	10.5%	7.9%
Economic Description					
Median household income	$36,947	$35,960	$36,532	$36,360	$36,808
Percent below poverty level	12.4%	12.6%	11.0%	12.2%	12.4%
Median house value	$73,400	$79,200	$70,600	$74,400	$78,600

3. US Bureau of the Census. *2000 Census of population and housing summary file 1(SF1)*. US Department of Commerce. 2001.
4. US Bureau of the Census. *2000 Census of population and housing summary file 3 (SF3).* US Department of Commerce. 2002.

Table 4. Respiratory hospital admissions for 1986-2005 in the higher potential exposure area (ZIP codes 14441, 14842, 14860, 14521, and 14541).

Primary Diagnosis of Hospitalization	Observed	Expected	Standardized Rate Ratio	Lower 95%CI	Upper 95% CI	Hospitalization Discharge Rate in Study Area*	Hospitalization Discharge Rate in Reference Area*
Acute Bronchitis	**212**	**246.4**	**0.86**	**0.75**	**0.98**	**130.2**	**153.0**
Asthma	**103**	**244.5**	**0.42**	**0.34**	**0.51**	**66.1**	**156.0**
COPD (Total)	334	347.1	0.96	0.86	1.07	211.9	217.0
Chronic bronchitis	252	251.4	1.00	0.88	1.13	160.1	157.4
Emphysema	14	21.2	0.66	0.36	1.11	8.7	13.2
COPD (NOS)	68	74.6	0.91	0.71	1.16	43.0	46.4

***Average annual age-adjusted hospitalization discharge rate per 100,000 persons**

Table 5. Respiratory hospital admissions for 1986-2005 in the moderate potential exposure area (ZIP code 14456).

Primary Diagnosis of Hospitalization	Observed	Expected	Standardized Rate Ratio	Lower 95%CI	Upper 95% CI	Hospitalization Discharge Rate in Study Area*	Hospitalization Discharge Rate in Reference Area*
Acute Bronchitis	**537**	**657.9**	**0.82**	**0.75**	**0.89**	**123.5**	**153.0**
Asthma	**477**	**645.8**	**0.74**	**0.67**	**0.81**	**117.1**	**156.0**
COPD (Total)	**866**	**973.7**	**0.89**	**0.83**	**0.95**	**194.9**	**217.0**
Chronic bronchitis	**615**	**707.9**	**0.87**	**0.80**	**0.94**	**138.8**	**157.4**
Emphysema	**22**	**58.0**	**0.38**	**0.24**	**0.57**	**4.9**	**13.2**
COPD (NOS)	229	207.7	1.10	0.96	1.25	51.2	46.4

***Average annual age-adjusted hospitalization discharge rate per 100,000 persons**

Table 6. Respiratory hospital admissions for 1986-2005, in the lower potential exposure area (ZIP codes 13165 and 1314).

Primary Diagnosis of Hospitalization	Observed	Expected	Standardized Rate Ratio	Lower 95%CI	Upper 95% CI	Hospitalization Discharge Rate in Study Area*	Hospitalization Discharge Rate in Reference Area*
Acute Bronchitis	**438**	**709.4**	**0.62**	**0.56**	**0.68**	**93.2**	**153.0**
Asthma	**360**	**701.6**	**0.51**	**0.46**	**0.57**	**80.6**	**156.0**
COPD (Total)	**849**	**1043.4**	**0.81**	**0.76**	**0.87**	**177.1**	**217.0**
Chronic bronchitis	**498**	**756.9**	**0.66**	**0.60**	**0.72**	**103.8**	**157.4**
Emphysema	**34**	**62.9**	**0.54**	**0.37**	**0.76**	**7.3**	**13.2**
COPD (NOS)	**317**	**223.6**	**1.42**	**1.27**	**1.58**	**66.1**	**46.4**

***Average annual age-adjusted hospitalization discharge rate per 100,000 persons**

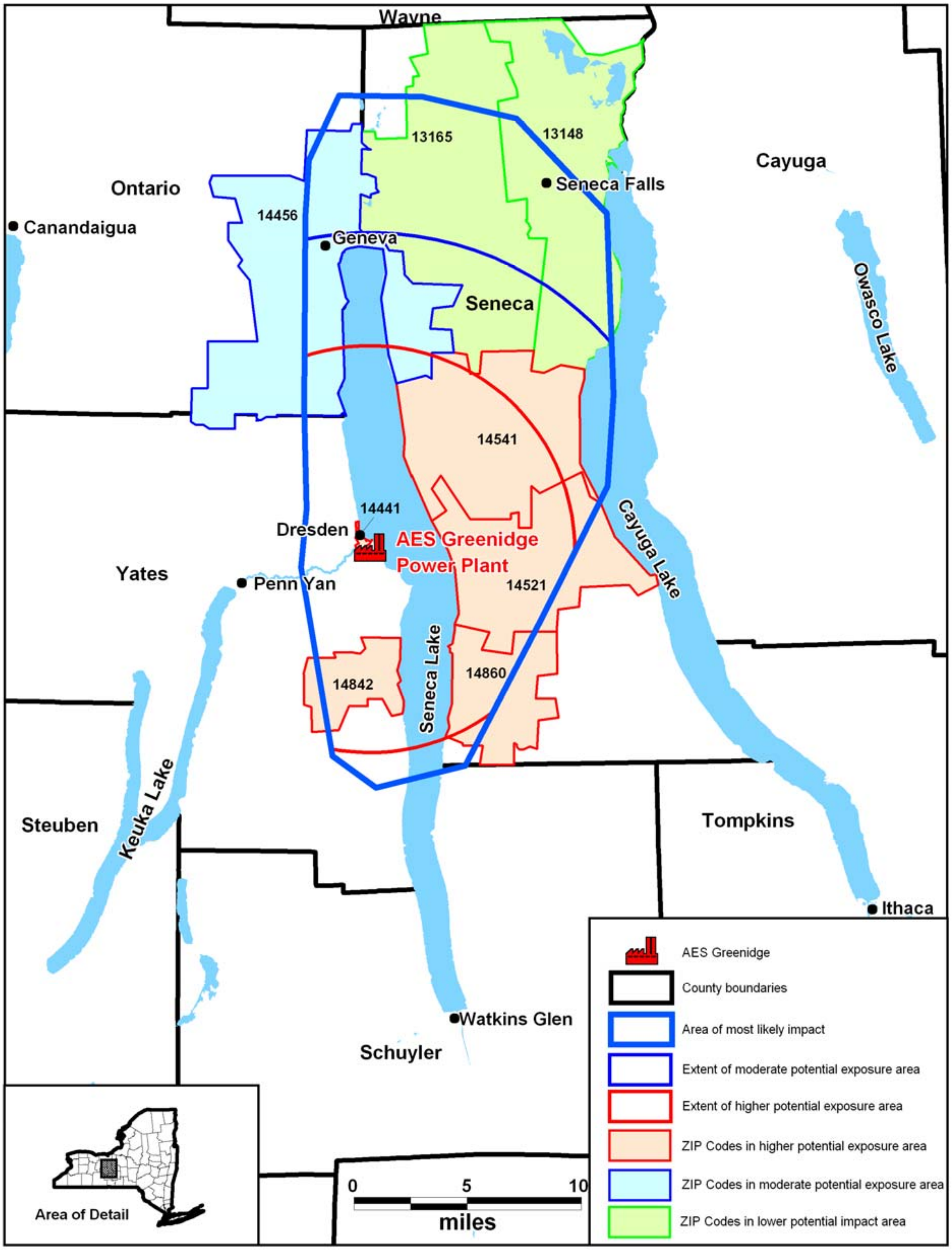
Table 7. Respiratory hospital admissions for 1986-2005, combining all study areas (ZIP codes14441, 14842, 14860, 14521, 14541, 14456, 13165 and 13148).

