OFFICE OF INSPECTOR GENERAL

Catalyst for Improving the Environment

Evaluation Report

Despite Progress, EPA Needs to Improve Oversight of Wastewater Upgrades in the Chesapeake Bay Watershed

Report No. 08-P-0049

January 8, 2008

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Abbreviations

CBPO	Chesapeake Bay Program Office
DCWASA	District of Columbia Water and Sewer Authority
EPA	U.S. Environmental Protection Agency
mg/l	Milligrams per liter
NPDES	National Pollutant Discharge Elimination System
OIG	Office of Inspector General
TMDL	Total Maximum Daily Load

Cover photo: Blue Plains Wastewater Treatment Plant, Washington DC.
(Photo courtesy District of Columbia Water and Sewer Authority)

U.S. Environmental Protection Agency
Office of Inspector General

08-P-0049
January 8, 2008

At a Glance

Catalyst for Improving the Environment

Why We Did This Review

This review is one of several conducted by the Office of Inspector General in response to a congressional request. We sought to determine how well the U.S. Environmental Protection Agency (EPA) is assisting its Chesapeake Bay partners in cleaning up the Bay. This report evaluates the progress in controlling discharges from wastewater treatment facilities.

Background

Nutrient overload has been identified as the primary cause of water quality degradation within the Chesapeake Bay. Wastewater treatment facilities are responsible for approximately 20 percent of nutrient discharges into the Bay. Of this amount, the 483 largest or "significant" facilities account for 95 percent of the discharges. Wastewater treatment facility operations are governed by the Clean Water Act's National Pollutant Discharge Elimination System Permitting Program.

For further information, contact our Office of Congressional and Public Liaison at (202) 566-2391.

To view the full report, click on the following link:
www.epa.gov/oig/reports/2008/20080108-08-P-0049.pdf

Despite Progress, EPA Needs to Improve Oversight of Wastewater Upgrades in the Chesapeake Bay Watershed

What We Found

Chesapeake Bay wastewater treatment facilities risk not meeting the 2010 deadline for nutrient reductions if key facilities are not upgraded in time. In the 7 years since signing the Chesapeake 2000 Agreement, EPA and its State partners have taken a number of steps to lay the foundation for achieving the 2010 wastewater nutrient reduction goals. Water quality standards have been set, nutrient loadings have been allocated, and nutrient limits are beginning to be incorporated into permits. However, States need to finish adding nutrient limits to the permits, and the facilities will need to make significant reductions in the 3 years remaining before the deadline. Crucially, these reductions will need to be maintained once achieved. Significant challenges include generating sufficient funding and addressing continuing population growth. EPA needs to better monitor progress to ensure needed upgrades occur on time and loading reductions are achieved and maintained. Otherwise, Bay waters will continue to be impaired, adversely affecting living resources throughout the ecosystem that supports commercial and recreational uses.

We also looked at the potential for obtaining additional reductions from wastewater treatment facilities to compensate for goals not being met in other areas, but determined that this would not be practical or cost effective.

What We Recommend

We recommend that the EPA Region 3 Regional Administrator work with the States to establish interim construction milestones for priority facilities; monitor milestone and financial funding progress for these facilities; and continue efforts in developing effective and credible water quality trading programs. The Regional Administrator should also have EPA and States continue to evaluate industrial discharges and refine industrial nutrient cap loads where appropriate. In response to our draft report, EPA concurred with all our recommendations and estimated that wastewater facilities will come close to achieving the nutrient reduction goals in 2010. EPA's estimate was based on new information which had not been verified by EPA and was received too late for the OIG to evaluate.

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460

OFFICE OF
INSPECTOR GENERAL

January 8, 2008

MEMORANDUM

SUBJECT: Despite Progress, EPA Needs to Improve Oversight of Wastewater Upgrades in the Chesapeake Bay Watershed
Report No. 08-P-0049

FROM: Wade T. Najjum
Assistant Inspector General, Office of Program Evaluation

TO: Donald S. Welsh
Regional Administrator, Region 3

This is our report on the subject evaluation conducted by the Office of Inspector General (OIG) of the U.S. Environmental Protection Agency (EPA). This report contains findings that describe the problems the OIG has identified and corrective actions the OIG recommends. This report represents the opinion of the OIG and does not necessarily represent the final EPA position. Final determinations on matters in this report will be made by EPA managers in accordance with established resolution procedures.

The estimated cost of this report – calculated by multiplying the project's staff days by the applicable daily full cost billing rates in effect at the time – is $571,638.

Action Required

In accordance with EPA Manual 2750, you are required to provide a written response to this report within 90 calendar days. You should include a corrective actions plan for agreed upon actions, including milestone dates. We have no objections to the further release of this report to the public. This report will be available at http://www.epa.gov/oig.

If you or your staff have any questions regarding this report, please contact me at 202-566-0827 or najjum.wade@epa.gov; Dan Engelberg, Director, at 202-566-0830 or engelberg.dan@epa.gov; or Linda Fuller, Project Manager, at 617-918-1485 or fuller.linda@epa.gov.

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Chapter 1
Introduction

Purpose

In 2000, the U.S. Environmental Protection Agency (EPA) and its Chesapeake Bay Program partners (Bay partners) agreed to improve the water quality of the Chesapeake Bay and its tidal tributaries. They sought to improve the water quality to the level needed to support aquatic life and to have the Bay removed from EPA's impaired waters list by 2010. If the Bay partners do not achieve their nutrient reduction goals by 2010, EPA plans to establish a total maximum daily load (TMDL) for the watershed.

Senator Barbara Mikulski of Maryland requested the EPA Office of Inspector General (OIG) to evaluate the progress being made toward achieving the 2010 goals. In 2006, after we had started this review, EPA acknowledged that the nutrient goals will not be met by 2010 but did not set a new date. We previously reported on progress in agriculture, air deposition, and land development. This report focuses on progress in reducing contributions from wastewater treatment facilities. We sought to answer the following questions:

- Will the 2010 goals for reducing nutrient loads from wastewater treatment facilities be achieved and sustained to restore the ecological health of the Chesapeake Bay?
- What challenges must be overcome to meet and sustain reduction goals for nutrient loads from wastewater treatment facilities within the Chesapeake Bay watershed?
- What further reductions can be achieved from wastewater treatment facilities if a future TMDL were to require point sources to compensate for non-point discharges not meeting 2010 goals?

Background

The Chesapeake Bay is North America's largest and most biologically diverse estuary and provides the region economic and recreational benefits. The Chesapeake Bay watershed covers 64,000 square miles and includes parts of six States – Delaware, Maryland, New York, Pennsylvania, Virginia, and West Virginia – and all of the District of Columbia. A watershed refers to a geographic area in which water drains to a common outlet. As of 2005, more than 16 million people lived within the Chesapeake Bay watershed.

Nutrients Primary Cause of Bay Water Quality Degradation

Nutrient overload has been identified as the primary cause of water quality degradation within the Chesapeake Bay. Nitrogen and phosphorus, also known as nutrients, are the basic building blocks for vegetation. However, in an aquatic environment, excess nutrients fuel large algal blooms that block sunlight and deplete oxygen as the algae decompose. Without sunlight, underwater bay grasses cannot grow, and without sufficient oxygen blue crabs and fish cannot live. Nutrients come from many sources, such as lawn fertilizer, wastewater treatment plants, septic systems, cropland, livestock, and the air. Figures 1.1 and 1.2 illustrate the contributions of nitrogen and phosphorus from various sectors.

Figure 1.1: Nitrogen Loads - 2005

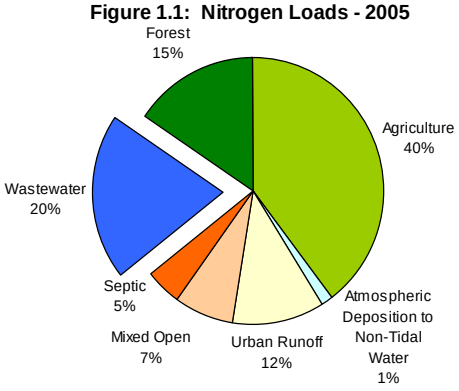
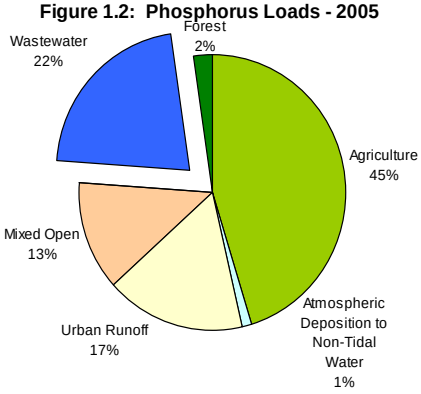


Figure 1.2: Phosphorus Loads - 2005



Source: Chesapeake Bay Program Office data

In an effort to protect and restore the Chesapeake Bay's ecosystem, State and Federal agencies, academic institutions, and non-government organizations formed a regional partnership in 1983. The State governments, District of Columbia, and EPA signed various agreements in 1983, 1987, and 2000. The latest agreement, *Chesapeake 2000*, was signed by the States of Maryland, Pennsylvania, and Virginia (the "signatory States"); the District of Columbia; the Chesapeake Bay Commission (a tri-state legislative advisory body); and EPA.

As the representative of the Federal Government, EPA and its Chesapeake Bay Program Office (CBPO) coordinate partner activity and implementation of strategies to meet the restoration goals of the Chesapeake Bay. CBPO, headquartered in Annapolis, Maryland, is part of EPA's Region 3. Part of the CBPO's charge is coordinating the actions of EPA with those of appropriate officials of other Federal agencies and State and local authorities in developing strategies to:

- improve the water quality and living resources in the Chesapeake Bay ecosystem, and
- obtain the support of the appropriate officials of the agencies and authorities in achieving the objectives of the Chesapeake Bay Agreement.

