



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

**OFFICE OF THE ADMINISTRATOR  
SCIENCE ADVISORY BOARD**

November 25, 2008

EPA-SAB-09-005

The Honorable Stephen L. Johnson  
Administrator  
U.S. Environmental Protection Agency  
1200 Pennsylvania Avenue, N.W.  
Washington, D.C. 20460

Subject: Consultation on Pollution Prevention Measures

Dear Administrator Johnson:

EPA's Office of Pollution Prevention and Toxics (OPPT) currently uses a suite of measures to evaluate the effectiveness of EPA's pollution prevention (P2) programs. OPPT requested the Science Advisory Board (SAB) provide consultative advice on sound methodologies for measuring P2 program performance results, particularly recurring results. In response to OPPT's request, the SAB Environmental Engineering Committee (EEC), augmented with additional SAB members, conducted a consultation on this subject at a public meeting on September 3-4, 2008. (See Enclosure 1 for the Committee's roster.)

The Committee commends OPPT on the creative development and substantial progress of the seven P2 programs. These programs have resulted in avoidance of emissions, energy consumption, and resource depletion and have provided other benefits documented by the metrics developed by OPPT. The P2 programs are among the most forward-looking and important programs of the EPA, defining a new model for environmental protection and restoration based on voluntary initiative that is prompted by incentives for cost savings and higher product and process performance. These are also among the most difficult programs to implement, as they are based on voluntary participation by partner organizations, the appropriate data to assess the individual programs are not readily available, the information can be sensitive as it may provide a competitive advantage to competing organizations, and effective approaches are often specific to the particular product or process. Measuring progress achieved at the program level is challenging because, for a variety of good reasons, results are measured in different ways, and on different time scales. As a consequence, results are often difficult to compare and aggregate. Nevertheless, the P2 programs of OPPT have made

significant progress, and the metrics developed to date at least partially document this success.

An SAB consultation is a mechanism for individual technical experts to provide comments for the Agency's consideration early in the development of a technical product. A consultation does not require achievement of consensus among the Committee members or preparation of a detailed report. In this consultation, however, the Committee would like to highlight key points that were developed in the discussions in response to the five charge questions (Enclosure 2) which are summarized in the document enclosed with this letter (Enclosure 3).

The Committee would like to thank EPA presenters for their expertise, perspectives, and insights that assisted the Committee's understanding of the P2 programs. Thank you for the opportunity to provide early advice on this important topic. As this is a consultation, the SAB does not expect a formal response from the Agency.

Sincerely,

*/Signed/*

David A. Dzombak, Chair  
Environmental Engineering Committee  
Science Advisory Board

cc: Deborah L. Swackhamer,  
Chair, Science Advisory Board

**U.S. Environmental Protection Agency  
Science Advisory Board  
Environmental Engineering Committee Augmented for Pollution  
Prevention Measure Consultation**

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Charge for the Consultation on  
Pollution Prevention Program Measures  
with the  
Environmental Engineering Committee  
of the  
EPA's Science Advisory Board

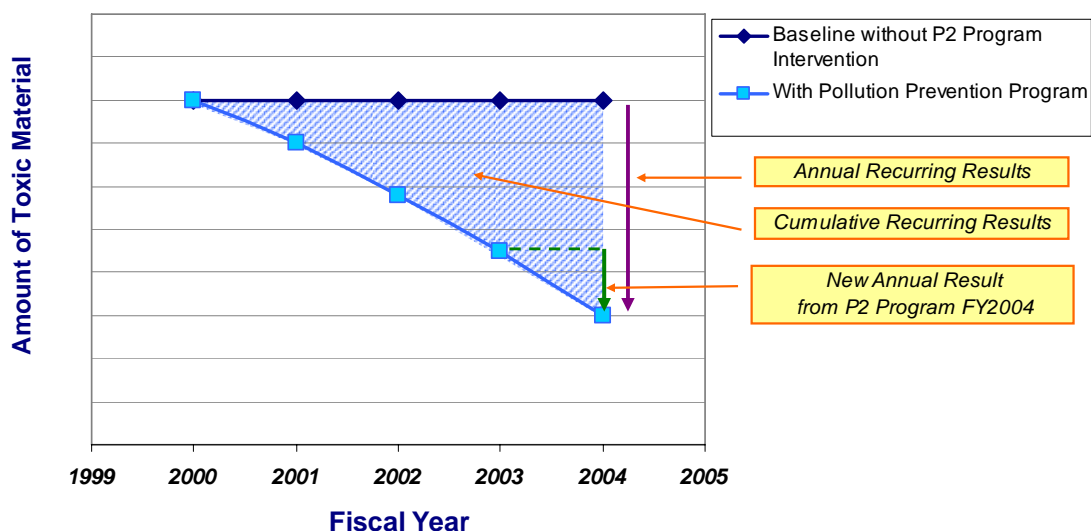
EPA Office of Pollution Prevention and Toxics