Primary Diagnosis of Hospitalization	Observed	Expected	Standardized Rate Ratio	Lower 95%CI	Upper 95% CI	Hospitalization Discharge Rate in Study Area*	Hospitalization Discharge Rate in Reference Area*
Acute Bronchitis	**1187**	**1613.7**	**0.74**	**0.69**	**0.78**	**111.3**	**153.0**
Asthma	**940**	**1591.8**	**0.59**	**0.55**	**0.63**	**92.8**	**156.0**
COPD (Total)	**2049**	**2364.3**	**0.87**	**0.83**	**0.91**	**189.4**	**217.0**
Chronic bronchitis	**1365**	**1716.2**	**0.80**	**0.75**	**0.84**	**126.4**	**157.4**
Emphysema	**70**	**142.1**	**0.49**	**0.38**	**0.62**	**6.5**	**13.2**
COPD (NOS)	**614**	**505.9**	**1.21**	**1.12**	**1.31**	**56.5**	**46.4**

***Average annual age-adjusted hospitalization discharge rate per 100,000 persons**

Figure 1. Map of the location of the AES facility and surrounding cities and villages.

Figure 2. Map of ZIP Codes selected for the higher, moderate and lower potential exposure study areas.



Appendix A

Dec-24-2005 01:00am From- T-036 P.002/002 F-896

12-21-05 14:55 From-CDC +4046397111 T-228 P.02/02 F-572

HILLARY RODHAM CLINTON
NEW YORK
SENATOR

RUSSELL SENATE OFFICE BUILDING
SUITE 476
WASHINGTON, DC 20510-3204
202-224-4451

COMMITTEES:
ARMED SERVICES
ENVIRONMENT AND PUBLIC WORKS
HEALTH, EDUCATION, LABOR, AND PENSIONS
SPECIAL COMMITTEE ON AGING

United States Senate

WASHINGTON, DC 20510-3204

December 16, 2005

2005 DEC 22 AM 11:44

ATSDR/DHAC/OD

Julie Louise Gerberding, M.D., M.P.H.
Administrator
Agency for Toxic Substances and Disease Registry
Department of Health & Human Services
1600 Clifton Road, N.E.
Atlanta, Georgia 30329

Dear Dr. Gerberding:

I write to request that the Agency for Toxic Substances and Disease Registry conduct a Public Health Assessment for the area around the AES power station in Dresden, New York.

Earlier this year, Dr. David O. Carpenter, director of the Institute for Health and the Environment at the University of Albany/SUNY published a study showing marked increases in respiratory ailments for six zip codes around the Dresden plant.

The study found a statistically significant 41 percent elevation in hospital diagnosis rates for chronic bronchitis and chronic obstructive pulmonary disease for six local zip codes (Dresden 14441, Penn Yan 14527, Bellona 14415, Dundee 14837, Watkins Glen 14891 and Rock Stream 14878) around Dresden. In addition, the study found a statistically significant 37 percent elevation for all forms of infectious respiratory diseases for these same areas.

These are troubling findings, and there is concern in these communities that emissions from the Dresden plant may be the cause of these elevated respiratory concerns. I believe that further study is warranted, and ask that you begin a study to examine these issues in more detail.

I look forward to your reply. Please contact Dan Utech (202-224-8365) on my staff if you have any question about this request.

Sincerely yours,

Hillary Rodham Clinton

Hillary Rodham Clinton

RECEIVED
DEC 21
35202

PRINTED ON RECYCLED PAPER

Appendix B

Statistical Summary from Dr. Carpenter's Preliminary Dresden (NY) Comparison

"The SPARCS data from the NYS Department of Health contains information about all of the diseases identified in every inpatient in state-regulated hospitals in New York (all but federal hospitals like the VA). This information is available to us with the age, sex, race and zip code of residence for each patient. Therefore we compared the rates of hospitalization for respiratory diseases in the six zip codes near the plant (14441, 14527, 14415, 14891, 14837 and 14878) to those in the "clean" zip codes reported in our previous studies (Seergev and Carpenter, *Environm Health Perspect* 113:756: 2005. This is not the perfect control, since these "clean" zip codes are those in upstate New York that do not contain any hazardous waste site on the state superfund list, which does not exclude coal-fired power plants. However it is the comparison group we have easily available. All calculations were based on rates of hospitalization diagnosis per 100,000 persons. After standardizing by age for the whole population, the incidence rate in the "clean" zip codes for chronic bronchitis and chronic obstructive pulmonary disease was 0.0078, while that in the six zip codes was 0.0109, this being 41% higher and statistically significant. The results for ages 0-54 years were not significantly different. For age 55-64, the rate in the "clean" zip codes was 0.0130, while that for the six zip codes was 0.0224 (72%) higher), for ages 65-74, 0.0346 for the "clean", and 0.0456 for the six (32% higher) and for age over 75 years 0.0614 for the "clean" and 0.0884 for the six (44% higher). All of these results were statistically significant. When we investigated all forms of infectious respiratory disease (which includes the two above), for all ages the rate was 0.0141 in the "clean" zip codes, and 0.0193 in the six (37% higher and statistically significant). There was a statistically significant elevation both in the ages listed above, and also in age 0-24 years, where the rate in the "clean" zip codes was 0.0036, as compared to 0.0055 (a 53% elevation). This result probably reflects respiratory infections primarily in young children. The elevation in hospitalization rates in the six zip codes was true for both men and women. We also investigated the effects of race, but there were too few minorities in the population to give any significant effects for races other than Caucasian."

