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New Jersey Dept. of Environmental Protection

(Air Resources and the Coast:
A Staff Working Paper

New Jersey Department of Environmental Protection
Division of Marine Services
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Note: This staff working paper is one of a series of Issue and Policy Alternative Papers presenting facts, analyses, and conceptual policy alternatives on coastal resources and coastal land and water resources. The purpose of this draft document is to stimulate discussion and comments that will assist preparation of the management program for the New Jersey coastal zone. This report was prepared in part with financial assistance under the Coastal Zone Management Act, P.L. 92-583.

Comments, criticism, additions, and suggestions are welcome and should be addressed to the New Jersey Office of Coastal Zone Management.

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INTRODUCTION

Air pollution is a major hazard to wildlife, vegetation, and humans, an aesthetic nuisance, and economic burden. Yet it has traditionally been accepted as a necessary evil, partner of modern economic development. In part, this acceptance has been caused by the inability of scientists to accurately quantify dangers and costs of pollution. This lack of awareness is accompanied by high costs of pollution control and a widespread reluctance on the part of private individuals and private industry to assume the costs. Pollution control is still a technological problem, but it is an economic and educational problem as well.

This paper is intended to briefly introduce and initiate further debate on important air issues. The first section presents alternative policies which could be part of the coastal zone management program in New Jersey.

Section II describes existing air quality in New Jersey's coastal area in terms of individual pollutants.

Section III briefly defines air resource issues and then analysis them in terms of their social, economic and environmental implications.

Two appendices conclude the paper. First, the sources and ambient existence of individual pollutants are presented for coastal zone counties. The second appendix provides sources used to support the text.

I. POLICY ALTERNATIVES

Policies to reduce air pollution could aim to reduce the number of automobile VMT's (Vehicle Miles Traveled), reduce emissions, and locate emissions in areas best able to accommodate the stress. Other possible policies include:

1. Standards currently applied to CAFRA permit applications could be maintained for future coastal development projects. Presently, applicants seeking CAFRA permits are required to address questions concerning air quality in the vicinity of the project, the level of emissions projected for the project and the resultant effect upon local air quality, and possible measures to reduce the volume of emissions likely to be generated by the project.

2. A tax on different emissions could be levied by the state. Such a tax would tend to discourage excess pollution and would also return some of the costs of pollution to polluters. Revenues could be used to defray some of the pollution costs presently borne by the general public. Polluters other than for transportation could be taxed either on the basis of emissions measured at their source, or by using a formula based on quantities of fuel combusted and the controls in use at the source.

3. Areas in the coastal zone could be designated for various levels and types of emissions. Minimum

federal ambient air quality standards would have to be met throughout the coast but the State could adopt more stringent area and point standards in non-polluting zones. This could enable localities to determine their own standards; it would also allow control variances to be determined more flexibly. Zoning designations should be developed jointly by DEP and the localities involved. Areas currently without major pollution problems would be discouraged from becoming polluting zones, while those areas that currently face economic dislocation because of strict pollution standards could be given some leeway.

4. More stringent auto emission standards could be established. The present standards were calculated such that 10% of all cars inspected would fail because they fell below air quality standards. The standards are designed to become progressively stricter in the next few years.

II. PHYSICAL CHARACTERISTICS

As one would expect from a densely populated, industrial state, New Jersey has air quality problems. The heavy concentration of petrochemical industries in North Jersey and the heavy volume to automobile traffic, are chiefly responsible for the air quality problems. The state's location, near two large urban concentrations magnifies the problem.

The six coastal counties, on the other hand, are not faced with the same. The automobile is practically the sole polluter; the low population density is reflected in comparatively lower volumes of auto traffic. If DEP's new emission control program is as successful as expected, coastal air quality will be that much cleaner. The proximity to ocean winds helps disperse the pollutants that are produced in the area, keeping polluting levels well within federal ambient standards.