September 3, 2008

## Pollution Prevention Program Measures

The Pollution Prevention (P2) Program seeks feedback from the SAB on considerations associated with technical elements for the development of a sound methodology for measuring recurring performance results for P2 Program Centers. It seems like there are a variety of measures that could be used, some of which are depicted in the illustration, below.

### Generic Depiction of Performance Results



This illustration addresses a single hypothetical P2 Program Center which may undertake one or more activities in any given year. It presents a baseline curve of toxic materials generated over a period of years without any P2 Program intervention; then a separate curve depicting generation over the same span of years as a result of P2 Program interventions. One measure of results would be to capture *new annual results*, the measure of new interventions in a year, which is calculated by taking the difference between the pounds of toxic materials generated in one year from the previous year. Many P2 Center interventions can also generate results over a span of years. One could consider an *annual recurring result* which is the vertical distance between the curves during any single year. Alternatively, *cumulative recurring results* are depicted by the shaded area between the curves. It is the recurring results measures that are the focus of this consultation with the Science Advisory Board.

In developing sound methodology for measuring different performance results, the P2 Program is particularly interested in understanding technical factors that are important to consider when measuring recurring results. This understanding should help us, for example, to decide on appropriate modifications to the methodology when facing constraints on the collection of results data, particularly on a year-after-year basis. The P2 Program has developed some understanding for counting recurring results in certain contexts, and is seeking additional input in order to develop sound methodology for counting recurring results across P2 Program Centers. The methodology will need to meet the following technical parameters:

- 1) completeness – a methodology for recurring results must work for all Centers because all Centers must report performance results into a unified Agency reporting system; and
- 2) comparability – a methodology for recurring results must support the ability to generate time-series data to analyze changes in performance over time, must support performance comparisons between Centers, must be sufficiently flexible to accommodate the design and implementation differences among Centers, and must be sufficiently neutral and transparent so that report users can understand the factors that may contribute to differences in performance among Centers.

## Key Terms

Please refer to the Annex 1 (Glossary) for a list of key terms that will be used throughout this document.

## Background

The P2 Program has a number of reasons for wanting to improve its measures of performance. The P2 Program is guided by statute to measure and report its performance. The Pollution Prevention Act (PPA) of 1990 directs the Agency to develop an approach to measuring P2 (42 USC 13101). The Government Performance and Results Act (GPRA) directs federal agencies to develop strategic plans outlining what programs intend to accomplish, how they measure their progress, and how they communicate that information about their performance to Congress and to the public, among other requirements. In response to GPRA, the Office of Management and Budget (OMB) developed the standardized Program Assessment Rating Tool (PART) to evaluate the effectiveness of program performance in budget submissions for individual programs and program groupings. Beyond these statutory reasons for measurement, in this age of results orientation it is important to be able to measure performance to demonstrate the value of P2 Programs to government and private sector stakeholders to foster support and participation.

## Supporting Materials

Additional information on the P2 Program, its Centers, and other topics relevant to performance measures and recurring results is provided in a supporting materials document. The additional information includes:

- a narrative overview of the seven P2 Centers and their streams of results, and
- a table on data management within the P2 Centers.

In addition, weblinks are provided for the following:

- the Pollution Prevention Act of 1990,<sup>1</sup>
- Executive Order 13423, Strengthening Federal Environmental, Energy, and Transportation Management,<sup>2</sup>

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<sup>1</sup> <http://www.epa.gov/oppt/p2home/pubs/p2policy/act1990.htm>

<sup>2</sup> [http://www.ofee.gov/eo/EO\\_13423.pdf](http://www.ofee.gov/eo/EO_13423.pdf)

- the Pollution Prevention Program PART Program Assessment (Fall 2006).<sup>3</sup>

Please keep in mind that some of these materials (e.g., PART assessment questions and answers) are provided as background only and are not directly relevant to this consultation.

