

## **Workshop Report: Pollution Abatement Costs and Expenditures (PACE) Survey Design for 2000 and Beyond**

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March 2001 • Discussion Paper 01-09



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Key Words:   Pollution Abatement Costs and Expenditures; PACE

JEL Classification Numbers: C81, K23, R38

# **Workshop Report: Pollution Abatement Costs and Expenditures (PACE) Survey Design for 2000 and Beyond**

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## **I. Introduction**

Accurate estimates of pollution abatement costs are crucial elements of any rational effort to set or evaluate environmental policies. One of the primary sources of this information in the United States has been the Bureau of the Census (BOC) Pollution Abatement Costs and Expenditures (PACE) survey, which collected annual establishment-level data on abatement costs for most years between 1972 and 1994. After a five-year lapse, the PACE survey was restarted in 2000, collecting 1999 data. Yet as firms have turned to more comprehensive abatement strategies involving process and design changes, pollution prevention, and recycling, the PACE survey has faced a number of problems that limit its ability to accurately measure abatement costs. At the same time, both national and international interest in understanding the true costs of environmental protection has grown, along with the complexity of the research and policy issues currently under discussion. There is now widespread interest in redesigning the PACE survey to improve its usefulness to policymakers as well as to researchers. In March 2000, Resources for the Future (RFF) convened an expert workshop to consider a wide range of issues relevant to future PACE surveys. This report describes the workshop and derives a number of conclusions based on discussions at the workshop.

## **II. Overview of the Workshop**

The workshop was envisioned as a means of bringing together economic and other researchers, industry representatives, and government officials knowledgeable about the PACE survey to address past concerns and future directions. Specifically, we identified three goals for the workshop:

- to understand problems encountered with previous versions of the PACE survey,
- to discuss possible solutions to these problems in light of the potential uses and goals for the new survey, and

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\* Quality of the Environment Division, Resources for the Future. The authors gratefully acknowledge financial support from the U.S. Environmental Protection Agency (Cooperative Agreement No. R825095-01-7). Kelly M. Maguire provided valuable comments on an earlier draft and Joe Cook provided excellent research assistance. Workshop participants contributed the insight and expertise that made this report possible. The authors alone are responsible for the contents of the report.

- to begin to develop concrete survey design options to implement these solutions.

Attending the session were more than 40 experts from the U.S. Environmental Protection Agency (EPA), BOC, the Bureau of Economic Analysis, the Office of Management and Budget, academia, nongovernmental organizations (NGOs), and industry. The day-and-a-half-long workshop was held at RFF in Washington, DC, on March 9 and 10, 2000. The agenda appears in Attachment A and a list of attendees is given in Attachment B.

Workshop panel discussions were held on four topics:

- Uses and clients of the PACE survey
- Scope of the survey
- Cost measurement
- Sample design and survey administration

### ***Uses and Clients of the PACE Survey***

This session considered the usefulness of the PACE data in providing public information about the costs of environmental protection, designing and analyzing current and future environmental regulations, assessing international trade agreements, and addressing a variety of research issues. The focus was on both past and future uses of the PACE data, much of which involves government-sponsored economic analyses. Many participants stressed the importance of using PACE data matched with other information sources to understand more about the plant-level effects of environmental regulation. There was also interest in using the data to assess the accuracy of cost estimates generated by other (nonsurvey) techniques and to further link the PACE data to EPA emissions reports.

### ***Scope of the Survey***

This session considered the nature of the pollutants, definitions of the industries, and the size of the establishments included in the PACE survey. Specific gaps in the survey were noted, including the absence of research and development (R&D) information (probably best collected at the firm rather than at the plant level), transaction costs, costs associated with production delays, behavior of small facilities, and the linkage between specific activities undertaken at the plant level and particular government programs, including voluntary programs. The inclusion of information on certain basic services, such as disposal of nonhazardous waste (trash), was also considered, as was the possibility of expanding the sample design to include other industries, such as utilities, agriculture, and mining. There was discussion of the need for collecting emissions data at the plant level, and the overall importance of consistency in measuring baselines. Some measure of private benefits to firms of pollution abatement was also discussed.

### ***Cost Measurement***

This session emphasized both the importance and the difficulty of measuring costs accurately. Particular emphasis was placed on the importance (and difficulty) of measuring capital expenditures. The aggregation of costs according to the factor of production, expenditure category, or pollutant was considered, as was the feasibility of linking the cost data to particular

regulations or voluntary programs. Considerable discussion focused on the desirability of identifying and measuring any cost offsets (e.g., savings in other areas) associated with reported environmental expenditures. Interest was also expressed in identifying and measuring the costs of pollution prevention. Several experts suggested the need to use indirect as opposed to direct measurement of such activities. Discussion also focused on the desirability of tailoring the survey instrument to the circumstances of different industries and, particularly, to establishments of differing complexity, such as small plants. Several experts also distinguished between the need to obtain highly detailed information from the respondents versus the feasibility of relying on (subsequent) econometric analysis to identify key patterns. The need for specific information on tradable permits was also discussed.

