From: "John Kelly" <jlejskelly@verizon.net>
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Date: Wed, Sep 19, 2007 3:35 PM

Gentlemen:

At the Indian Point Environmental Scoping Meeting today, I made a statement referencing a study of the impact on air pollution that would be caused by shutdown of the Indian Point plants. I gave a copy of the study to an NRC representative at the meeting and I have attached an electronic copy to this email for your information. Thank you.

John J Kelly

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Entergy Nuclear Indian Point 2, LLC and Entergy Nuclear Indian Point 3, LLC Village of Buchanan, New York

Emissions Avoidance Study

Prepared for

Entergy Nuclear Northeast

Prepared by

TRC Environmental Corporation
Lyndhurst, New Jersey

Revised August 2002

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EXECUTIVE SUMMARY

In evaluating the impact of decommissioning Entergy Nuclear Indian Point 2, LLC and Entergy Nuclear Indian Point 3, LLC, the potential emissions increases associated with replacement electricity generation sources need to be evaluated. TRC evaluated several different scenarios to determine the impact on the air quality in New York State and the local area. Replacement sources examined included existing fossil generating stations located in the entire state of New York, the Hudson Valley and New York City. To provide context for interpreting the projected emissions increases, the increases for each replacement scenario are expressed as percent increases relative to regional and statewide emissions, and the health and welfare effects associated with each pollutant and the groups most susceptible to them have been tabulated.

When evaluating the emission increase from sources located throughout the state, it was necessary to develop a "generation fuel mix." This consisted of the anticipated mix of coal, gas, oil etc. expected for the replacement generation sources during the years 2002 through 2005. Data from the current New York State Energy Plan, dated December 2001, serves as the basis for the existing and projected future generation fuel mix applied in the analysis

Indian Point Units 2 and 3 have an average net maximum capacity of 983.7 and 989 Megawatts (MW), respectively, based on information provided to the Independent System Operator (ISO). Based on a 90% capacity factor, the annual generating capacity of these two units is 15,552,767 Megawatt-hours (MWh), which represents approximately 10% of the state's total generation.

The first set of calculations presented assumes that the demand is met by increased operation of existing New York State fossil stations, so that a generation mix of coal, oil and natural gas in the years 2002 through 2005 replaces the generating capacity of Units 2 and 3. To establish a baseline, emissions estimates for the existing units are based on a combination of data from the US Environmental Protection Agency (EPA) utility Emissions & Generation Resource Integrated Database 2000 (EGRID2000), Version 2.0 and the US EPA Document AP-42 emission factors for stationary sources. When more than one emission factor was available, the lower emission factor was chosen. This approach represents a conservative estimate of the potential increase.

Since it is reasonable to assume that the majority of lost output would be made up by increased generation of units nearest to the New York City / Westchester load pocket, replacement by the four large fossil power stations in the Hudson Valley (Bowline Point, Lovett, Danskammer and Roseton) and the existing units in New York City was also studied. For each of these plants,

baseline emissions and generation were obtained from the EGRID2000 database. Data for the most recent year included in this database (1998) was utilized in this study.

The first task in this set of calculations assumed replacement by the four large plants in the Hudson Valley: Bowline Point, Lovett, Danskammer, and Roseton. These plants utilize boilers that are fired with coal, No. 6 residual oil and natural gas. These plants currently operate at capacity factors ranging from 32% to 58%. These four stations would need to operate at over 90% capacity factor in order to make up the lost generation from Indian Point 2 and 3. It has been determined that these plants are already operating more during the ozone season (May through September) based on the EGRID2000 data; thus the increased demand during the ozone season cannot be met by these four stations alone.

The next situation that was evaluated was the replacement by the 14 existing power plants in the five boroughs of New York City. The replacement demand is approximately 33% of the available generation from the New York City plants. In order to determine the generation and emissions increases, it was assumed that the total fuel and plant mix from these plants would remain constant, except for the plants that could not meet this increase. Since the current generation for all of these facilities combined is roughly equal to that of Indian Point 2 and 3, the emission rates in New York City would nearly double in order to make up the lost generation.

The final scenario of replacement by existing sources that was evaluated was the replacement by a combination of the four Hudson Valley plants and the plants located in New York City. For the purposes of this evaluation, it was assumed that half of the make-up generation would come from the four Hudson Valley Plants and the other half would come from the plants in New York City, with the increase determined by assuming that the total fuel and plant mix from these two sets of plants would remain constant, except for the plants that could not meet this increase.

The increases from each of the above-described scenarios were compared to the current emissions from the power generation industry in New York. The results are presented in the table below:

Replacement Generation Sources	CO_2	SO_2	NO_x	PM-10	CO	VOC
New York State: 2002 Generation Mix	20.20%	23.81%	21.58%	22.69%	17.76%	17.28%
New York State: 2003 Generation Mix	20.12%	23.54%	21.42%	22.51%	17.80%	17.34%
New York State: 2004 Generation Mix	19.41%	21.10%	20.03%	21.11%	9.28%	18.36%
New York State: 2005 Generation Mix	21.05%	20.06%	20.66%	22.14%	11.66%	23.44%
Hudson Valley Power Plants	21.08%	18.77%	20.80%	52.59%	74.31%	56.97%
New York City Power Plants	18.10%	2.52%	15.02%	9.28%	17.24%	16.83%
Hudson Valley and New York City	19.83%	11.32%	18.89%	28.49%	42.02%	34.63%

Note: Total increase is compared to utility source emissions only in New York. Baseline data obtained from USEPA's EGRID2000 database (1998)

In addition to evaluating the increase in emissions, TRC prepared a matrix summarizing the potential effects and health hazards from these pollutants. Currently, Westchester County is classified as a non-attainment area for ozone. Ozone can cause lung irritation, permanent lung damage, aggravated asthma, reduced lung capacity, pneumonia and bronchitis. Persons that are most susceptible to the negative effects of ozone are those with respiratory illnesses, outdoor workers, and children. Ozone also increases the susceptibility of plants to disease, thus reducing crop and forest yields.

The entire state of New York is located in the Ozone Transport Region (OTR), which requires that new sources of NO_x and VOC be subject to Lowest Achievable Emission Rates (LAER) and emissions offsets. In essence, this massive increase in generation by existing sources is comparable to constructing one large new source without subjecting it to these current applicable regulations since the majority of these existing sources were constructed prior to the new source review requirements and were not subject to LAER and offset requirements. The increase in NO_x and VOC, the precursors to ozone, would constitute a significant setback in the area's efforts to meet progress goals toward ozone attainment status in the near future. In order to reach attainment, the area needs to further reduce emissions in the area as opposed to unnecessarily increasing these emission rates.

The attached matrix outlines the effects of all criteria pollutants and the groups that are most greatly impacted by them. As shown with carbon monoxide and ozone, these pollutants affect all people, regardless of age and current health, in addition to the vegetation in the area.

Regulatory Impacts and Effects of Major Air Pollutants

Pollutant	NAAQS Attainment Status for New York State	Basis for NAAQS	Most Susceptible Population Groups	Additional Impacts
SO_2	Attainment	Temporary breathing difficulty Respiratory illness Aggravates existing Heart Disease	Asthmatics, Children, Elderly, Persons with Heart or Lung Disease	Precursor to acid rain formation Visibility impairment from Sulfate Particles (PM-2.5) Aesthetics damage due to accelerated building decay Acidification of lakes due to Atmospheric Deposition Soil degradation due to Atmospheric Deposition
NO_x	Attainment	Damage to lung tissue Respiratory illnesses – Bronchitis Reduction in lung function	Children, Asthmatics, Outdoor Workers	Precursor to ground-level Ozone (Smog) Precursor to acid rain formation Water quality deterioration (Oxygen depletion) Visibility impairment
PM-10	Attainment for all Counties with exception of New York County	Aggravated Asthma Chronic Bronchitis Decreased lung function Premature Death	Persons with Heart Disease or Influenza, Asthmatics, Children, Elderly	Major cause of reduced visibility (Haze) Aesthetics damage due to stains from soot Acidification of lakes due to Atmospheric Deposition Soil degradation due to Atmospheric Deposition
CO	Attainment with exception of Metropolitan New York City (recently redesignated as attainment by USEPA, but New York State redesignation pending)	Cardiovascular effects Vision problems Reduced ability to work and learn Death (extremely high levels)	Persons with Heart or Lung Disease	
Ozone	Attainment for all counties with exceptions of New York State Metropolitan Areas and Long Island, but entire state is located within northeast Ozone Transport Region	Lung irritation (wheezing, coughing) Permanent lung damage Aggravated Asthma Reduced lung capacity Pneumonia and Bronchitis	Persons with respiratory illnesses, Children, Outdoor workers	Increases susceptibility of plants to disease Reduces crop and forest yields Aesthetics damage due to damage to leaves and trees Damages rubber and fabrics Reduced visibility
VOC	Not Applicable	Not Applicable	Not Applicable	Precursor to ground-level Ozone (Smog) Damage to plants
CO_2	Not Applicable	Not Applicable	Not Applicable	Contributes to Global Warming

1.0 INTRODUCTION

TRC Environmental Corporation (TRC) was retained by Entergy Nuclear Operations, Inc. (Entergy Nuclear) to perform an assessment of the potential increase in emissions of criteria pollutants from non-nuclear generating assets within New York State in the event that the Indian Point 2 and 3 are decommissioned. The assessment assumed that additional non-nuclear generation would be required within the State of New York to replace the electric generating output of Indian Point Units 2 and 3 and evaluated increase in annual potential emissions for the period of 2002 through 2005.

