Challenges to Using Performance Measures to Assess the Health of the Nation's Waters

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Biographical Sketches

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Abstract:

Congress and others are increasingly scrutinizing the quality of the U.S. Environmental Protection Agency's (EPA) performance goals and measures, and the quality of the data needed to report these measures. Specifically, EPA is under increasing pressure to assess the health of the nation's water resources, and the safety of the nation's water supply, with more results-based measures supported by sound environmental data. EPA continues to struggle to answer such important questions as: "Are the nation's waters cleaner? How safe is the drinking water supply? How do we know?" Since 1996, EPA has worked closely with state agencies to identify a set of performance measures for national water quality and drinking-water programs. Ideally, these measures will provide a succinct and accurate characterization of water quality, and of Federal and state programs to protect national water and drinking-water quality.

Developing results-based performance goals and measures presents such challenges as: planning for a diversity of program activities using a limited set of goals and measures; obtaining sufficient resources for monitoring and data collection; and inconsistent data collection and reporting methods. For EPA to meet these challenges successfully, it must work cooperatively with a variety of partners. For some programs, developing results-based measures may require new monitoring and data collection, and additional resources may be necessary. In addition, EPA may need data collected by other federal agencies, states, universities, and public interest groups, to develop results-based measures derived from sound water quality data.

Challenges to Using Performance Measures to Assess the Health of the Nation's Waters[1]

Introduction

Are the Nation's waters cleaner? How safe is the Nation's drinking water supply? More importantly, *how do we know*? Currently, the U.S. Environmental Protection Agency (EPA or the Agency) can provide only incomplete answers to these important questions. To obtain the best available information on the quality of the nation's surface and drinking water, the Agency must continue to make progress in implementing performance-based management. The primary objective of a performance-based management system for water programs is to maximize the ability of regulators, legislatures, communities and public interest groups to protect and enhance water quality. To achieve this objective, an environmental performance-based management system must include three fundamental components: technically sound data, useful performance measures, and systematic use of performance measures to evaluate their effectiveness in guiding program management decisions.[2]

Throughout the 1990s, EPA has begun to develop the components of a performance-based management system that would allow EPA, States, Congress, the public and others to assess the effectiveness of federal and state efforts to protect water quality. In this paper we outline the challenges that face EPA as it attempts to develop and utilize performance measures for national water programs. We also describe current EPA activities to build components of a performance-based management system that would enable the Agency to meet the increasing demand for environmental and human-health protection.

I. Background: Development of Performance Measures for National Water Programs

In the Beginning: Measuring Actions not Results, and Lack of Trend Data

Historically, assessing progress toward protecting and improving the Nation's waters has focused on measuring agencies' regulatory activities to improve water quality and protect drinking water. These activities include issuing point-source (NPDES) permits, developing effluent guidelines, issuing drinking water regulations, and establishing maximum-contaminant levels (MCLs) for drinking water. Water quality data is essential for each of these activities. Section 305(b) of the Federal Water Pollution Control Act (Clean Water Act) requires states to survey their waters biennially to determine whether, and to what extent, a state's waters meet designated beneficial uses. EPA compiles the results of these surveys into the National Water Quality Inventory (the Inventory). Although the Inventory provides comprehensive information on national water quality, it is limited in two important ways. First, data-collection methodologies and data quality vary widely among states, which limits EPA's ability to aggregate the results into a cohesive national picture.[3] Second, regulators are unable to develop trend comparisons, primarily because the Inventory does not always include the same water bodies, and because states assess only a fraction of water bodies each year. As a result, decision makers increasingly perceive the Inventory as an insufficient basis for evaluating water quality.

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[1]**The views and opinions expressed in this paper are strictly those of the authors and do not represent those of the U.S. Environmental Protection Agency.**

[2]Detailed discussion of the complexity of performance management is beyond the scope of this paper. A summary of the fundamental aspects of a performance management system, however, helps clarify the challenges that face EPA in meeting increasing demand for results-based environmental policy.

[3] The use of the term "data methodology" in this instance includes the collection design, collection methods, data analysis practices and data management practices.