### ***Sample Design and Survey Administration***

This session emphasized the value of data accessibility as well as the importance of linking PACE with other BOC (and non-BOC) data sets, including both firm- and plant-level information. One expert emphasized the value of trying to harmonize the survey instrument with sources of information in other countries. Making PACE user-friendly was extensively discussed. One researcher stressed the importance of employing modern survey research techniques of the types used in consumer preference research. Computer-assisted techniques of administering PACE were also suggested. One researcher emphasized the dynamic nature of the research and policy issues in this field and the need to establish an ongoing panel of experts to oversee the development and administration of future PACE surveys.

### **III. Key Issues Identified by Workshop Participants**

After completing the four main sessions, the workshop participants compiled a list of key issues that should be considered in the design of future PACE surveys. These are displayed in Table 1. The priority issues vary in their relative importance to meeting public policy and research goals and in the degree of difficulty they present to the implementing agencies. The degree of importance is highly subjective, and we turn to that issue below. The degree of difficulty is also somewhat subjective, although one can make a rough assessment of the resources required to resolve each issue so that it can achieve at least modest success. For example, workshop participants called for the fielding of the 1999 survey early in 2000 (item 1.1). Since the proposed 1999 survey has already been designed and funding is in place, the decision at this point is simply a matter of executive branch review. In contrast, workshop participants called for the compilation of required emissions data and the linkage of those data to PACE and other BOC data sets (item 1.2). Such a task would involve the commitment of technical and other resources, most likely by EPA. Additional technical issues also surfaced, including the use of consistent definitions and categories for pollutants and for abatement activities.

Another issue raised by workshop participants involves enabling researchers to easily access the data (item 1.3). Such access is current BOC policy, but the researcher must comply with certain conditions before accessing the data. There was widespread agreement that ready access by researchers is vital for generating information and analysis needed for environmental policymaking and continued improvement of the PACE survey.

Workshop participants also voiced concern about verification and improved data accuracy (item 1.4). Virtually all the elements listed in this category would require additional resources to implement, although some elements represent only modest changes to the survey. (Representatives from BOC indicated they already had plans to do a response analysis regarding items 1.4.5 and 1.4.7.) Workshop participants proposed use of a short form for some industries and small plants and polluters coupled with a long-form supplement (item 1.5). Such an approach would involve the creation of a new short-form survey instrument and potentially significant changes in sample design. Item 1.6 concerns the establishment of an ongoing advisory process to help design, evaluate, and review survey questions, along with a series of suggestions to improve public communication. Although some new resources would be required to set up such an advisory process workshop, participants were in general agreement that such an activity would have enormous payoff.

Item 2 describes survey design issues. In total, almost three dozen suggestions were made by the workshop participants. Many of these suggestions involve expanding the PACE survey, and hence the number of so-called burden hours (currently the average is about eight hours per respondent) associated with the data collection. Items 2.1 and 2.2 concern year-to-year consistency and the use of cognitive interviews to review questions, and item 2.3 concerns the design of the survey to encourage detailed responses without discouraging general answers when the details are unavailable. These particular items involve relatively modest changes. Item 2.4, which involves capital cost information, was an issue to several workshop participants, who were concerned about the quality of the data in the current PACE survey. Items 2.5 and 2.6 both involve types of indirect costs (plant shutdowns and offsets) not measured well or at all in the current PACE survey. Item 2.7 concerns issues that may be more appropriate at the firm as opposed to the plant level, including transactions costs, R&D, and banked emissions permits. Item 2.8 concerns questions related to the Annual Survey of Manufacturers (ASM). The specific focus was on the importance of collecting detailed information on capital expenditures and on the fraction of emissions subject to New Source Requirements. Item 2.10 concerns a number of issues relating to the disaggregation of PACE data by pollutant, regulation, and type or source of waste. Item 2.11 seeks clarification on a specific question on tradable permits included in the proposed 1999 PACE survey. Item 2.12 seeks the inclusion of specific measures of environmental outputs, including both physical measures of emissions and discharges, and identification of particular voluntary programs run by EPA and other agencies (e.g., Green Lights<sup>1</sup>).

Workshop participants also made suggestions related to the coverage or breadth of the PACE survey (item 3), some of which have already been incorporated into the 1999 instrument. Most of the suggestions in this section involve altering the sample design and/or expanding the sample size, such as focusing on smaller or newer plants, or plants in the pollution equipment and service industry. Adding new industry subsectors to the sample, such as state and local facilities, hospitals, and schools, was also suggested.

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<sup>1</sup> Green Lights is a voluntary program launched by EPA in 1993. The overall goal of the program is to reduce pollution by encouraging major U.S. institutions—businesses, governments, and other institutions—to switch to energy-efficient lighting.

Other suggestions include matching the sample more closely to the ASM and the possibility of periodic oversampling in particular geographic regions. As in the case of item 2, most of these items would expand the total number of burden hours required by PACE survey.

