



2005 Atmospheric Deposition Summary

New Jersey Department of Environmental Protection

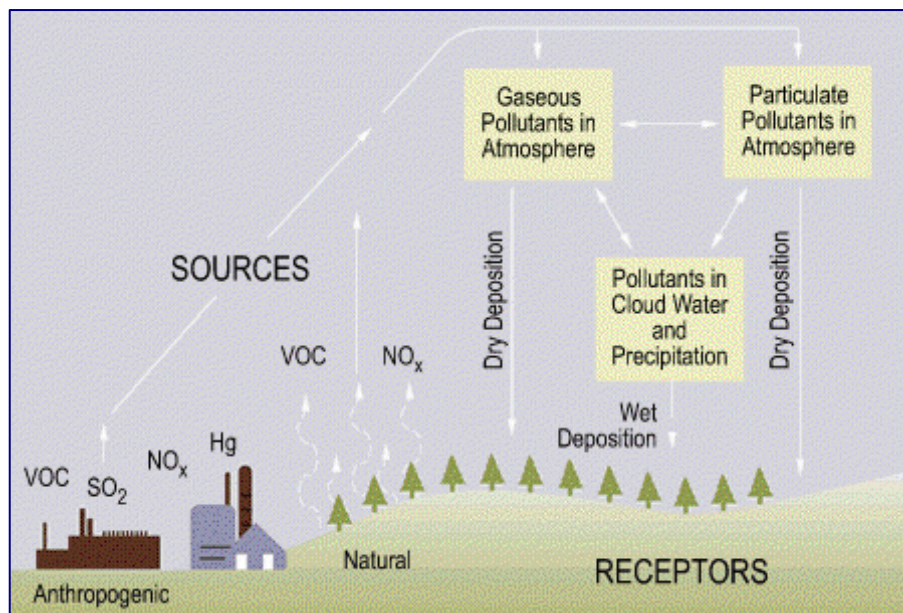
NATURE AND SOURCES

Atmospheric deposition refers to pollutants that are deposited on land or water from the air. Deposition is usually the result of pollutants being removed from the atmosphere and deposited by precipitation (wet deposition) or by the settling out of particulates (dry deposition). Dry deposition also includes gaseous pollutants that are absorbed by land or water bodies. Figure 1 shows the basic mechanisms of deposition and the major pollutants of concern. These include sulfur dioxide (SO₂), nitrogen oxides (NO_x), mercury (Hg), and volatile organic compounds (VOCs). SO₂ is a major contributor to acid deposition, which can reduce the ability of water bodies to support certain types of fish and other aquatic organisms. NO_x also contributes to the acid deposition problem and can contribute to eutrophication of water bodies as well. Hg will accumulate in fish by a process

known as bio-magnification. Small concentrations of Hg in water are concentrated in smaller organisms. These smaller organisms are in turn consumed by larger ones. As the Hg moves up the food chain, it becomes more concentrated. Fish in Hg contaminated water can become contaminated to the point where they are no longer safe for people to eat. For more information on Hg in fish see "A Guide to Health Advisories for Eating Fish and Crabs Caught in New Jersey Waters" which is available at www.state.nj.us/dep/dsr/njmainfish.htm. VOCs are a very diverse group of compounds, some of which are toxic, including known carcinogens.

Atmospheric deposition is the result of pollution from a wide variety of sources and in some cases the pollution can travel great distances before being deposited on the land or water. Some known sources of atmospheric deposition are power plants, motor vehicles, incinerators, and certain industries.

Figure 1



Source: USEPA Clean Air Markets

Web Site: <http://www.epa.gov/airmarkets/acidrain/index.html#what>

MONITORING LOCATIONS

The state monitored wet deposition levels at 2 locations in 2005. These sites are shown in Figure 2. A sample is collected each week from both sites and after each significant rain event at the Washington Crossing State Park site. The Washington Crossing site is also part of the National Atmospheric Deposition Program (NADP) network which is used by the U.S. Environmental Protection Agency to assess national deposition patterns and trends.

Both sites shown in Figure 2 have a sampler for collecting wet deposition (rain and snow) and a rain gauge for determining precipitation amounts. Due to the Lebanon monitor's remote location, it was phased out of operation during 2004.

**Figure 2
Acid Precipitation Monitoring
Network - 2005**



SUMMARY OF 2005 DATA

A summary of the 2005 wet deposition data is provided in Table 1. The table shows total deposition, pH, conductivity and concentrations of several important ions. When acidity is reported on the pH scale, neutral is considered a 7 with decreasing pH values corresponding to increasing acidity. Normal rainfall has a pH of approximately 5.6 due to the natural presence of carbonic acid in the air. The mean pH value recorded at the Washington Crossing State Park weekly sampler was 4.47 and the Ancora State Hospital sampler recorded a mean pH of 4.57.

Conductivity is a measure of the total density of ions in the water collected. It is used as an indicator of the total amount of pollution in the sample. Conductivity is the ability of the water to conduct electricity and generally increases as the concentration of ions in water increases.