While the six county area is by and large non-industrial, there are major polluters other than the automobile. Electric generating stations in Atlantic, Cape May, and Salem counties and glass manufacturers in Cumberland County. The glass industry has complained that state emission and sulfur-in-fuel content regulations place them at a competitive disadvantage with other glass manufacturers. Energy is more expensive in New Jersey than in most other states; more stringent control measures would probably raise prices even higher. Clean air vs. more jobs in an issue of

concern to the coastal zone.

The major pollutants present in the atmosphere are Carbon Monoxide (CO), Sulfur Dioxide (SO₂), Oxides of Nitrogen (NO_x), unburned Hydrocarbon compounds (HC), and particulates. A sixth, and more obvious pollutant, photochemical smog, is actually a product of many of the above, particularly of Nitrogen Dioxide and Hydrocarbons. Less plentiful pollutants exist, but are by and large absent in the New Jersey coastal zone.

A. Carbon Monoxide

CO is a product of incomplete combustion of Hydrocarbon compounds. In the six CAFRA counties, CO is primarily a product of the internal combustion engine. Federal ambient air quality standards for CO have frequently been violated according to DEP's air monitoring sites in Atlantic City and Toms River, and to a lesser extent in Asbury Park. New auto emission standards should clean up the problem well before 1985. However, CO remains the major pollutant in the six coastal counties.

B. Sulfur Dioxide

Sulfur dioxide has been held responsible for the most serious urban pollution disaster. The major sources are power plants, space heating, and fuel combustion industry. In the coastal area, SO₂ has not been a major problem, although increased power plant construction could change the situation in the next 10 years. Only Salem and Cape May have high emission levels (because of power plants, the Atlantic City generating station at Brezely Point, Cape May is by far the biggest polluter in the area), but expected switches to low sulfur content fuels would ease the situation. Federal standards, except in North Jersey, are currently being met.

C. Nitrogen Oxides

The Nitrogen Oxide compounds, particularly Nitric Oxide and Nitrogen Dioxide, are caused by fuel combustion, either in automobile, power plants, or home heating sources. Nitrogen Dioxide then absorbs light and helps in the production of smog and oxidants. Air monitoring for NO₂ does not exist at the Asbury Park, Atlantic City, and Toms River sites; the North Jersey stations do show violation of federal standards. A big problem here is the fact that devices installed in cars to eliminate CO production tend to increase NO_x production. NO₂ reduction is not foreseen for the coastal area until the 1980's.

D. Hydrocarbons

Hydrocarbons, like most of the other pollutants mentioned here, are primarily caused by automobile and truck traffic. Hydrocarbons play an important role in the formation of ozone and photochemical smog. Better evaporation prevention methods and more complete combustion should do much to lower the HC content in the atmosphere in the next 10 years. No hydrocarbon monitoring taken place in the coastal area, but North Jersey is in frequent violation of federal standards, and it is likely that areas with heavy traffic volumes near the coast have problems here.

E. Particulates

Particulates are emitted into the air from a number of sources. They include industrial ash and soot, as well as dust, salt water, and other natural and man-made particles. Most burning results in the emission of particulate material, be it industrial, commercial, or even solid waste incineration. Coastal counties presently are not in contravention of standards, with no predicted increase except in Ocean County. More careful regulation of burning is expected to help.

III. ISSUES AND ANALYSIS

Parts of the coast have among the cleanest air in the state. Air pollution, however, is a potential health hazard and an aesthetic nuisance to the residents of New Jersey. As development in the area increases, pollution levels are likely to increase as well. There is thus both a current need for reduction of current levels of emissions, and a need for comprehensive planning to mitigate the polluting effects of future development.

A. Economic Questions

The economics, as well as the technology of pollution must be examined. While the cost of controls is likely to be high, existing pollutants already place a great economic strain upon all segments of the population through; decreasing property values, increased cleaning and maintenance costs, damage to crops, transit delays and accidents caused by smog, man-hours lost because of pollution-related diseases, and other health costs. Per capital pollution cost estimates vary greatly; figures mentioned vary from \$65/person (more than 13 billion dollars annually) to as much as five times that amount. Yet except in few instances such as crop diseases, these costs are inadequately recognized by policy makers and by the general public.