## Charge to the SAB

The P2 Program is seeking the consultative input of the SAB Engineering Committee on the technical elements necessary to consider in the development of a sound methodology for measuring P2 program performance results, particularly recurring results. The Program is at a fairly early stage of methodological development, and is seeking the benefit of Committee members' thinking and expertise at this stage of the process. The Program is specifically interested in receiving input from the SAB on the questions presented below on the technical elements identified thus far.

### 1. Over what time period is it appropriate to count recurring results?

It is generally accepted that entities adopting a pollution prevention practice will frequently keep such a practice in place for more than a year, generating pollution reduction results over a span of years. The life span over which it is appropriate to count these results likely varies by industry. What technical elements should be considered when determining how long to count recurring results? What data sources exist to estimate the typical lifecycle of a commercial technology and how might this typical lifecycle vary by industry?

Are there other factors that are relevant to consider when identifying the end of a benefits stream of results from a P2 practice?

### 2. What are appropriate data sources?

What data sources are appropriate for substantiating recurring results from P2 Centers whose technical assistance activities are referral driven, and facility driven, but not sector driven?

*Discussion:* Could innovation rates, and/or the birth and death rate of firms, be used towards building a basis for counting recurring results from Centers that work with small- and medium-sized businesses broadly across sectors on a technical assistance basis? What data sources exist to estimate the typical length of time an innovation is retained in small U.S. businesses, and for medium-sized U.S. businesses? What other factors can be considered when determining how to substantiate recurring results for technical assistance programs that work broadly across sectors?

What should we do with data source gaps over time for producing time-series data?

*Discussion:* See Table 3 in the supporting materials comparing our data sources and literature search data sources and identifying gaps to explore.

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<sup>3</sup> <http://www.whitehouse.gov/omb/expectmore/summary/10004304.2006.html>



### **3. How should aggregation issues be addressed?**

Assuming practices have different life cycles, thus different time periods over which results would presumably be counted, what are the technical issues faced when aggregating results for all practices at a center or across all centers?

### **4. How do other programs and organizations consider or measure recurring results, and can we benchmark and learn from their experience?**

The experiences of other programs and organizations regarding recurring results may be informative to the P2 Program's decision on a path forward on its own methodology development. The P2 Program would like to understand how other programs or organizations considered or measured recurring results and, if so, whether there are existing benchmarks that the P2 Program can utilize. The Program has conducted an initial benchmarking exercise and is interested in expanding the scope and depth of information searched and compiled. The Program is particularly interested in additional information on the following:

Are there other programs and organizations that count recurring results? What is the scope and purpose of these programs and are they similar to the voluntary P2 Program?

- What data do these programs collect and what is (are) the source(s) of the data?
- What are the typical performance results that are measured and what is the methodology used to compute the performance results?
- Do any of their experiences relate to specific P2 Program Centers?
- Are there other indicators as to how recurring benefits are viewed (regardless whether they are reflected in measurement approaches)?

See Section III in the supporting materials for the P2 Program's initial findings from a benchmark literature search summarized in Table 2 organized by program/organization with a description of each approach to recurring results. Section III provides a discussion of the P2 Program's initial benchmark literature search findings, including the relevance of specific findings to the individual seven P2 Program Centers as well as across the P2 Program. Information gathered includes government programs (state and federal), some industry practices (at the individual company level), as well as global environmental measurement principles. The benchmark information in Section III is provided solely as a source of ideas

building on the experience of others who have addressed similar performance measurement questions OPPT is facing. It is not intended that they will be part of this consultation in any other manner.

## **5. How can we best use the initial benchmark literature search findings to help us further inform our investigation on recurring results and begin methodology development?**

The P2 Program is seeking to relate findings of the initial benchmark literature search to the data sources that differentiate our Centers and are relevant to resolving how to approach recurring results across the P2 Program. Additionally, the Program is interested in how to use the initial findings to further focus and prioritize our investigation on recurring results for the purpose of methodology development. The P2 Program has identified the following preliminary list of task-related considerations on which we are seeking consultative advice. See also Section IV of the supporting materials for more information.

