U.S. House of Representatives
Committee on Transportation and Infrastructure
Washington, DC 20515

James L. Oberstar
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Ranking Republican Member

David Heymsfeld, Chief of Staff
Ward W. McCarragher, Chief Counsel

James W. Coon II, Republican Chief of Staff

April 16, 2007

SUMMARY OF SUBJECT MATTER

TO: Members of the Subcommittee on Water Resources and Environment

FROM: Subcommittee on Water Resources and Environment Staff

SUBJECT: Hearing on Nonpoint Source Pollution: Atmospheric Deposition and Water Quality

PURPOSE OF HEARING

On Tuesday, April 17, 2007, at 2:00 p.m., in Room 2167 Rayburn House Office Building, the Subcommittee on Water Resources and Environment will receive testimony from representatives of the U.S. Environmental Protection Agency, the State of Massachusetts, the Leech Lake Band of Ojibwe, the Chesapeake Bay Foundation, and academia on the impact of atmospheric deposition on water quality.

BACKGROUND

This memorandum briefly summarizes nonpoint source pollution. It then focuses in more detail on atmospheric deposition. Atmospheric deposition is a form of nonpoint source pollution.

Nonpoint Source Water Pollution

Nonpoint source (NPS) pollution emanates from diffuse sources. It is pollution that enters waters through a pathway other than a discernible, confined and discrete conveyance such as a pipe, ditch or channel. NPS pollution occurs after rainwater or snowmelt moves across the ground and into a water body. As the runoff moves over the ground it may pick up natural and man-made pollutants. These pollutants are eventually deposited in water bodies.

NPS pollution encompasses a wide variety of pollutants and sources. These include:

- Excess fertilizers, herbicides, and pesticides from agricultural lands and residential areas;

- Sediment from improperly managed construction sites, crop and forest lands, and eroding streambanks;
- Atmospheric deposition of particulates, toxic chemicals, and metals; (*see Atmospheric Deposition section below*)
- Oil, grease, heavy metals, and toxic chemicals from urban stormwater runoff, including runoff from roads, and energy production;
- Salt from irrigation practices and acid drainage from abandoned mines; and
- Bacteria, pathogens, and nutrients from livestock, pet wastes, wildlife, and faulty septic systems.

The successes of the Clean Water Act in improving water quality have primarily resulted from enforceable technology-based efforts to control point sources of pollution. Point sources are defined as discernable, confined and discrete conveyances, such as municipal or industrial sources. Since passage of the Clean Water Act (CWA, or the Act) in 1972, reliance on an enforceable permit program has resulted in decreased water pollution from point source conveyances.

For example, in 1968, sewage treatment facilities served approximately 140 million people in this country, many at a primary treatment level.[1] Today, after Federal investments of more than $82 billion in wastewater assistance since the passage of the Clean Water Act, 207.8 million people, representing more than 71 percent of the total population, are serviced by more than 16,000 publicly owned treatment works providing secondary or more advanced treatment.[2]

In 1968, about 39 percent (54.2 million) of the 140 million people served by publicly owned treatment works received less than secondary treatment (raw and primary). By 2000, the last year data are available, this percentage was reduced to just over two percent (6.4 million) of the 207.8 million people served by publicly owned treatment works.[3] In addition, the U.S. population served by publicly owned treatment works with secondary or greater treatment more than doubled between 1968 and 1996.[4]

However, unlike the enforceable requirements of the Act in controlling point sources, the Clean Water Act does not require the implementation or enforcement of any nonpoint source management plans, such as buffer strips or nutrient management plans, to reduce polluted runoff. The Act does authorize financial and technical assistance to states for the development and implementation of state nonpoint source management plans (section 319), which should include the identification of voluntary best management practices for reducing nonpoint sources of pollution. In addition, the Act provides for the implementation of the Total Maximum Daily Load (TMDL) program, which determines the maximum pollutant load a water body can handle without becoming

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[1] U.S. EPA. "Progress in Water Quality: An Evaluation of the National Investment in Municipal Wastewater Treatment." June 2000.