The costs of eliminating pollution are also difficult to quantify and may be extremely high, perhaps billions of dollars. The present costs of pollution are more insidious because they remain relatively untouched by traditional

marketplace economics - they are borne by the population at large. Currently, the air is regarded as a free dumping ground. Polluters are forced to pay damages only in extreme cases when causal links are strong enough to indicated sole responsibility for the damages. The burden of proof is presently assumed by those that suffer damages, not by those that cause the damage.

B. Land Development

Certain types of development, such as industrial growth and sprawl development, promote auto traffic and produce large amounts of emmitants. Microclimatic and other local conditions are also important in decisions of spatial growth patterns, some areas are more suseptable to pollution hazards, having specific thresholds of assimilation. This may be due to physiographic conditons, wind patterns, existing air quality, etc.

C. Control Variances

Federal standards were designed to limit the level of emission by controlling area levels. New Jersey regulations, designed to achieve low emission levels, limit pollutants at sources by controlling the sulfur content in fuels and by mandating pollution abatement equipment. Present air pollution control policies do not generally allow for control variances. The New Jersey glass industry has long sought permission to burn higher sulfur-content fuels in order to remain competitive with manufacturers in neighboring states. As the air quality of the coastal zone is generally good, and as a relaxation of standards (if allowed) is likely to apply only in relatively clean areas, the possible issue of control variances is an issue of great concern to the coastal zone.

D. Transportation

In New Jersey, transportation is the major cause of carbon monoxide, hydro-carbon, and nitrogen oxides (the catalyst for photochemical smog) pollution. The other major source is fuel combustion for electric generating, industrial, and space-heating uses. Because parts of the coastal zone currently have little heavy industry, transportation (more specifically, the private automobile) is the major target for coastal air improvement. This is clearly seen in Appendix A: Pollution Sources.

APPENDIX A:
POLLUTION SOURCES AND EXISTING CONDITIONS

TABLE 1: POLLUTION SOURCES

ATLANTIC COUNTY

| | Particulates | SO ₂ | CO | HC | NO ₂ |
|-----------------------|--------------|-----------------|--------|--------|-----------------|
| Power Plants | 174 | 5,684 | 80 | 122 | 5,840 |
| Point Sources | 22 | 16 | 0 | 41 | 187 |
| Area Sources | 1,263 | 5,290 | 253 | 232 | 3,119 |
| Total Fuel Combustion | 1,459 | 10,990 | 333 | 395 | 9,176 |
| Industrial Processes | 0 | 0 | 0 | 0 | 0 |
| Solid Waste | 0 | 0 | 0 | 0 | 0 |
| Cars | 582 | 140 | 60,076 | 10,047 | 5,102 |
| Medium Duty Vehicles | 18 | 5 | 2,146 | 394 | 216 |
| Heavy Duty Vehicles | 76 | 71 | 6,282 | 1,146 | 1,384 |
| Miscellaneous | 676 | 1,357 | 1,528 | 1,274 | 1,640 |
| Total 1970 | 2,436 | 12,563 | 70,365 | 13,256 | 17,488 |
| Projected 1972 | 2,259 | 7,436 | 65,451 | 12,310 | 18,155 |
| Projected 1980 | 1,930 | 8,110 | 49,927 | 9,145 | 19,483 |
| Projected 1985 | 2,528 | 10,688 | 14,528 | 4,567 | 18,119 |