David O. Carpenter, M.D.
Institute for Health & the Environment

Appendix C

History of generating station and pollution control measures

The Greenidge power plant was built in the 1930s for the New York State Electric and Gas Corporation (NYSEG), and was bought in 1999 by the AES Corporation. The facility's first generator, Unit 1, went into service in 1937. Additional generating units were built in 1939 (Unit 2), 1950 (Unit 3), and 1953 (Unit 4) to meet growing electricity demands in the area. In 1985, Units 1 and 2 were retired from service and their respective boilers and turbines removed from the premises (DOE, 2004).

The remaining generating units, Units 3 and 4, have a combined generating output of 161 megawatts (MW). Unit 3 consists of two dry-bottom, wall-fired, pulverized coal boilers (Boilers 4 and 5) which exhaust through a common stack. Unit 4 consists of one dry bottom, tangentially fired, pulverized coal boiler (boiler 6) which exhausts to another stack. Both Units 3 and 4 have a stack height of 250 feet, although the stack for Unit 3 begins 23 feet above ground level. Water for cooling is drawn from Seneca Lake, and returned via a discharge channel and the Keuka Outlet. The coal handling system encompasses coal delivery, transfer to hoppers, storage, crushing, and conveyer belt transportation to the boilers (DOE, 2004). All emissions from the plant are reported to NYS DEC as part of AES Greenidge's Titles IV and V permits (NYS DEC, n.d.).

All three boilers burn eastern bituminous pulverized coal as their primary fuel. Boiler 4 is permitted to burn up to 30% untreated wood and wood waste from furniture manufacturing**,** and #2 fuel oil, diesel oil, waste oil, and natural gas on an occasional or as-needed basis. Typical content for coal burned at the facility is as follows: 5.8-7.6% moisture content, 67.9-72.2% carbon, 3.9-4.8% hydrogen, 1.4-1.6% nitrogen, 0.9-2.9% sulfur, 7.9-13.5% ash, 4.7-5.0% oxygen and 0.07-0.10% chlorine (DOE, 2004). The Greenidge plant also began a biomass cofiring program in October 1994 (IEA, n.d.). Biomass co-firing involves replacing a portion of the coal that normally would have been used with biomass fuels such as wood waste either before or during the combustion process (DOE, 2006). Because biomass fuels have very little sulfur, SO_2 emissions are reduced proportionally to the amount of coal not used. NO_x emissions may also be somewhat reduced by the process.

Unit 3 and 4 are equipped with electrostatic precipitators to remove particulate matter from flue gas, thereby reducing emission of particulate matter to air. Until recently, sulfur dioxide (SO_2) from all three boilers has been controlled primarily by limiting the sulfur content of the coal fuel**.** Nitrogen oxides (NO_x) emissions have been controlled until recently by using an overfire air reburn system (air injected above the main burn zone) to reduce the production of NO_x in Unit 3; while Unit 4 had relied on two technologies to limit NO_x emissions. First, a gas reburn system which supplied both natural gas and overfire air, limited the production of NO_x further than overfire air alone. Second, an advanced gas reburn system was installed as part of a 1996 demonstration project to reduce NO_x emissions post-combustion. This process involved the injection of a nitrogen agent, in this case, ammonia (NH_3), to convert NO_x created in the fuel combustion process to nitrogen and oxygen in addition to gas reburn (DOE, 2004; Zamansky and Folsom, 1997). However, this system was able to achieve only modest NO_x reductions and has been discontinued. Neither Unit 3 nor 4 were equipped with scrubbers.

Latest pollutant control modifications

In January 2005, then New York State Governor George Pataki and Attorney General Eliot Spitzer announced two landmark agreements designed to substantially reduce emissions from six-upstate New York coal-fired electric generating plants. Overall goals are the reduction of NO_x emissions by 70% and SO_2 emissions by 90%, as well as the reduction of particulate matter for the protection of public health and the environment (NYS Office of the Attorney General (OAG), 2005a).

Included in these agreements, the operators of AES Greenidge facility in the Town of Torrey, NY agreed that Unit 3 would meet Best Available Control Technology (BACT) standards, re-power (with cleaner technologies), or shut down by 2009. In addition, a multi-pollutant control project (MCP project) was begun on Unit 4 during a scheduled outage at the plant in September 2006. If the objectives of the MCP can not be met, Unit 4 must also meet BACT standards, repower, or shut down by December 2009 (NYS OAG, 2005b).

The MPC project, part of the agreement between AES and NYS, will demonstrate control technologies to reduce emissions of NO_x, SO_2, mercury (Hg), particulate matter ($PM_{2.5}$ and PM_{10}), and acidic gases such as hydrochloric acid (HCl), sulfur trioxide (SO_3), and hydrogen fluorides (HF) at the AES Greenidge plant. Specifically, the new demonstration technologies will include: a circulating dry scrubber (CDS) with an activated carbon injection system to capture 95% of SO_2 emissions, up to 90% Hg, and 95% of acidic gases; a single-bed selective catalytic reduction (SCR) system (using urea injected into the boiler, which is converted to ammonia for use in the catalyst) in combination with low- NO_x combustion technology for NO_x control and; a selective non-catalytic reduction (SNCR) with urea injection and associated storage tank for additional NO_x control.

According to preliminary project and quarterly reports major construction on Unit 4 was completed in early 2007 (Connell, 2007a; Connell 2007b). Currently the Unit is undergoing a 20 month period of operation during which the performance of the system will be evaluated. The MCP project is part of a demonstration project approved and partially funded by the Department of Energy (DOE) (DOE, n.d.).

REFERENCES (Appendix C)

Connell, DP. 2007a. *Greenidge Multi-Pollutant Control Project: Quarterly Progress Report for work performed during the period January 1, 2007 to March 31, 2007*. April 2007. Retrieved August 17, 2007 from http://www.netl.doe.gov/technologies/coalpower/cctc/PPII/bibliography/demonstration/environmental/greenidge/GreenidgeProgressQ4_010107-033107.pdf

Connell, DP. 2007b. *Greenidge Multi-Pollutant Control Project: Preliminary Public Design Report*. May 2007. Retrieved August 17, 2007 from http://www.netl.doe.gov/technologies/coalpower/cctc/PPII/bibliography/demonstration/environmental/greenidge/GreenidgePrePubDesFinal.pdf

International Energy Agency. (n.d.). *IEA Bioenergy: Biomass and Cofiring: Cofiring Database*. Retrieved February 28, 2007 from http://www.ieabcc.nl/database/info/cofiring/118.html

New York State Department of Environmental Conservation (NYSDEC). (n.d.). *Environmental Conservation Rules and Regulations*. Retrieved March 1, 2007 from http://www.dec.ny.gov/regulations/regulations.html

New York State Office of the Attorney General. 2005a. Press Releases: 2005: January: 01/11/05: *Governor and Attorney General Announce New York States Largest Coal Plants to Slash Pollution Levels*. Retrieved February 28, 2007 from http://www.oag.state.ny.us/press/2005/jan/jan11c_05.html