In *Chesapeake 2000*, the Bay partners agreed to improve water quality in the Bay and its tributaries so that these waters would be removed from EPA's impaired waters list by 2010 and avoid the development of a TMDL. The non-signatory Bay watershed States of Delaware, New York, and West Virginia also agreed to nutrient goals by signing a six-State Memorandum of Understanding with EPA. A TMDL is a calculation of the maximum amount of a pollutant a waterbody can receive and still meet water quality standards, and an allocation (wasteload allocation) of that amount to the pollutant's sources. These allocations would be incorporated as new discharge limits in permits of wastewater treatments facilities.

Wastewater Sector Governed by Clean Water Act Regulations

Wastewater treatment facility operations are governed by the Clean Water Act's National Pollutant Discharge Elimination System (NPDES) Permitting Program. Facilities must obtain a permit from the State or EPA to discharge pollutants into a waterbody. Permits are issued for a specific period of time not to exceed 5 years. Facilities are expected to monitor and report on their compliance with permit limits. Region 3 administers the NPDES program for the District of Columbia while the States administer their own programs.

In 2004, EPA, the six watershed States and District of Columbia agreed to the *NPDES Permitting Approach of Discharges of Nutrients in the Chesapeake Bay Watershed*, with the purpose of issuing NPDES permits to "significant" municipal and industrial wastewater treatment facilities to further the goals of the *Chesapeake 2000* agreement. "Significant" facilities were defined as a subset of all municipal and industrial facilities in the Chesapeake Bay watershed that are discharging or have potential to discharge significant amounts of nitrogen and phosphorus.

EPA and its Bay partners expect most significant municipal wastewater treatment facilities to upgrade plant technologies to meet the new NPDES permit limits. Most limits have been set to require biological nutrient removal technology, through which bacteria-enhanced treatment reduces effluent total nitrogen to an average of 5 milligrams per liter (mg/l) and total phosphorus to an average of 0.5 mg/l. Maryland has required all of its significant facilities and Virginia half to use state-of-the-art, or enhanced, nutrient removal technology. Such technology can achieve total nitrogen levels as low as 3 mg/l and total phosphorus levels as a low as 0.03 mg/l.

To date, EPA and its Bay partners have identified 483 facilities (402 municipal wastewater plants and 81 industrial wastewater plants) as "significant" dischargers of nitrogen and phosphorus. Table 1.1 provides a breakdown by jurisdiction. The total number of significant facilities will increase over time as growth in population leads to increased flows at the smaller facilities.

Table 1.1: Chesapeake Bay Significant Wastewater Treatment Facilities

Jurisdiction	Municipal	Industrial	Total	Design Flow (million gallons per day)
District of Columbia	1	0	1	370
Delaware	3	1	4	3
Maryland	75	10	85	676
New York	26	2	28	91
Pennsylvania	183	30	213	648
Virginia	101	23	124	1,206
West Virginia	13	15	28	46
Total	**402**	**81**	**483**	**3,040**[1]

Source: CBPO as of July 2007

The size of significant facilities, measured in terms of design flow – the quantity of sewerage a plant is designed to discharge – typically starts with a minimum design flow of 0.4 to 0.5 million gallons per day, depending on the State's definition. These plants account for approximately 95 percent of the nitrogen and phosphorus wastewater loads into the Chesapeake Bay watershed. Discharges from wastewater treatment facilities are described in terms of "delivered" or "discharged" loads. Loads express the amount of a particular pollutant discharged to the receiving water. The discharged load is that discharged at the end-of-pipe. The delivered load is an estimated load from the Bay watershed model that represents the amount of nutrient that reaches the tidal waters of the Chesapeake Bay or its tributaries.

Noteworthy Achievements

EPA and its Bay partners have taken considerable steps to lay the foundation for achieving the 2010 wastewater point source nutrient reduction goals. EPA worked with its Bay partners to establish the overall nutrient reduction goals so that the Bay and its tributaries can be removed from the impaired waters list. EPA assisted the States in revising their water quality standards by issuing its April 2003 *Ambient Water Quality Criteria for Dissolved Oxygen, Water Clarity, and Chlorophyll a for the Chesapeake Bay and Its Tidal Tributaries,* and its October 2003 *Technical Support Document for Identification of Chesapeake Bay Designated Uses and Attainability*.

In December 2004, EPA Regions 2 and 3 and the Chesapeake Bay jurisdictional partners developed and agreed to the *NPDES Permitting Approach for Discharges of Nutrients in the Chesapeake Bay Watershed* for municipal and industrial wastewater NPDES discharge sources. With this approach, EPA and State NPDES permitting authorities agreed to place annual total nitrogen and phosphorus load limits (consistent with the individual State tributary strategies) and monitoring requirements (consistent with Chesapeake Bay nutrient goals) in

[1] For two high flow cooling water facilities, the CBPO tracks only the loadings and not the design flow; therefore, the design flow represents 481 rather than 483 facilities.

the permits of all significant dischargers in the Chesapeake Bay watershed. This is particularly noteworthy considering some dischargers are hundreds of miles upstream and may not directly benefit from improvements to the Bay.

Scope and Methodology

We conducted this evaluation in accordance with generally accepted government auditing standards. Those standards require that we plan and perform the evaluation to obtain sufficient, appropriate evidence to provide a reasonable basis for our findings and conclusions based on our evaluation objectives. We believe that the evidence obtained provides a reasonable basis for our findings and conclusions based on our evaluation objectives.

We reviewed loadings data from 1985 to 2005 to determine the progress the Chesapeake Bay Program partners have made in reducing nutrients, and the activities the Bay partners had taken in meeting wastewater treatment nutrient reduction goals resulting from the *Chesapeake 2000* agreement. We performed our work at EPA Region 3 and the Chesapeake Bay Program, and Chesapeake Bay jurisdictions, from October 2006 through July 2007. For the purposes of this evaluation, the only point sources reviewed were wastewater treatment facilities. We did not review discharges from concentrated animal feeding operations or stormwater point sources. Discharges from stormwater are discussed in another report.[2]

Appendix A provides further details on our scope and methodology, including prior reviews.

[2] EPA OIG Report No. 2007-P-00031, *Development Growth Outpacing Progress in Watershed Efforts to Restore the Chesapeake Bay*, September 10, 2007.

Chapter 2
Wastewater Treatment Facilities Risk Not Achieving 2010 Goals if Various Challenges Are Not Overcome

Chesapeake Bay wastewater treatment facilities risk not achieving the 2010 deadline for nutrient reductions if key facilities are not upgraded in time. EPA and its Bay partners agreed wastewater treatment facilities should discharge no more than 43.6 million pounds of nitrogen and 3.3 million pounds of phosphorus on an annual basis.[3] EPA and its Bay partners have made progress in controlling nutrient discharges from these facilities but challenges persist, including:

- generating sufficient funding to upgrade technology,
- developing viable trading programs, and
- maintaining existing cap loads with increasing population.

If wastewater treatment facilities are not upgraded as expeditiously as possible, Bay waters will continue to be impaired, adversely affecting the living resources throughout the ecosystem that support commercial and recreational uses.

More Nutrient Reductions Needed

Although the wastewater treatment sector has made progress, more reductions are needed to achieve the nutrient reduction goals. Based on CBPO data, nitrogen loads delivered to the Bay declined from 88 million pounds per year in 1985 to 63 million pounds in 2000. These reductions can be attributed to industrial reductions and installation of biological nutrient reduction technology at some municipal facilities. Phosphorus loads delivered to the Bay declined from 9 million pounds per year in 1985 to 4 million pounds in 2000 as a result of improved treatment capability and implementation of phosphate detergent bans.

Since 2000, when the 2010 nutrient goals were established, nitrogen and phosphorus loadings have declined. Based on CBPO data, nitrogen loads delivered to the Bay declined from 63 million pounds per year in 2000 to 54 million pounds in 2005. Phosphorus loads delivered to the Bay declined from 4.3 million pounds per year in 2000 to 4 million pounds in 2005. Despite this progress, more reductions are needed to achieve the 2010 goals, which are 43.6 million pounds for nitrogen and 3.3 million pounds for phosphorus on an annual basis. Achieving the goals on time is uncertain based on the existing rate

[3] The wastewater treatment nutrient reductions goals were obtained from State-provided documents and may have changed slightly from the tributary strategies. EPA and State officials both agreed that it is more accurate to present current State nutrient reductions goals.

of decline for both total nitrogen and phosphorus. EPA and its Bay partners are relying on a number of significant wastewater treatment facilities to install or upgrade nutrient removal technology during the remaining years before, as well as after, the 2010 deadline.

A Few Facilities Responsible for Majority of Nutrient Reductions

A few States and facilities are responsible for the majority of nutrient reductions needed. At the State level, Maryland and Virginia are responsible for approximately 81 percent of the additional 10.4 million pounds per year of nitrogen reductions needed to meet the wastewater treatment reduction goal. West Virginia, Virginia, and Maryland are responsible for approximately 73 percent of the additional 724,000 pounds per year needed in phosphorus reductions. See Appendix B, Table B.1, for more details. At the facility level, five municipal facilities account for approximately half of overall nitrogen reductions required, and two facilities account for approximately a third of the phosphorus reductions needed. See Appendix B, Tables B.2 and B.3, for more information.

Limited Facility Progress Information

We cannot reasonably estimate when the wastewater facilities will achieve the nutrient reduction goals because neither EPA nor all the States we reviewed were able to provide up-to-date information on the status of facility upgrades. Much progress remains to be made by EPA and the States in revising permits, and by the wastewater treatment facilities in constructing and improving nutrient removal technology at their plants. As of July 2007, only 32 percent of the 483 significant facilities had received nitrogen and phosphorus permit limits. These 156 facilities represent approximately 55 percent of the Chesapeake Bay design flow. Revising NPDES permits represents an important step in achieving the reduction goals. The nutrient discharge limits will provide the facilities with permit requirements that are enforceable by EPA and the States. Therefore, EPA and the States need to incorporate these new limits into the permits as quickly as possible to allow sufficient time for construction and implementation.