The evaluation performed by TRC included the following activities:

- Development of a "generation fuel mix" (i.e., coal, gas, oil, etc.) assumption for use in developing the avoided emissions calculations. TRC utilized data from the current New York State Energy Plan, dated December 2001, as the basis for the existing and projected future generation fuel mix applied in the analysis.

- Estimation of projected criteria pollutant emissions for the non-nuclear generating assets which would be required to replace the electric generating output of Entergy Nuclear's Indian Point Units 2 and 3 in the event that the Indian Point Nuclear Generating Station is decommissioned. The emission calculations are based on a projected 90% capacity factor for Units 2 and 3 through the study period of 2002 to 2005. Indian Point Units 2 and 3 have an average net maximum capacity, as reported to the Independent System Operator, of 983.7 Megawatts (MW) and 989 MW, respectively. The annual generating capacity of these two units is 15,548,036 Megawatt-hours (MWh) per year at a 90% capacity factor, representing approximately 10% of the state's total generation. Calculations of replacement generation emissions were based upon the "generation fuel mix" discussed above, assuming that the lost generation would be made up by a mix of existing in-state fossil (coal/oil/gas) fired units. Emissions estimates for the existing units were based on a combination of data from a US Environmental Protection Agency (EPA) utility emissions database and the US EPA Document AP-42 emission factors for stationary sources. Replacement by the sources located in the Hudson Valley and New York City was also evaluated as an option.

- Preparation of a matrix of regulatory impacts and effects of major air pollutants.

- Evaluation of additional costs for NO_x allowances.

TRC's findings relative to the above activities are summarized on the following pages.

2.0 DEVELOPMENT OF GENERATION FUEL MIX

For the purpose of this study, the future fuel mix information was obtained from the New York State Energy Plan, dated December 2001. This plan provides future estimates of generation by fuel type for the years 2002 through 2020. The fuel types listed include natural gas, oil, coal, nuclear and hydro, as well as "other" and net imports. The projected Gigawatt-hours (GWh) listed in the plan for 2002 through 2005 were used in this study and are summarized below:

Projected Generation – GWh

Generation Fuel	2002	2003	2004	2005
Natural Gas	24,706	25,628	34,115	54,902
Oil	24,774	24,509	19,212	9,384
Coal	29,380	29,295	28,030	17,934
Nuclear	32,563	32,559	32,662	32,558
Hydro	29,109	29,090	29,111	29,011
Other	2,866	3,004	3,150	3,283
Net Imports	18,799	19,463	18,747	19,731
TOTAL	**162,197**	**163,548**	**165,027**	**166,803**

Source: New York State Energy Plan, Table 9 – " Reference Resource Case – Generation by Fuel Type for the New York Electricity System," December 2001

Projected Generation – Percent of Total

Generation Fuel	2002	2003	2004	2005
Natural Gas	15.2%	15.7%	20.7%	33.0%
Oil	15.3%	15.0%	11.6%	5.6%
Coal	18.1%	17.9%	17.0%	10.8%
Nuclear	20.1%	19.9%	19.8%	19.6%
Hydro	17.9%	17.8%	17.6%	17.4%
Other	1.8%	1.8%	1.9%	2.0%
Net Imports	11.6%	11.9%	11.4%	11.6%
TOTAL	**100%**	**100%**	**100%**	**100%**

Source: New York State Energy Plan, Table 9 – " Reference Resource Case – Generation by Fuel Type for the New York Electricity System," December 2001

3.0 EMISSION CALCULATIONS

Using the projected generation mix provided above, criteria emissions were calculated for non-nuclear electricity generation, which would be required in the event that Entergy's Indian Point Nuclear Generating Station is decommissioned. As stated, all calculations for Units 2 & 3 at Indian Point are based on a 90% capacity factor. As provided by Elise N. Zoli, Esq. of Goodwin Procter, LLP, Entergy's Counsel, Units 2 and 3 have an average net maximum capacity of 983.7 MW and 989 MW.

Operating at a 90% capacity factor, Units 2 and 3 are capable of generating 15,548,036 MWh annually. This accounts for approximately 10% of the state's total generation. If Indian Point Nuclear Generating Station were to be decommissioned, there are numerous ways that the lost generation from Units 2 and 3 could be replaced. The first possibility that was examined was the replacement of Units 2 and 3 by the existing generation mix. This case yields the highest increase in emissions since it assumes older fossil fuel fired facilities, approximately 40% of which are coal, are used to replace the generating capacity of Units 2 and 3. The existing sources that are in the generation fuel mix include natural gas, oil, coal, nuclear, hydro and "other". For the purpose of this study, it was assumed that Units 2 and 3 would be replaced by natural gas, oil and coal fired facilities only. This unit mix would likely be used to replace lost generation if Indian Point 2 and 3 were not available during a low- to moderate-demand period (during mild weather). Nuclear, hydro and "other" were not included in the calculations. Hydro was not included because it is not possible to increase the capacity of existing hydropower sources. Emissions were not calculated for "other" sources, which account for less than 2% of the state's total capacity. The type of "other" sources is unknown; therefore it was not possible to develop emission factors for these sources.

Replacement by the four large fossil fuel power stations in the Hudson Valley: Bowline Point, Lovett, Danskammer and Roseton, and replacement by existing units in New York City were also studied. It is likely that the majority of the replacement generation would come from these sources. Three combinations of these plants were examined. The first possible scenario assumed that the Hudson Valley plants were the sole replacement source. The second scenario assumed that the New York City plants would replace all the lost generation. Finally, it was assumed that the Hudson Valley plants would account for half of the required generation and the New York City plants would account for the other half.

4.0 REPLACEMENT BY EXISTING SOURCES

Emission factors were obtained from the U.S. EPA's Emissions & Generation Resource Integrated Database 2000 (EGRID2000), Version 2.0. The most recent year included in this database is 1998; therefore, this data was utilized in this study. Data provided included total net generation, total state electricity usage, net imports, total CO_2, NO_x and SO_2 emissions, and emission factors in pounds of pollutant per MWh separated by fuel type. For the remaining criteria pollutants (CO, VOC, and PM-10), emission factors were obtained from the U.S. EPA's AP-42 document. For coal-fired units, emission factors for dry-bottom pulverized bituminous coal boilers equipped with electrostatic precipitators were used. PM-10 emissions include both filterable and condensable particulates, assuming that the coal has an ash content of 10%. The majority of emission factors for coal were given in pounds of pollutant per ton of coal. Based on an assumed heating value of 12,000 Btu/lb for the coal, these factors were then converted to pound per million Btu, which was then converted to pound per MWh based on the heat rate that was obtained from the data for the other pollutants listed in the EGRID2000 database.

For oil and natural gas, emission factors for external combustion (boilers) and internal combustion (i.c.engines and combustion turbines) were examined, since it is unknown what the breakdown of sources is. The lowest emission factor for each pollutant was chosen to yield a conservative (low) estimate of displaced emissions. It should be noted that the range in emission factors varied mostly with fuel type, as opposed to combustion source type. After evaluating the various emission factors, those for combustion turbines were used to yield a lower increase in annual emissions. These emission factors were given in pounds of pollutant per million Btu. Based on the data provided in EGRID2000, the emission factors were converted to pounds per MWh. A summary of the estimated additional emissions related to the replacement of Indian Point by existing sources applied to the projected future generation mix is presented in the following table:

Additional Annual Emissions with Replacement Power from Generation Fuel Mix

Pollutant	2002	2003	2004	2005
CO_2 (tons)	13,941,742	13,888,209	13,396,046	14,527,670
SO_2 (tons)	75,665	74,794	67,048	63,747
NO_x (tons)	23,140	22,971	21,480	22,152
PM-10 (tons)	1,890	1,875	1,758	1,844
CO (tons)	1,145	1,148	1,201	1,508
VOC (tons)	145	146	155	197

5.0 REPLACEMENT BY EXISTING HUDSON VALLEY AND NEW YORK CITY SOURCES

The next section of the evaluation assumed that the four large plants in the Hudson Valley, and the plants in New York City would replace the generation from Indian Point, as opposed to statewide facility-type replacement. For each of these subgroups, baseline emissions were obtained from EGRID2000. The most recent year included in this database is 1998; therefore, this data was utilized in this study. Data provided included total net generation separated by fuel type, total CO_2, NO_x and SO_2 emissions, and emission factors in pounds of pollutant per MWh separated by fuel type.