New York State Office of the Attorney General. 2005b. *Settlement with AES/NYSEG*. Retrieved February 28, 2007 from http://www.oag.state.ny.us/press/2005/jan/jan11c_05_attach1.pdf

US Department of Energy (DOE). (n.d.) *Power Plant Improvement Initiative: Project Abstracts*, p.12. Retrieved February 28, 2007 from http://www.fossil.energy.gov/programs/powersystems/cleancoal/ppii/tl_ppii_selabstracts.html#consol

US Department of Energy (DOE). 2004. *Environmental Assessment: Greenidge Multi-Pollutant Control Project: AES Greenidge Station, Dresden, New York*. Retrieved May 25, 2006 from http://www.netl.doe.gov/technologies/coalpower/cctc/PPII/bibliography/demonstration/environmental/greenidge/EA_CONSOL.pdf

US Department of Energy (DOE). 2006. *Energy Efficiency and Renewable Energy: Biomass Program: Electrical Power Generation*. Retrieved March 1, 2007 from http://www1.eere.energy.gov/biomass/electrical_power.html

Zamansky VM, Folsom BA. 1997. *Second Generation Advanced Reburning for High Efficiency NOx Control: Quarterly Report No. 8 for Period July 1 – September 30, 1997*. Retrieved May, 25, 2006 from http://www.osti.gov/bridge/servlets/purl/600564-q9LC7u/webviewable/600564.pdf

Appendix D

Modeling approach to identify the area most likely to be affected by emissions from AES Greenidge

Methods

We used an approach called dispersion modeling to predict the area most likely affected by emissions from the AES Greenidge facility. Dispersion models are mathematical tools that predict the relationship between pollutant emissions from a source and resulting air quality by incorporating factors that affect pollutant release and movement in air. We considered using a kind of model often called a refined dispersion model, however this type of model requires site-specific meteorological data (e.g., wind speed and wind direction) and these data are not available for the AES facility area. Therefore, we chose to use a less complex model, known as a screening model, which does not require site-specific meteorological data. Screening models use information about the emission source, local terrain features (such as elevation) and land uses features (such as rural or urban) and the model output provides a rough, often conservative, estimate of the magnitude and distance of facility impacts without considering site-specific wind patterns. The model we used, which is called "SCREEN3," was developed by the US Environmental Protection Agency.

A limitation with using a screening model is that the model output does not provide any information on the direction (e.g., north, south) in which the estimated impact occurs. Therefore, we evaluated whether any local meteorological data could be incorporated in our approach. In consultation with New York Department of Environmental Conservation (NYS DEC) staff, we determined that data from a meteorological station at Cornell University would be appropriate to use. The Cornell station is located near Cayuga Lake, approximately 12 miles east of Seneca Lake. Both lakes are similar in size and shape, both have a general north-south orientation and the terrain characteristics near both lakes are similar. Specifically, both lakes are located in valleys with general north-south orientation and in both locations the terrain rises sharply to the west and east. Therefore, wind flow patterns are expected to be similar in both locations.

We worked with NYS DEC staff to combine the screening model with meteorological data from Cornell and terrain characteristics near the AES facility to qualitatively estimate facility impacts. Specifically, we used the screening model to provide a distance estimate of the impacts for locations where the terrain is relatively flat (north and south of the facility). We used the terrain data to help inform us of areas where terrain height might restrict pollutant dispersal (such as east and west). We used the Cornell meteorological data to tell us the area most likely affected by the emissions. The outcome of screening model provided an estimated range of pollutant concentrations by distance. We used this information to identify three different study areas, based on relative impacts from the AES facility, to assist in stratifying population exposures.

Additionally, we evaluated the potential for nearby electrical generating facilities, which primarily use coal, to impact the community surrounding AES Greenidge.

Results
NYS DEC provided us with a diagram developed from data collected in 2001 at the Cornell station, indicating wind direction, frequency and speed (see Figure 1). This diagram, called a wind rose, shows that winds coming from the south to southeast direction were most frequent, and winds from the west to northwest were somewhat less frequent. That is, the winds tend to follow the channeling of Cayuga Lake. Winds near the AES facility would be expected to follow the orientation of Seneca Lake.

Because the terrain north, northeast and south of AES Greenidge is relatively flat (because much of this area is the lake surface with adjacent shore) we used the screening type model to estimate the range of potential significant long-term impact. Applying the wind frequency information from Cayuga Lake to Seneca Lake indicates that there would be a strong southerly wind component, and therefore the region north of the AES Greenidge facility would likely be the most impacted area. Combining the screening model results, terrain characteristics and wind information for the region north of the facility yielded an estimated distance of impacts of approximately 20 miles. Applying the same method for the region south of the facility yielded an impact range estimated to be up to 10 miles south of the facility. The potential for impacts west or east from the facility would be relatively small due to the low frequency of winds from these directions and the channeling effect due to the sharp rise in terrain elevation. Figure 2 shows the estimated area of likely long-term impact and the location of the Cornell meteorological station. The AES facility has tall stacks (250 feet); therefore the estimated impacts of stack emissions close to the facility are relatively low (except for during certain weather conditions that decrease transport of the pollutants away from the facility). However, because of the tall stacks, areas as far away as 30 miles could experience some impacts from the facility.

To stratify exposure levels we used the screening model results and wind direction data to identify three areas of higher potential exposure, defined by distance from the facility and relative magnitude of estimated impact. The three exposure areas that we identified are those that include most of the area estimated to experience greater than 75% and within 50% to 75% and less than 50% of the estimated maximum impact. The higher potential exposure area, within which greater than 75% of the estimated maximum impact may occur, extends approximately 9 miles north, south and east of the facility. The moderate potential exposure area, within which 50 to 75% of the estimated maximum impact may occur, extends about another 5 miles to the north and east of the facility. The lower potential exposure area, within which less than 50% of the estimated maximum impact may occur, extends about another 6 miles north of the facility (see Figure 2).

Our evaluation of the surrounding electrical generating facilities indicated that these facility contributions would be negligible compared to the AES Greenidge contribution to the community.

Figure 1. Wind rose for 2001 based on Cornell meteorological data. Bars indicate direction from which the wind blows, wind frequency and speed.