EPA and States should also include interim construction milestones for the major phases of design completion, construction start, construction completion, and compliance with permit limits. Because the pace of nutrient reductions needs to be accelerated, milestones should provide for an aggressive schedule to complete construction as expeditiously as possible. EPA and the States should routinely monitor progress and take appropriate action to get any facilities falling behind schedule back on track. EPA and the States also need to monitor the construction progress of facilities under a general permit and follow up to ensure these facilities are upgraded on a timely basis.

State managers said they expect well over 200 wastewater treatment facilities to meet the 2010 nutrient reduction goals. However, as of the end of 2006, only Maryland could provide a schedule of plant upgrades, and reported only two facilities as construction completed. Pennsylvania and Virginia did not have schedules. Based on the limited information provided to us, we believe these projections may be optimistic given the long lead times necessary to complete these projects, and the increased demand on limited construction companies and rising construction costs. To meet the deadline, the State agencies will need to be aggressive by issuing permits with enforceable milestones as soon as possible.

Based on November 2006 data, Maryland officials expect 54 municipal facilities to be upgraded with state-of-the-art, or enhanced, nutrient removal technology by 2010. Nine additional municipal facilities are expected to be upgraded by 2011.[4] Excluding the Maryland portion of the largest facility (Blue Plains) in the watershed, Maryland officials estimate the next two largest Maryland facilities (Back River and Patapsco) will be upgraded in 2012. Table 2.1 provides more details for Maryland. As of July 2007, Maryland reported issuing six permits with the stricter nutrient limits. Other wastewater treatment permits will include stricter nutrient limits as they come up for renewal on their 5-year permitting cycles. Only two facilities currently are operating with enhanced nutrient removal technology.

Table 2.1: Status of Maryland Municipal Facilities in Upgrading to Enhanced Nutrient Removal Technology

	Enhanced Nutrient Removal Technology Installed	Construction Phase	Design, Planning, or Pre-planning
Number of Facilities	2	10	53
Design Flow (million gallons per day)	3.7	25.9	551.7

Source: Maryland Department of the Environment, November 2006 implementation data.

Note: The Blue Plains facility, specifically Maryland's portion of Blue Plains' design flow (169.6 million gallons per day), is not included in this analysis.

According to Pennsylvania Department of Environmental Protection's Section Chief, Engineering and Construction Section, the State reopened the permits for its 63 largest facilities in January 2007 to include more stringent limits. Officials are relying on the upgrade of these facilities and a successful nutrient trading program to meet their wastewater treatment nutrient reduction goals. Of the three signatory States, Pennsylvania is the one State that expects to meet these goals by 2010.

Virginia issued a general permit with more stringent nutrient limits in September 2006 covering all 124 of its significant wastewater treatment facilities. However, compliance plans were not available at the time of the OIG review. As a result, Virginia officials were unable to tell which facilities planned to upgrade in the near future and which planned to utilize the State nutrient trading program.

[4] Maryland Department of the Environment officials did not provide implementation data on the six Federal municipal facilities and four small municipal facilities (Piney Orchard, Marlboro Meadows, Hampstead, and Rock Hall).

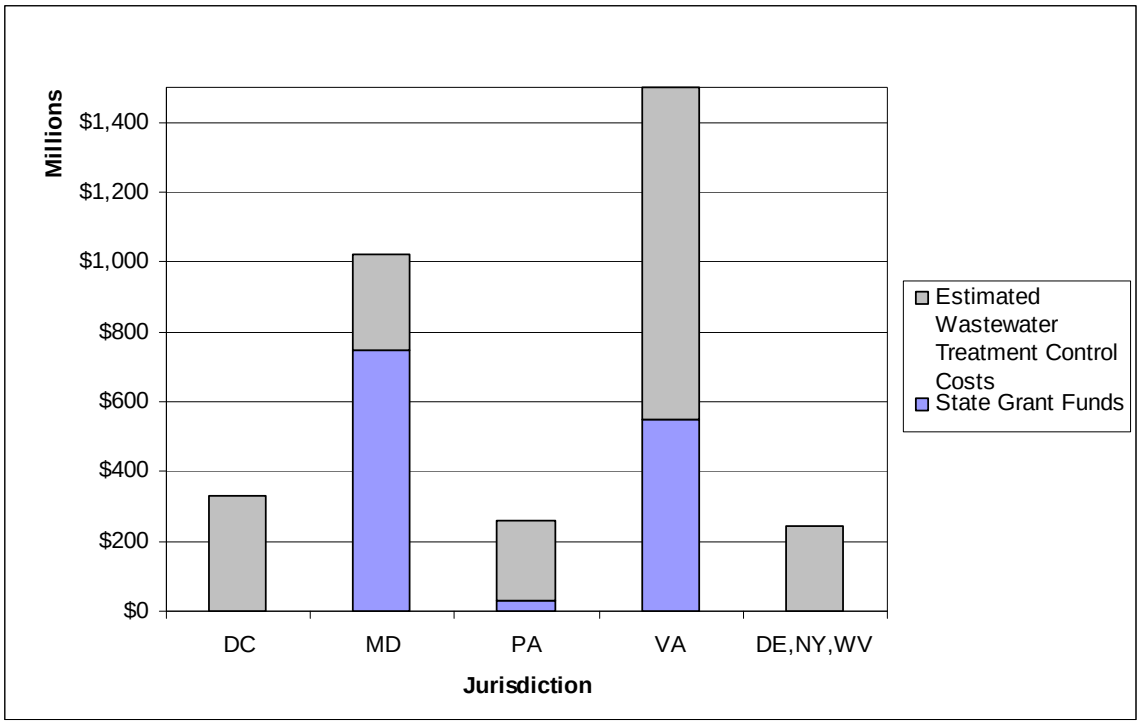
Challenges Must Be Overcome to Achieve Nutrient Reduction Goals

Facilities will need to overcome challenges to achieve nutrient reduction goals. These include obtaining sufficient funds for new technology, establishing viable trading programs, and addressing population growth.

Additional Funds Needed to Implement Technology

Obtaining sufficient and timely funding to install nutrient removal technology poses the greatest challenge faced by municipalities in achieving nutrient reduction goals. Based on the jurisdiction and CBPO data, a minimum of $3.36 to $3.96 billion is needed to upgrade wastewater treatment plants to meet Tributary Strategies. See Figure 2.1.

Figure 2.1: Estimated Nutrient Removal Technology Costs Compared to State Grant Funds Provided



Sources:
a. District of Columbia Water and Sewer Authority officials. District numbers only include the District's portion of Blue Plains.
b. Maryland Department of the Environment. Maryland grant funds represent the amount Maryland officials expect will be available from the Chesapeake Bay Restoration Fund.
c. Pennsylvania Department of Environmental Protection. Pennsylvania grants funds represent grant funds provided to date.
d. Virginia Department of Environmental Quality. Virginia's grant funds represent a combination of past appropriations, interest earned, and significant General Assembly funding provided.
e. Delaware, New York, and West Virginia data obtained from the Chesapeake Bay Program *Nutrient Reduction Technology Cost Estimates for Point Sources in the Chesapeake Bay Watershed*, November 2002.

Even though Maryland, Pennsylvania, and Virginia are providing municipalities with grants to install nutrient upgrades, these grants will not fund all the costs. EPA does not have a dedicated grant program to provide funding for the construction or upgrade of wastewater treatment facilities. Therefore, municipalities will need to determine how they will generate sufficient funding.

The jurisdictions have addressed the funding challenge in different ways. Virginia and Maryland created Chesapeake Bay watershed-specific funding sources to support plant upgrades. In contrast, the District of Columbia and Pennsylvania do not have dedicated Chesapeake Bay watershed-specific funding sources for nutrient removal technology. All jurisdictions, including Maryland and Virginia, face funding gaps due to increasing construction costs. The additional funds needed may be obtained from rate payers or loans from the State revolving fund or other lending institutions.

District of Columbia Water and Sewer Authority (DCWASA) officials have not identified how they plan to fund the District's portion (approximately $330 million) of the estimated $800 million for the Blue Plains facility upgrade. The Blue Plains facility is the largest wastewater treatment facility in the Chesapeake Bay watershed, and also serves communities in Maryland and Virginia. Progress in reducing nutrients has been made at the Blue Plains facility. The facility already is meeting its phosphorus wasteload cap allocation and has achieved approximately 90 percent of the total nitrogen reductions needed. However, because of its significant size and location on the Bay, achieving the remaining 10 percent nitrogen reductions is vital to the ultimate protection of the Bay. In April 2007, EPA modified DCWASA's NPDES permit to further reduce Blue Plains facility's nitrogen limits. A timeline for installing the nutrient removal technology needed to meet these new limits is expected to be outlined in a forthcoming consent agreement with EPA. Similar to other facilities, the Blue Plains facility has competing priorities, such as a court-ordered consent decree to reduce combined sewer overflows at an estimated cost of $2 billion. DCWASA officials estimate addressing both nutrient reduction goals and the combined sewer overflow issue could result in double-digit rate increases for District of Columbia rate payers.

Pennsylvania officials estimate it will cost approximately $260 to $360 million to achieve its wastewater treatment tributary strategy goals. Pennsylvania does not have a dedicated funding source to support nutrient removal technology upgrades at wastewater treatment facilities within the Chesapeake Bay watershed. However, the State has provided approximately $28 million in grant funds to wastewater treatment facilities within the Bay watershed. Pennsylvania municipal wastewater treatment facilities are exploring various options to fund nutrient removal technology upgrades. These options include securing loans from State revolving funds, leveraging bonds, and increasing user fees.