The first task assumed replacement by the four large plants in the Hudson Valley: Bowline Point, Lovett, Danskammer, and Roseton. These plants utilize boilers that are fired with No. 6 residual oil and natural gas. Lovett and Danskammer also have the ability to fire coal, and PM-10 emission factors while burning coal were obtained from the facilities' Title V permits. For the remaining criteria pollutants (CO, VOC, and PM-10), emission factors were obtained from the U.S. EPA's AP-42 document for external combustion sources. A combined emission factor for each of the pollutants was developed for each facility based on the source of generation (coal/oil/gas).

Based on the data provided in EGRID2000, it is known that these plants currently operate at capacity factors ranging from 32% to 58%. When evaluating the available generation, it was assumed that each of these plants could operate at a 90% capacity factor. Assuming a 100% capacity factor is not realistic and does not allow for necessary shutdowns required for maintenance to ensure the equipment is functioning properly. Based on the generation from 1998 provided in EGRID2000, and the total generation based on a 90% capacity factor, the combined available generation from these four plants is 15,374,598 MWh. This is only 99% of Indian Point's current generation of 15,552,767. Therefore, more than just these four plants would be required to meet the increased demand that would result from Indian Point Units 2 and 3 being decommissioned. The following tables summarize the total emission increases from increasing the operating capacity to 90% for each of these plants.

Additional Annual Emissions with Replacement Power from Hudson Valley Plants

Plant	Annual CO_2 (tons)	Annual SO_2 (tons)	Annual NO_x (tons)	Annual PM-10 (tons)	Annual CO (tons)	Annual VOC (tons)	Annual Hg (pounds)
Bowline Point	5,266,203	3,919	7,619	1,114	2,699	217	0
Lovett	1,600,331	6,606	3,237	212	292	26	26
Danskammer	1,620,126	7,651	3,536	229	207	22	70
Roseton	6,062,113	41,468	7,913	2,825	1,596	215	0
Total	**14,548,772**	**59,644**	**22,305**	**4,380**	**4,794**	**480**	**96**

Facility Specific Percent Emissions Increase from Replacement Power from Hudson Valley Plants

Plant	Annual CO_2	Annual SO_2	Annual NO_x	Annual PM-10	Annual CO	Annual VOC	Annual Hg
Bowline Point	178%	179%	178%	178%	178%	178%	0%
Lovett	71%	71%	71%	71%	71%	71%	71%
Danskammer	55%	55%	55%	55%	55%	55%	55%
Roseton	168%	168%	168%	168%	168%	168%	0%
Total	**123%**	**119%**	**112%**	**145%**	**147%**	**147%**	**58%**

As shown in the second table, the increase in the NO_x emissions during the ozone season (May – September) is not as great as the annual increase. This shows that these plants are already operating more during this season. In addition to the annual average availability of these plants being only 99% of the Indian Point demand, the increased replacement demand during the ozone season will not be able to be met by these four plants alone.

The next situation that was evaluated was the replacement by the 14 existing power plants in the five boroughs of New York City. It should be noted that the recently installed NYPA peaker turbines have not been included in this analysis, since they were installed after the most recent version of EGRID2000 was updated (1998 emissions data.

Similar to the Hudson Valley plants, emissions data was obtained from EGRID2000 for CO_2, SO_2 and NO_x. Emission factors for PM, CO, and VOC were obtained from U.S. EPA's AP-42. Emission factors for external combustion (boilers) and internal combustion (i.c. engines and combustion turbines) were examined, since facility specific emission rates are not provided by EGRID2000. The lowest emission factor for each pollutant was chosen to yield a conservative (low) estimate of displaced emissions. It should be noted that the range in emission factors varied mostly with fuel type, as opposed to combustion source type. After evaluating the various emission factors, those for combustion turbines were used to yield a lower increase in annual

emissions. These emission factors were given in pounds of pollutant per million Btu. Based on the data provided in EGRID2000, the emission factors were converted to pounds per MWh.

The available generation from the New York City plants was again determined based on a capacity factor of 90%. The replacement demand, 15,552,767 MWh, is approximately 33% of the available generation from these plants. In order to determine how much each plant would need to increase its generation to meet the demand of Units 2 and 3 at Indian Point, it was assumed that the total fuel and plant mix from these plants would remain constant, except for the plants that could not meet this increase. The Bronx Zoo, Brooklyn Navy Yard and the JFK International Airport Cogeneration facilities were increased to their maximum generation at 90% capacity factor while the remainder of the facilities kept the same mix. The following table provides the increased emissions.

Additional Annual Emissions with Replacement Power from New York City Plants

Plant	Annual CO_2 (tons)	Annual SO_2 (tons)	Annual NO_x (tons)	Annual PM-10 (tons)	Annual CO (tons)	Annual VOC (tons)
Bronx Zoo	3,833	1	3	0.2	0.4	0.1
Ravenswood	3,290,850	1,204	3,808	195.5	340.2	46.2
Charles Poletti	2,467,169	4,069	3,650	178.1	80.0	10.5
JFK Cogen	173,088	0	114	9.9	22.4	3.0
Far Rockaway	256,091	2	232	14.2	32.3	4.4
Astoria	3,773,229	1,785	4,947	225.8	370.6	51.1
Arthur Kill	1,021,253	7	925	56.9	129.2	17.7
East River	436,741	508	783	29.0	27.1	3.8
Waterside	277,744	3	167	15.0	34.0	5.0
Hudson Ave	1,832	4	10	0.1	0.0	0.0
Brooklyn Navy Yard	437,418	4	34	24.1	54.1	7.1
Warbasse Cogen	69,560	10	45	4.1	8.0	1.1
Gowanus	176,550	344	976	13.3	3.6	0.5
Narrows	108,814	81	412	6.9	9.8	1.4
Total	**12,494,172**	**8,020**	**16,107**	**773**	**1,112**	**142**

Once the increase in emissions was calculated, the percent increase from current generation was also calculated. Since the current generation for all of these facilities combined is 16,887,894 MWh, just slightly over the generation of Indian Point's Units 2 and 3, all of the emission rates are nearly double what they are currently. The results are summarized in the tables below.

Facility Specific Percent Emissions Increase from Replacement Power from New York City Plants

Plant	Annual CO_2	Annual SO_2	Annual NO_x	Annual PM-10	Annual CO	Annual VOC
Bronx Zoo	39%	39%	39%	39%	39%	39%
Ravenswood	106%	106%	106%	106%	106%	106%
Charles Poletti	106%	106%	106%	106%	106%	106%
JFK Cogen	68%	0%	68%	68%	68%	68%
Far Rockaway	106%	159%	106%	106%	106%	106%
Astoria	106%	106%	106%	106%	106%	106%
Arthur Kill	106%	134%	106%	106%	106%	106%
East River	106%	106%	106%	106%	106%	106%
Waterside	106%	96%	106%	106%	106%	106%
Hudson Ave	105%	105%	105%	106%	106%	106%
Brooklyn Navy Yard	47%	64%	46%	47%	47%	47%
Warbasse Cogen	106%	107%	106%	106%	106%	106%
Gowanus	106%	106%	106%	106%	106%	106%
Narrows	106%	106%	106%	106%	106%	106%
Total	**101%**	**106%**	**105%**	**101%**	**99%**	**93%**

The final replacement scenario that was evaluated was the replacement by a combination of the four Hudson Valley plants and the plants located in New York City. For the purposes of this evaluation, it was assumed that half of the make-up generation, 7,776,383 MWh, would come from the four Hudson Valley Plants and the other half would come from the plants in New York City. As in the evaluation of the emission increase from the New York City plants only, the increase of each of the plants was determined by assuming that the total fuel and plant mix from these two sets of plants would remain constant, except for the plants that could not meet this increase. The Bronx Zoo, Brooklyn Navy Yard and Danskammer were increased to their maximum generation at 90% capacity factor while the remainder of the facilities kept the same mix. The following table provides the increased emissions:

Additional Annual Emissions with Replacement Power from Hudson Valley and New York City Plants

Plant	Annual CO_2 (tons)	Annual SO_2 (tons)	Annual NO_x (tons)	Annual PM-10 (tons)	Annual CO (tons)	Annual VOC (tons)	Annual Hg (pounds)
Bowline Point	2,005,749	1,493	2,902	424	1,028	83	0
Lovett	1,532,411	6,326	3,100	203	279	25	25
Danskammer	1,620,126	7,651	3,536	229	207	22	70
Roseton	2,451,486	16,769	3,200	1,142	646	87	0
Bronx Zoo	3,833	1	3	0.2	0.4	0.1	--
Ravenswood	1,526,271	558	1,766	90.7	157.8	21.4	--
Charles Poletti	1,144,254	1,887	1,693	82.6	37.1	49	--
JFK Cogen	125,849	0	83	7.2	16.3	2.2	--
Far Rockaway	118,773	1	108	6.6	15.0	2.1	--
Astoria	1,749,995	828	2,294	104.7	171.9	23.7	--
Arthur Kill	473,649	3	429	26.4	59.9	8.2	--
East River	202,557	235	363	13.5	12.6	1.8	--
Waterside	128,816	1	78	7.0	15.8	2.3	--
Hudson Ave	850	2	5	0.1	0.0	0.0	--
Brooklyn Navy Yard	437,418	4	34	24.1	54.1	7.1	--
Warbasse Cogen	32,262	4	21	1.9	3.7	0.5	--
Gowanus	81,883	160	453	6.2	1.7	0.2	--
Narrows	50,467	38	191	3.2	4.5	0.6	--
Total	**13,686,648**	**35,961**	**20,258**	**2,373**	**2,710**	**292**	**94**

Again, once these emissions were calculated, the percent increase for each of these plants and the combined increase was calculated. The results are presented in the following table.