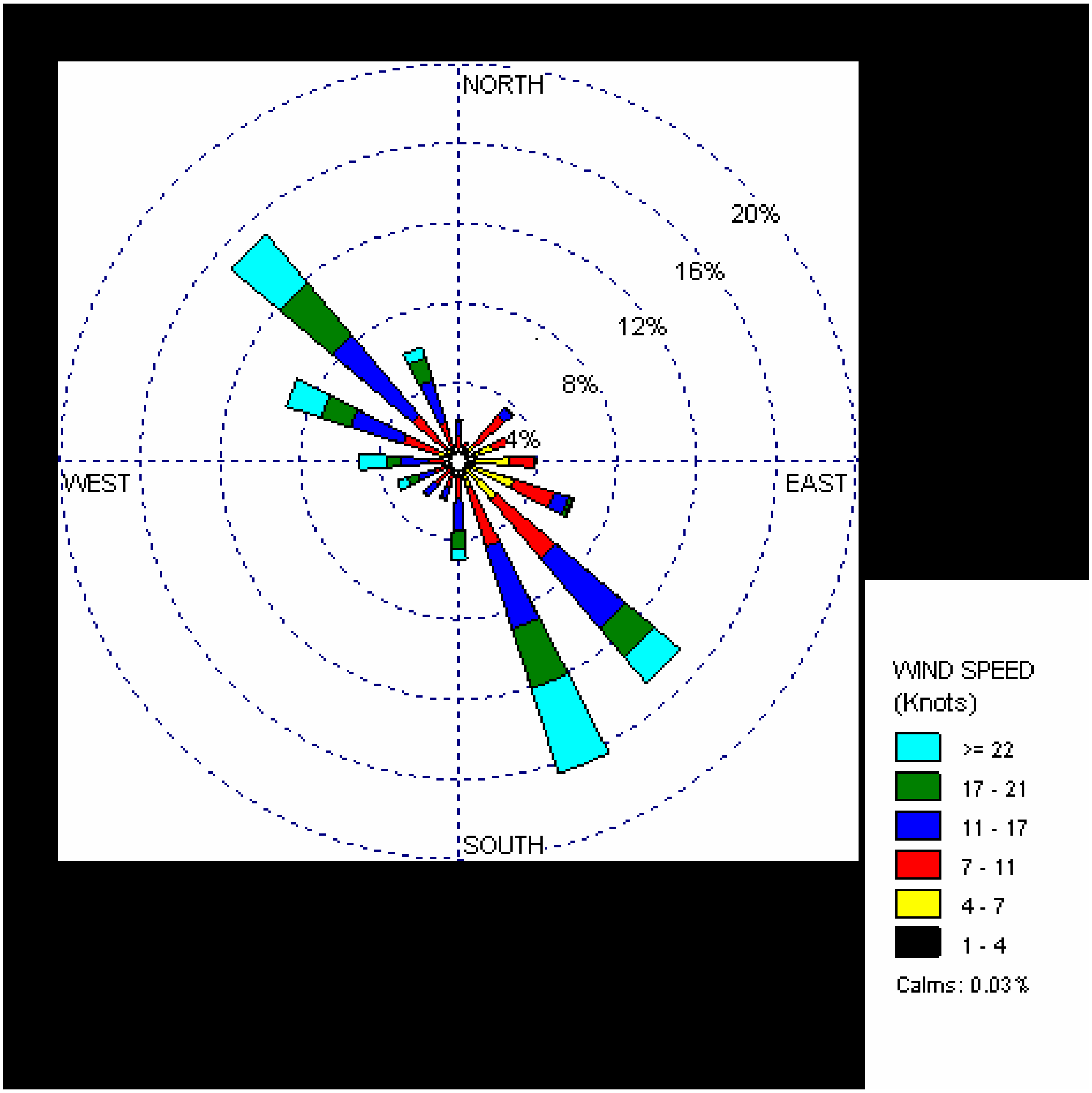
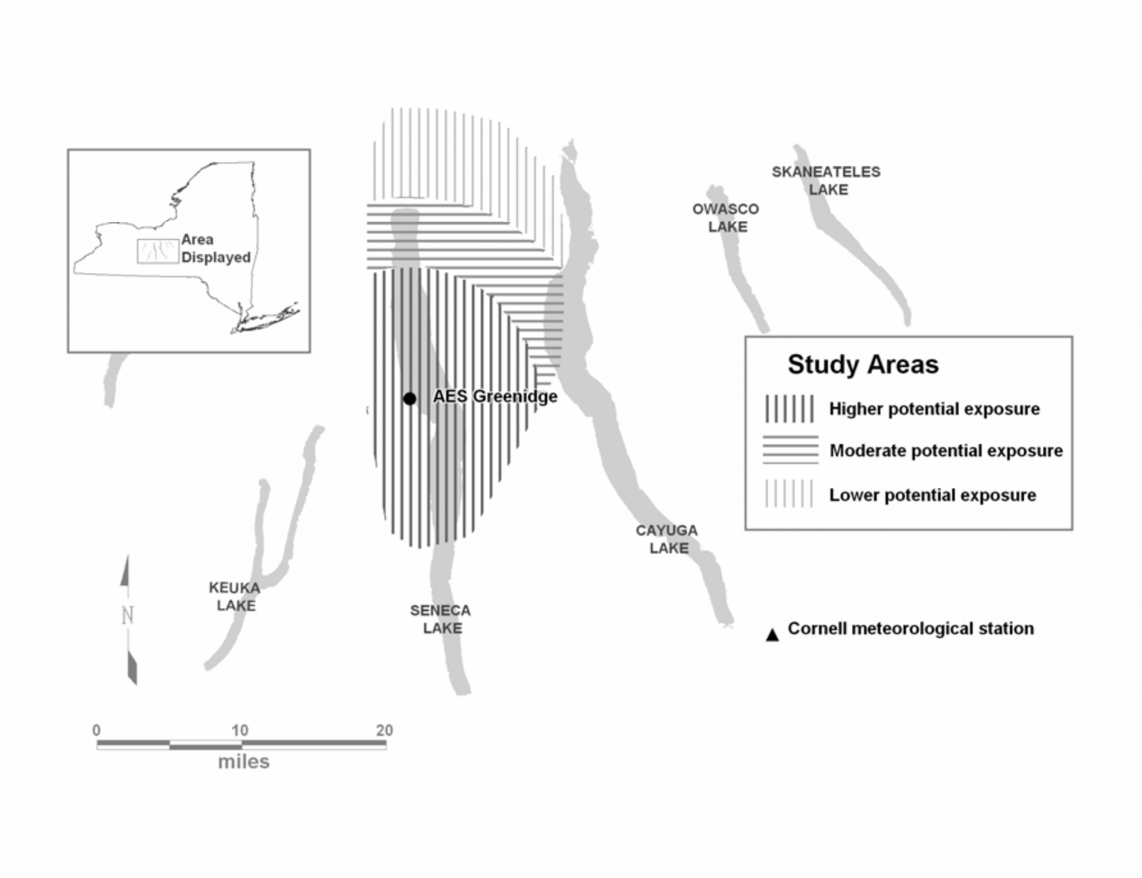


Figure 2. Map showing location of the AES Greenidge facility, three study areas and Cornell meteorological station.