Virginia officials estimate it will cost approximately $1.5 to $2.0 billion to meet wastewater treatment allocations. Virginia established the Water Quality Improvement Fund to provide funding for nutrient removal technology upgrades. Virginia officials estimate the cost to the State for providing grants to meet the allocations is between $750 million and $1 billion. It has appropriated $550 million to the Fund, and based on Virginia's information, the OIG calculated that an additional $200 to $450 million in Fund commitments will be needed for nutrient removal technology upgrades.

Maryland officials estimate it will cost approximately $1 billion to achieve its wastewater nutrient allocations. In 2004, Maryland created the Bay Restoration Fund to fully finance enhanced nutrient removal technology upgrades at all municipal wastewater treatment plants. The Bay Restoration Fund, supported by a monthly $2.50 household user fee, provides approximately $65 million a year. Maryland officials estimate user fees will generate approximately $750 million for enhanced nutrient removal projects. Despite this dedicated funding, Maryland officials still expect a funding shortfall of approximately $250 million.

The issue of insufficient funding is magnified by the fact that construction costs have rapidly increased in recent years. Revised cost estimates from Maryland's wastewater treatment facilities demonstrate this trend. Maryland's estimate of the cost of upgrades to enhanced nutrient removal technology increased by more than 35 percent, from $740 million to more than $1.02 billion, in the last 2 years. Following the 20-City Average Construction Cost Index, a leading construction industry indicator, the construction market inflation rate increased from an historical 2 to 3 percent annual rate to 3.79 percent annually between 2000 and 2004 and 4.51 percent annually between 2004 and 2006. Within the Chesapeake Bay watershed, these inflation rates may be even higher due to an increased volume of construction activity.

Costs to implement nutrient removal technology differ widely for each wastewater treatment plant. Costs depend on the plant's size, configuration, existing nutrient removal processes, and treatment needs. We estimate "typical" construction costs for nutrient removal technology to be approximately $12.5 million for a 10-million-gallons-per-day plant serving 52,000 people (approximately 20,000 households).[5] Construction costs give smaller communities or communities with lower median household incomes a larger financial problem. States are exploring alternative ways to lessen the economic burden, including nutrient trading.

[5] OIG calculated costs using $1.25 per gallon for nutrient removal (obtained from Pennsylvania and Maryland cost documents). A domestic treatment plant is expected to treat an average of 74 gallons per day per capita (source: Water Environment Federation's *Design of Municipal Wastewater Treatment Plants*). The average number of persons in a typical U.S. household is estimated to be 2.59 (source: 2000 U.S. Census). [10 million gallons per day / (74 gallons per day*2.59 average number of person in a typical household) = 52,000 people, or 20,000 households.]

As recognized by EPA and the State partners, funding is critical to the success of the Chesapeake Bay wastewater nutrient reduction effort. The existing grant money provided by the States will not address all of the costs. Municipalities will need to consider other funding options. On its Website, EPA provides guidance and software programs for analyzing the financing of clean water projects, which municipalities may find useful. EPA's March 2007 *Tools for Financing Water Infrastructure* refers readers to tools municipalities can use in financial analysis. In June 2007, EPA announced the availability of the Financing Alternatives Comparison Tool, which provides a side-by-side comparison of various financing options. EPA needs to further promote the use of these tools to the Chesapeake Bay wastewater community. EPA should also gather information from States and report on the progress individual wastewater facilities are making in funding and constructing nutrient removal technology as part of the CBPO's annual reporting process. The CBPO recently started to issue health and restoration assessments annually but these reports do not include financial data. Reporting facility progress in obtaining funding will help publicize the need, as appropriate, for greater public support for facility upgrades.

EPA Needs to Continue Working with States on Trading Programs

EPA needs to develop a formal plan to capture and disseminate lessons learned from its oversight of the Chesapeake Bay States' development of water quality trading programs. Water quality trading allows facilities facing higher pollution control costs to meet regulatory obligations by purchasing equivalent (or superior) pollution reductions from another source at lower cost. States are relying on trading as a tool in achieving and maintaining the goals.

In August 2007, EPA issued the non-binding, *Water Quality Trading Toolkit for Permit Writers.* The toolkit provides national guidance to States on developing their water quality trading programs. The guidance recommends that EPA and its Bay partners (a) ensure permits contain enforceable trading provisions, (b) review monitoring data, and (c) ensure enforcement takes place if credits are not realized. EPA and its partners need to ensure that the developing water quality programs are consistent with the Clean Water Act and include the above recommended provisions so that programs will be credible and successful across the watershed.

EPA has provided guidance to the Chesapeake Bay States in developing their trading programs. Senior EPA officials stated that they do not want to stifle creativity and have encouraged flexibility. Both Virginia and Pennsylvania regard their trading programs as integral tools to achieving wastewater commitments. Maryland plans to use the trading program as a tool for maintaining its 2010 nutrient goal reductions. Because the States are testing different approaches, it is important that EPA have a formal mechanism to track water quality trading so that others can learn.

Considering that the Bay partners will be using innovative trading techniques – such as point to non-point source trading – Bay partners, traders, and other stakeholders need to be assured the programs are credible. Otherwise, trades could result in non-point sources receiving credit for more nutrient reductions than actually available. To prevent this, EPA needs to continue to ensure State programs establish baselines and enforceable agreements that allow for inspections.

Another concern is the future viability of interstate trades when each State has the flexibility to develop their own programs. EPA should continue working with the States to address these concerns on a watershed basis. EPA and the States should develop a "common currency" – equivalent and clearly defined units of trades – which allows participants and regulators to evaluate and monitor potential trades. This will also help ensure programs have sufficient safeguards.

EPA will need to develop a system to collect the information it needs to share with States on lessons learned in developing trading programs. This will be an important task considering that States are being allowed flexibility in developing their programs and the partners are still addressing complex trades between point and non-point sectors. When interstate trading starts, EPA should develop a tracking system for these trades.

Rising Population Growth Can Impact Cap Loads

Maintaining existing cap loads amidst rapid population growth presents a major challenge. If the wastewater treatment facilities cannot further upgrade or expand their capacity to take on additional customers, new development may need to rely on septic systems or build their own small treatment systems. The Bay partners project population growth of greater than 20 percent in many watershed areas, with some areas projected to grow by more than 60 percent by 2030. The suburban and rural edges surrounding the District of Columbia, Baltimore, and Richmond are expected to experience the greatest growth, putting stress on the wastewater treatment capacity of local municipal systems.[6]

EPA and the States have not overlooked growth's effect on the wastewater treatment sector. EPA and State officials maintain that existing cap load allocations will not change in response to population growth, and that any increases in load resulting from population growth at wastewater treatment facilities will be offset by other means, such as water quality trading or advances in technology. Even though non-significant facilities represent approximately 5 percent of the nutrient load to the Bay, States are planning to place controls on limiting expansion of non-significant facilities, down to facilities as small as 40,000 gallons per day in Virginia. While this is a positive effort, it may have the

[6] For example, independent analysts project Virginia basins could experience 2 to 6 percent average annual flow increases between 2004-2010 (*CH2MHill, May 31, 2006 Technical Memorandum).*

unintended consequence of increasing reliance on less regulated septic systems or small wastewater treatment facilities, or even illegal hookups.

We discussed land development issues in more detail in a prior report, *Development Growth Outpacing Progress in Watershed Efforts to Restore the Chesapeake Bay*. We recommended that EPA take the lead in addressing such issues by developing a strategy to reverse the trend of increasing loads from developing lands. In this strategy, EPA would develop a set of environmentally-sensitive design practices that result in no-net increase in nutrient and sediment loads in new development, and methods to work with States and communities to adopt these practices.

Conclusions

Wastewater treatment plants have made progress in reducing nutrients, but wastewater facilities risk not meeting the 2010 deadline if key facilities are not upgraded in time. EPA and its Bay partners must address the challenges of securing adequate funding, establishing a sound and viable trading program, and controlling nutrient loading amidst rapid population growth. Construction costs have been rising faster than dedicated funding sources. However, these challenges are not insurmountable. Better management and tracking, and early detection of shortfalls, can help achieve and sustain required wastewater reductions. EPA and the States need to take a more active role in monitoring the progress of municipalities in addressing these challenges and provide assistance or other appropriate actions as necessary.

Recommendations

We recommend that the EPA Region 3 Regional Administrator instruct staff to:

2-1 Review and comment on State-drafted NPDES permits for significant facilities to ensure that interim construction milestones are included in compliance schedules longer than 1 year to meet the Chesapeake Bay allocations. The milestones should include:

- design completion
- construction start
- construction completion
- compliance with permit limits

2-2 Obtain from NPDES-authorized States information on progress in achieving the milestones above for "select priority facilities." Such priority facilities include those that are identified as needing the largest nutrient reductions and are identified by the States as missing the interim milestones noted in Recommendation 2-1. If milestones are missed, EPA

will work with the States to take appropriate followup action to ensure compliance with the milestones.

2-3 Collect information and report on the amount and source of funding for the aforementioned “select priority facilities” as part of the CBPO’s annual reporting process.

2-4 Promote awareness of and use of the "Financing Alternatives Comparison Tool" and other financial analysis tools within the Chesapeake Bay community.

2-5 Continue to assist States in their development of effective trading programs by ensuring that: (a) States establish a common nutrient trading currency, and (b) lessons learned are captured and disseminated. In addition, if an interstate trading protocol or program is developed, EPA should develop a formal mechanism to track water quality trading across State lines.

Agency Response and OIG Comments

EPA concurred with all our recommendations. EPA also included an estimate showing that the wastewater facilities will come close to meeting their nutrient reduction goals in 2010. This information was received from State Agencies when EPA was reviewing our draft report. The new information had not yet been verified by EPA. Because our review had been completed, we could not evaluate the new information and therefore do not express an opinion on the veracity or accuracy of the data.

A complete copy of the Agency’s response can be found in Appendix C and our detailed comments in Appendix D.