[2] U.S. EPA. "Clean Watersheds Needs Survey 2000: Report to Congress." August 2003.

[3] Should all of the projects called for in the 2000 Needs Survey be constructed, the number of facilities that provide less-than secondary treatment is projected to decline from 47 facilities serving 6.4 million to 27 facilities serving 3.9 million, nearly all of whom (99.99 percent) will be served by facilities with special waivers allowing the discharge of less than secondary treated effluent to deep, well-mixed ocean waters. *See* U.S. EPA. "Clean Watersheds Needs Survey 2000: Report to Congress." August 2003, and U.S. EPA. "Progress in Water Quality: An Evaluation of the National Investment in Municipal Wastewater Treatment." June 2000.

[4] U.S. EPA. "Progress in Water Quality: An Evaluation of the National Investment in Municipal Wastewater Treatment." June 2000.

impaired, both from point and nonpoint sources of pollution. EPA has also recently advocated a watershed approach to holistically address all forms and sources of water pollution on a watershed basis. (*See Appendix for a more detailed description of these programs.*)

The United States Environmental Protection Agency (EPA), the Office of Management and Budget, and the states report that NPS pollution is now the leading remaining source of water quality problems.[5,6] While the effects may vary by specific water body, the EPA reports that NPS pollution has harmful effects on drinking water supplies, recreation, fisheries, and wildlife.[7]

In its 2006-2011 Strategic Plan, EPA has identified 39,798 'impaired' water bodies.[8,9] A water body is designated as impaired if one or more of the 'uses' designated in water quality standards is not being attained. Uses are identified by taking into consideration the use and value of the water body for a combination of public water supply, fish, shellfish, and wildlife protection, or for recreational, agricultural, industrial, or navigational purposes. According to the 1998 Clean Water Act Section 303(d) list, 43 percent of water quality impairments were attributed exclusively to nonpoint source pollution. The remaining 47 percent were attributed to both point and nonpoint source pollution. Regulation of discharges from point sources is still critical to maintaining water quality because point source pollution continues to play a part in water quality impairment. However, NPS pollution is now the leading cause of water quality impairment.

Atmospheric Deposition and Water Quality

Atmospheric deposition[10] is a process by which airborne pollutants settle directly onto the surface of a water body (direct deposition), or reach a water body indirectly through deposition onto land surfaces and subsequent run-off through wet weather events (indirect deposition). Atmospheric deposition is a multimedia pollution problem whereby airborne pollutants are emitted from a "source" and are eventually deposited in a water body, the "receptor". Many of these pollutants can be transported over both short and long distances through the atmosphere.

Atmospheric deposition is increasingly recognized as a significant cause of water quality impairments, acidification of water bodies, and toxic contamination of the fish and birds that eat them.[11] In its *National Water Quality Inventory – 2000 Report,* EPA's Office of Water identified atmospheric deposition as a leading source of water body impairment. The *National Water Quality Inventory – 2000 Report* does not include data on all of the nation's water bodies. Instead, it includes those waters that have been assessed by the states at the time of the report's release.[12] The following

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[5] http://www.epa.gov/owow/nps/qa.html

[6] http://www.whitehouse.gov/omb/expectmore/detail/10000224.2004.html

[7] http://www.epa.gov/owow/nps/qa.html

[8] EPA 2006-11 Strategic Plan, p. 47

[9] This number is the 2002 baseline and is being used by the EPA for subsequent performance measurement and reporting.

[10] Also known as "aerial deposition".

[11] *See* EPA, *Frequently Asked Questions about Atmospheric Deposition*, at 2 (Sep. 2001).