- In analyzing the current data sources for each Center, how does the availability or limitations in data sources for an individual Center (such as publicly available market data or statutory barriers to data collection) affect P2 Program options for measuring recurring results program-wide? Table 3 in Section IV of the supporting materials compares P2 Program data sources with data sources inferred from examples in the literature.
- Where data gaps exist for certain Centers, are there other data sources that the Centers could consider (such as economic, market trends, market demographics) in methodology development to allow for measuring recurring results consistently across the P2 Program?
- In continuing a benchmarking exercise, are there other benchmarks we might consider?

## ANNEX 1 - Glossary

**P2 Centers.** The P2 Program has seven Centers or distinct program units that produce performance results. Each P2 Center has its own program design, targets, and goals. All P2 Centers use common outcome performance measures – pounds of hazardous materials reduced, BTUs of energy/million metric tons of carbon equivalent reduced (program is switching from BTUs to MMTCE), gallons of water reduced, dollars saved. Not every center reports to all four measures, but all of them report to at least three of these measures. Details on the Centers appear in attached background documents, identified immediately below.

**Program intervention (or P2 intervention).** This is a Center activity that produces a specific environmental outcome (pounds reduced, energy saved, etc.) at a point in time. There is also a view that it includes the ongoing administrative investments in building and/or maintaining the overall project which produces the series of specific environmental outcomes.

**Results.** For purposes of this consultation, “results” refers to program performance results expressed in terms of specific indicator measures. These specific P2 Program indicator measures are pounds of hazardous materials (releases to air, water, land, and material inputs) reduced, billion BTUs of energy reduced (this measure is being changed to million metric tons of carbon equivalent reduced), gallons of water reduced, and dollars saved from P2 interventions. Provided on the following pages is a graph that further illustrates how a P2 Center may represent annual and recurring results. Equations and examples are also provided to illustrate how the various types of results may be interpreted from the example graph.

**Baseline Year.** The baseline year is the year from which results in following years are measured. In the example below, there are no Annual Results in the baseline year (FY2000).

**(New) Annual Results.** New Annual Results or simply Annual Results refer to one year’s worth of performance results from a program intervention that occurred in a given year.

*Example:* To calculate the New Annual Result in FY2004 in the graph below, subtract the amount of toxic material generated in FY2004 (with the P2 Program in place) from the amount of toxic material generated in FY2003.

e.g.  $\text{New Annual Result}_{\text{FY2004}} = 16,500 - 15,000 = 1,500$  lbs of toxic materials reduced

**Annual Recurring Results (Cumulative Annual Results).** Annual Recurring Results are benefits that occur in a single year from P2 interventions initiated in previous years. The P2 Programs include any New Annual Results in this total as well. Note: Annual Recurring Results are equivalent to Cumulative Annual Results which are the sum of New Annual Results year-after-year, starting from a baseline year of measurement.

Assuming a baseline year of FY2000, New Annual Results begin to occur in FY2001 and

continue every year through FY2004. Then the Annual Recurring Results for the P2 Center in FY2004 would be:

$$\text{Annual Recurring Results}_{\text{FY2004}} = \sum_{k=2001}^{2004} \text{Annual Results}_{\text{FYk}}$$

*Example:* To calculate the Annual Recurring Result in FY2004 in the graph below, add the Annual Results in each year. This calculation can be simplified to subtract the total amount of toxic waste generated with the P2 Program in place from the baseline level of waste.

*e.g.* Annual Recurring Result<sub>FY2004</sub> = 20,000 lbs – 15,000 lbs = 5,000 lbs of toxic materials reduced.

**Cumulative Recurring Results.** Cumulative recurring results are the sum of recurring results over two or more years, starting from the baseline year of measuring.

Starting with a baseline year of FY2000, the cumulative recurring results for the P2 Center in FY2004 would be:

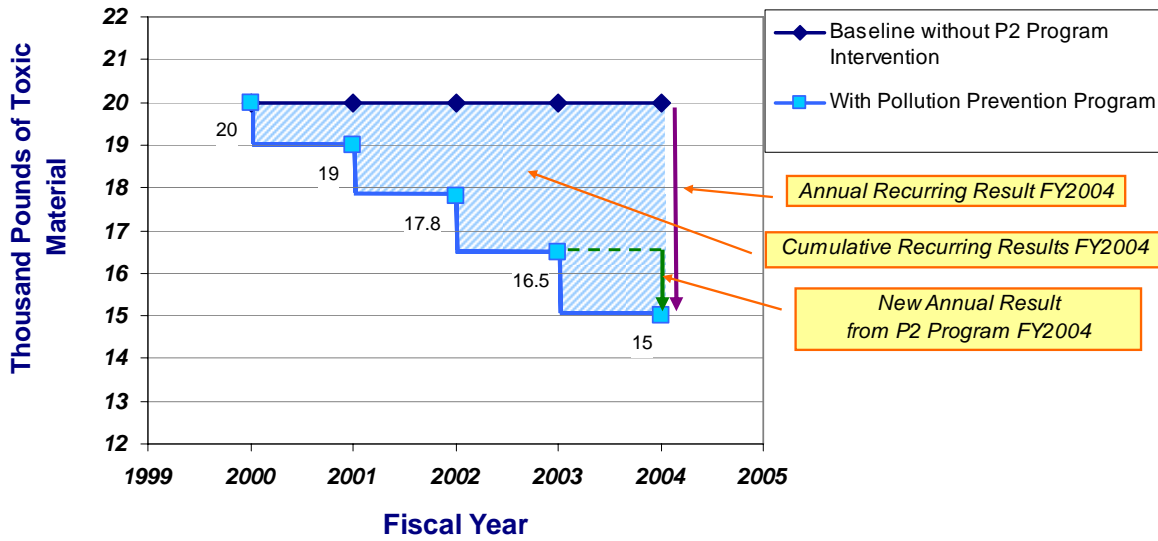
$$\text{Cumulative Recurring Results}_{\text{FY2004}} = \sum_{k=2001}^{2004} \text{Annual Recurring Results}_{\text{FYk}}$$

(Note: In FY2001, annual recurring results are equivalent to new annual results.)

*Example:* To calculate the Cumulative Recurring Results in FY2004 in the graph below, add the Annual Recurring Results in each year.

*e.g.* Cumulative Recurring Results<sub>FY2004</sub> = (20,000-19,000) + (20,000-17,800) + (20,000-16,500) + (20,000-15,000) = 11,700 lbs of toxic materials reduced.

## Depiction of Performance Results



$$\text{Annual Recurring Results}_{\text{FY2004}} = \sum_{k=2001}^{2004} \text{Annual Results}_{\text{FYk}}$$

$$\text{Cumulative Recurring Results}_{\text{FY2004}} = \sum_{k=2001}^{2004} \text{Annual Recurring Results}_{\text{FYk}}$$

**EPA SAB Consultation on Pollution Prevention Program Measure  
Methodology  
September 3-4, 2008**

**Summary of Key Points**

Charge Question 1: Over what time period is it appropriate to count recurring results?

1. It is appropriate to count results over the life of a technology (product or process), when the technology use is stable and not largely displaced by a new technology. An argument can be made for only counting results during the time period of technology distribution in the marketplace, but the majority opinion on the committee favored counting results over the life of the technology use.
2. Appropriate time periods depend on the particular technology. For example, a time period relevant for some devices could be the mean time to failure and its replacement with a new technology.
3. By focusing on the technology rather than the company, OPPT can avoid counting problems associated with the birth and death of companies.
4. The baselines or benchmarks used for counting are extremely important, they should be carefully selected and the reasoning for their selection should be both clear and defensible. Because EPA P2 programs are not the only source of innovation, defining a baseline needs to account for the conventional innovation rate and ranges of outcomes.
5. OPPT currently uses amounts of materials that are not emitted to the environment and reduction in energy consumption as measures. Resources not expended and cumulative impacts avoided could also be used as measures of results that consider preservation of natural capital more broadly.

Charge Question 2: What are appropriate data sources?

6. OPPT has chosen appropriate data sources and evaluated them. OPPT also has opportunities to use other EPA data sources not directly related to P2 programs, e.g., air and water permitting data, and TRI data.
7. OPPT should continue to strengthen processes for data validation.
8. OPPT should continue to develop uniform methods of data collection across the P2 centers.