Appendix E

Differences in methods and findings between the NYSDOH/ATSDR health statistics review and Dr. David Carpenter's statistical summary

1. What were the findings of Dr. Carpenter's one-page statistical summary?

In the six zip code areas he analyzed, Dr. Carpenter reported higher than expected hospitalization rates for chronic bronchitis and chronic obstructive pulmonary disease (COPD) combined as well as for all forms of infectious respiratory disease (not defined in the summary). No other respiratory diseases were reported.

2. What were the findings of our health statistics review?

We found lower than expected rates of hospitalizations for respiratory illnesses (Acute Bronchitis, Asthma, Chronic Bronchitis, Emphysema and Total COPD* in an eight zip code area most likely impacted by AES power plant emissions. COPD (NOS)**, a component of COPD, was higher than expected but only in the lower potential exposure area (2 ZIP codes); the rate for COPD(NOS) was lower than expected in the moderate and higher potential exposure areas. In addition, when combined chronic bronchitis and COPD (NOS) were significantly lower than expected both in the lower exposure area and in all areas combined.

* Total COPD = Chronic Bronchitis + Emphysema + COPD(NOS)

** COPD(NOS) = Form of COPD not specified by physician

3. Why do the results of our health statistics review differ from those in Dr. Carpenter's statistical summary?

Although the source of the health data (SPARCS hospitalization data) was the same for our health statistics review and the statistical summary done by Dr. Carpenter in 2005, there were several methodological differences between the two investigations that may have lead to the differing results.

Different study area/population:

We chose an 8 ZIP code study area based on an air modeling analysis performed by scientists at the Department in consultation with air pollution modeling specialists at the NYSDEC. The analysis took into account local weather patterns, terrain and facility characteristics (such as stack height). Wind patterns in the area are predominantly from the south and west meaning that the area most likely to be impacted by pollutants from the facility would be in the opposite direction (i.e. to the north and east of the facility) the majority of the time. After modeling the most likely area to be impacted by pollutants emitted from the facility, we further subdivided the area into higher (5 ZIP codes), moderate (1 ZIP code) and lower (2 ZIP codes) potential exposure areas based on increasing distance from the facility. A map showing the prevailing wind patterns and the ZIP codes used by each analysis is shown in Figure 1 of this appendix.

Dr. Carpenter chose 6 ZIP codes which lie predominantly to the south of the facility. We do not know the basis for this selection. Only one ZIP code (14441) was common to both analyses (See Fig. 1).

Different comparison area/population:

We chose our comparison area based on counties that had similar rural characteristics to the study area. Forty upstate counties without metropolitan areas greater than 100,000 people as defined by the 2000 census were chosen as the comparison area. This helped to control for not only urban/rural characteristics but also for race and socioeconomic status to some degree, as these areas tended to be more similar to the study area than metropolitan areas would be.

Dr. Carpenter's comparison population was chosen based on ZIP codes outside of New York City which had no hazardous wastes sites.

Neither Dr. Carpenter's approach nor ours excluded ZIP codes based on whether or not they had power plants or other major sources of air pollution. The differences in selection methods, however, could have resulted in the differences in results observed.

Different time period:

Our health statistics review used SPARCS data from 1986-2005, while the statistical summary done by Dr. Carpenter included SPARCS data from the years 1993-2000. In general, a longer time period would lead to a greater number of cases evaluated which, in turn, would lead to more stable estimates of hospitalization rates.

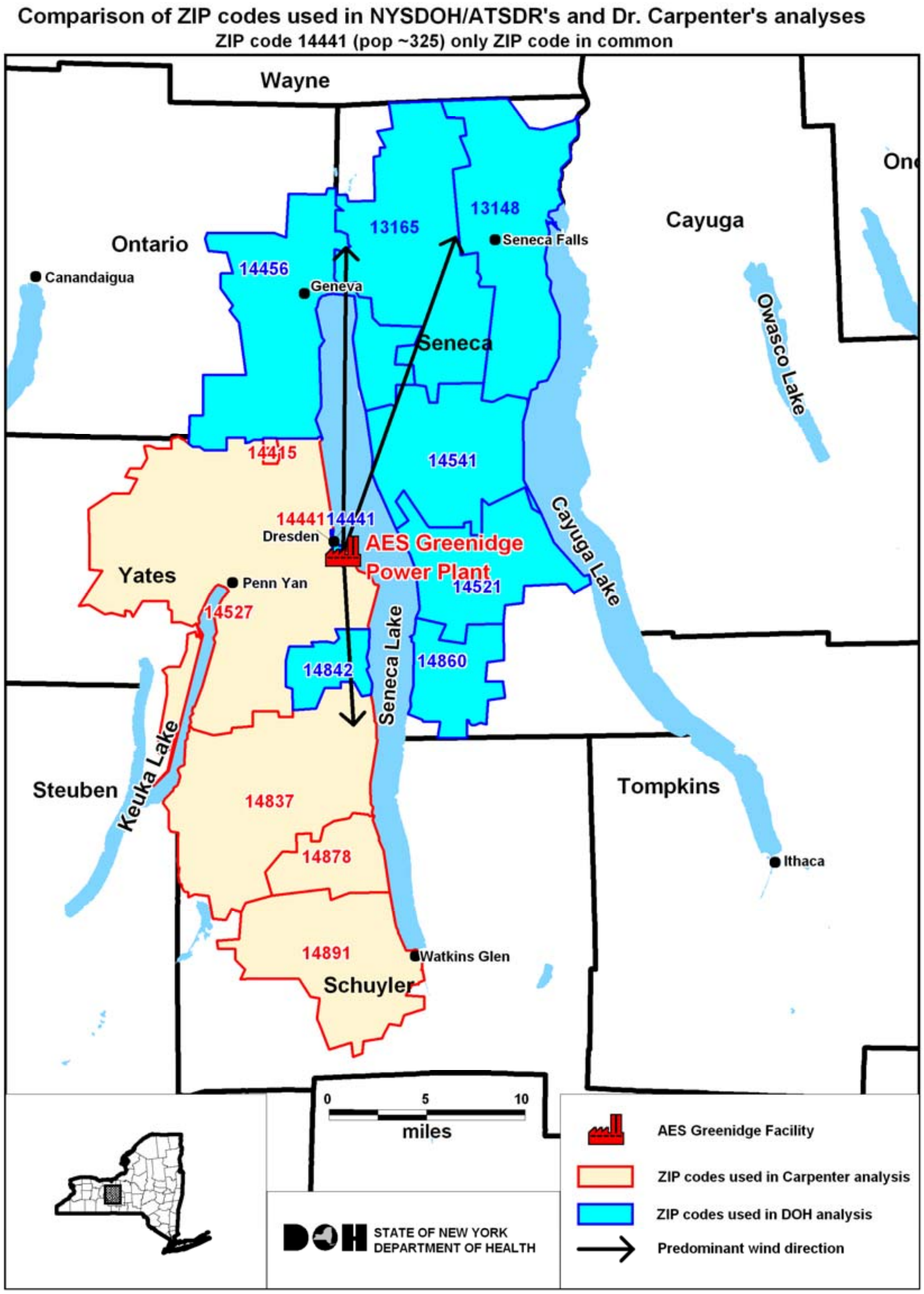
Different criteria for selection of individuals with respiratory conditions:

Somewhat different respiratory outcomes were evaluated, and the methodology used to select individuals with respiratory conditions was different in each analysis. In our health statistics review we used only the primary diagnosis code listed on the SPARCS record to select individuals with respiratory conditions. The primary diagnosis represents the illness for which the person was admitted to the hospital. There are 14 additional diagnosis codes listed on SPARCS records however, for conditions that co-existed with the primary diagnosis at the time of admission or developed subsequently to admission.