Shifting EPA's Focus Toward Environmental Outcomes

Throughout the 1990s, EPA and Congress have placed increasing emphasis on the need to set goals and objectives for national water programs. These goals and objectives focus on desired environmental outcomes - clean and safe water - and encourage regulators to assess progress through the use of performance measures. In the mid-1990s, the EPA developed Environmental Goals for America (the Goals Project). The goals for national water programs included "waters supporting healthy aquatic communities and safe for fishing and swimming" and "public water systems providing water that is consistently safe to drink." At the same time, EPA focused greater attention on assessing the actual conditions of the nation's water supplies. EPA worked with a number of other federal, state, tribal, and private partners in a multi-year process to identify and develop a set of water-quality indicators. This effort resulted in the development of 18 water-quality indicators that EPA published in a 1996 report, including:[4]

- Population served by drinking water systems with one or more violations of health-based requirements;
- Percentage of rivers and lakes with fish that states have determined should not be eaten or should be eaten in only limited quantities; and
- Rate of wetland acreage loss.

EPA and its partners developed these measures to show changes in the environmental conditions of the nation's waters. However, there is currently a lack of technically sound data that are accurate, precise, statistically representative, and complete, which limits the usefulness of these indicators. In 1993, the U.S. Congress passed the Government Performance and Results Act (GPRA or Results Act).[5] The Results Act requires federal agencies to account for the outcomes of their expenditures and activities. Under the Results Act, each Agency must develop:

- a strategic plan that establishes long-term goals and objectives for the outcomes to be achieved;
- a forward-looking annual performance plan that includes annual performance goals (APGs) and annual performance measures (APMs) that federal agencies can use to assess incremental progress toward long-term objectives, as well as the costs of that progress; and
- a retrospective annual performance report that describes the progress made (or, in some cases, not made) toward meeting the goals and objectives with emphasis on how well the annual performance goals and measures were met.

For EPA's Office of Water (OW), the Results Act increases Congress' expectations that EPA will be able to answer fundamental questions about the quality of the nation's waters. In setting goals and objectives for protecting and improving the national water quality, EPA used the goals and milestones developed through the Goals Project as a starting point. Similarly, EPA incorporated some of the environmental indicators for water quality into its annual performance goals and measures for national water programs.

A major obstacle to setting both annual and long-term goals and measures is the lack of a sufficient amount of technically sound data on water quality trends. This trend data is essential to establish performance baselines and demonstrate progress in improving water quality over time. For example, the GPRA objective for point-source pollutant loadings (loadings) to surface waters is an overall percentage reduction. However, there are currently no data available to quantify the entire universe of loadings. Thus, until the data are available and EPA can establish a baseline, EPA's ability to measure a percentage reduction in loadings over time is limited. Currently, the Agency makes a general reference to an overall reduction and quantifies the reductions using data from subsets of sources (e.g. industrial sources, publicly owned treatment works, and combined sewer overflows) for which EPA is able either to measure directly, or to model, the percentage reductions in loadings that will be

[4] Environmental Indicators of Water Quality in the United States, U.S. EPA, June 1996. EPA 841 R-96-002.

[5] Agencies implemented GPRA in full starting in Fiscal Year 1999 (October 1, 1998 - September 30, 1999)

achieved through point source controls.

The lack of outcome data and data quality limitations also have affected EPA's recent work with state agencies to develop outcome-oriented "core" performance measures (CPMs). Water program CPMs are intended to be a focused set of performance measures that states and EPA can use to assess water quality. In developing the CPMs for federal water programs, EPA and states continue to be limited by: (1) inconsistent data collection methods among states, (2) insufficient baseline information, and (3) lack of outcome-oriented data. As a result, in the absence of outcome data many CPMs are limited to tracking state activities that can be measured available data.

II. Components of a National Performance Management System for Water Programs

The primary objective of a performance management system for water programs is to maximize the ability of regulators, legislatures, communities and public interest groups to protect and enhance water quality. To meet this objective, decision makers must have the best available information on the extent to which federal, state and tribal programs have protected or improved water quality. It is important to emphasize that the term "best *available* information" means that agencies can invest in data quality improvements *and* take action to protect and enhance water quality *concurrently*.