TABLE 1: POLLUTION SOURCES

CAPE MAY COUNTY

| | Particulates | SO ₂ | CO | HC | NO ₂ |
|-----------------------|--------------|-----------------|--------|-------|-----------------|
| Power Plants | 822 | 26,792 | 378 | 576 | 27,534 |
| Point Sources | 177 | 612 | 2 | 23 | 462 |
| Area Sources | 323 | 1,432 | 70 | 73 | 1,054 |
| Total Fuel Combustion | 1,322 | 28,846 | 450 | 672 | 29,050 |
| Industrial Processes | 400 | 0 | 0 | 0 | 0 |
| Solid Waste | 1 | 0 | 1 | 1 | 0 |
| Cars | 199 | 48 | 17,289 | 3,163 | 1,893 |
| Medium Duty Vehicles | 6 | 2 | 618 | 122 | 80 |
| Heavy Duty Vehicles | 26 | 24 | 1,834 | 358 | 490 |
| Miscellaneous | 583 | 3,177 | 1,746 | 1,411 | 5,605 |
| Total 1970 | 2,537 | 32,097 | 21,938 | 5,727 | 37,118 |
| Projected 1972 | 2,307 | 16,283 | 20,840 | 5,569 | 37,937 |
| Projected 1980 | 2,126 | 23,097 | 17,016 | 5,069 | 37,974 |
| Projected 1985 | 2,779 | 24,124 | 7,592 | 4,393 | 57,425 |

TABLE 1: POLLUTION SOURCES

CUMBERLAND COUNTY

| | Particulates | SO ₂ | CO | HC | NO ₂ |
|-----------------------|--------------|-----------------|--------|--------|-----------------|
| Power Plants | 1,550 | 5,029 | 0 | 0 | 0 |
| Point Sources | 36 | 103 | 0 | 21 | 143 |
| Area Sources | 1,507 | 5,690 | 272 | 228 | 2,858 |
| Total Fuel Combustion | 3,093 | 10,822 | 272 | 249 | 3,001 |
| Industrial Processes | 1,365 | 3,469 | 0 | 29 | 392 |
| Solid Waste | 1,289 | 276 | 1,841 | 552 | 552 |
| Cars | 405 | 98 | 40,956 | 6,926 | 3,599 |
| Medium Duty Vehicles | 12 | 4 | 1,463 | 271 | 152 |
| Heavy Duty Vehicles | 53 | 50 | 4,290 | 789 | 969 |
| Miscellaneous | 370 | 1,872 | 1,392 | 1,211 | 1,520 |
| Total 1970 | 6,587 | 16,591 | 50,214 | 10,027 | 10,185 |
| Projected 1972 | 5,611 | 11,215 | 47,330 | 9,497 | 10,950 |
| Projected 1980 | 3,897 | 11,026 | 37,169 | 7,493 | 12,473 |
| Projected 1985 | 4,952 | 15,117 | 13,106 | 4,754 | 12,877 |

TABLE 1: POLLUTION SOURCES
MONMOUTH COUNTY

| | Particulates | SO ₂ | CO | HC | NO ₂ |
|-----------------------|--------------|-----------------|---------|--------|-----------------|
| Power Plants | 0 | 0 | 0 | 0 | 0 |
| Point Sources | 63 | 205 | 1 | 8 | 165 |
| Area Sources | 1,542 | 6,718 | 811 | 413 | 3,680 |
| Total Fuel Combustion | 1,605 | 6,923 | 812 | 421 | 3,845 |
| Industrial Processes | 7 | 0 | 0 | 0 | 0 |
| Solid Waste | 2,101 | 448 | 2,973 | 894 | 893 |
| Cars | 1,525 | 367 | 166,716 | 27,108 | 12,949 |
| Medium Duty Vehicles | 46 | 14 | 5,955 | 1,069 | 547 |
| Heavy Duty Vehicles | 199 | 186 | 17,360 | 3,100 | 3,579 |
| Miscellaneous | 972 | 2,903 | 6,790 | 11,409 | 4,497 |
| Total 1970 | 6,455 | 10,841 | 200,606 | 44,001 | 26,310 |
| Projected 1972 | 5,856 | 8,582 | 189,076 | 40,974 | 28,001 |
| Projected 1980 | 4,802 | 9,867 | 148,747 | 31,069 | 31,468 |
| Projected 1985 | 6,525 | 15,009 | 53,341 | 22,230 | 27,210 |