Chapter 3
Obtaining Additional Nutrient Reductions from Wastewater Facilities Not Cost Effective or Practical

Although EPA and its Bay partners could obtain additional nutrient reductions from significant municipal wastewater treatment facilities to compensate for other sources not meeting 2010 goals, these additional reductions are not cost effective or practical. Obtaining these additional reductions would require justifying additional expenditures, recalculating wasteload allocations, and reopening and modifying permits already being put in place. At this point, EPA has no plans to require additional reductions from wastewater treatment facilities.

Limited Additional Reductions

Municipal Facilities – Additional Reductions Possible but Not Cost Effective

Potential additional nutrient reductions from municipal wastewater treatment facilities can be obtained beyond their cap load allocations if all significant municipal facilities operated with state-of-the-art nutrient removal technology. Facilities in the District of Columbia, Maryland, Pennsylvania, and Virginia could reduce the nutrients delivered to the Bay by up to 9.9 million pounds per year for nitrogen and 1 million pounds for phosphorus. This equates to approximately 14 and 20 percent, respectively, of the overall reductions needed by the non-point nutrient sources to meet the Chesapeake Bay nutrient goals. Based on our methodology (see Appendix E), our estimate represents the upper reaches.

However, these additional reductions may not be cost effective or practical. Funding the estimated $3.4 billion needed to install the nutrient removal technology to meet current goals still remains a challenge for most communities. Installing enhanced nutrient removal technology will substantially increase costs even further. The 2003 *Chesapeake Futures* report estimates that improving technology to reduce total nitrogen from 6 to 3 mg/l would increase costs 4-to-10-fold. This incremental upgrade from regular to state-of-the-art technology is less cost-effective than other measures to reduce additional nutrients. Certain agricultural best management practices in particular may provide a more justifiable means for nutrient reduction.

Seeking additional reductions would require resetting wasteload allocations. The Bay partners have already begun to include nitrogen and phosphorus discharge limits in significant facilities' NPDES permits, which are issued for a period of up to 5 years. Some facilities have already begun the capital-intensive process of

upgrading their plant technologies to meet these current limits. Amending current permits because of the regulatory process would not be an easy task

Industrial Facilities – Ability to Reduce Nutrients Should Be Reviewed

EPA and its Bay partners may be able to obtain additional nutrient reductions from industrial wastewater treatment facilities beyond current cap load allocations. Most industries do not have technology-based limits for nitrogen and phosphorous. Since the technology-based limits are developed on a national basis, those permits with technology-based limits may not be as stringent as permit limits driven by Chesapeake Bay water quality standards. EPA and its State partners have the authority under the Clean Water Act to require stricter nutrient limits than the technology-based limits. However, during the *Chesapeake 2000* nutrient allocation process, most States in the Chesapeake Bay watershed opted not to require stricter nutrient limits for industrial facilities, even though many municipal facilities were given near state-of-the-art technology allocations to meet the sector nutrient reduction quota.

The OIG did not estimate the additional nutrient reductions available from industrial facilities. These facilities have different wastewater streams than municipal systems. Therefore, additional reductions cannot be calculated in the same manner. Also, industrial facilities operate on widely variant production and nutrient removal processes, with no universal state-of-the-art nutrient discharge concentration. For example, in 2005, average nutrient discharge concentrations of significant industrial facilities in the Chesapeake Bay watershed ranged from 0.4 mg/l to 210 mg/l for nitrogen and 0.01 mg/l to 14.6 mg/l for phosphorus; one outlier facility reported an average total nitrogen concentration of 2,754 mg/l. Because some of these concentrations appear high, EPA and its Bay partners should work with industrial facilities to gain additional nutrient reductions.

Equity with Other Sectors

The concept of "fair and equitable" nutrient allocations among the various partners underlined the collaborative process used to derive the final 2010 nutrient allocation commitments. It has been largely credited for the progress the Chesapeake Bay program has made to date. Resetting nutrient wasteload allocations for municipal or industrial wastewater facilities as a result of other sectors not delivering on their commitments could undermine the agreement achieved by the States amongst themselves and with their nutrient sources. Maintaining the momentum gained thus far should be foremost in the goal of improving the Chesapeake Bay water quality. This would involve building on the effort and progress made by the Bay partners so far. If the wastewater treatment community perceives that non-point source sectors have not followed through in the partnership of "shared sacrifice," they may challenge any requirements for additional reductions.

Potential Additional Wastewater Reductions Cannot Compensate for Other Sectors' Missed Goals

Additional reductions from the wastewater treatment community, both municipal and industrial, are not large enough to compensate for shortfalls from the agricultural and developed land sectors. As of 2005, the agricultural sector needed to reduce nitrogen by more than 50 million pounds per year, nearly five times the total additional reductions that could be gained by imposing an Enhanced Nutrient Removal goal on all significant municipal wastewater treatment facilities. Phosphorus needs to be reduced by 3.3 million pounds per year, or over three times. Gains from industrial facilities are also limited. Based on previous progress, the agricultural sector will have a significant shortfall in meeting its nutrient reduction goals, but wastewater treatment facilities could make up only a small portion of this gap.

Conclusions

Although the wastewater treatment community could achieve additional nutrient reductions beyond existing cap load allocations, such an effort would not promote equity or be the most cost-effective track. While EPA and its Bay partners should review industrial facility operations for potential additional reductions, these reductions will not compensate for shortfalls from other sectors. EPA and the Bay partners' primary focus should be on overcoming the present challenges and reaching the current nutrient reduction goals. The success of the Chesapeake Bay program and the health of the bay depend on the efforts of all the partners sharing the responsibility to reduce loads.

Recommendation

We recommend that the EPA Region 3 Regional Administrator:

3-1 Work with NPDES-delegated States to complete current efforts, related to industrial discharges, to: (a) characterize current nutrient discharge levels; (b) refine nutrient cap loads, where appropriate; and (c) issue permits reflecting modified cap loads.

Agency Response and OIG Comments

EPA concurred with our recommendation. A complete copy of the Agency's response can be found in Appendix C and our detailed comments in Appendix D.

Status of Recommendations and Potential Monetary Benefits

RECOMMENDATIONS						POTENTIAL MONETARY BENEFITS (in $000s)	
Rec. No.	Page No.	Subject	Status[1]	Action Official	Planned Completion Date	Claimed Amount	Agreed To Amount
2-1	14	Review and comment on State-drafted NPDES permits for significant facilities to ensure that interim construction milestones are included in compliance schedules longer than 1 year to meet the Chesapeake Bay allocations. The milestones should include: • design completion • construction start • construction completion • compliance with permit limits	O	EPA Region 3 Regional Administrator			
2-2	14	Obtain from NPDES-authorized States information on progress in achieving the milestones above for "select priority facilities." Such priority facilities include those that are identified as needing the largest nutrient reductions and are identified by the States as missing the interim milestones noted in Recommendation 2-1. If milestones are missed, EPA will work with the States to take appropriate followup action to ensure compliance with the milestones.	O	EPA Region 3 Regional Administrator			
2-3	15	Collect information and report on the amount and source of funding for the aforementioned "select priority facilities" as part of the CBPO's annual reporting process.	O	EPA Region 3 Regional Administrator			
2-4	15	Promote awareness of and use of the "Financing Alternatives Comparison Tool" and other financial analysis tools within the Chesapeake Bay community.	O	EPA Region 3 Regional Administrator			
2-5	15	Continue to assist States in their development of effective trading programs by ensuring that: (a) States establish a common nutrient trading currency, and (b) lessons learned are captured and disseminated. In addition, if an interstate trading protocol or program is developed, EPA should develop a formal mechanism to track water quality trading across State lines.	O	EPA Region 3 Regional Administrator			
3-1	18	Work with NPDES-delegated States to complete current efforts, related to industrial discharges, to: (a) characterize current nutrient discharge levels; (b) refine nutrient cap loads, where appropriate; and (c) issue permits reflecting modified cap loads.	O	EPA Region 3 Regional Administrator			

[1] O = recommendation is open with agreed-to corrective actions pending;
C = recommendation is closed with all agreed-to actions completed;
U = recommendation is undecided with resolution efforts in progress

Appendix A

Details on Scope and Methodology

We reviewed loadings data from 1985 to 2005 to determine the progress the Chesapeake Bay Program partners have made in reducing nutrients, and the activities the Bay partners have taken in meeting the wastewater treatment nutrient reduction goals agreed upon in the *Chesapeake 2000* agreement. We performed our work at EPA Region 3 and the Chesapeake Bay Program, and Chesapeake Bay jurisdictions from October 2006 through July 2007 in accordance with generally accepted government auditing standards.

The scope of this evaluation is limited to nutrient discharges from "significant" wastewater treatment facilities as defined and identified by the partner States. These facilities account for approximately 95 percent of the wastewater nutrient discharge into the Chesapeake Bay. We limited our inquiry to the four signatory jurisdictions: Maryland, Virginia, Pennsylvania, and the District of Columbia. According to CBPO data, these jurisdictions accounted for more than 95 percent of nitrogen wastewater loads and 86 percent of phosphorus wastewater loads in 2005.

We interviewed EPA staff from Region 3, including in CBPO, and the Office of Water. We also interviewed State and district staff working in the NPDES permits division and involved in implementing the wastewater treatment aspect of the tributary strategies. Other relevant interviewees included staff from the U.S. Geological Survey, wastewater treatment officials and representatives, industry consultants, academic experts, and environmental advocacy groups. We visited the largest wastewater treatment facility in the Chesapeake Bay watershed – Blue Plains. We also reviewed numerous documents and publications, including the Clean Water Act, the *Chesapeake 2000* agreement, State and district tributary strategies and implementation plans, State regulations and public notices, the Blue Plains wastewater treatment permit, and reports by Chesapeake Bay Program-affiliated workgroups. We performed various quantitative analyses using wastewater discharge data from the CBPO Nutrient Point Source Database and jurisdictional cost and construction data obtained from State officials.