Facility Specific Percent Emissions Increase from Replacement Power from Hudson Valley and New York City Plants

Plant	Annual CO_2 (tons)	Annual SO_2 (tons)	Annual NO_x (tons)	Annual PM-10 (tons)	Annual CO (tons)	Annual VOC (tons)	Annual Hg (pounds)
Bowline Point	68%	68%	68%	68%	68%	68%	0%
Lovett	68%	68%	68%	68%	68%	68%	68%
Danskammer	55%	55%	55%	55%	55%	55%	55%
Roseton	68%	68%	68%	68%	68%	68%	0%
Bronx Zoo	39%	39%	39%	39%	39%	39%	--
Ravenswood	49%	49%	49%	49%	49%	49%	--
Charles Poletti	49%	49%	49%	49%	49%	49%	--
JFK Cogen	50%	0%	50%	49%	49%	49%	--
Far Rockaway	49%	74%	49%	49%	49%	49%	--
Astoria	49%	49%	49%	49%	49%	49%	--
Arthur Kill	49%	62%	49%	49%	49%	49%	--
East River	49%	49%	49%	49%	49%	49%	--
Waterside	49%	44%	49%	49%	49%	49%	--
Hudson Ave	49%	49%	49%	49%	49%	49%	--
Brooklyn Navy Yard	47%	64%	46%	47%	47%	47%	--
Warbasse Cogen	49%	50%	49%	49%	49%	49%	--
Gowanus	49%	49%	49%	49%	49%	49%	--
Narrows	49%	49%	49%	49%	49%	49%	--
Total	**57%**	**62%**	**57%**	**58%**	**63%**	**62%**	**58%**

6.0 COSTS FOR NO_x ALLOWANCES

Lastly, the increased costs for NO_x allowances associated with additional ozone season (May – September) NO_x emissions were evaluated. The March 2001 New York Independent System Operator report provided estimated costs for one ton of NO_x in the years 2001, 2003 and 2005. Costs for the years 2002 and 2004 were graphically interpolated. Based on the scenarios presented above, the following table shows the additional ozone season emissions and total costs for the NO_x emissions in the next four years.

It should be noted that it is likely that there is not enough generation available from the Hudson Valley plants during the ozone season to meet the lost generation of Indian Point Units 2 and 3. Data obtained from the EGRID database indicates that the ozone season NO_x emissions are nearly half of the annual emissions in some cases. Some of the New York City plants may not be able to meet the demand either. However, a combination of these plants would be available during that time and the ozone season NO_x emissions presented in the table below are based on a fraction of the annual emissions. These ozone season emissions are reasonable estimates provided the required generation was replaced by sources similar to those in the Hudson Valley and New York City.

Projected NO_x Allowance Costs

Replacement Source	NO_x tons	2002 Cost	2003 Cost	2004 Cost	2005 Cost
2002 Fuel Mix	9,725	$21,881,250	--	--	--
2003 Fuel Mix	9,657	--	$28,584,720	--	--
2004 Fuel Mix	9,062	--	--	$28,001,580	--
2005 Fuel Mix	9,411	--	--	--	$29,832,870
Hudson Valley	5,613	$12,629,250	$16,614,480	$17,344,170	$17,793,210
New York City	3,580	$8,055,000	$10,596,800	$11,062,200	$11,348,600
Hudson Valley & NYC	4,846	$10,903,500	$14,344,160	$14,974,140	$15,361,820

7.0 POTENTIAL EFFECTS AND HEALTH HAZARDS FROM STUDIED POLLUTANTS

In addition to evaluating the increase in emissions, TRC prepared a matrix summarizing the potential effects and health hazards from these pollutants. Currently, Westchester County is classified as a non-attainment area for ozone. High levels of ozone can cause lung irritation, permanent lung damage, aggravated asthma, reduced lung capacity, pneumonia and bronchitis. Persons that are most susceptible to the negative effects of ozone are those with respiratory illnesses, outdoor worker, and children. Ozone also increases the susceptibility of plants to disease, thus reducing crop and forest yields.

The entire state of New York is located in the Ozone Transport Region (OTR), which requires that new sources of NO_x and VOC be subject to Lowest Achievable Emission Rates (LAER) and emissions offsets. These regulations are subject to facilities constructed after August 9, 1984. In essence, this massive increase in generation by existing sources is comparable to constructing one large new source without subjecting it to these current applicable regulations. The increase in NO_x and VOC, the precursors to ozone, will likely mean that the area will not reach attainment status in the near future. In order to reach attainment, the area needs to further reduce emissions in the area as opposed to unnecessarily increasing these emission rates.

The matrix outlines the effects of all criteria pollutants and the groups that are most greatly impacted by them. As shown with carbon monoxide and ozone, these pollutants affect all people, regardless of age and current health, in addition to the vegetation in the area.

Regulatory Impacts and Effects of Major Air Pollutants

Pollutant	NAAQS Attainment Status for New York State	Basis for NAAQS	Most Susceptible Population Groups	Additional Impacts
SO_2	Attainment	Temporary breathing difficulty Respiratory illness Aggravates existing Heart Disease	Asthmatics, Children, Elderly, Persons with Heart or Lung Disease	Precursor to acid rain formation Visibility impairment from Sulfate Particles (PM-2.5) Aesthetics damage due to accelerated building decay Acidification of lakes due to Atmospheric Deposition Soil degradation due to Atmospheric Deposition
NO_x	Attainment	Damage to lung tissue Respiratory illnesses – Bronchitis Reduction in lung function	Children, Asthmatics, Outdoor Workers	Precursor to ground-level Ozone (Smog) Precursor to acid rain formation Water quality deterioration (Oxygen depletion) Visibility impairment
PM-10	Attainment for all Counties with exception of New York County	Aggravated Asthma Chronic Bronchitis Decreased lung function Premature Death	Persons with Heart Disease or Influenza, Asthmatics, Children, Elderly	Major cause of reduced visibility (Haze) Aesthetics damage due to stains from soot Acidification of lakes due to Atmospheric Deposition Soil degradation due to Atmospheric Deposition
CO	Attainment with exception of Metropolitan New York City	Cardiovascular effects Vision problems Reduced ability to work and learn Death (extremely high levels)	Persons with Heart or Lung Disease	
Ozone	Attainment for all counties with exceptions of New York State Metropolitan Areas and Long Island	Lung irritation (wheezing, coughing) Permanent lung damage Aggravated Asthma Reduced lung capacity Pneumonia and Bronchitis	Persons with respiratory illnesses, Children, Outdoor workers	Increases susceptibility of plants to disease Reduces crop and forest yields Aesthetics damage due to damage to leaves and trees Damages rubber and fabrics Reduced visibility
VOC	Not Applicable	Not Applicable	Not Applicable	Precursor to ground-level Ozone (Smog) Damage to plants
CO_2	Not Applicable	Not Applicable	Not Applicable	Contributes to Global Warming

APPENDIX A

EMISSION AVOIDANCE CALCULATIONS

Entergy - Indian Point
Emission Avoidance Study

Gneration Fuel Mix Data - from Table 9 from New York State Energy Plan

Generation Fuel	In GWh			
	2002	2003	2004	2005
Natural Gas	24,706	25,628	34,115	54,902
Oil	24,774	24,509	19,212	9,384
Coal	29,380	29,295	28,030	17,934
Nuclear	32,563	32,559	32,662	32,558
Hydro	29,109	29,090	29,111	29,011
Other	2,866	3,004	3,150	3,283
Net Imports	18,799	19,463	18,747	19,731
TOTAL - calc	**162,197**	**163,548**	**165,027**	**166,803**
TOTAL - given	**162,207**	**163,549**	**165,028**	**166,442**

Note: Total provided in source table does not correspond to the arithmetic total of GWh produced for each of the fuels. The calculated total was used in the calculation of the percentages in the following table.