TABLE 1: POLLUTION SOURCES

OCEAN COUNTY

| | Particulates | SO ₂ | CO | HC | NO ₂ |
|-----------------------|--------------|-----------------|--------|--------|-----------------|
| Power Plants | 0 | 0 | 0 | 0 | 0 |
| Point Sources | 99 | 415 | 2 | 17 | 238 |
| Area Sources | 746 | 2,985 | 168 | 157 | 2,232 |
| Total Fuel Combustion | 845 | 3,400 | 170 | 174 | 2,470 |
| Industrial Processes | 28 | 72 | 0 | 2,100 | 306 |
| Solid Waste | 0 | 0 | 0 | 0 | 0 |
| Cars | 708 | 170 | 72,649 | 12,189 | 6,231 |
| Medium Duty Vehicles | 21 | 7 | 2,595 | 478 | 263 |
| Heavy Duty Vehicles | 92 | 86 | 7,601 | 1,390 | 1,687 |
| Total | 821 | 263 | 82,845 | 14,057 | 8,181 |
| Miscellaneous | 1,330 | 3,296 | 8,691 | 3,699 | 3,027 |
| Total 1970 | 3,024 | 7,031 | 91,706 | 20,090 | 13,984 |
| Projected 1972 | 3,075 | 6,026 | 88,735 | 18,815 | 15,086 |
| Projected 1980 | 3,162 | 6,888 | 75,710 | 14,686 | 17,588 |
| Projected 1985 | 4,669 | 10,650 | 35,428 | 10,027 | 16,560 |

TABLE 1: POLLUTION SOURCES

SALEM COUNTY

| | Particulates | SO ₂ | CO | HC | NO ₂ |
|-----------------------|--------------|-----------------|--------|-------|-----------------|
| Power Plants | 792 | 20,484 | 4 | 0 | 0 |
| Point Sources | 177 | 1,207 | 0 | 44 | 594 |
| Area Sources | 409 | 1,632 | 188 | 81 | 674 |
| Total Fuel Combustion | 1,378 | 23,323 | 194 | 125 | 1,288 |
| Industrial Processes | 108 | 1,838 | 500 | 4,196 | 1,191 |
| Solid Waste | 436 | 93 | 659 | 187 | 186 |
| Cars | 198 | 48 | 18,074 | 3,223 | 1,849 |
| Medium Duty Vehicles | 6 | 2 | 646 | 125 | 78 |
| Heavy Duty Vehicles | 26 | 24 | 1,909 | 366 | 484 |
| Total | 230 | 74 | 20,629 | 3,714 | 2,411 |
| Miscellaneous | 384 | 2,022 | 1,341 | 1,085 | 1,471 |
| Total 1970 | 2,536 | 27,305 | 23,323 | 9,307 | 6,547 |
| Projected 1972 | 2,211 | 14,318 | 21,964 | 8,585 | 7,052 |
| Projected 1980 | 1,668 | 14,247 | 17,360 | 6,613 | 8,002 |
| Projected 1985 | 2,664 | 28,156 | 7,183 | 6,084 | 8,536 |