[12] The states assessed 19% of the nation's total river and stream miles, 43% of the its lake, pond, and reservoir acres, 36% of its estuarine square miles, and 92% of Great Lakes shoreline miles for the *National Water Quality Inventory – 2000 Report*

table highlights the atmospheric deposition findings of those water bodies assessed in the 2000 *National Water Quality Inventory.*

Water Body Type	Area Impacted by Atmospheric Deposition	Assessed Impaired Waters: Impairment due to Atmospheric Deposition
Lakes[13]	1 million acres	13%
Coastal[14]	3,692 estuarine square miles	24%
Great Lakes Shoreline (shoreline miles)[15]	71 shoreline miles	<2%

The EPA highlights five categories of atmospheric deposition pollutants with the greatest potential to impact water quality: nitrogen; mercury; metals (excluding mercury); pesticides; combustion emissions.[16] The EPA also considers sulfates an important atmospheric deposition pollutant because of their constituent role in acid rain.[17]

- **Nitrogen:** Nitrogen compounds (NO_x (nitrogen oxides) and NH_3 (ammonia)) and organic nitrogen occur through both natural and manmade processes. Emissions from natural sources include forest fires, volcanic eruptions, and certain microbial processes, among others. Manmade sources that combust fossil fuels, including power plants, industrial facilities, and automobile emissions, contribute to the largest emissions of nitrogen to the atmosphere. The largest sources of NH_3 (ammonia) emissions are from fertilizers and domesticated animals. Most commonly, nitrogen pollution leads to eutrophication, or harmful increases in the growth of algae. "Dead" or hypoxia zones emerge in water bodies subject to excessive eutrophication because the dissolved oxygen necessary for life for other organisms has been depleted by organisms and decaying matter.

- **Mercury:** Mercury is a toxic metal that is released through both manmade and natural processes and passed along to humans through contaminated fish and shellfish. The EPA has found that manmade activities have greatly increased its concentration in the environment – accounting for 75 percent of worldwide mercury emissions.[18] Mercury emissions come from both foreign and domestic sources. A large majority of these emissions come from international sources. However, some regions of the U.S., such as the northeast, receive a greater proportion of mercury deposition from domestic sources. Manmade sources of mercury emissions include incinerators, coal-burning power plants, and household items, among others. Biological processes, potentially stimulated by the atmospheric deposition of sulfates,[19] convert mercury emanating from atmospheric deposition into the very toxic methylmercury. The primary health effects from mercury are on the development of the brain and nervous system. As of December 2000, 41 states had issued fish advisories for mercury.[20]

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[13] EPA – Office of Water. 2000. *National Water Quality Inventory – 2000 Report.* p. 22
[14] EPA – Office of Water. 2000. *National Water Quality Inventory – 2000 Report.* pp. 30-31
[15] EPA – Office of Water. 2000. *National Water Quality Inventory – 2000 Report.* P. 35
[16] http://www.epa.gov/owow/oceans/airdep/air1.html
[17] http://www.epa.gov/ne/eco/acidrain/causes.html
[18] http://www.epa.gov/owow/oceans/airdep/air2.html
[19] http://pubs.acs.org/subscribe/journals/esthag-w/2006/may/science/nl_methylmercury.html
[20] http://www.epa.gov/waterscience/fishadvice/mercupd.pdf

- **Other Metals (excluding mercury):** Metals such as lead, cadmium, nickel, copper, and zinc are atmospheric deposition pollutants that can cause harm to both human health and the environment. These metals are emitted through various industrial processes such as smelting and incineration. Metals can bioaccumulate as contaminated species are eaten. Human health effects from these substances include impaired mental and physical development, kidney damage, high blood pressure, and bone and joint pain.

- **Pesticides:** Many thousands of pesticides are used across the United States and around the world. Whether a given pesticide will become an atmospheric deposition pollutant depends on factors such as its use and chemical characteristics. Pesticides and their byproducts can range in toxicity and persistence. The EPA has found that the toxic effects of some pesticides include damage to the liver, and digestive, nervous, and endocrine systems.[21]

- **Combustion Emissions:** Combustion emissions are pollutants that are produced by the incineration of wastes. They include dioxins, furans, polycyclic aromatic hydrocarbons (PAHs) and polychlorinated biphenyls (PCBs). These pollutants degrade very slowly and can build-up in the tissues of humans and other species and cause a variety of health problems.