An effective environmental performance management system has three fundamental components: technically sound data, useful performance measures, and, most importantly, the systematic use of performance measures over time to manage and fund government programs.[6]

Key Component: Technically Sound Water Quality Data

Good data are the foundation on which the entire performance management system depends. The usefulness of the performance measures is entirely dependent on the quality of the data that support their use. As noted by the National Water Quality Monitoring Council (NWQMC):

> monitoring [data] is a more important element of [water program] management than ever before...nonpoint sources that discharge intermittently and are dispersed across the landscape...are not easily regulated. Monitoring [data are] essential to identify these sources, prove a further understanding of their impacts, and guide control efforts. Monitoring [data] ultimately prove the value of the controls that are implemented.[7]

There are at least two crucial aspects to good water quality data. First, the data must be technically and scientifically sound. As the technical quality and completeness of the data that support the measures improves, agency managers increasingly will be inclined to use performance measures. Ideally, data that support performance measures are accurate, precise, statistically representative, and complete.[8] Second, as the Intergovernmental Task Force on Monitoring Water Quality (ITFM) has noted, data from diverse sources must be comparable to allow regulatory agencies to aggregate data on a national scale. Aggregation on a national scale would enable regulators to develop more effective federal environmental policies and regulations, establish

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[6]Detailed discussion of the complexity of performance management is beyond the scope of this paper. A summary of the fundamental aspects of a model performance management system, however, helps clarify the challenges that face EPA.

[7] National Water Quality Monitoring Council. National Water Quality Monitoring Council Work Plan, June 1999, p.1

[8]Several other criteria are important. See e.g. the Volunteer Monitor's Guide to Quality Assurance Project Plans, US EPA, Office of Water, September 1996, pp.15-21.

priorities, and allocate resources more efficiently. In its final report on the strategy for improving national water-quality monitoring, ITFM noted that:

> one of the biggest barriers to sharing water-quality monitoring data is that [state and federal] agencies often use methods that are not comparable to obtain data (collect and analyze samples) for the same variable. This means that data from these agencies cannot be combined to allow scientists and the public to assess water-quality conditions. [9]

EPA's experience with performance measures has demonstrated that ensuring data quality and comparability, and establishing good baseline data, are significant challenges to implementing performance management. The National Water Quality Monitoring Council (the Council) has begun three initiatives that should help meet these challenges. These efforts are:

- encouraging participation of the monitoring community in producing comparable data;
- building and supporting partnerships to foster collaboration among those who carry out water monitoring including federal agencies (e.g., EPA, NOAA, USGS, USDA), states, tribes, local governments, universities, the private sector, and volunteer organizations; and
- encouraging adoption of standard data formats and data transfer protocols to make water quality monitoring information more accessible and more usable.[10]

The Role of the Volunteer Monitoring Community

The volunteer monitoring community can increase the amount of outcome-oriented data. Currently, thousands of volunteers across the country collect information on water quality, habitat and land use in their watersheds. In a number of cases, volunteer programs share their data with state water quality or natural resource agencies and with local government agencies, which may use it to complete water quality assessment reports, conduct watershed assessments, and make local planning decisions. To make this data available centrally, EPA encourages volunteer groups to use its newly modernized national Storage and Retrieval database (STORET) to store, manage, and share their data.[11] STORET should increase the availability of quality, comparable information that can be used for performance measurement.

EPA's Chesapeake Bay Program demonstrates that volunteer monitoring data can contribute to EPA's efforts to implement performance-based management. The Bay Program has found that citizen monitoring data is useful to characterize near-shore environments through mid-channel water quality monitoring stations, and for providing species identification as an integral component of the Bay aerial survey program.[12] This volunteer work can enhance the Bay Program's ability to report on the state of the Bay and eliminate data gaps.

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[9] The Strategy for Improving Water Quality Monitoring in the United States - Final Report of the ITFM. Intergovernmental Task Force on Monitoring Water Quality, 1995.

[10] National Water Quality Management Council Workplan, pp. 4-6.

[11] To increase interest in STORET among volunteers, EPA is working with them to identify ways to simplify their use of the database.

[12] Personal communication, Nita Sylvester, EPA Office of Water, March 2000.

Efforts to Ensure Data Quality and Comparability

The National Methods and Data Comparability Board (Methods Board) has continued ITFM's work to promote the comparability of water quality data.[13] To facilitate assessments of water quality on a national scale, the Board has endorsed the development of a voluntary Performance Based Methods System (PBMS) for water quality monitoring.[14] PBMS involves the establishment of measurement objectives and data quality criteria to "permit the use of any appropriate [method] that demonstrates the ability to meet established performance criteria." [15] The Methods Board encourages agencies and other data collection sources to improve data quality and comparability using established criteria (e.g. accuracy, sensitivity, bias, precision) and validated methods, but does not *prescribe* a particular data collection method. The goals of the Methods Board are laudable: without a common set of data quality objectives, measurement quality objectives, and data quality criteria, it is impossible for federal agencies to aggregate data from a variety of sources and to make informed decisions based on the best available information.