Dr. Carpenter's statistical summary included cases with any report of a respiratory illness in any of the 15 diagnosis categories. Thus, persons admitted to the hospital for reasons unrelated to respiratory illness could be included in the analysis. For example a person who was admitted to the hospital with a broken leg due to a car accident but also had acute bronchitis (caused by a cold) at the time of admission may be included in the analysis. Because approximately 60% of all respiratory diagnoses are for secondary diagnoses this could result in substantially different findings.

	NYSDOH/ATSDR Health statistics review	**Dr. Carpenter's Statistical summary**
Study area	8 ZIP codes mostly east and north of the facility	6 ZIP codes predominantly south of the facility
Comparison area	40 rural Upstate counties	ZIP codes in Upstate and Long Island without a hazardous waste site
Time period	1986-2005	1993-2000
Outcomes reported	Acute bronchitis; asthma; chronic bronchitis; emphysema; COPD (NOS); COPD (total)	Chronic bronchitis + COPD (combined); all forms of infectious respiratory disease combined
Selection criteria	Primary diagnosis	Primary diagnosis or any other co-diagnoses (15 total)

Figure 1. ZIP codes used to define the NYSDOH/ATSDR study area and Dr. Carpenter's study area, along with indicators of prevailing winds.



Appendix F
Summary of Public Comments and Responses

This summary was prepared to address comments and questions on the public comment draft of the Public Health Consultation *Respiratory Hospitalizations in Areas Surrounding the AES Greenidge Power Plant* , Town of Torrey, Yates County. The public was invited to review the draft during a public comment period that ran from January 7, 2007 through February 8, 2008. No formal written comments were received. However, questions and concerns were raised by Senator Hillary Clinton's staff regarding the hospitalization rates in the six ZIP Codes evaluated by Dr. David Carpenter and reported in a local newspaper. To address this issue, NYSDOH evaluated respiratory hospitalization rates in these six ZIP Codes using the same methodology described in the Health Consultation for the ZIP Code areas most likely impacted by AES Plant emissions. We found rates of chronic bronchitis and chronic obstructive pulmonary disease (COPD) as well as rates of acute respiratory infections in the six ZIP Code area to be similar to those in other parts of upstate New York. Several methodological differences between the two analyses may explain why we did not see the 30% to 40% increases in hospitalizations reported by Dr. Carpenter. A detailed description of the results of our follow up analysis was included in the NYSDOH response to Senator Clinton, a copy of which is included in Appendix G of this Health Consultation.

In addition, in the public comment draft, hospitalization discharge rates listed in tables 4-7 represented crude hospitalization rates not adjusted for age. These were presented this way to allow easy comparison with other published respiratory hospitalization rates. However, the standardized rate ratios presented in the tables were adjusted for age. This led to some confusion over which set of measures to focus on, since the results differed slightly from one another. To avoid confusion, age adjusted hospitalization rates were calculated and used in the tables of the final documents. Also, we discovered that, due to a coding error, one county (Allegany) had been inadvertently left out of the comparison group while one county (Albany) was inadvertently placed into the comparison group of upstate rural counties. Correction of this error resulted in minor revisions to the expected rates; however the overall results remained unchanged. Specifically all standardized rate ratios which showed statically significant elevations remained statistically elevated while those that showed statistically significant deficits remained lower significantly lower than expected, after these minor adjustments. Rate ratios have been updated throughout the text and tables of the final document.

Appendix G
Response letter to Senator Clinton's office

2008154. 37784

STATE OF NEW YORK
DEPARTMENT OF HEALTH

Flanigan Square 547 River Street Troy, New York 12180-2216

Richard F. Daines, M.D.
Commissioner

Wendy E. Saunders
Chief of Staff

June 17, 2008

Hon. Hillary Rodham Clinton
United States Senator
SR-464 Russell Senate Office Building
Washington, D.C. 20510

Dear Senator Clinton:

I am writing in response to a question posed by Mr. Dan Utech of your staff following the release by the New York State Department of Health (NYSDOH) of the public comment draft report entitled, "Respiratory Hospitalizations in Areas Surrounding the AES Greenidge Power Plant, Town of Torrey, Yates County, New York" in January, 2008. The report summarized our analysis of respiratory hospitalizations in the area most affected by emissions from the AES Greenidge power plant. The analysis was conducted following your request to the Agency for Toxic Substances and Disease Registry (ATSDR) for a study of respiratory health in the communities surrounding the AES Greenidge power station in Torrey, New York, due to concerns about respiratory illness in the area. This was prompted by an informal statistical summary prepared by David Carpenter, M.D., Director of the University at Albany's Institute for Health and the Environment, and published in a local newspaper. It found statistically significant elevations of several respiratory diseases in six ZIP codes near the facility.

In the NYSDOH draft report we identified the areas near the AES Greenidge facility most likely to be affected by its emissions using local meteorology data and an air dispersion model to identify the ZIP codes that would be impacted by the AES Greenidge emissions. We then compared respiratory hospitalization rates in those areas to rates in similar areas of upstate New York. In general, the report showed that respiratory hospitalization rates were lower in this area of central New York than in other areas upstate. In terms of evaluating health effects that may be related to a particular exposure or hazard, this approach makes sense. However, there remained concerns that hospitalization rates in the original six ZIP Code area analyzed by Dr. Carpenter were not evaluated in the NYSDOH report, even though our model did not indicate that this area was likely the most impacted by power plant emissions. While we did not receive any formal public comments on the report, this issue was raised by Mr. Utech as well as by the local media.

To address this, NYSDOH evaluated respiratory hospitalization rates in the 6 ZIP Code area first evaluated by Dr. Carpenter using the same methodology described in the NYSDOH report. Throughout the analysis NYSDOH conferred with ATSDR on methodological issues and findings. We found rates of chronic bronchitis and COPD (Chronic Obstructive Pulmonary Disease) and rates of acute respiratory infections in this 6 ZIP Code area to be similar to those of other parts of upstate New York between

1993 and 2000. These are the same outcomes and years that Dr. Carpenter originally evaluated. Several subtle, methodological differences between the two analyses may explain why we did not see the 30-40% increases in respiratory hospitalizations noted by Dr. Carpenter. A more detailed description of the results is attached. These tables will also be included in the final version of the report.