- **Sulfates:** Sulfur dioxide (SO_2) and sulfates (SO_x) occur from both natural and manmade sources. Naturally they come from sea spray and volcanoes. Manmade sources include fossil fuel burning power plants, vehicles, and smaller emission sources such as small industrial facilities or residences. The EPA has found that manmade sources of SO_x make up a larger proportion of emissions than do natural sources. The primary environmental effect of SO_2 and SO_x atmospheric deposition is the acidification of water bodies, resulting in the impairment of water bodies and damage to aquatic ecosystems.

Tools for Dealing with Atmospheric Deposition: According to EPA documents, the EPA recognizes that the water quality impacts due to atmospheric deposition are an important problem.[22] In addition to the non-regulatory programs described in the previous section, EPA is attempting to coordinate some of its activities to curtail atmospheric deposition. However, some states and EPA's Office of Inspector General have criticized the efficacy of tools currently in use.

In 2001 the EPA developed an *Air-Water Interface Work Plan* to better coordinate atmospheric deposition reduction programs between EPA's Office of Water and Office of Air and Radiation.[23] Major activities included:

1. Continued reduction of national loadings of atmospheric deposition pollutants through implementation of existing Clean Air Act rules; as well as the promulgation of additional regulations;
2. Working with the states to continue developing and implementing TMDLs for impaired water bodies;
3. Improving and expanding monitoring networks for atmospheric deposition pollutants;

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[21] http://www.epa.gov/owow/oceans/airdep/air2.html
[22] http://www.epa.gov/owow/oceans/airdep/grubbssig1.pdf
[23] http://www.epa.gov/owow/oceans/airdep/grubbssig1.pdf

4. Communication with stakeholders.[24]

EPA has not posted subsequent reports or performance evaluations of its *Air-Water Interface Work Plan* on its website. As a result, it is unclear as to whether the program has been effective.

As noted in the *Air-Water Interface Work* Plan, existing EPA air regulations can be used to decrease atmospheric deposition – even if they are not explicitly designed to do so. For example, EPA's Clean Air Interstate Rule is designed to reduce air pollution generally. However, as a side benefit, nitrogen atmospheric deposition to the Chesapeake Bay is anticipated to be reduced by eight million pounds per year. EPA's Chesapeake Bay Program Office anticipates that other Clean Air Act regulations will partially contribute to a reduction of 102 million pounds of nitrogen (from all sources) from 2000 levels into the Chesapeake Bay watershed by 2010. Acid rain precursors (NO_x and SO_x) also may be substantially reduced, thereby reducing acidification of waterbodies.

While some EPA activities are reducing atmospheric deposition into the Chesapeake, the EPA Office of Inspector General has found that EPA currently is not addressing a "potentially significant source of deposition", ammonia emissions from animal feeding operations.[25] Ammonia emissions are a nitrogen compound that can lead to atmospheric nitrogen deposition impacts, such as on the Chesapeake Bay. EPA currently does not regulate these emissions, and does not monitor their release.[26] EPA does plan to begin monitoring emissions from animal feeding operations (including ammonia) later in 2007 for a 24-month period.[27]

As stated earlier, EPA's policy towards reducing the impacts of atmospheric deposition relies, in part, on the TMDL program. The TMDL program calls for States to identify those waters or segments of waters that are not meeting the State's water quality standards even after the implementation of the technology-based controls required under the Act, to identify the pollutants that are causing the impairment, and to develop individualized plans to reduce the pollutants of concern so that water quality standards can be met. However, unlike point sources or distinct nonpoint sources of pollution, a challenge exists for individual States to identify and control pollution from atmospheric sources in the TMDL program. For example, when the source of the pollution emanates from outside the State's boundaries – as is the case with some types of atmospheric deposition NPS pollution – the state is inherently limited in its ability to reduce those loadings from sources outside its state boundaries. A TMDL does not provide any regulatory means for reducing those extra-state loadings. In response to this conundrum, EPA suggests that "A state will have to coordinate with other states and EPA to determine how best to address those sources."[28]

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[24] http://www.epa.gov/owow/oceans/airdep/airwater_plan16.pdf, p.2