In recognition of the importance of data comparability, EPA has included the adoption of performance-based methods as a goal in the 1998 Clean Water Action Plan.[16] Further, in October 1999 the EPA formed the Office of Environmental Information (OEI). OEI reflects the increasing prominence at the federal level of such issues as information technology, information management and public access to environmental information.

The efforts of the Council, the Methods Board and the volunteer monitoring community illustrate that important efforts are underway to provide consistent, robust data on the conditions of the nation's waters. These efforts increase the likelihood that in the near future, EPA will have access to comparable, high-quality data as part of an effective performance management system.

Key Component: Useful Performance Measures

The EPA and several state agencies currently use a variety of environmental performance measures to evaluate water programs.[17] At the federal level, EPA's Office of Water lists close to 100 performance measures in its FY2001 budget. At the state level, environmental agencies in Florida, Oregon, New Hampshire, and Minnesota are generally recognized for having developed several performance measures to evaluate programs.[18] In one sense the abundance of measures at the federal and state levels is an encouraging development, if one assumes that it indicates increasing interest in performance-based management. Conversely, the actual *number* of

[13] The Methods Board was chartered as a FACA in May 1997 under the National Water Quality Management Council (the Council).

[14] Position Paper: Towards a definition of a performance-based approach to laboratory methods, National Methods and Data Comparability Board, April 1999. The Methods Board notes that either performance-based *methods* or performance-based *measurements* have the same goal: to provide information of known quality that will satisfy user needs.

[15] Ibid 6.

[16] Clean Water Action Plan: Restoring and Protecting America's Waters. US EPA, USDA, et. al., February 1998, p.67.

[17] It is important to note that it is not necessary for all state and federal agencies use the *same* measures for a performance management system to work. Although transaction costs for EPA and States would be lower if all agencies used the same measures, only data standards and data collection frameworks (such as PBMS) are essential for data comparability and aggregation.

[18] Personal communication: William T. Gormley, Professor of Government and Public Policy, Georgetown University, March 2000

measures is far less important than the *usefulness* of the measures. A *useful* measure is understandable to intended audiences, and is based on a logical and verifiable relationship between its intended use and the supporting data. Another desirable characteristic of performance measures is cost-effectiveness: data to support the measure should be affordable to a broad spectrum of agencies and volunteer organizations that collect and report data, and should be significant enough to justify their collection cost.[19] It is important to note, however, that under some circumstances cost-effectiveness may be infeasible. For example, federal and state agencies may need data whose collection costs are prohibitive to other state agencies or volunteer organizations, but which are crucial to measure environmental outcomes.

Performance Measurement In Practice: Chesapeake Bay Program

EPA's Chesapeake Bay Program (Bay Program) is an example of a federal program that has attempted performance-based management, and serves as a model for the development and application of performance measures. The Bay Program's environmental indicators serve several key purposes:

- to monitor environmental condition and environmental response to restoration efforts
- to evaluate progress in the Bay Program
- to provide information needed to establish restoration goals;
- to regularly inform and involve the public in achieving the restoration goals;
- to make detailed information and reference data for these indicators available upon request so that others may participate in monitoring progress.[20]

Currently the Bay Program uses about 90 indicators (including program activities) to measure its progress in restoring the health of the Bay. In 1984, the Chesapeake Bay Executive Council initiated the Chesapeake Bay Monitoring Program (Monitoring Program), a watershed-wide monitoring effort led by EPA and States. Under the Monitoring Program, EPA and its partners, including states and other federal agencies in the Chesapeake Bay watershed, collect data several times a year at over 130 sites in the mainstem and many tributaries of the Chesapeake. The Monitoring Program collects data on nineteen physical, chemical and biological indicators of the Bay's health, including nutrients, sediment, toxic pollutants, fish and shellfish populations, and dissolved oxygen levels. Accordingly, since 1984 the Monitoring Program has produced consistent and comparable data for several key water quality indicators. [21] The success of the Monitoring Program demonstrates the benefits of an effective performance management system, including the ability of the Bay Program to: communicate a clear and consistent public message, establish program goals, increase and allocate resources, and regularly evaluate its management strategies.

Although the Bay Program is a model of applied performance-based management, it may be difficult achieve similar success at the national level given the unique circumstances of the Bay Program. The Chesapeake Bay is a large, culturally and economically vital resource which captures the attention of regulators, legislators, industry, public interest groups and Chesapeake Bay residents. The success of the Bay Program may also be due in part to its voluntary, consensus-based approach, in which state governments have been involved since the inception of the Bay Program. Finally, standing Bay Program subcommittees have taken leadership of the program and have the responsibility for reviewing, revising, approving, and maintaining work on environmental

[19] Saving Bays and Estuaries, A Primer: Appendix C, Criteria for Using Finfish as Indicators of Toxic Contamination, US EPA, Office of Water, 1989, p.C2.