Generation Fuel	In Percent of Total			
	2002	2003	2004	2005
Natural Gas	15.2%	15.7%	20.7%	33.0%
Oil	15.3%	15.0%	11.6%	5.6%
Coal	18.1%	17.9%	17.0%	10.8%
Nuclear	20.1%	19.9%	19.8%	19.6%
Hydro	17.9%	17.8%	17.6%	17.4%
Other	1.8%	1.8%	1.9%	2.0%
Net Imports	11.6%	11.9%	11.4%	11.6%
TOTAL	**100.0%**	**100.0%**	**100.0%**	**100.0%**

Note: Above Information Obtained from Table 9 from the New York State Energy Plan

Generation Fuel	In Percent of Total			
	2002	2003	2004	2005
Natural Gas	15.2%	15.7%	20.7%	32.9%
Oil	15.3%	15.0%	11.6%	5.6%
Coal	18.1%	17.9%	17.0%	10.8%
Nuclear	20.1%	19.9%	19.8%	19.5%
Hydro	17.9%	17.8%	17.6%	17.4%
Other	1.8%	1.8%	1.9%	2.0%
Net Imports	11.6%	11.9%	11.4%	11.8%
TOTAL	**100.0%**	**100.0%**	**100.0%**	**100.0%**

Note: Above Percentages Calculated from given Generation Fuel Mix

Entergy - Indian Point
Emission Avoidance Study

1998 Data - E-Grid

Capacity	38,519	MW
Heat Input	933,615,646	MMBtu
Generation	144,795,255	(MWh)

Fuel	Fuel Mix %	MWh
Coal	17.0%	24,401,936
Oil	10.4%	14,939,368
Gas	29.7%	42,689,444
Nuclear	21.8%	31,313,708
Other Fossil	0.4%	587,139
Biomass	1.3%	1,803,829
Hydro	19.5%	28,065,751
TOTAL	**100.0%**	**143,801,175**

Indian Point - Units 2 & 3	
MWh	15,552,767
% of Total	10.8%

		FOSSIL		COAL		OIL		GA
		output	input	output	input	output	input	output
Pollutant	tons	lbs/MWh	lbs/MMBtu	lbs/MWh	lbs/MMBtu	lbs/MWh	lbs/MMBtu	lbs/MWh
Annual CO_2	69,010,726	1658.57	151.68	2295.74	202.42	1753.03	150.88	1234.69
Annual SO_2	317,766	7.57	0.69	19.06	1.68	7.94	0.68	0.43
Annual NO_x	107,232	2.56	0.23	4.87	0.43	2.55	0.22	1.15
Ozone NO_x	50,339	2.52	0.21	4.88	0.41	2.54	0.21	1.23
PM-10*				0.48	0.042	0.14	0.012	0.069
CO*				0.23	0.020	0.038	0.0033	0.16
VOC*				0.028	0.0024	0.005	0.00041	0.022
Annual Hg	1,156	0.014	0.0012	0.044	0.0039			

* Emissions are based on AP-42 emission Factors. Particulate emissions include condensables and filterables. Output-based factor 10, CO and VOC are calculated based on heat rate for each fuel type derived from the above data. Natural gas and oil factors based comparing combustion turbine and boiler factors and selecting the lower factor.

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input lbs/MMBtu
118.36
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Entergy - Indian Point
Emission Avoidance Study

Generation Fuel	In Percent of Total			
	2002	2003	2004	2005
Natural Gas	15.2%	15.7%	20.7%	32.9%
Oil	15.3%	15.0%	11.6%	5.6%
Coal	18.1%	17.9%	17.0%	10.8%
Nuclear	20.1%	19.9%	19.8%	19.5%
Hydro	17.9%	17.8%	17.6%	17.4%
Other	1.8%	1.8%	1.9%	2.0%
Net Imports	11.6%	11.9%	11.4%	11.8%
TOTAL	**100.0%**	**100.0%**	**100.0%**	**100.0%**

Note: Above Percentages Calculated from given Generation Fuel Mix

Emission Factors Obtained from E-Grid - 1998 data (and AP-42 for PM-10, CO and VOC)

		COAL		OIL		GAS	
		output	input	output	input	output	input
Pollutant	tons	lbs/MWh	lbs/MMBtu	lbs/MWh	lbs/MMBtu	lbs/MWh	lbs/MMBtu
Annual CO_2	69,010,726	2295.74	202.42	1753.03	150.88	1234.69	118.36
Annual SO_2	317,766	19.06	1.68	7.94	0.68	0.43	0.040
Annual NO_x	107,232	4.87	0.43	2.55	0.22	1.15	0.11
Ozone NO_x	50,339	4.88	0.41	2.54	0.21	1.23	0.11
PM-10*	NA	0.48	0.042	0.14	0.012	0.069	0.0066
CO*	NA	0.23	0.020	0.038	0.003	0.16	0.015
VOC*	NA	0.028	0.0024	0.0048	0.00041	0.022	0.0021
Annual Hg	1,156	0.044	0.0039	0	0	0	0

Assume Replacement by existing Natural Gas, Oil and Coal fired sources.

2002 Generation Fuel Mix

	Unit #2	Unit #3	Total
Net Output (MW)	983.7	989	1972.7
Capacity Factor (%)	90%	90%	90%
12-month Net Generation (MWh)	7,755,491	7,797,276	15,552,767
Annual CO_2 (tons)	6,952,142	6,989,599	13,941,742
Annual SO_2 (tons)	37,731	37,934	75,665
Annual NO_x (tons)	11,539	11,601	23,140
Ozone NO_x (tons)	4,849	4,876	9,725
PM-10	942	947	1,890
CO	571	574	1,145
VOC	73	73	145
Annual Hg (tons)	64	64	128

2003 Generation Fuel Mix

	Unit #2	Unit #3	Total
Net Output (MW)	983.7	989	1972.7
Capacity Factor (%)	90%	90%	90%
12-month Net Generation (MWh)	7,755,491	7,797,276	15,552,767
Annual CO_2 (tons)	6,925,448	6,962,761	13,888,209
Annual SO_2 (tons)	37,297	37,497	74,794
Annual NO_x (tons)	11,455	11,516	22,971
Ozone NO_x (tons)	4,815	4,841	9,657
PM-10	935	940	1,875
CO	573	576	1,148
VOC	73	73	146
Annual Hg (tons)	63	63	126

2004 Generation Fuel Mix

	Unit #2	Unit #3	Total
Net Output (MW)	983.7	989	1972.7
Capacity Factor (%)	90%	90%	90%
12-month Net Generation (MWh)	7,755,491	7,797,276	15,552,767
Annual CO_2 (tons)	6,680,028	6,716,018	13,396,046
Annual SO_2 (tons)	33,434	33,614	67,048
Annual NO_x (tons)	10,711	10,769	21,480
Ozone NO_x (tons)	4,519	4,543	9,062
PM-10	877	881	1,758
CO	599	602	1,201
VOC	77	78	155
Annual Hg (tons)	59	59	118

2005 Generation Fuel Mix

	Unit #2	Unit #3	Total
Net Output (MW)	983.7	989	1972.7
Capacity Factor (%)	90%	90%	90%
12-month Net Generation (MWh)	7,755,491	7,797,276	15,552,767
Annual CO_2 (tons)	7,244,319	7,283,350	14,527,670
Annual SO_2 (tons)	31,788	31,959	63,747
Annual NO_x (tons)	11,046	11,106	22,152
Ozone NO_x (tons)	4,693	4,718	9,411
PM-10	919	924	1,844
CO	752	756	1,508
VOC	98	99	197
Annual Hg (tons)	63	63	126

Entergy - Indian Point
Emission Avoidance Study

	Coal Generaton (MWh)	Oil Generation (MWh)	Gas Generation (MWh)	Total Generation (MWh)	Capacity (MW)	Capacity Factor	Heat Rate (Btu/kWh)
Bowline Point	0	1,018,218	2,503,152	3,521,370	1,242	0.324	12,880
Lovett	1,618,392	86	454,188	2,072,666	449.1	0.527	11,745
Danskammer	2,514,449	264	220,461	2,735,174	537.4	0.581	10,891
Roseton	0	3,228,349	429,265	3,657,614	1,242	0.336	12,592

	Annual CO_2 (tons)	Annual SO_2 (tons)	Annual NO_x (tons)	Ozone Season NO_x (tons)	Annual Hg (lbs)
Bowline Point	2,957,361	2,193	4,273	2,358	0
Lovett	2,259,440	9,324	4,570	2,096	36.2
Danskammer	2,950,904	13,938	6,444	2,811	127.2
Roseton	3,614,561	24,729	4,714	2,181	0

	CO_2 Rate (lbs/MWh)	CO_2 Rate (lbs/MMBtu)	SO_2 Rate (lbs/MWh)	SO_2 Rate (lbs/MMBtu)	Annual NO_x Rate (lbs/MWh)	Annual NO_x Rate (lbs/MMBtu)	Ozone Season NO_x Rate (lbs/MWh)	Ozone Season NO_x Rate (lbs/MMBtu)	Hg Rate (lbs/GWh)	Hg Rate (lbs/Bbtu)
Bowline Point	1,679.66	130.41	1.25	0.10	2.43	0.19	2.48	0.19	0	0
Lovett	2,180.23	185.63	9.00	0.77	4.41	0.38	4.29	0.36	0.0175	0.0015
Danskammer	2,157.74	198.11	10.19	0.94	4.71	0.43	4.57	0.42	0.0465	0.0043
Roseton	1,976.46	156.96	13.52	1.07	2.58	0.20	2.58	0.20	0	0

	PM Rate (lbs/MWh)	PM Rate (lbs/MMBtu)	CO Rate (lbs/MWh)	CO Rate (lbs/MMBtu)	VOC Rate (lbs/MWh)	VOC Rate (lbs/MMBtu)
Bowline Point	0.36	0.028	0.86	0.069	0.069	0.0054
Lovett	0.289	0.025	0.40	0.034	0.036	0.0031
Danskammer	0.31	0.028	0.28	0.025	0.029	0.0027
Roseton	0.92	0.073	0.520	0.0412	0.0700	0.00542