[25] EPA OIG. 2007. *EPA Relying on Existing Clean Air Act Regulations to Reduce Atmospheric Deposition to the Chesapeake Bay and its Watershed.* 2007-P-00009

[26] EPA OIG. 2007. *EPA Relying on Existing Clean Air Act Regulations to Reduce Atmospheric Deposition to the Chesapeake Bay and its Watershed.* 2007-P-00009

[27] EPA OIG. 2007. *EPA Relying on Existing Clean Air Act Regulations to Reduce Atmospheric Deposition to the Chesapeake Bay and its Watershed.* 2007-P-00009, p. 11

[28] EPA. 2001. *Frequently Asked Questions About Atmospheric Deposition: A Handbook for Watershed Managers.* pp. 65-66 (http://www.epa.gov/oar/oaqps/gr8water/handbook/airdep_sept_4.pdf)

Some states have urged EPA to reconsider TMDL guidance for waters impacted by atmospheric mercury deposition.[29] State regulators from a number of New England states have recently urged EPA to "focus its efforts on a national approach to reducing the water impacts of mercury pollution rather than among individual states, because airborne mercury that is deposited into state waters often originates from emissions sources in other states."[30] However, EPA continues to encourage the use of a mercury TMDL approach.[31]

[29] Inside EPA. 2007. "States Fault EPA Guide on Mercury Pollution in Impaired Waters." (March 16, 2007)
[30] Inside EPA. 2007. "States Fault EPA Guide on Mercury Pollution in Impaired Waters." (March 16, 2007)
[31] Inside EPA. 2007. "States Fault EPA Guide on Mercury Pollution in Impaired Waters." (March 16, 2007)

APPENDIX

The EPA has a number of programs and tools by which to reduce NPS pollution. This Appendix describes some of these in detail.

Section 319 Program: In 1987, the Congress amended the Clean Water Act to establish the Section 319 Nonpoint Source Management Program. The Section 319 Program requires that states must identify waters that are damaged or threatened by runoff sources, and then develop comprehensive NPS pollution reduction programs to reduce NPS pollution. Section 319 provides grant funding to states, territories, and tribes that goes toward activities such as technical and financial assistance, technology transfer, and monitoring of nonpoint source implementation projects, among other activities. Under the program, States are required to provide performance reports of their NPS programs' performance. Inadequate performance towards these goals may result in the withholding of grant funding. Section 319 is the only federal program to address all sources of NPS pollution. As opposed to United States Department of Agriculture (USDA) NPS pollution programs, Section 319 funds can be used for monitoring and watershed planning. The Section 319 program does not have enforceable policies or mechanisms (such as National Pollutant Discharge Elimination System (NPDES) permits for point source discharges) to implement water quality improvement management measures.

In its FY 2008 budget proposal the Administration proposes funding cuts for the Section 319 program of over $10 million, or five percent, from FY 2007 enacted levels, to $194 million.

Through their various water pollution programs, by the end of fiscal year 2006, the EPA and the states restored 12.1 percent of water bodies identified in 2000 as impaired.[32] Based on the 2000 figure of 21,632 impaired water bodies, this still leaves over 19,000 water bodies impaired. However, based off of EPA's most recent figures of 39,768 impaired water bodies (cited in its 2006-2011 Strategic Plan), it would still have to restore over 37,000 existing impaired water bodies. EPA itself states:

> "...[S]ome of the restorations to date represent waters where improved assessments have found that the waters were in fact already meeting water quality standards. Thus we anticipate that the numbers of these "easier" restorations will soon decline, as states and EPA begin tackling waters with such complex problems as nonpoint sources or issues related to increasing population growth and changing land use."[33]

To address these continued, impaired water bodies, EPA's current goal is to restore 2,250 of the 39,798, or six percent, of its impaired waters by 2012. EPA plans to address these continued water impairments through continued use and improvement of the watershed approach.