[20] Environmental Outcome-based Management: Using Environmental Goals and Measures in the Chesapeake Bay Program. US EPA, Chesapeake Bay Program, July 1999.

[21] Ibid.

indicators. The subcommittees also make decisions on what data sets to use and how the data should be interpreted. As a result, the Bay Program maintains a considerable amount of scientific information and data on environmental conditions.

Research into Cause-Effect Relationships: Lake Michigan Mass Balance Project

Useful performance measures are based on a logical and verifiable relationship between the intended use and the supporting data. In addition to developing water quality indicators through the Chesapeake Bay Program, EPA's Great Lakes National Program Office is working to understand cause-effect relationships between toxic pollutants and the health of plant and animal life in the Great Lakes. In 1989-1990 EPA conducted the Green Bay Mass Balance Project (Green Bay Project) to pilot the technique of mass balance analysis.[22] The Lake Michigan Mass Balance Project (LMMB), conducted from 1994-1999, built upon the monitoring and modeling approaches and technology EPA developed during the Green Bay Project. The LMMB study focuses on four particular pollutants common to the Great Lakes: PCBs, trans-nonachlor, atrazine and mercury. The overall goal of the LMMB is to develop a sound, scientific base of information to guide future toxic load reduction efforts by federal state and local governments in the Great Lakes Region. The objectives of LMMB are to:

- Determine amounts of pollutants entering the Great Lakes through air and water
- Improve EPA's ability to predict the benefits of reducing pollution and how long it would take to realize those benefits; and
- Improve EPA's ability to understand the fate of pollutants once they enter the ecosystem.[23]

Projects such as the LMMB are important to EPA's work to develop a performance-based management system because of the potential transferability of the findings to other ecosystems. One of the most difficult challenges to demonstrating cause-effect relationships is the time "lag" between a regulatory action and the desired effect on the environment. The LMMB project attempts to take this time lag into account, which may help the Agency determine not just what program adjustments need to be made on the basis of water quality data, but *when*.

Further, just as data comparability is important to establish performance baselines and national trend data through aggregation, an understanding of the cause-effect relationships between pollutant loading rates and their environmental impacts can help agencies measure the incremental benefits of regulatory activities. The better EPA is able to demonstrate the incremental benefits of its regulatory activities, the more effective it will be in using performance measures to manage programs.

Key Component: Systematic Use of Performance Measures Over Time

We have outlined above numerous benefits to the use of outcome performance measures that are based on technically sound environmental data. Outcome measures provide important information on key parameters such as the health and population sizes of fish and shellfish, the quality of underwater vegetation, the concentration of contaminants in surface and groundwater, and the quality of drinking water. These parameters are essential to answer fundamental questions about surface and drinking water quality. We also have described how information on regulatory activities, such as the number of permits issued or number of rules promulgated, is insufficient to assess the health of the nation's waters. Good outcome measures enable decision makers to evaluate the impact of agency activities such as permitting, wetland restoration, source water protection, and limits on pollutant

[22]Based on the principle of conservation of mass, the amount of pollution entering a lake should equal the amount of pollutant leaving, trapped in, or chemically changed in the lake.

[23] Lake Michigan Mass Budget/Mass Balance Work Plan, U.S. EPA Great Lakes National Program Office, 1994.

loading. Decision makers may then adjust programs and allocate resources accordingly.

Assuring the quality of the data and developing outcome measures, however, are necessary but insufficient to implement an effective environmental performance management system. Only by *using* performance measures can agencies verify their usefulness and make adjustments. As such, the actual *use* of performance measures is an intuitively obvious component of a performance management system. Use is, however, the most difficult element for agencies to implement. The challenges to using performance measures fall into two general categories. The first category consists of technical and financial issues such as data quality, data comparability and data collection costs.