TABLE 2: COUNTY BY COUNTY COMPARISON

| | Atlantic | Bergen | Burlington | Camden |
|-----------------|----------|---------|------------|---------|
| Population | 175,043 | 897,148 | 323,132 | 456,291 |
| % of state | 2.4% | 12.5% | 4.5% | 6.4% |
| Area | 569 | 234 | 819 | 221 |
| % of state | 7.6% | 3.1% | 10.9% | 2.9% |
| Pop. density | 307.6 | 3,834.0 | 394.5 | 2,064.7 |
| Particulates | 2,436 | 16,413 | 4,956 | 6,120 |
| % State | 1.7% | 11.4% | 3.4% | 4.2% |
| Per Person | 13.9 | 18.3 | 15.3 | 13.4 |
| Per sq. mile | 4.3 | 70.1 | 6.1 | 27.7 |
| SO ₂ | 12,563 | 57,999 | 23,467 | 11,489 |
| % State | 2.3% | 10.8% | 4.4% | 2.1% |
| Per Person | 71.7 | 64.6 | 72.6 | 25.2 |
| Per sq. mile | 22.1 | 247.9 | 28.7 | 52.0 |
| CO | 70,365 | 395,629 | 131,534 | 195,977 |
| % State | 2.2% | 12.6% | 4.2% | 6.2% |
| Per Person | 402.0 | 441.0 | 407.0 | 429.5 |
| Per sq. mile | 123.7 | 1,690.7 | 160.6 | 886.8 |
| HC | 13,256 | 75,562 | 25,640 | 42,746 |
| % State | 1.6% | 9.3% | 3.2% | 5.3% |
| Per person | 75.7 | 84.2 | 79.3 | 93.7 |
| Per sq. mile | 23.3 | 322.9 | 31.3 | 193.4 |
| NO ₂ | 17,488 | 113,947 | 42,746 | 25,240 |
| % State | 2.6% | 16.9% | 6.3% | 3.7% |
| Per person | 99.9 | 127.0 | 132.3% | 55.3 |
| Per sq. mile | 30.7 | 487.0 | 52.2 | 114.2 |

TABLE 2: COUNTY BY COUNTY COMPARISON

| | Cape May | Cumberland | Essex | Gloucester |
|-----------------|----------|------------|---------|------------|
| Population | 59,554 | 121,374 | 932,526 | 172,681 |
| % of state | 0.8% | 1.7% | 13.0% | 2.4% |
| Area | 267 | 500 | 130 | 329 |
| % of state | 3.6% | 6.6% | 1.7% | 4.4% |
| Pop. density | 223.0 | 242.7 | 7,173.3 | 524.9 |
| <hr/> | | | | |
| Particulates | 2,537 | 6,587 | 15,831 | 3,995 |
| % State | 1.8% | 4.6% | 10.9% | 2.8% |
| Per Person | 42.6 | 54.3 | 17.0 | 23.1 |
| Per sq. mile | 9.5 | 13.2 | 121.8 | 12.1 |
| <hr/> | | | | |
| SO ₂ | 32,097 | 16,591 | 44,866 | 18,570 |
| % State | 6.0% | 3.1% | 8.4% | 3.5% |
| Per Person | 539.0 | 136.7 | 48.1 | 107.5 |
| Per sq. mile | 120.2 | 33.2 | 345.1 | 56.4 |
| <hr/> | | | | |
| CO | 21,938 | 50,214 | 401,524 | 80,230 |
| % State | 0.7% | 1.6% | 12.8% | 2.6% |
| Per Person | 368.4 | 413.7 | 430.6 | 464.6 |
| Per sq. mile | 82.2 | 100.4 | 3,008.6 | 243.9 |
| <hr/> | | | | |
| HC | 3,727 | 10,027 | 72,120 | 15,475 |
| % State | 0.7% | 1.2% | 8.9% | 1.9% |
| Per person | 96.2 | 82.6 | 77.3 | 89.6 |
| Per sq. mile | 21.4 | 20.1 | 554.8 | 47.0 |
| <hr/> | | | | |
| NO ₂ | 37,118 | 10,185 | 58,659 | 22,765 |
| % State | 5.5% | 1.5% | 8.7% | 3.4% |
| Per person | 623.3 | 83.9 | 62.7 | 131.8 |
| Per sq. mile | 139.0 | 20.0 | 451.2 | 69.2 |