Concentrations of specific ions considered important because they can affect the chemistry of lakes, streams and other water bodies, are also reported for each site. Summaries are provided for each season of the year along with annual averages in Table 1.

Table 1
Acid Precipitation Monitoring Network - 2005
Annual and Seasonal Averages

Weighted by Precipitation Amount

Ca ²⁺	- Calcium	PO ₄ ³⁻	- Phosphate
Mg ⁺	- Magnesium	Cond.	- Specific conductance
K ⁺	- Potassium	us/cm	- MicroSiemens per centimeter
Na ⁺	- Sodium	mg/l	- Milligrams per liter
NH ₄	- Ammonium	<MDL	- Below minimum detection limit
NO ₃ ⁻	- Nitrate	Winter	- January – March
Cl ⁻	- Chloride	Spring	- April – June
SO ₄ ²⁻	- Sulfate	Summer	- July – September
-	- No Data	Fall	- October – December

Ancora State Hospital – Weekly

	Precip. Inches	pH	Cond. us/cm	Ca ²⁺ mg/l	Mg ⁺ mg/l	K ⁺ mg/l	Na ⁺ mg/l	NH ₄ ⁻ mg/l	NO ₃ ⁻ mg/l	Cl ⁻ mg/l	SO ₄ ²⁻ mg/l	PO ₄ ³⁻ mg/l
Winter	8.28	4.37	25.6	0.081	0.046	0.045	0.346	0.424	1.734	0.599	1.974	< MDL
Spring	9.51	4.56	17.5	0.099	0.049	0.048	0.317	0.290	1.293	0.552	1.500	< MDL
Summer	8.09	4.39	23.3	0.113	0.039	0.027	0.176	0.353	1.280	0.413	2.301	< MDL
Fall	17.75	4.86	9.2	0.036	0.045	0.033	0.364	0.070	0.489	0.624	0.660	< MDL
Annual	43.63	4.57	16.7	0.072	0.045	0.037	0.315	0.238	1.047	0.564	1.397	< MDL

Washington Crossing State Park – Weekly

	Precip. Inches	pH	Cond. us/cm	Ca ²⁺ mg/l	Mg ⁺ mg/l	K ⁺ mg/l	Na ⁺ mg/l	NH ₄ ⁻ mg/l	NO ₃ ⁻ mg/l	Cl ⁻ mg/l	SO ₄ ²⁻ mg/l	PO ₄ ³⁻ mg/l
Winter	8.98	4.41	20.8	0.069	0.018	0.011	0.135	0.191	1.328	0.275	1.343	< MDL
Spring	9.28	4.52	16.7	0.071	0.025	0.016	0.161	0.232	1.017	0.319	1.424	< MDL
Summer	12.78	4.26	28.1	0.092	0.022	0.013	0.084	0.328	1.325	0.205	2.541	< MDL
Fall	15.59	4.81	11.5	0.134	0.051	0.123	0.280	0.115	0.687	0.522	1.010	0.054
Annual	46.63	4.47	18.9	0.097	0.031	0.050	0.175	0.211	1.051	0.347	1.576	0.022

Table 1 (Continued)
Acid Precipitation Monitoring Network – 2005
Annual and Seasonal Averages
 Weighted by Precipitation Amount

Ca ²⁺	- Calcium	PO ₄ ³⁻	- Phosphate
Mg ⁺	- Magnesium	Cond.	- Specific conductance
K ⁺	- Potassium	us/cm	- MicroSiemens per centimeter
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Washington Crossing State Park – Event

	Precip. Inches	pH	Cond. us/cm	Ca ²⁺ mg/l	Mg ⁺ mg/l	K ⁺ mg/l	Na ⁺ mg/l	NH ₄ ⁻ mg/l	NO ₃ ⁻ mg/l	Cl ⁻ mg/l	SO ₄ ²⁻ mg/l	PO ₄ ³⁻ mg/l
Winter	9.19	4.42	21.1	0.089	0.024	0.034	0.171	0.220	1.485	0.331	1.440	< MDL
Spring	9.10	4.52	17.7	0.073	0.030	0.034	0.177	0.254	1.133	0.358	1.523	< MDL
Summer	12.89	4.29	26.6	0.104	0.026	0.031	0.109	0.345	1.445	0.246	2.600	< MDL
Fall	15.74	4.76	12.2	0.157	0.064	0.134	0.303	0.106	0.866	0.486	1.149	< MDL
Annual	46.92	4.48	19.0	0.113	0.039	0.067	0.200	0.223	1.198	0.365	1.677	< MDL

TRENDS

Figure 3 shows the change in the amount of sulfate ion deposited over the last 15 years at the site in Washington Crossing State Park. The figure shows “wet deposition” only. It does not include dry particulate sulfate that was deposited when no precipitation was occurring.

Therefore, the total deposition is higher than what is shown here.