	COAL	**NO. 6 OIL**	**GAS**
	input	**input**	**input**
Pollutant	**lbs/MMBtu**	**lbs/MMBtu**	**lbs/MMBtu**
PM-10*	0.042	0.082	0.0054
CO*	0.020	0.036	0.082
VOC*	0.0024	0.0054	0.0054
Annual Hg	0.0039	--	--

* Emissions are based on AP-42 emission Factors. Particulate emissions include condensables and filterables. Output-based factors for PM-10, CO

Entergy - Indian Point
Emission Avoidance Study

Indian Point Generating Capacity	
Unit 2 (MW)	983.7
Unit 3 (MW)	989
Total (MW)	1972.7
Capacity Factor	90%
12-month Net Generation (MWh)	15,552,767

Current Emissions

	Current Generation (MWh)	Available Generation (MWh)*	Annual CO_2 (tons)	Annual SO_2 (tons)	Annual NO_x (tons)	Ozone Season NO_x (tons)	Annual Hg (lbs)	Annual PM-10 (tons)	Annual CO (tons)	Annual VOC (tons)
Bowline Point	3,521,370	6,270,558	2,957,361	2,193	4,273	2,358	0	626	1,516	122
Lovett	2,072,666	1,468,038	2,259,440	9,324	4,570	2,096	36	300	412	37
Danskammer	2,735,174	1,501,688	2,950,904	13,938	6,444	2,811	127	417	377	40
Roseton	3,657,614	6,134,314	3,614,561	24,729	4,714	2,181	0	1,684	952	128
TOTAL	**11,986,824**	**15,374,598**	**11,782,266**	**50,184**	**20,002**	**9,447**	**163**	**3,027**	**3,256**	**327**

*** Assuming a 90% capacity factor for necessary shutdowns.**

Replace Emissions - Scenario 1

	Percent Replaced	Increased Generation (MWh)	Annual CO_2 (tons)	Annual SO_2 (tons)	Annual NO_x (tons)	Ozone Season NO_x (tons)	Annual Hg (lbs)	Annual PM-10 (tons)	Annual CO (tons)	Annual VOC (tons)
Bowline Point	40.3%	6,270,558	5,266,203	3,919	7,619	1,960	0	1,114	2,699	217
Lovett	9.4%	1,468,038	1,600,331	6,606	3,237	794	26	212	292	26
Danskammer	9.7%	1,501,688	1,620,126	7,651	3,536	865	70	229	207	22
Roseton	39.4%	6,134,314	6,062,113	41,468	7,913	1,995	0	2,825	1,596	215
TOTAL	**99%**	**15,374,598**	**14,548,772**	**59,644**	**22,305**	**5,613**	**96**	**4,380**	**4,794**	**480**

Increased Emissions - Scenario 1

	Annual CO_2 (tons)	Annual SO_2 (tons)	Annual NO_x (tons)	Ozone Season NO_x (tons)	Annual Hg (lbs)	Annual PM-10 (tons)	Annual CO (tons)	Annual VOC (tons)
Bowline Point	178%	179%	178%	83%	0%	178%	178%	178%
Lovett	71%	71%	71%	38%	71%	71%	71%	71%
Danskammer	55%	55%	55%	31%	55%	55%	55%	55%
Roseton	168%	168%	168%	91%	0%	168%	168%	168%
TOTAL	**123%**	**119%**	**112%**	**59%**	**58%**	**145%**	**147%**	**147%**

Entergy - Indian Point
Emission Avoidance Study

	Oil Generation (MWh)	Gas Generation (MWh)	Total Generation (MWh)	Capacity (MW)	Capacity Factor	Heat Rate (Btu/kWh)
Bronx Zoo	1,957	19,529	21,486	3.80	0.648	7,553
Ravenswood	620,133	3,102,402	3,722,535	2,310	0.184	13,210
Charles Poletti	2,247,830	390,380	2,638,210	883.0	0.341	11,373
JFK Cogen	0	569,591	569,591	121.1	0.537	7,684
Far Rockaway	0	359,190	359,190	100.0	0.410	11,317
Astoria	863,747	3,398,031	4,261,778	1,150.6	0.423	12,991
Arthur Kill	0	1,237,781	1,237,781	928.0	0.152	13,129
East River	259,283	231,769	491,052	356.3	0.157	11,795
Waterside	1,074	507,733	508,807	199.8	0.291	8,427
Hudson Ave	2,547	0	2,547	48.9	0.006	8,590
Brooklyn Navy Yard	12,742	1,788,404	1,801,146	336.6	0.611	8,500
Warbasse Cogen	6,868	60,780	67,648	37.8	0.204	16,064
Gowanus	114,743	0	114,743	688.0	0.019	18,182
Narrows	26,377	65,003	91,380	393.1	0.027	17,404

	Annual CO_2 (tons)	Annual SO_2 (tons)	Annual NO_x (tons)	Ozone Season NO_x (tons)	Annual Hg (lbs)
Bronx Zoo	9,720	2	8	3	0
Ravenswood	3,104,337	1,140	3,586	2,602	0
Charles Poletti	2,327,340	3,835	3,446	1,695	0.0
JFK Cogen	253,407	0	167	69	0.0
Far Rockaway	241,576	1	220	97	0.0
Astoria	3,559,363	1,676	4,676	2,191	0.0
Arthur Kill	963,372	5	874	829	0.0
East River	411,987	480	738	334	0.0
Waterside	262,004	3	158	62	0.0
Hudson Ave	1,747	3	10	4	0.0
Brooklyn Navy Yard	924,051	7	73	26	0.0
Warbasse Cogen	65,618	9	42	18	0.0
Gowanus	166,544	324	921	384	0.0
Narrows	102,647	77	388	162	0.0

	CO_2 Rate (lbs/MWh)	CO_2 Rate (lbs/MMBtu)	SO_2 Rate (lbs/MWh)	SO_2 Rate (lbs/MMBtu)	Annual NO_x Rate (lbs/MWh)	Annual NO_x Rate (lbs/MMBtu)	Ozone Season NO_x Rate (lbs/MWh)	Ozone Season NO_x Rate (lbs/MMBtu)
Bronx Zoo	904.75	119.79	0.17	0.02	0.76	0.10	0.76	0.10
Ravenswood	1,667.86	126.26	0.61	0.05	1.93	0.15	1.97	0.15
Charles Poletti	1,764.33	155.13	2.91	0.26	2.61	0.23	2.59	0.23
JFK Cogen	898.78	115.80	0.00	0.00	0.59	0.08	0.59	0.08
Far Rockaway	1,345.12	118.86	0.01	0.00	1.22	0.11	1.11	0.10
Astoria	1,670.37	128.58	0.79	0.06	2.19	0.17	2.04	0.16
Arthur Kill	1,556.61	118.56	0.01	0.00	1.41	0.11	1.51	0.11
East River	1,677.98	142.26	1.95	0.17	3.01	0.25	2.29	0.26
Waterside	1,029.87	122.22	0.01	0.00	0.62	0.07	0.61	0.07
Hudson Ave	1,357.06	159.65	2.64	0.31	7.50	0.88	3.75	0.88
Brooklyn Navy Yard	1,026.07	120.71	0.01	0.00	0.08	0.01	0.07	0.01
Warbasse Cogen	1,939.98	120.76	0.27	0.02	1.25	0.08	1.25	0.08
Gowanus	2,902.90	159.65	5.66	0.31	16.05	0.88	8.87	0.88
Narrows	2,246.60	129.08	1.68	0.10	8.50	0.49	4.44	0.49

	PM Rate (lbs/MWh)	PM Rate (lbs/MMBtu)	CO Rate (lbs/MWh)	CO Rate (lbs/MMBtu)	VOC Rate (lbs/MWh)	VOC Rate (lbs/MMBtu)
Bronx Zoo	0.05	0.007	0.11	0.014	0.015	0.0019
Ravenswood	0.10	0.007	0.17	0.013	0.023	0.0018
Charles Poletti	0.13	0.011	0.06	0.005	0.007	0.0007
JFK Cogen	0.05	0.007	0.12	0.015	0.015	0.0021
Far Rockaway	0.07	0.007	0.17	0.015	0.023	0.0021
Astoria	0.10	0.008	0.16	0.013	0.023	0.0018
Arthur Kill	0.09	0.007	0.20	0.015	0.027	0.0021
East River	0.11	0.009	0.10	0.009	0.015	0.0012
Waterside	0.06	0.007	0.13	0.015	0.019	0.0021
Hudson Ave	0.10	0.012	0.03	0.003	0.003	0.0004
Brooklyn Navy Yard	0.06	0.007	0.13	0.015	0.017	0.0021
Warbasse Cogen	0.11	0.007	0.22	0.014	0.030	0.0019
Gowanus	0.22	0.012	0.06	0.003	0.007	0.0004
Narrows	0.14	0.008	0.20	0.012	0.028	0.0016