TABLE 2: COUNTY BY COUNTY COMPARISON

| | Hudson | Hunterdon | Mercer | Middlesex |
|-----------------|----------|-----------|---------|-----------|
| Population | 607,839 | 69,718 | 304,116 | 583,813 |
| % of state | 8.5% | 1.0% | 4.2% | 8.1% |
| Area | 47 | 423 | 228 | 312 |
| % of state | 0.6% | 5.6% | 3.0% | 4.1% |
| Pop. density | 12,932.7 | 164.8 | 1,333.8 | 1,871.2 |
| <hr/> | | | | |
| Particulates | 12,147 | 1,164 | 9,1451 | 22,868 |
| % State | 8.4% | 0.8% | 6.3% | 15.8% |
| Per Person | 20.0 | 16.7 | 30.1 | 39.2 |
| Per sq. mile | 258.4 | 2.8 | 40.1 | 73.3 |
| <hr/> | | | | |
| SO ₂ | 72,891 | 8,417 | 45,918 | 66,555 |
| % State | 13.6% | 1.6% | 8.6% | 12.4% |
| Per Person | 119.9 | 120.7 | 151.0 | 114.0 |
| Per sq. miles | 1,550.9 | 19.9 | 201.4 | 213.3 |
| <hr/> | | | | |
| CO | 257,242 | 20,376 | 126,452 | 345,003 |
| % State | 8.2% | 0.6% | 4.3% | 11.0% |
| Per Person | 119.9 | 120.7 | 151.0 | 114.0 |
| Per sq. mile | 1,550.9 | 19.9 | 201.4 | 213.3 |
| <hr/> | | | | |
| HC | 250,319 | 4,9737 | 25,641 | 59,372 |
| % State | 31.0% | 0.6% | 3.2% | 7.3% |
| Per person | 411.8 | 71.3 | 84.3 | 121.7 |
| Per sq. mile | 5,325.9 | 11.8 | 112.5 | 190.3 |
| <hr/> | | | | |
| NO ₂ | 70,513 | 7,856 | 36,333 | 67,231 |
| % State | 10.4% | 1.2% | 5.4% | 10.0% |
| Per person | 116.0 | 112.7 | 119.5 | 115.2 |
| Per sq. mile | 1,500.3 | 18.6 | 159.4 | 215.5 |

TABLE 2: COUNTY BY COUNTY COMPARISON

| | Monmouth | Morris | Ocean | Passiac |
|-----------------|----------|---------|---------|---------|
| Population | 461,849 | 383,454 | 208,470 | 460,782 |
| % of state | 6.4% | 5.3% | 2.9% | 6.4% |
| Area | 476 | 468 | 642 | 192 |
| % of state | 6.3% | 6.2% | 8.5% | 2.6% |
| Pop. density | 970.3 | 819.3 | 324.7 | 2,399.9 |
| <hr/> | | | | |
| Particulates | 6,455 | 4,845 | 3,024 | 5,556 |
| % State | 4.5% | 3.4% | 2.1% | 3.8% |
| Per Person | 14.0 | 12.6 | 14.5 | 12.1 |
| Per sq. mile | 13.6 | 10.4 | 4.7 | 28.9 |
| <hr/> | | | | |
| SO ₂ | 10,841 | 11,729 | 7,031 | 13,149 |
| % State | 2.0% | 2.2 | 1.3% | 2.5% |
| Per Person | 23.5 | 30.6 | 33.7 | 28.5 |
| Per sq. mile | 22.8 | 25.1 | 11.0 | 68.5 |
| <hr/> | | | | |
| CO | 200,606 | 163,316 | 91,706 | 190,150 |
| % State | 6.4% | 5.2% | 2.9% | 6.0% |
| Per Person | 434.4 | 425.9 | 439.9 | 412.7 |
| Per sq. mile | 421.4 | 349.0 | 142.8 | 990.4 |
| <hr/> | | | | |
| HC | 44,001 | 30,783 | 20,090 | 34,380 |
| % State | 5.4% | 3.8% | 2.5% | 4.2% |
| Per person | 95.3 | 80.3 | 96.4 | 74.6 |
| Per sq. mile | 92.4 | 65.8 | 31.8 | 179.1 |
| <hr/> | | | | |
| NO ₂ | 26,310 | 23,204 | 13,984 | 25,784 |
| % State | 3.9% | 3.4% | 2.1% | 3.8% |
| Per person | 57.0 | 60.5 | 67.1 | 56.0 |
| Per sq. mile | 55.3 | 49.6 | 21.8 | 134.3 |