Management Controls

We reviewed CBPO's database management controls and operating procedures. We determined that CBPO had adequate procedures for managing the Chesapeake Bay Nutrient Point Source Database. However, we identified some improvements CBPO could make to strengthen its procedures, including the development of a data dictionary, and made suggestions to CBPO. The CBPO Data Manager responded positively by creating a data dictionary, which is under review, and will consider incorporating the data dictionary and other suggestions into an updated version of the program's standard operating procedures. We also conducted a limited data reliability review of the wastewater treatment data from the Chesapeake Bay Nutrient Point Source database. While we found some data missing from non-critical fields, critical fields had relevant data and this did not impact our review. EPA officials plan to remove these non-critical fields, which are no longer used, in an updated version of the database. Removing these fields will not impact management controls.

Limitations

We did not review discharges from concentrated animal feeding operations, stormwater, septic systems, or "non-significant" wastewater treatment facilities. We did not address the combined sewage overflow systems associated with some "significant" wastewater treatment facilities.

Prior Reviews

EPA's OIG has completed several reports evaluating progress occurring in the Chesapeake Bay. These reports included the following:

> **EPA OIG Report No. 2007-P-00004*, Saving the Chesapeake Bay Watershed Requires Better Coordination of Environmental and Agriculture Resources,* November 20, 2006 (conducted jointly with the U.S. Department of Agriculture).**
> We reported that Bay partners have committed the agricultural community to making the largest nutrient reductions, but few of the practices in the tributary strategies have been implemented. We recommended that EPA improve its coordination and collaboration with the U.S. Department of Agriculture and other agricultural community partners.
>
> **EPA OIG Report No. 2007-P-00009*, EPA Relying on Existing Clean Air Act Regulations to Reduce Atmospheric Deposition to the Chesapeake Bay and its Watershed,* February 28, 2007.**
> We reported that Federal clean air regulations for decreasing nitrous oxide emissions should sufficiently reduce the amount of nitrogen that reaches the Bay to meet the reduction goals set out by EPA for the air sector. We recommended that CBPO develop actions and strategies to address nitrogen deposition from animal feeding operations.
>
> **EPA OIG Report No. 2007-P-00031, *Development Growth Outpacing Progress in Watershed Efforts to Restore the Chesapeake Bay,* September 10, 2007.**
> We reported that the developed land sector goals under the *Chesapeake 2000* agreement will not be met by 2010. The ability to attain these goals diminishes as new development increases nutrient and sediment loads at rates faster than they are reduced. We recommended that the CBPO Director prepare and implement a strategy that demonstrates leadership in reversing the trend of increasing nutrient and sediment loads from developed and developing lands.

The following additional reviews by the EPA OIG and the Government Accountability Office also addressed the Chesapeake Bay:

> **Government Accountability Office Report No. GAO-06-96, *Chesapeake Bay Program: Improved Strategies Are Needed to Better Assess, Report, and Manage Restoration Progress,* November 2005.**
> The Government Accountability Office recommended that the EPA Administrator instruct CBPO to (1) complete its efforts to develop and implement an integrated assessment approach; (2) revise its reporting approach to improve the effectiveness and

credibility of its reports; and (3) develop a comprehensive, coordinated implementation strategy that takes into account available resources.

EPA OIG Report No. 2006-P-00032, *EPA Grants Supported Restoring the Chesapeake Bay,* September 6, 2006.
We reported that EPA awarded grants that contributed toward meeting the goals of the Clean Water Act and the *Chesapeake 2000 Agreement*.

EPA OIG Report No. 2007-P-00032, *Federal Facilities in Chesapeake Bay Watershed Generally Comply with Major Clean Water Act Permits,* September *5,* 2007.
We reported that, overall, EPA and States are doing well managing how major Federal facilities in the Chesapeake Bay watershed comply with their NPDES permits. In EPA's last reporting period (2004), major Federal facilities in the watershed had a lower rate of Significant Noncompliance than other Federal and non-Federal major-permit facilities nationwide.

Appendix B

Tables on Reductions Needed

Table B.1: Reductions Needed from 2005 Wastewater Delivered Loadings to 2010 Wastewater Delivered Goals for Total Nitrogen and Total Phosphorus (as of June 2007)

	Total Nitrogen (delivered pounds/year)				Total Phosphorus (delivered pounds/year)			
Jurisdiction	2000[a]	2005[a]	2010 Goal [b,c,& d]	Reductions Needed[e]	2000[a]	2005[a]	2010 Goal [b,c,& d]	Reductions Needed[e]
Maryland[f]	17,226,873	15,570,921	9,960,249	5,610,672	963,524	719,861	593,919	125,942
Pennsylvania	12,862,681	11,216,949	10,358,618	858,331	672,237	689,254	608,223	81,031
Virginia[f]	25,554,098	22,290,624	19,507,426	2,783,198	2,216,318	1,962,062	1,782,759	179,303
Washington, DC[fg]	4,548,767	2,581,447	2,114,528	466,919	98,452	80,248	86,941	-6,693
Delaware	286,852	177,233	154,772	22,461	23,777	8,956	6,167	2,789
New York	2,142,744	1,695,678	1,105,569	590,109	214,182	223,941	123,084	100,857
West Virginia	328,585	460,119	390,666	69,453	70,245	308,988	67,977	241,011
Bay-wide	**62,950,600**	**53,992,971**	**43,591,828**	**10,401,143**	**4,258,735**	**3,993,310**	**3,269,070**	**724,240**

Sources: a. 2000 and 2005 loadings data provided by CBPO.
b. 2010 goals for Delaware, New York, and West Virginia provided by CBPO. The New York and Delaware 2010 goals were estimated by CBPO and based on draft numbers provided by States.
c. 2010 goals for Maryland, Pennsylvania, and Virginia from State environmental departments.
d. District of Columbia 2010 goals from NPDES permits.
e. OIG calculations using data provided by CBPO; Pennsylvania, Maryland, and Virginia State environmental departments; and NPDES permits.
f. Includes States' respective portion of the Blue Plains nutrient loads and allocations.
g. Includes only the District of Columbia's portion of the Blue Plains nutrient loads and allocations.

Table B.2: Municipal Wastewater Treatment Plants Needing the Most Total Nitrogen Reductions to Meet Wasteload Allocation Goals (as of June 2007)

NPDES Identification Number	Plant Name	Design Flow (million gallons per day)	2005 Total Nitrogen Discharged Load (lbs/yr)[a]	Total Nitrogen Delivery Factor[b]	Total Nitrogen Wasteload Allocation Concentration (mg/l)[b]	Total Nitrogen Delivered Wasteload Allocation (lbs/yr)[b&c]	Total Nitrogen Reductions Needed to Reach Goal (lbs/yr)[d]
DC0021199	Blue Plains	370	5,195,719	1.0	4.20	4,689,000	506,719
MD0021555	Back River	180	3,068,592	1.0	4.00	2,192,803	875,789
MD0021601	Patapsco	73	3,001,906	1.0	4.00	889,304	2,112,602
PA0027197	Harrisburg	38	1,224,688	1.0	6.00	688,575	536,113
VA0063177	Richmond	45	2,246,479	1.0	8.00	1,096,402	1,150,077
		706	**14,737,384**			**9,556,084**	**5,181,300**

Sources: a. 2005 loadings data provided by CBPO.
b. 2010 goals for Maryland, Pennsylvania, and Virginia from State environmental departments.
c. District of Columbia 2010 goals from NPDES permits.
d. OIG calculations using data provided by CBPO; Pennsylvania, Maryland, and Virginia State environmental departments; and NPDES permits.

Table B.3: Municipal Wastewater Treatment Plants Needing the Most Total Phosphorus Reductions to Meet Wasteload Allocation Goals (as of June 2007)

NPDES Identification Number	Plant Name	Design Flow (million gallons per day)	2005 Total Phosphorus Discharged Load (lb/yr)[a]	Total Phosphorus Delivery Factor[b]	Total Phosphorus Wasteload Allocation Concentration (mg/l)[b]	Total Phosphorus Delivered Wasteload Allocation (lbs/yr)[b]	Total Phosphorus Reductions Needed to Reach Goal (lbs/yr)[c]
MD0021601	Patapsco	73	140,530	1.0	0.3	66,698	73,832
VA0063177	Richmond	45	227,189	1.0	0.5	68,525	158,664
		118	**367,719**			**135,223**	**232,496**

Sources: a. 2005 loadings data provided by CBPO.
b. 2010 goals for Maryland and Virginia from State environmental departments.
c. OIG calculations using data provided by CBPO; Pennsylvania, Maryland, and Virginia State environmental departments; and NPDES permits.

Appendix C

Agency Response

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION III
1650 Arch Street
Philadelphia, Pennsylvania 19103-2029

SUBJECT: **Draft Evaluation Report: Despite Progress, EPA Needs to Expand Oversight of Wastewater Upgrades in the Chesapeake Bay Watershed**

FROM: ***Donald S. Welsh***
Regional Administrator (3RA00)

TO: Dan Engelberg
Director of Program Evaluations, Water Issues
Office of the Inspector General (2460T)

Thank you for the opportunity to comment on the ***Draft Evaluation Report: Despite Progress, EPA Needs to Improve Oversight of Wastewater Upgrades in the Chesapeake Bay Watershed***. The recommendations of the draft report are appropriately focused on EPA actions to track, promote, and assist federal, state, and local efforts to reduce the discharge of nutrients from wastewater facilities in the Chesapeake Bay watershed. Therefore, EPA concurs with all of the recommendations in the draft report (see Attachment A).