Consider the following scenario: Two states - State A and State B - provide EPA with information on fish tissue samples. State A may use a stringent monitoring method and monitor a large number of waters within the state, resulting in a large number of fish consumption advisories. Conversely, State B may use a less stringent monitoring method and only monitor a few waters within the state, resulting in relatively smaller number of fish consumption advisories in comparison to State A. Comparisons of fish quality in State A and State B may lead EPA and others to the conclusion that State B outperforms State A in protecting people from contaminated fish. However, since State B does less stringent monitoring and monitors fewer waters, the fish in State B may in fact be less healthy to eat than fish in State A. Ultimately, the data to make a straightforward comparison between States A and B are unavailable, and making a comparison based on the data currently available (i.e., number of fish consumption advisories in one state versus another) could to mistaken conclusions. This potential for misrepresentation of outcomes complicates the use of outcome performance measures.

A second category consists of the potential political and budgetary consequences of data interpretation. Decision makers may reach different conclusions using the same performance measures, for the simple reason that performance measures do not lead to unambiguous conclusions. For example, if the data indicate that surface water quality in a watershed is decreasing, does that mean that the regulatory agency should invest more in the current approach or change its approach altogether? This ambiguity leads state and Federal agencies to a logical question: how will legislators and the public react if the measures indicate that agencies have not achieved their goals? This is particularly significant given the complexity of demonstrating cause-effect relationships between Agency activities and improvements in environmental quality. Ironically, therefore, better data can increase agencies' exposure to the potential political and budgetary consequences of "poor" performance.

Progress at the State Level: Florida's Focus-Watch System

Fortunately, there are examples of agencies that have accepted these risks and have made progress using performance management systems. At the state level, Florida's Depart of Environmental Protection (DEP) serves as a model of performance management. In 1997-1998 the DEP initiated its "Focus-Watch" system, in which the DEP rates the performance of its district offices using "good", "watch" and "focus" categories. A "good" rating means that the district has met the DEP's goals for the year. A "watch" rating requires district managers to examine the data for potential causes of pollution problems and determine if action is necessary. A "focus" rating is a cause for immediate attention from DEP senior management, requiring the district manager to propose what actions DEP should take to rectify the problem. In recognition of the importance of the Focus Watch system to performance management, in 1998 the DEP received an Innovations in American Government award from the Ford Foundation and the John F. Kennedy School of Government at Harvard University.[24]

[24] Secretary's Quarterly Performance Report. Florida Department of Environmental Protection, Vol. 2, No. 4, September 1999.

III. Conclusion

Implementing a performance-based management system will enable the EPA to answer fundamental questions about the status of, and trends in, national water quality. With the advent of GPRA and the increasing public demand for environmental information, the Agency's ability to answer these questions is increasingly important. As this paper has demonstrated, to implement a robust performance management system, agencies must overcome a number of challenges. These challenges include improving the quality and comparability of data, establishing performance baselines, designing and experimenting with outcome performance measures, and accepting the risks associated with implementing performance-based management. The work of the National Water Quality Monitoring Council, the Methods Board, and the volunteer monitoring community increase the Agency's chances of successfully meeting these challenges. As demonstrated by the Chesapeake Bay Program and the Florida DEP's Focus-Watch system, performance based management can be well worth the effort. High-quality, outcome data could guide EPA to create more effective federal regulations. State agencies could more easily demonstrate to EPA a reasonable assurance that water quality standards have been met. Ultimately, however, even the best performance management system does not free decision makers from having to make controversial decisions. As noted by NAPA in its 1997 Report on environmental protection:

> It is unlikely that any set of [performance] measures will ever provide managers and the public with unambiguous guidance on how best to manage. The burden of making decisions in the face of uncertainty and political controversy will remain firmly on the shoulders of public managers.[25]

The experiences of both the Chesapeake Bay Program and Florida's Focus-Watch system demonstrate the importance of strong leadership and a commitment to use performance measures in the face of uncertainty. An agency's initial attempt to use performance measures is the catalyst of a crucial, reciprocal relationship between use of performance measures and data quality improvements. In this reciprocal relationship, use of performance measures increases as data quality increases and data quality increases as use increases. In an effective performance management system, these two components - use and data quality - reinforce each other, driving the performance measurement system forward. As both the Bay Program and Focus-Watch system demonstrate, agencies must first experiment with using the measures (regardless of data quality or measurement effectiveness), to reveal data gaps and measurement limitations. Agencies then can revise or replace the measures accordingly, and agencies' confidence in using performance measures improves as data gaps are filled and technical criteria are met. For this reason it is important for agencies to focus continuously on using the best available information, rather than to strive for error-free data, before taking action to improve the quality of the nation's waters.

[25] National Academy of Public Administration. Resolving the Paradox of Environmental Protection: An Agenda for Congress, EPA and the States. September 1997.

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