Finally, although we did not generally find elevated rates of respiratory hospitalizations in the area, we have no way of knowing if respiratory hospitalization rates would have been even lower if there were no emissions from the power plant. In addition, more subtle adverse respiratory effects may have occurred in the population. Studies of other coal burning power plants have shown emissions to be associated with decreased respiratory health and any reductions in emissions from power plants should benefit the public's health. The installation of state-of-the-art pollution control devices in response to the landmark agreement between AES and the State of New York in 2005 has substantially reduced emissions from this facility. The NYSDOH will continue to be vigilant in addressing health concerns for respiratory illness that may be related to power plant emissions. If you have further questions on this study, please have your staff contact me at 518-402-7550 or Steven Forand in the NYSDOH Bureau of Environmental and Occupational Epidemiology at 1-800-458-1158, extension 2-7950.

Sincerely,

Nancy Kim

Nancy Kim, Ph.D.
Interim Director
Center for Environmental Health

Attachment

cc: D. Utech
E. Bederman
H. Frumkin, M.D., Dr.P.H.
R. Weston
G. Ulirsch, Ph.D.
A. Block
S. Hwang, Ph.D.
E. Horn, Ph.D
A. Grey, Ph.D.
D. Miles
S. Forand
T. Gentile

Attachment:
Respiratory hospitalizations in 6 ZIP Code area near the AES Power Plant.

The following tables contain the results of an analysis by the New York State Department of Health (NYSDOH) which assessed hospitalization rates in the six ZIP Code area near the AES power plant which was first evaluated by Dr. Carpenter. The current NYSDOH analysis was done using the same methodology described in the original NYSDOH report entitled "Respiratory Hospitalizations in Areas Surrounding the AES Greenidge Power Plant, Town of Torrey, Yates County, New York", released in January, 2008.

Findings

- Chronic bronchitis and COPD (Chronic Obstructive Pulmonary Disease) as well as rates of acute respiratory infections were statistically similar to those of other parts of upstate New York between 1993 and 2000. These are the same outcomes and years that Dr. Carpenter originally evaluated.

- Asthma rates during this period were 37% lower than expected in this area and this deficit was statistically significant.

- During the earliest period examined, from 1986-1992 acute respiratory infections and asthma were significantly higher than expected while chronic bronchitis and COPD were significantly lower than expected.

- In the latest study period examined, 2001-2005, asthma was significantly lower than expected and no respiratory illnesses were significantly higher.

- For the 20 year time period, acute respiratory infections were about 10% higher than expected while asthma and chronic bronchitis and COPD were about 10% lower than expected. All of these findings were statistically significant. The excess in respiratory infections was due entirely to excesses reported during the first time period.

- Rates of chronic and acute respiratory infections have changed dramatically over the twenty year study period for both the study area and the 40 county comparison area. This may be due to changes in billing practices and changes in NYSDOH hospitalization data reporting requirements and regulations over the past 20 years which has resulted in apparent variations in the rates of certain hospital admissions over that time period.

Several methodological differences between the two analyses may explain why results differ. As in our original analysis, we used a group of 40 predominantly rural upstate NY counties as our comparison area. This is somewhat different than the comparison area examined by Dr. Carpenter which was based on whether or not a ZIP code had or was near a hazardous waste site (and thus included ZIP codes from downstate (excluding NYC) and Long Island). Also, as noted in our original analysis, we only considered primary diagnosis for the hospitalization in selecting individuals whereas Dr. Carpenter evaluated primary diagnosis and 14 additional secondary diagnosis codes. While neither method should cause substantial bias, the results will not be directly comparable. The NYSDOH report describing the methods used and a detailed account of differences between the two analyses can be found at
http://www.health.state.ny.us/environmental/investigations/aes/index.htm

New York State Department of Health

Respiratory hospitalization rates for 6 ZIP codes used in the previous analysis conducted by Dr. Carpenter, compared to rates in 40 rural upstate NY counties. The *Standardized Prevalence Ratio (SPR)* is the ratio of the observed number of hospitalizations to the expected number based on age adjusted statewide hospitalization rates. The confidence interval represents the range around the SPR that tells us there is a 95% chance that the true result is within this range (similar to the margin of error in a poll). Statistically significant, higher than expected results are highlighted in red, while those that are significantly lower than expected are highlighted in blue. Hospitalization rates shown are per 100,000 persons per year.

1986 – 1992.

Primary Diagnosis of Hospitalization	Observed Number of Cases	Expected Number of Cases	SPR	95% Confidence Interval		Age adjusted Hospitalization Rate in Study Area	Hospitalization Rate in Reference Area
Acute respiratory infections*	632	510	**1.24**	**1.15**	**1.34**	350.4	279.1
Asthma	410	343	**1.20**	**1.08**	**1.32**	234.8	200.6
Chronic bronchitis and COPD NOS*	118	196	**0.60**	**0.50**	**0.72**	61.8	102.6

1993 – 2000.

Primary Diagnosis of Hospitalization	Observed Number of Cases	Expected Number of Cases	SPR	95% Confidence Interval		Age adjusted Hospitalization Rate in Study Area	Hospitalization Rate in Reference Area
Acute respiratory infections*	217	229	0.95	0.83	1.08	102.7	108.9
Asthma	174	278	**0.63**	**0.54**	**0.73**	87.4	140.1
Chronic bronchitis and COPD NOS*	549	555	0.99	0.91	1.07	246.6	251.0

2001 – 2005.

Primary Diagnosis of Hospitalization	Observed Number of Cases	Expected Number of Cases	SPR	95% Confidence Interval		Age adjusted Hospitalization Rate in Study Area	Hospitalization Rate in Reference Area
Acute respiratory infections*	82	100	0.82	0.65	1.02	59.1	72.3
Asthma	117	152	**0.77**	**0.64**	**0.92**	92.2	118.4
Chronic bronchitis and COPD NOS*	363	372	0.98	0.88	1.08	259.6	266.5

All years, 1986 - 2005.

Primary Diagnosis of Hospitalization	Observed Number of Cases	Expected Number of Cases	SPR	95% Confidence Interval		Age adjusted Hospitalization Rate in Study Area	Hospitalization Rate in Reference Area
Acute respiratory infections*	931	841	**1.11**	**1.04**	**1.18**	176.1	158.8
Asthma	701	775	**0.90**	**0.84**	**0.97**	138.1	155.7
Chronic bronchitis and COPD NOS*	1,030	1,124	**0.92**	**0.86**	**0.97**	185.4	203.3

* Outcomes evaluated in Dr. Carpenter's analysis