EPA is proud of the enormous progress that has been made and is underway in the upgrade of wastewater treatment plants in the Chesapeake Bay watershed for nutrient pollution control. Through EPA's and our state partners' efforts, we are well on our way to achieving the largest nutrient reduction technology upgrade of wastewater treatment facilities in the country (estimated at nearly $4 billion in controls). EPA has played a leadership role with our state partners in developing credible water quality criteria and agreeing to a comprehensive nutrient budget to achieve those criteria. EPA has also led the development of the *NPDES Permit Approach for Discharges of Nutrients in the Chesapeake Bay Watershed (Permitting Approach).* This Permitting Approach has guided all of our partner states in consistent and effective permitting of nutrients in the Bay. EPA has also significantly increased our NPDES oversight of nearly 500 significant point source facilities, including about 200 minor facilities, in the Chesapeake Bay watershed. EPA is closely tracking the drafting and issuance of permits for all significant facilities, major and minor. This increased oversight has been, and continues to be, a significant investment of EPA staff resources.

Due to EPA's leadership and a committed watershed partnership, the latest information, shared recently with the OIG, projects that the basin-wide aggregate phosphorus loading caps for wastewater treatment facilities will be met by 2010 with Maryland, Virginia, Pennsylvania and the District of Columbia all meeting their jurisdiction-specific cap loads (see Attachment B). Furthermore, by 2010, this same information suggests that the basin-wide aggregate nitrogen loading caps for wastewater treatment facilities will be met in Pennsylvania and Virginia; and 95% of the reductions necessary to attain the aggregate basin-wide nitrogen loading cap will be achieved. As recently as December 3, 2007, Virginia's Governor Kaine announced that Virginia's largest wastewater treatment facilities and industries within the Chesapeake Bay watershed expect to meet their nutrient reduction goals by the end of 2010. This most recent information was provided to the OIG after the draft report was submitted to EPA for comment. We understand that this timing does not allow the OIG to verify the validity of this most recent data for inclusion in the final report.

While we are confident that the progress that has been realized is a remarkable example of a strong and committed partnership, we are aware that more work needs to be done to ensure that the job is fully accomplished. The partnership needs to complete plans to issue NPDES permits with aggressive compliance schedules for the reduction of nutrients. We need to track progress and develop contingencies if unforeseen delays occur. It is this tracking and response to potential delays that are appropriately the focus of the recommendations of the draft OIG report.

If you or your staff have any questions related to our response to the draft report, please contact Robert Koroncai, at 215-814-5730 or Richard Batiuk, at 410-267-5731.

cc: Benjamin Grumbles, Assistant Administrator, Office of Water
Jon Capacasa, Director, Water Protection Division, Region III
Jeff Lape, Director, Chesapeake Bay Program Office, Region III
Bob Koroncai, Associate Director, Water Protection Division, Region III
Richard Batiuk, Associate Director for Science, Chesapeake Bay Program Office
Lorraine Fleury, Audit Coordinator, Region III
Michael Mason, Office of Water

Attachments

Attachment A

Recommendations- Draft Evaluation Report: *Despite Progress, EPA Needs to Improve Oversight of Wastewater Upgrades in the Chesapeake Bay Watershed*

We recommend that the EPA Region 3 Regional Administrator instruct staff to:

2-2 ***Review and comment on State-drafted NPDES permits for significant facilities to ensure that interim milestones are included in compliance schedules longer than 1 year to meet the Chesapeake Bay allocations. The milestones should include:***

- design completion
- construction start
- construction completion
- compliance with permit limits

2-6 Obtain from NPDES-authorized States information on progress in achieving the milestones above for "select priority facilities." Such priority facilities include those that are identified as needing the largest nutrient reductions and are identified by the States as missing the interim milestones noted in Recommendation 2-1. If milestones are missed, EPA will work with the States to take appropriate follow-up action to ensure compliance with the milestones.

2-7 Collect information and report on the amount and source of funding for the aforementioned "select priority facilities" as part of the CBPO's annual reporting process.

2-8 Promote awareness and use of the "Financing Alternatives Comparison Tool" and other financial analysis tools within the Chesapeake Bay community.

2-9 Continue to assist States in their development of effective trading programs by ensuring that: (a) States establish a common nutrient trading currency, and (b) lessons learned are captured and disseminated. In addition, if an interstate trading protocol or program is developed, EPA should develop a formal mechanism to track water quality trading across State lines.

3-2 Work with NPDES delegated-States to complete current efforts, related to industrial discharges, to: (a) characterize current nutrient discharge levels; (b) refine nutrient cap loads, where appropriate; and (c) issue permits reflecting modified cap loads.

Attachment B

More Recent Documentation from Chesapeake Bay Watershed State Partners on Scheduled Significant Wastewater Facility Upgrades and Estimated Delivered Loadings

Through e-mail attachments transmitted on October 19, 2007, EPA provided the OIG with the latest detailed documentation supporting the Chesapeake Bay Program partnership's estimated delivered nitrogen and phosphorus loads from wastewater treatment facilities by 2010. We estimate the basin-wide aggregate phosphorus cap loads for wastewater treatment facilities will be met by 2010 with Maryland, Virginia, Pennsylvania, and the District of Columbia each achieving their jurisdiction-specific phosphorus cap load. Furthermore, based on available information, by 2010 we anticipate that the nitrogen cap loads for wastewater treatment facilities will be met in Pennsylvania and Virginia. Basin-wide, we expect to achieve 95 percent of the reductions needed to attain the aggregate nitrogen cap load by 2010.

The information provided by the delegated NPDES regulatory agencies in Maryland, Virginia, and Pennsylvania is credible data, to be supported by permit limits, compliance schedules, and funding sources. Below is documentation on each set of data provided to the OIG supporting the above stated 2010 projections.

"2010 Ches Bay Watershed WWTP Delivered Load Projections.xls" - This file contains the summation of the Chesapeake Bay Program Office's calculations of the basin-wide and jurisdiction specific estimates of projected wastewater treatment facility delivered loads by 2010 for total nitrogen and total phosphorus. These 2010 estimates for the Maryland, Virginia, and Pennsylvania facilities were based directly on current treatment facility upgrade schedules recently received from the three states. New York, Delaware, and West Virginia do not yet have similar facility specific upgrade schedules. For the significant facilities in these three states, the Chesapeake Bay Program Office assumed 2005 concentrations and 2010 flows in making the 2010 projections. In the case of the Blue Plains facility in the District of Columbia, EPA knows the facility will not be upgraded for additional nitrogen reductions prior to 2010, so the Chesapeake Bay Program Office again assumed 2005 concentrations and 2010 flows in making the 2010 projections. Given there are likely to be wastewater treatment facilities in New York, Delaware, and West Virginia, upgraded prior to 2010 (based on communications with agency regulators in each jurisdiction) using a 2005 concentration and a 2010 flow across all facilities in these three jurisdictions, at this time, just makes the current 2010 projections that much more conservative.

"1985-2005 Watershed Model Estimated Loads.exl" - This file contains the 1985-2005 record of Phase 4.3 Chesapeake Bay Watershed Model's estimated total nitrogen, total phosphorus, and sediment loads delivered to the Chesapeake Bay tidal waters from all sources and all jurisdictions. This spreadsheet provided the OIG with the official state-by-state nitrogen and phosphorus cap load allocations for the wastewater sector.

"PA DEP Phase 1 Scheduled WWTP Upgrades and Estimated Loads.xls" - This file contains the Pennsylvania Department of Environmental Protection's latest schedule for their

Phase 1 wastewater treatment facilities upgrades. Pennsylvania DEP provided detailed facility-by-facility information on the timing of facility upgrades and planned trades supporting the state's projection for making its statewide nitrogen and phosphorus wastewater treatment facility cap loads by 2010.

"MDE 2010 Estimate WWTP Delivered Load.xls" - This file contains the Maryland Department of the Environment's latest estimates for which facilities will be upgraded by 2010, and their estimates for total nitrogen and total phosphorus delivered loads from all their significant facilities by 2010. Maryland's estimates are supported by a well-defined funding source (Maryland's "Flush Fee") and a long record of tracking real wastewater facility upgrades—from secondary to BNR in the 1990s and from BNR to ENR in the 2000s.

"VA DEQ Jan 2011 Estimated WWTP Delivered Loads.xls" - This file contains the Virginia Department of Environmental Quality's latest estimates for their
January 1, 2011, delivered loads from all their significant facilities (hence the reference to 2011 and not 2010). This file is a concise summation of the wealth of data and information contained in their recently released "Exchange Compliance Plan" also submitted by EPA to the OIG.

"Exchange Compliance Plan" – This set of 15 PDF files contains the entire set of documentation on each of Virginia's 126 significant facilities' planned upgrades, planned trades and estimated flows and loads out through 2030.

Appendix D

OIG Evaluation of Agency Response

As noted in its response (Appendix C) to our draft report, EPA and its State partners have taken several important steps that have resulted in wastewater facilities reducing their nutrient discharges. However, to achieve the 2010 loading goal, all the Bay partners will need to fast-track their respective responsibilities. Considering that only 3 years are left to meet the goal, time does not allow for delays. Yet, as we reported, major challenges continue to threaten the partners' progress. The new information provided by the State agencies identifies which facilities are expected to either complete their plant upgrades or be participating in a trading program by 2010. EPA correctly states in its response that its focus should now be on tracking progress and developing contingencies in the event of unforeseen delays to ensure that the plans are achieved.

EPA also provided several documents, which it describes in Attachment B to its December 14, 2007, response. The following provides our detailed comments on these documents.