	NO. 2 OIL	**GAS**
	input	**input**
Pollutant	**lbs/MMBtu**	**lbs/MMBtu**
PM-10*	0.012	0.0066
CO*	0.0033	0.015
VOC*	0.00041	0.0021

* Emissions are based on AP-42 emission Factors. Particulate emissions include condensables and filterables. Output-based factors for PM-

Entergy - Indian Point
Emission Avoidance Study

Indian Point Generating Capacity	
Unit 2 (MW)	983.7
Unit 3 (MW)	989
Total (MW)	1972.7
Capacity Factor	90%
12-month Net Generation (MWh)	15,552,767

Current Emissions

	Current Generation (MWh)	Available Generation (MWh)	Annual CO_2 (tons)	Annual SO_2 (tons)	Annual NO_x (tons)	Ozone Season NO_x (tons)	Annual PM-10 (tons)	Annual CO (tons)	Annual VOC (tons)
Bronx Zoo	21,486	8,473	9,720	2	8	3	0.6	1.1	0.2
Ravenswood	3,722,535	14,485,563	3,104,337	1,140	3,586	2,602	184.4	320.9	43.5
Charles Poletti	2,638,210	4,323,362	2,327,340	3,835	3,446	1,695	168.0	75.5	9.9
JFK Cogen	569,591	385,161	253,407	0	167	69	14.6	33.2	4.4
Far Rockaway	359,190	429,210	241,576	1	220	97	13.4	30.5	4.2
Astoria	4,261,778	4,809,552	3,559,363	1,676	4,676	2,191	213.0	349.6	48.2
Arthur Kill	1,237,781	6,078,571	963,372	5	874	829	53.6	121.9	16.7
East River	491,052	2,318,017	411,987	480	738	334	27.4	25.5	3.6
Waterside	508,807	1,066,416	262,004	3	158	62	14.2	32.1	4.7
Hudson Ave	2,547	382,981	1,747	3	10	4	0.1	0.0	0.0
Brooklyn Navy Yard	1,801,146	852,608	924,051	7	73	26	50.8	114.2	15.0
Warbasse Cogen	67,648	230,367	65,618	9	42	18	3.9	7.5	1.0
Gowanus	114,743	5,309,449	166,544	324	921	384	12.5	3.4	0.4
Narrows	91,380	3,007,820	102,647	77	388	162	6.5	9.2	1.3
TOTAL	**15,887,894**	**43,687,552**	**12,393,712**	**7,561**	**15,307**	**8,476**	**763**	**1,125**	**153**

Replaced Emissions

	Percent Replaced	Increased Generation (MWh)	Annual CO_2 (tons)	Annual SO_2 (tons)	Annual NO_x (tons)	Ozone Season NO_x (tons)	Annual PM-10 (tons)	Annual CO (tons)	Annual VOC (tons)
Bronx Zoo	0.054%	8,473	3,833	1	3	1	0.2	0.4	0.1
Ravenswood	25.4%	3,946,194	3,290,850	1,204	3,808	980	195.5	340.2	46.2
Charles Poletti	18.0%	2,796,720	2,467,169	4,069	3,650	913	178.1	80.0	10.5
JFK Cogen	2.5%	385,161	173,088	0	114	29	9.9	22.4	3.0
Far Rockaway	2.4%	380,771	256,091	2	232	53	14.2	32.3	4.4
Astoria	29.0%	4,517,836	3,773,229	1,785	4,947	1,162	225.8	370.6	51.1
Arthur Kill	8.4%	1,312,150	1,021,253	7	925	250	56.9	129.2	17.7
East River	3.3%	520,556	436,741	508	783	150	29.0	27.1	3.8
Waterside	3.5%	539,377	277,744	3	167	41	15.0	34.0	5.0
Hudson Ave	0.017%	2,700	1,832	4	10	1	0.1	0.0	0.0
Brooklyn Navy Yard	5.5%	852,608	437,418	4	34	8	24.1	54.1	7.1
Warbasse Cogen	0.46%	71,712	69,560	10	45	11	4.1	8.0	1.1
Gowanus	0.78%	121,637	176,550	344	976	136	13.3	3.6	0.5
Narrows	0.62%	96,870	108,814	81	412	54	6.9	9.8	1.4
TOTAL	**100%**	**15,552,767**	**12,494,172**	**8,020**	**16,107**	**3,580**	**773**	**1,112**	**142**

Increased Emissions

	Annual CO_2 (tons)	Annual SO_2 (tons)	Annual NO_x (tons)	Ozone Season NO_x (tons)	Annual PM-10 (tons)	Annual CO (tons)	Annual VOC (tons)
Bronx Zoo	39%	39%	39%	24%	39%	39%	39%
Ravenswood	106%	106%	106%	38%	106%	106%	106%
Charles Poletti	106%	106%	106%	54%	106%	106%	106%
JFK Cogen	68%	0%	68%	41%	68%	68%	68%
Far Rockaway	106%	159%	106%	55%	106%	106%	106%
Astoria	106%	106%	106%	53%	106%	106%	106%
Arthur Kill	106%	134%	106%	30%	106%	106%	106%
East River	106%	106%	106%	45%	106%	106%	106%
Waterside	106%	96%	106%	67%	106%	106%	106%
Hudson Ave	105%	105%	105%	32%	106%	106%	106%
Brooklyn Navy Yard	47%	64%	46%	29%	47%	47%	47%
Warbasse Cogen	106%	107%	106%	64%	106%	106%	106%
Gowanus	106%	106%	106%	35%	106%	106%	106%
Narrows	106%	106%	106%	33%	106%	106%	106%
TOTAL	**101%**	**106%**	**105%**	**42%**	**101%**	**99%**	**93%**

Entergy - Indian Point
Emission Avoidance Study

Indian Point Generating Capacity	
Unit 2 (MW)	983.7
Unit 3 (MW)	989
Total (MW)	1972.7
Capacity Factor	90%
12-month Net Generation (MWh)	15,552,767

Current Emissions

	Current Generation (MWh)	Available Generation (MWh)*	Annual CO_2 (tons)	Annual SO_2 (tons)	Annual NO_x (tons)	Ozone Season NO_x (tons)	Annual Hg (lbs)	Annual PM-10 (tons)	Annual CO (tons)	Annual VOC (tons)
Bowline Point	3,521,370	6,270,558	2,957,361	2,193	4,273	2,358	0	626	1,516	122
Lovett	2,072,666	1,468,038	2,259,440	9,324	4,570	2,096	36	300	412	37
Danskammer	2,735,174	1,501,688	2,950,904	13,938	6,444	2,811	127	417	377	40
Roseton	3,657,614	6,134,314	3,614,561	24,729	4,714	2,181	0	1,684	952	128
TOTAL	**11,986,824**	**15,374,598**	**11,782,266**	**50,184**	**20,002**	**9,447**	**163**	**3,027**	**3,256**	**327**

	Current Generation (MWh)	Available Generation (MWh)	Annual CO_2 (tons)	Annual SO_2 (tons)	Annual NO_x (tons)	Ozone Season NO_x (tons)	Annual PM-10 (tons)	Annual CO (tons)	Annual VOC (tons)
Bronx Zoo	21,486	8,473	9,720	2	8	3	0.6	1.1	0.2
Ravenswood	3,722,535	14,485,563	3,104,337	1,140	3,586	2,602	184.4	320.9	43.5
Charles Poletti	2,638,210	4,323,362	2,327,340	3,835	3,446	1,695	168.0	75.5	9.9
JFK Cogen	569,591	385,161	253,407	0	167	69	14.6	33.2	4.4
Far Rockaway	359,190	429,210	241,576	1	220	97	13.4	30.5	4.2
Astoria	4,261,778	4,809,552	3,559,363	1,676	4,676	2,191	213.0	349.6	48.2
Arthur Kill	1,237,781	6,078,571	963,372	5	874	829	53.6	121.9	16.7
East River	491,052	2,318,017	411,987	480	738	334	27.4	25.5	3.6
Waterside	508,807	1,066,416	262,004	3	158	62	14.2	32.1	4.7
Hudson Ave	2,547	382,981	1,747	3	10	4	0.1	0.0	0.0
Brooklyn Navy Yard	1,801,146	852,608	924,051	7	73	26	50.8	114.2	15.0
Warbasse Cogen	67,648	230,367	65,618	9	42	18	3.9	7.5	1.0
Gowanus	114,743	5,309,449	166,544	324	921	384	12.5	3.4	0.4
Narrows	91,380	3,007,820	102,647	77	388	162	6.5	9.2	1.3
TOTAL	**15,887,894**	**43,687,552**	**12,393,712**	**7,561**	**15,307**	**8,476**	**763**	**1,125**	**153**

	Current Generation (MWh)	Available Generation (MWh)*	Annual CO_2 (tons)	Annual SO_2 (tons)	Annual NO_x (tons)	Ozone Season NO_x (tons)	Annual Hg (lbs)	Annual PM-10 (tons)	Annual CO (tons)	Annual VOC (tons)
TOTAL	**27,874,718**	**59,062,150**	**24,175,978**	**57,745**	**35,309**	**17,922**	**163**	**3,790**	**4,380**	**480**