9. The EEC recognizes that, because of the government's interest in not overburdening individuals and organizations with requests for information and the need to limit barriers to voluntary participation in P2 programs, collection of additional data is neither a simple question nor is it a choice fully within the domain of OPPT or EPA. However, if it was possible, it would be useful to collect data that document how EPA is accelerating innovation and economic competitiveness. The acceleration of innovation and related economic competitiveness are also measures of the P2 programs' results.
10. Ideally and over the long-term, more meaningful measures of the results of programs, including pollution prevention programs, should incorporate risk averted in addition to chemical releases averted. Unfortunately, the data required to implement this measure for all EPA P2 programs do not exist and will not exist any time soon. Similarly, measures of energy conservation could be improved by weighting energy sources by human health and environmental impacts because not all amounts of energy have equal impacts on resources and the environment.
11. To support better analyses when complete suites of data are lacking, OPPT should examine the scientific literature on missing data and develop methodologies based on this literature, e.g., the use of proxy data for particular facilities or processes.

Charge Question 3: How should aggregation issues be addressed?

12. While aggregation makes it difficult to convey the influence of P2 programs on systems, it is acceptable if similar data that describe, for example, source reductions or changes in consumption, are being aggregated. As noted in (1), health risks averted could be a valuable common measure, but it is not yet possible to determine this for the range and variety of technologies in the P2 programs. This is primarily due to the lack of available data, the constraints on collecting the relevant data, and the lack of resources with which to do so.
13. Work to segregate product and process impacts because a process that produces a product can have a different lifetime than its product. Also, the duration and degree of the impact to the environment by the process can be quite different than its product.
14. If OPPT considers different ways of normalizing results, e.g., per unit of production or per functional unit (per action, facility, household, etc), it is likely to find a measure robust enough that changes of production can be considered more realistically when describing the impact of results from P2 activities over a wide range of programs.

Charge Question 4: How do other programs and organizations consider or measure recurring results?

15. Companies track performance to change behavior, with objectives for the behavior change desired. Using this model, OPPT could consider setting specific targets for P2 programs.
16. Experience with other organizations demonstrates that, for P2 metrics to be effective, they need to be clear and simple.
17. OPPT should establish metrics only for activities that can be clearly and defensibly influenced by the P2 programs.
18. Experience with other organizations demonstrates that it really matters what is measured, as performance metrics motivate and demotivate behavior.
19. OPPT may find it helpful to examine the Global Reporting Initiative ([www.globalreporting.org](http://www.globalreporting.org)) and how this organization handles recurring results and includes life cycle considerations.
20. The Intergovernmental Panel on Climate Change has developed methods of accounting for recurring and cumulative emission reductions achieved by control measures for greenhouse gases. The IPCC methods may serve as useful models for counting recurring results for P2 programs.
21. Industrial trade associations have developed methods for counting recurring and cumulative results of pollution prevention activities, e.g., the Aluminum Association, the American Chemistry Council, and the World Business Council for Sustainable Development.
22. The U.S. Center for Disease Control and the World Health Organization track recurring results from interventions for disease prevention. The methodologies developed may be useful in determining methods for counting recurring results from P2 program interventions.

Charge Question 5: How can EPA best use the initial benchmark literature search findings to help further inform recurring results method development?

23. Information in peer-reviewed journals should be explored in much greater depth.
24. It would be useful to explore how other organizations (e.g., IPCC) reflect uncertainty in new or recurring results from interventions.



25. The EPA should examine international sources to inform recurring results method development, e.g., emission accounting compendia developed by the Institute for International Studies and Training (IIST) and by the European Union.

#### Other Key Observations

26. There are multiple audiences for the P2 program metrics: Measures of P2 can be used to evaluate OPPT's programs, as OMB does in PART evaluations. Another important audience is the companies/organizations being solicited to participate in the program. While EEC recognizes that development of metrics to document performance is a priority, it suggests some thought be given to development of additional metrics that capture innovation, economic competitiveness, and the evolution of the P2 discipline that should be directed to the participants in these voluntary programs.
27. It is important to convey the barriers to data collection faced by the P2 programs. The programs involve voluntary participation and data submittal by the organizations that partner with EPA. Too much pressure for data submittal could result in the loss of participation by the partner organizations. Further, the EPA is limited in the surveys it can conduct by federal information collection request (ICR) regulations.
28. OPPT has been careful to be conservative in its estimates of impacts of P2 program interventions. This care is commendable, but the Committee encourages the OPPT to be less conservative in its data compilation and analysis in order to demonstrate more clearly the range of benefits. The current bias toward underestimating benefits is counterproductive with respect to attracting more organizations as participants in the P2 programs. In this respect there is harm in underestimating benefits. Defensible approaches to estimation of benefits that are not so conservative could help expand P2 program participation more rapidly.