TABLE 2: COUNTY BY COUNTY COMPARISON

| | Salem | Somerset | Sussex | Union | Warren |
|-----------------|--------|----------|--------|---------|--------|
| Population | 60,346 | 198,372 | 77,528 | 543,116 | 73,960 |
| % of state | 0.8% | 2.8% | 1.1% | 7.6% | 1.0% |
| Area | 365 | 307 | 527 | 103 | 362 |
| % of state | 4.9% | 4.1% | 7.0% | 1.4% | 4.8% |
| Pop. density | 165.3 | 646.2 | 147.1 | 5,273.0 | 204.3 |
| <hr/> | | | | | |
| Particulates | 3,536 | 6,364 | 821 | 9,439 | 1,349 |
| % State | 1.8% | 4.4% | 0.6% | 6.5% | 0.9% |
| Per Person | 42.0 | 32.1 | 10.6 | 17.4 | 18.2 |
| Per sq. mile | 6.9 | 20.7 | 1.6 | 91.6 | 3.7 |
| <hr/> | | | | | |
| SO ₂ | 27,305 | 5,775 | 1,010 | 47,737 | 2,506 |
| % State | 5.1% | 1.1% | 0.2% | 8.4% | 0.5% |
| Per Person | 452.5 | 29.1 | 13.0 | 82.4 | 33.9 |
| Per sq. mile | 74.8 | 18.8 | 1.9 | 434.3 | 6.9 |
| <hr/> | | | | | |
| CO | 23,323 | 86,536 | 24,719 | 230,394 | 27,182 |
| % State | 0.7% | 2.8% | 0.8% | 7.3% | 0.9% |
| Per Person | 386.5 | 436.2 | 318.8 | 424.2 | 367.5 |
| Per sq. mile | 63.9 | 281.9 | 46.9 | 2,236.8 | 75.1 |
| <hr/> | | | | | |
| HC | 9,307 | 16,375 | 5,057 | 45,033 | 46,340 |
| % State | 1.1% | 2.0% | 0.6% | 5.6% | 5.8% |
| Per person | 154.2 | 82.5 | 65.2 | 82.9 | 640.1 |
| Per sq. mile | 25.5 | 53.3 | 9.6 | 437.2 | 130.8 |
| <hr/> | | | | | |
| NO ₂ | 6,547 | 13,222 | 4,104 | 47,340 | 5,579 |
| % State | 1.0% | 2.0% | 0.6% | 7.0% | 0.7% |
| Per person | 108.5 | 66.7 | 52.9 | 87.2 | 61.9 |
| Per sq. mile | 17.9 | 43.1 | 7.8 | 459.6 | 12.6 |

TABLE 2: COUNTY BY COUNTY COMPARISON

| | NEW JERSEY |
|-----------------|------------|
| Population | 7,168,164 |
| % of state | - |
| Area | 7,521 |
| % of state | - |
| Pop. density | 953.1 |
| <hr/> | |
| Particulates | 144,588 |
| % State | - |
| Per Person | 21.7 |
| Per sq. mile | 20.6 |
| <hr/> | |
| SO ₂ | 535,501 |
| % State | - |
| Per Person | 74.7 |
| Per sq. mile | 7.10 |
| <hr/> | |
| CO | 3,144,416 |
| % State | - |
| Per Person | 438.7 |
| Per sq. mile | 416.8 |
| <hr/> | |
| HC | 810,989 |
| % State | - |
| Per person | 113.1 |
| Per sq. mile | 107.4 |
| <hr/> | |
| NO ₂ | 675,005 |
| % State | - |
| Per person | 94.2 |
| Per sq. mile | 89.5 |
| <hr/> | |

APPENDIX B:
SOURCES

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