Replaced Emissions - half replacement by Hudson Valley Plants, half from NYC plants

	Percent Replaced	Increased Generation (MWh)	Annual CO_2 (tons)	Annual SO_2 (tons)	Annual NO_x (tons)	Ozone Season NO_x (tons)	Annual Hg (lbs)	Annual PM-10 (tons)	Annual CO (tons)	Annual VOC (tons)
Bowline Point	15.4%	2,388,279	2,005,749	1,493	2,902	746	0	424	1,028	83
Lovett	9.0%	1,405,733	1,532,411	6,326	3,100	760	25	203	279	25
Danskammer	9.7%	1,501,688	1,620,126	7,651	3,536	865	70	229	207	22
Roseton	16.0%	2,480,683	2,451,486	16,769	3,200	807	0	1,142	646	87
TOTAL	**50.0%**	**7,776,383**	**7,609,771**	**32,239**	**12,738**	**3,178**	**94**	**1,999**	**2,159**	**217**

	Percent Replaced	Increased Generation (MWh)	Annual CO_2 (tons)	Annual SO_2 (tons)	Annual NO_x (tons)	Ozone Season NO_x (tons)	Annual PM-10 (tons)	Annual CO (tons)	Annual VOC (tons)
Bronx Zoo	0.054%	8,473	3,833	1	3	1	0.2	0.4	0.1
Ravenswood	11.8%	1,830,215	1,526,271	558	1,766	454	90.7	157.8	21.4
Charles Poletti	8.3%	1,297,098	1,144,254	1,887	1,693	423	82.6	37.1	4.9
JFK Cogen	1.8%	280,044	125,849	0	83	21	7.2	16.3	2.2
Far Rockaway	1.1%	176,599	118,773	1	108	25	6.6	15.0	2.1
Astoria	13.5%	2,095,338	1,749,995	828	2,294	539	104.7	171.9	23.7
Arthur Kill	3.9%	608,565	473,649	3	429	116	26.4	59.9	8.2
East River	1.6%	241,430	202,557	235	363	70	13.5	12.6	1.8
Waterside	1.6%	250,159	128,816	1	78	19	7.0	15.8	2.3
Hudson Ave	0.008%	1,252	850	2	5	1	0.1	0.0	0.0
Brooklyn Navy Yard	5.5%	852,608	437,418	4	34	8	24.1	54.1	7.1
Warbasse Cogen	0.21%	33,260	32,262	4	21	5	1.9	3.7	0.5
Gowanus	0.36%	56,414	81,883	160	453	63	6.2	1.7	0.2
Narrows	0.29%	44,928	50,467	38	191	25	3.2	4.5	0.6
TOTAL	**50%**	**7,776,383**	**6,076,877**	**3,722**	**7,520**	**1,668**	**374**	**551**	**75**

	Percent Replaced	Increased Generation (MWh)	Annual CO_2 (tons)	Annual SO_2 (tons)	Annual NO_x (tons)	Ozone Season NO_x (tons)	Annual Hg (lbs)	Annual PM-10 (tons)	Annual CO (tons)	Annual VOC (tons)
TOTAL	**100%**	**15,552,767**	**13,686,648**	**35,961**	**20,258**	**4,846**	**94**	**2,373**	**2,710**	**292**

Increased Emissions

	Annual CO_2 (tons)	Annual SO_2 (tons)	Annual NO_x (tons)	Ozone Season NO_x (tons)	Annual Hg (lbs)	Annual PM-10 (tons)	Annual CO (tons)	Annual VOC (tons)
Bowline Point	68%	68%	68%	32%	0%	68%	68%	68%
Lovett	68%	68%	68%	36%	68%	68%	68%	68%
Danskammer	55%	55%	55%	31%	55%	55%	55%	55%
Roseton	68%	68%	68%	37%	0%	68%	68%	68%
Bronx Zoo	39%	39%	39%	24%	--	39%	39%	39%
Ravenswood	49%	49%	49%	17%	--	49%	49%	49%
Charles Poletti	49%	49%	49%	25%	--	49%	49%	49%
JFK Cogen	50%	0%	50%	30%	--	49%	49%	49%
Far Rockaway	49%	74%	49%	26%	--	49%	49%	49%
Astoria	49%	49%	49%	25%	--	49%	49%	49%
Arthur Kill	49%	62%	49%	14%	--	49%	49%	49%
East River	49%	49%	49%	21%	--	49%	49%	49%
Waterside	49%	44%	49%	31%	--	49%	49%	49%
Hudson Ave	49%	49%	49%	15%	--	49%	49%	49%
Brooklyn Navy Yard	47%	64%	46%	29%	--	47%	47%	47%
Warbasse Cogen	49%	50%	49%	30%	--	49%	49%	49%
Gowanus	49%	49%	49%	16%	--	49%	49%	49%
Narrows	49%	49%	49%	16%	--	49%	49%	49%
TOTAL	**57%**	**62%**	**57%**	**27%**	**58%**	58%	63%	62%

Entergy - Indian Point
Emission Avoidance Study

Baseline Statewide Emissions and Calculated Increases Under Different Generation Replacement Source Assumptions

Source	CO_2	SO_2	NO_x	PM-10	CO	VOC
NY Statewide - All Sources[(a)]	248,241,000	688,000	723,000	767,000	3,337,000	753,000
NY Statewide - Utilities Only[(b)]	69,010,726	317,766	107,232	8,328	6,450	842
2002 Generation Mix	13,941,742	75,665	23,140	1,890	1,145	145
2003 Generation Mix	13,888,209	74,794	22,971	1,875	1,148	146
2004 Generation Mix	13,396,046	67,048	21,480	1,758	599	155
2005 Generation Mix	14,527,670	63,747	22,152	1,844	752	197
Hudson Valley	14,548,772	59,644	22,305	4,380	4,794	480
New York City	12,494,172	8,020	16,107	773	1,112	142
Hudson Valley and New York City	13,686,648	35,961	20,258	2,373	2,710	292

(a) based on USEPA Emission Trends Report (baseline year = 1998)

(b) based on USEPA's E-GRID database (baseline year = 1998)

Percent Increase in NY Statewide Emissions from All Sources

Source	CO_2	SO_2	NO_x	PM-10	CO	VOC
2002 Generation Mix	5.62%	11.00%	3.20%	0.25%	0.03%	0.02%
2003 Generation Mix	5.59%	10.87%	3.18%	0.24%	0.03%	0.02%
2004 Generation Mix	5.40%	9.75%	2.97%	0.23%	0.02%	0.02%
2005 Generation Mix	5.85%	9.27%	3.06%	0.24%	0.02%	0.03%
Hudson Valley	5.86%	8.67%	3.09%	0.57%	0.14%	0.06%
New York City	5.03%	1.17%	2.23%	0.10%	0.03%	0.02%
Hudson Valley and New York City	5.51%	5.23%	2.80%	0.31%	0.08%	0.04%

Percent Increase in NY Statewide Utility Emissions

Source	CO_2	SO_2	NO_x	PM-10	CO	VOC
2002 Generation Mix	20.20%	23.81%	21.58%	22.69%	17.76%	17.28%
2003 Generation Mix	20.12%	23.54%	21.42%	22.51%	17.80%	17.34%
2004 Generation Mix	19.41%	21.10%	20.03%	21.11%	9.28%	18.36%
2005 Generation Mix	21.05%	20.06%	20.66%	22.14%	11.66%	23.44%
Hudson Valley	21.08%	18.77%	20.80%	52.59%	74.31%	56.97%
New York City	18.10%	2.52%	15.02%	9.28%	17.24%	16.83%
Hudson Valley and New York City	19.83%	11.32%	18.89%	28.49%	42.02%	34.63%

Entergy - Indian Point
Emission Avoidance Study

Emission Prices - $/ton

2001	841
2002	***2250***
2003	2960
2004	***3090***
2005	3170

2001, 2003 and 2005 were obtained from NYISO document
Bold and Italic - graphically interpolated

Replacement Source	Ozone NOx (tons)	2002 Cost	2003 Cost	2004 Cost	2005 Cost
2002 Generation Fuel Mix	9,725	$21,881,250	--	--	--
2003 Generation Fuel Mix	9,657	--	$28,584,720	--	--
2004 Generation Fuel Mix	9,062	--	--	$28,001,580	--
2005 Generation Fuel Mix	9,411	--	--	--	$29,832,870
Hudson Valley Plants*	5,613	$12,629,250	$16,614,480	$17,344,170	$17,793,210
New York City Plants*	3,580	$8,055,000	$10,596,800	$11,062,200	$11,348,600
Hudson Valley & NYC Plants*	4,846	$10,903,500	$14,344,160	$14,974,140	$15,361,820

* NOTE: It is unclear whether the necessary generation is available during the ozone season from these sources. These ozone season emissions are based on assuming that the generation is available, and the mix of the plants is the same on an annual basis.

Entergy - Indian Point
Emissions Avoidance Study

NO_x Allowance Cost Estimation