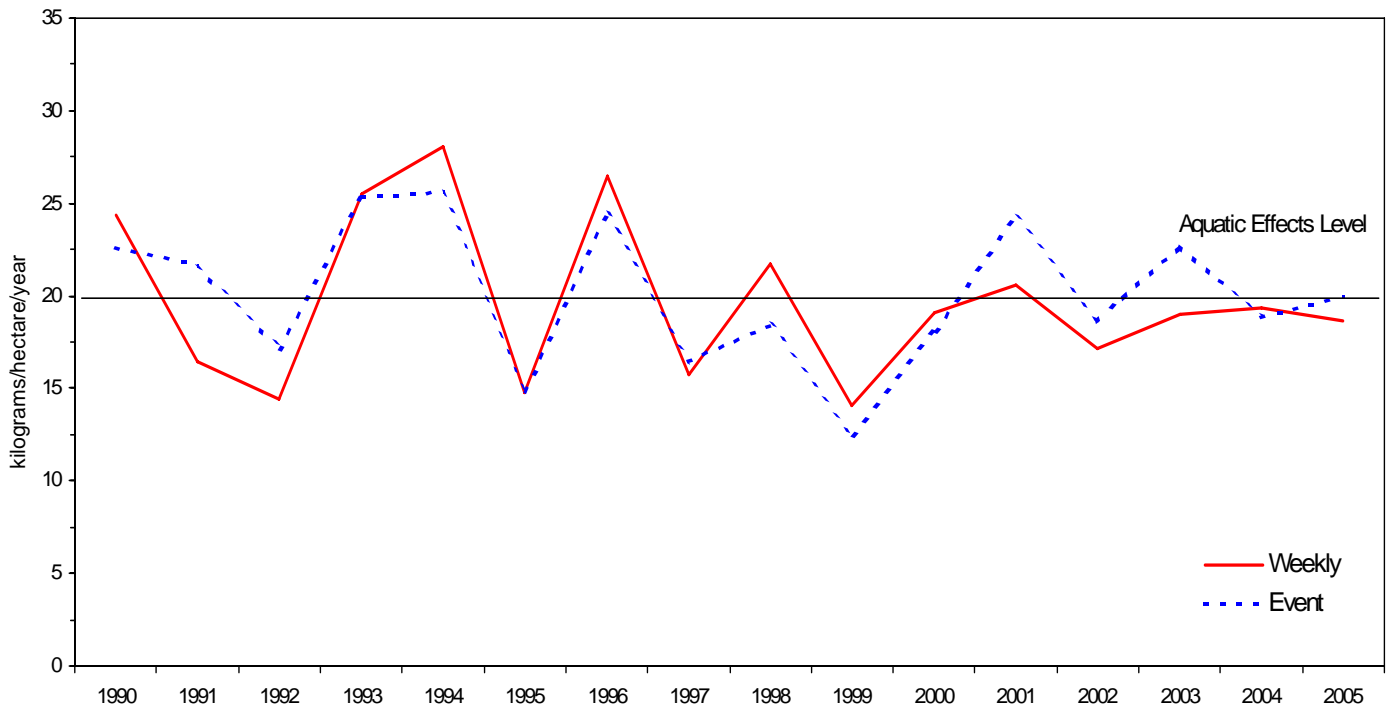
The factors controlling the trend are the sulfate concentrations in air and cloud droplets and the total amount of precipitation in a given year. For example, in 1991 and 1992, both the sulfate concentrations and the total precipitation were below normal, while they were high in 1993 and 1994. Since the values shown here are annual totals, they are also sensitive to loss of samples due to contamination or other factors.

Sulfate can alter soil and water chemistry, and a deposition level of 20 kilograms per hectare per year has been generally accepted as the limit above which damage to sensitive natural resources is likely to occur (i.e. Aquatic Effect Level). However, there are no national or New Jersey standards for sulfate deposition.

According to the New Jersey Comparative Risk Project Ecological Technical Work Group, streams and lakes with significant buffering capacity are somewhat protected from the effects of acid deposition. It is for this reason, that the risk assessment is based primarily on observation of reduced pH in streams and lakes, and on observed effects on aquatic species.

Sulfate deposition in rain and snow is expressed as mass per unit land area over time. To convert the values shown in Figure 3 to pounds per acre per year, multiply by 0.89 (since one kilogram equals 2.21 pounds and one hectare equals 2.47 acres).

Figure 3
Trend in Sulfate Deposition in Precipitation at
Washington Crossing State Park, New Jersey, 1990-2005:
Annual Loading



REFERENCES

FISH SMART, EAT SMART: A Guide to Health Advisories for Eating Fish & Crabs Caught in New Jersey Waters -2006, New Jersey Department of Environmental Protection (NJDEP), Division of Science, Research and Technology, 2006, URL: www.state.nj.us/dep/dsr/njmainfish.htm.

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United States Environmental Protection Agency (USEPA) Clean Air Markets, 2007, URL: <http://www.epa.gov/airmarkets/acidrain/index.html#what>.