No.	Region 3 Response Attachment B	OIG Response
1	Through e-mail attachments transmitted on October 19, 2007, EPA provided the OIG with the latest detailed documentation supporting the Chesapeake Bay Program partnership's estimated delivered nitrogen and phosphorus loads from wastewater treatment facilities by 2010. We estimate the basin-wide aggregate phosphorus cap loads for wastewater treatment facilities will be met by 2010 with Maryland, Virginia, Pennsylvania, and the District of Columbia each achieving their jurisdiction-specific phosphorus cap load. Furthermore, based on available information, by 2010 we anticipate that the nitrogen cap loads for wastewater treatment facilities will be met in Pennsylvania and Virginia. Basin-wide, we expect to achieve 95 percent of the reductions needed to attain the aggregate nitrogen cap load by 2010. The information provided by the delegated NPDES regulatory agencies in Maryland, Virginia, and Pennsylvania is credible data, to be supported by permit limits, compliance schedules, and funding sources. Below is documentation on each set of data provided to the OIG supporting the above stated 2010 projections.	The OIG completed its field work in July 2007 and issued its draft report to EPA on September 20, 2007. EPA received the new information from the States when it was in the process of responding to our draft report. Because our review was completed, we could not evaluate the new information and therefore the OIG has no position on the veracity or accuracy of EPA's projections.

No.	Region 3 Response Attachment B	OIG Response
2	The information provided by the delegated NPDES regulatory agencies in Maryland, Virginia, and Pennsylvania is credible data, to be supported by permit limits, compliance schedules, and funding sources. Below is documentation on each set of data provided to the OIG supporting the above stated 2010 projections.	Only about 32 percent of the NPDES permits have been issued as final and few of the facilities have completed construction upgrades as of the fall of 2007. The Maryland and Pennsylvania data did not contain compliance schedules, only the estimated dates of when the significant facilities were expected to achieve their 2010 nutrient goals. Additionally, very little financial data was provided for these facilities. We do not know if loans or grants have been secured or if user rates have been increased. As discussed in our report, funding has been identified as a significant challenge that must be addressed to achieve 2010 nutrient goals.
3	**"2010 Ches Bay Watershed WWTP Delivered Load Projections.xls"** - This file contains the summation of the CBPO's calculations of the basin-wide and jurisdiction specific estimates of projected wastewater treatment facility delivered loads by 2010 for total nitrogen and total phosphorus. These 2010 estimates for the Maryland, Virginia, and Pennsylvania facilities were based directly on current treatment facility upgrade schedules recently received from the three States. New York, Delaware, and West Virginia do not yet have similar facility specific upgrade schedules. For the significant facilities in these three States, the CBPO assumed 2005 concentrations and 2010 flows in making the 2010 projections. In the case of the Blue Plains facility in the District of Columbia, EPA knows the facility will not be upgraded for additional nitrogen reductions prior to 2010, so the CBPO again assumed 2005 concentrations and 2010 flows in making the 2010 projections. Given there are likely to be wastewater treatment facilities in New York, Delaware, and West Virginia, upgraded prior to 2010 (based on communications with Agency regulators in each jurisdiction) using a 2005 concentration and a 2010 flow across all facilities in these three jurisdictions, at this time, just makes the current 2010 projections that much more conservative.	State officials project that approximately 160 wastewater treatment facilities of the almost 500 facilities will meet the 2010 nutrient reduction goals. The majority of these facilities will need construction upgrades to meet the new limits. Based on limited information as of October 2007, little construction has begun. Some facilities plan to engage in water quality trading to meet the limits. However, the trading programs are presently evolving and are largely unproven. Region 3 Water Division and CBPO managers described these compliance schedules as "aggressive." These schedules leave little room for error. If one or two of the most significant facilities expected to meet the 2010 goal date fails to meet their 2010 projected wasteload allocation goals, the one facility could seriously jeopardize the aggregate achievement of the 2010 nutrient goals.
4	**"1985-2005 Watershed Model Estimated Loads.exl"** - This file contains the 1985-2005 record of Phase 4.3 Chesapeake Bay Watershed Model's estimated total nitrogen, total phosphorus, and sediment loads delivered to the Chesapeake Bay tidal waters from all sources and all jurisdictions. This spreadsheet provided the OIG with the official State-by-State nitrogen and phosphorus cap load allocations for the wastewater sector.	This information provides cap load allocations but on its own does not provide evidence of meeting future loadings.

No.	Region 3 Response Attachment B	OIG Response
5	**"PA DEP Phase 1 Scheduled WWTP Upgrades and Estimated Loads.xls"** - This file contains the Pennsylvania Department of Environmental Protection's latest schedule for their Phase 1 wastewater treatment facilities upgrades. Pennsylvania Department of Environmental Protection provided detailed facility-by-facility information on the timing of facility upgrades and planned trades supporting the State's projection for making its Statewide nitrogen and phosphorus wastewater treatment facility cap loads by 2010.	Pennsylvania officials project 5 facilities are presently meeting their wasteload allocation limits and 20 of the 63 Phase I facilities will need to upgraded by 2010. At the time of our review, none of the 20 facilities had more stringent nutrient wasteload allocation limits in the permits. The data provided does not contain construction start or construction completion dates. The OIG believes these dates are necessary to ensure facilities are on schedule.
6	**"MDE 2010 Estimate WWTP Delivered Load.xls"** - This file contains the Maryland Department of the Environment's latest estimates for which facilities will be upgraded by 2010, and their estimates for total nitrogen and total phosphorus delivered loads from all their significant facilities by 2010. Maryland's estimates are supported by a well-defined funding source (Maryland's "Flush Fee") and a long record of tracking real wastewater facility upgrades—from secondary to Biological Nutrient Removal in the 1990s and from Biological Nutrient Removal to Enhanced Nutrient Removal in the 2000s.	Even with the well-defined funding source, Maryland is the only State not projecting to meet the 2010 nutrient limits. It should be pointed out that Maryland has required the most significant reductions. As of October 2007, Maryland is now projecting that 39 facilities, rather than 54 facilities as originally planned, will be upgraded by 2010. In our opinion, this is an indication that challenges are delaying plans. These 39 facilities represent approximately 12 percent of estimated 2010 total nitrogen loads. Many of these 39 facilities do not have more stringent Enhanced Nutrient Removal wasteload allocation limits in the permits.
7	**"VA DEQ Jan 2011 Estimated WWTP Delivered Loads.xls"** - This file contains the Virginia Department of Environmental Quality's latest estimates for its January 1, 2011, delivered loads from all its significant facilities (hence the reference to 2011 and not 2010). This file is a concise summation of the wealth of data and information contained in its recently released "Exchange Compliance Plan" also submitted by EPA to the OIG. **"Exchange Compliance Plan"** – This set of 15 PDF files contains the entire set of documentation on each of Virginia's 126 significant facilities' planned upgrades, planned trades and estimated flows and loads out through 2030.	Virginia officials expect 96 of the 104 facilities in the Exchange Compliance Plan to meet nutrient limits by 2011. Only 8 are not projected to meet the goals. Fifty-nine facilities are planning upgrades, of which 46 are expected to be completed by 2011. Twenty facilities will rely on water quality trading to meet the 2011 goals. To date, trading is still an unproven program in Virginia, which further necessitates EPA oversight. The Virginia data indicates the Potomac-Shenandoah River Basin (perhaps the most critical river basin in Virginia to the Bay's health) will not be compliant by 2011 for both total nitrogen and total phosphorus. The Virginia Exchange Compliance Plan discusses concerns with rising costs and the large demand for construction services, which could potentially present obstacles for achieving nutrient reduction goals.

Appendix E

Calculation of Potential Additional Nutrient Reductions Below Existing Cap Load Allocations

We calculated the potential additional nutrient reductions, beyond current allocation goals, that may be gained from significant municipal wastewater treatment facilities. For the purposes of this analysis, we assume that all significant municipal wastewater treatment facilities have reached their wasteload allocation goals, and that municipal facilities can achieve and maintain state-of-the-art, or enhanced, technology limits of 4.0 mg/l total nitrogen and 0.3 mg/l total phosphorus. The analysis also does not consider trading or compliance rates. This analysis omits municipal wastewater treatment facilities in Delaware, New York, and West Virginia because, at the time of the analysis, facility-specific wasteload allocations had not been designated and the total design flow from these facilities accounted for less than 5 percent of the total Chesapeake Bay design flow. We also excluded the more than 2,000 non-significant facilities in the Chesapeake Bay watershed since they also represent less than 5 percent of the nutrient wastewater load into the Chesapeake Bay.

We based our analysis on facilities operating at their permitted limit. However, facilities will typically operate below their permitted pollutant limits as a safety measure, which will allow the facility to stay within the bounds of their permit. We do not have a standard measure to factor this practice into our calculations. To provide some accounting for this practice, we compared the permitted level against 4.0 mg/l for total nitrogen and 0.3 mg/l for phosphorus rather than the state-of-the-art levels of 3.0 mg/l and 0.1 mg/l, respectively. We selected those levels because Maryland, which is requiring facilities to upgrade to state-of-the-art enhanced nutrient removal technology, is using those levels in permits. Therefore, our estimates represent the upper reaches and actual reductions could be lower. This demonstrates an annual discharged reduction of 10.7 million pounds per year of total nitrogen and 1.4 million pounds of total phosphorus.

Natural attenuation of nutrients en route to the Bay from the original discharge point alters the nutrient reductions actually delivered to the Bay. We estimated the *delivered* nutrient reductions by multiplying the additional discharged reductions above with location-specific nutrient delivery factors. Estimates show a 9.9 million nitrogen pound-per-year and 1 million phosphorous pound-per-year reduction delivered to the Bay as a result of basin-wide state-of-the-art technology implementation.

Industrial wastewater treatment facilities typically have different wastewater streams and nutrient removal processes than municipal systems. Since enhanced nutrient removal technology concentration limits vary by industry type, it is difficult to gauge their potential additional nutrient reductions. As a result, we did not estimate the potential additional nutrient reductions for significant industrial facilities. However, we did review their nutrient discharge concentrations, many of which were substantially higher than concentrations for municipal facilities. Because nutrient effluent guidelines for available industry types are based on best available technology economically achievable, not state-of-the-art technology or Chesapeake Bay watershed goals, we believe the potential for additional nutrient reductions exists for the industrial facilities.

Appendix F

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