Total Maximum Daily Load Program: Under Section 303 of the Clean Water Act, states, territories, and tribes are required to develop lists of all impaired waters under their jurisdiction. The Clean Water Act requires that these jurisdictions establish priority rankings and Total Maximum

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[32] A water body is designated as impaired if one or more of the 'uses' designated in water quality standards is not being attained. Uses are identified by taking into consideration the use and value of the water body for a combination of public water supply, fish, shellfish, and wildlife protection, or for recreational, agricultural, industrial, or navigational purposes.
[33] US EPA Performance and Accountability Report, FY 2006, p.69

Daily Loads (TMDL) for these impaired water bodies. The TMDL is a calculation of the maximum amount of a pollutant that a waterbody can receive and still meet water quality standards. The TMDL calculation is the sum of the contributions from both point and nonpoint sources. Once the TMDL for a given water body is determined, the appropriate jurisdiction (state, territory, or tribe) develops a plan for implementing point and nonpoint source pollutant reductions to achieve desired water quality standards. A given TMDL calculation is not, in and of itself, an enforceable regulatory standard. Instead, the primary implementation mechanism for the nonpoint source components of a TMDL on a given water body is the Section 319 nonpoint source management program. This program does not, as noted earlier, generally have enforceable mechanisms under the Clean Water Act.

TMDLs are a useful tool for allowing the EPA, the states and others to determine how much of a given pollutant is acceptable in a given water body, and to help to generate appropriate management plans as a result. However, while they were established in the 1972 Clean Water Act, it is only in recent years that EPA has required states to develop them. As a result of nearly 40 legal actions across 38 states, the EPA is under numerous consent decrees or court orders to ensure that TMDLs are established.[34] At the end of 2006, EPA and the states had approved 24,131 TMDLs for impaired water bodies.[35] Each TMDL is written per pollutant, therefore, a given waterbody may have multiple TMDLs 'assigned' to it. As a result, EPA has to approve many thousands more TMDLs to address all 39,798 impaired water bodies throughout the nation. EPA anticipates that approximately 3,500 TMDLs will be completed and approved per year in coming years.[36]

Watershed Approach: EPA's watershed[37] approach is not prescribed by the Clean Water Act, but has been adopted as a management tool to comprehensively address water pollution problems. While the EPA has supported the watershed approach since the early 1990s, it elevated the importance of the tool by designating it as an explicit subobjective in its 2003-2008 Strategic Plan. The watershed approach is a central mechanism in two of EPA's three key approaches to improving water quality: maintaining strong core programs that emphasize watershed protection; and restoring impaired waters on a watershed basis.[38] EPA's premise is that many water quality problems are best dealt with at the watershed level rather than by individual waterbody or discharger.[39] The watershed approach is designed to help focus existing, traditional water pollution control programs, such as the point source program, in a more comprehensive manner and address problems such as NPS pollution. According to EPA, the watershed approach is being integrated into its core water programs.

EPA's watershed approach offers the potential to address point and nonpoint source pollution in a holistic fashion by setting up comprehensive watershed management plans. However, because it is not prescribed through the Clean Water Act, it has not been fully integrated into EPA's core water programs. In its most recent *Accomplishments and Performance Report* (FY 2006), EPA did

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[34] http://www.epa.gov/owow/tmdl/overviewfs.html

[35] US EPA Performance and Accountability Report, FY 2006, p.69

[36] US EPA 2006-2011 Strategic Plan. p.47.

[37] A watershed refers to a geographic area in which water drains to a common outlet. The watershed includes not only the water resources, such as streams, rivers, and lakes, but also the land surrounding those resources.

[38] The other area or mechanism that EPA will use to improve water quality is the investment in water infrastructure and the strengthening of management practices to improve the sustainability of water systems. (US EPA 2006-2011 Strategic Plan. p.45)

[39] EPA OIG. 2005. Sustained Commitment Needed to Further Advance Watershed Approach. 2005-P-00025.

not meet one of two national outcome performance measures established to determine its success in implementing the watershed approach. In addition, EPA's Office of Inspector General found in 2005 that EPA had not developed other necessary measures to evaluate key programs and activities under its watershed approach program.[40]

[40] OIG. 2005. *Sustained Commitment Needed to Further Advance Watershed Approach.* 2005-P-00025. Executive Summary.