#### IV. Ranking the Issues

To help assess the myriad issues discussed at the workshop, we asked the participants to rank the individual suggestions for future PACE surveys according to both importance and feasibility, as follows:

1. Important and feasible
2. Important but difficult
3. Less important
4. Unimportant

The tabulated responses of the workshop participants are shown in Table 2. The first column corresponds to the item number of key issues that appeared in Table 1. The second column indicates the proportion of the respondents who considered the item important (responses 1 and 2). The third column indicates the proportion of respondents who considered the item important and also considered it feasible (response 1 as a fraction of the sum of 1 and 2). The fourth column indicates the overall importance ranking (responses 1 and 2 collapsed into a single category; items 3 and 4 counted as 2 and 3, respectively). The fifth column indicates the number of responses to each item.

In the following discussion, we organize items according to their perceived importance. For example, 78% of the respondents indicated that item 1.1 (going forward with the 1999 survey) was important. Of this group, 86% also said this suggestion was feasible. This item received an overall ranking of 1.26 out of a total range of 1.08 to 1.79, where the lower the ranking, the greater the overall importance.

Table 2 reveals a number of interesting patterns. In the category of broad issues, the suggestions listed below were scored as important by 75% or more of the respondents. Those important suggestions that were further judged to be feasible by more than 75% of the respondents are *italicized*.

- 1.1 *Field the 1999 version of the PACE survey in 2000.*
- 1.2 Compile EPA emissions data by facility; link to PACE, other census data.
- 1.3 *Encourage and protect researcher access to microdata.*
- 1.4.3 Compare PACE with other data, including case-controlled analyses.
- 1.4.6 Conduct audits of responses to assess validity and accuracy.
- 1.4.10 Assess availability of information required for each question.
- 1.5.3 Ask for more disaggregation (by pollutant or regulation) in small sample.
- 1.6.1 *Create ongoing panel to help design, evaluate, and regularly review survey.*

*1.6.2 Hold annual public meetings to discuss results and future design.*

If the cutoff point were lowered to a score of 70% or more, the following suggestions would be added:

*1.4.2 Encourage feedback on outlying responses.*

*1.4.5 Conduct follow-up interviews.*

*1.4.7 Ask respondents about uncertainty in responses.*

*1.5.1 Vary supplement by industry to address industry-specific questions.*

*1.5.2 Vary supplement periodically to address specific topics.*

In the category of survey design, the following items were scored important (*and feasible*) by 75% or more of the respondents:

*2.1 Recognize importance of question consistency from year to year.*

*2.3.1 Ask binary questions when appropriate.*

*2.3.2 Ask for overall expenditures before disaggregation.*

*2.3.3 Create distinction between “zeros” and missing data.*

*2.4.4 Ask what fraction of investment is environmentally motivated.*

*2.5 Provide examples of costs to be included in operating and cost data.*

*2.6.1 Expand questions to include measures of direct savings to plant.*

*2.8.1 Link total capital expenditure questions in ASM.*

If the cutoff point were lowered to a score of 70% or more, the following suggestions for survey design would be added:

*2.4.3 Include primarily environmental capital when allocating capital costs.*

*2.6.2 Expand questions to include measures of productivity gains to plant.*

In the category of survey coverage, the following items were scored as important (*and feasible*) by 75% or more of the respondents:

*3.3.1 Include the mining sector in PACE sample.*

*3.3.2 Include the utility sector in PACE sample.*

If the cutoff point were lowered to a score of 70% or more, the following suggestion for survey coverage would be added:

*3.1.1 Balance concerns about reporting burden with value of matched data.*

In thinking about those suggestions, it is useful to consider the notion of feasibility as a proxy for the level of effort required. Thus, the items deemed important but less feasible (the items not italicized) may be more relevant for a longer-term agenda.



## V. Conclusions and Recommendations

In an exercise of this sort it is often difficult to see the forest for the trees. Nonetheless, some clear recommendations emerged from the workshop. The most basic conclusion is that certain important changes to the PACE survey should be considered immediately. The changes in this category involve few if any additional budgetary resources and are expected to have relatively high payoff. Probably the most important recommendation is to establish an ongoing panel of experts to provide technical advice and review (1.6.1). Because of the complex, dynamic design and evaluation issues involved in fielding the PACE survey, this panel should be organized jointly by EPA and the Commerce Department and should include government and nongovernment experts. Such a panel could be established in the near term and could serve to assess the validity and accuracy of the survey instrument (1.4.3, 1.4.6, 1.4.10), to ensure consistency from year to year (2.1), and to encourage and protect research access to the data (1.3).

The second set of recommendations focuses on near-term changes to the instrument itself. The first proposal in this category is to make sure that any emphasis on detail in a particular question does not come at the expense of discouraging overall survey response (2.3). Beginning the questionnaire with aggregate and binary questions in advance of more disaggregated and detailed responses should be encouraged. BOC should also consider replacing the single PACE survey with a short survey that could be sent to a broader sample of plants (1.5). This shorter survey would be coupled with supplements for particular industries and for the periodic study of specific questions (1.5.1, 1.5.2). Finally, efforts should be made to gauge the accuracy of responses, including feedback on outlying responses and follow up interviews (1.4.2, 1.4.6). If the new advisory panel is established in a timely manner, it could review and comment on these proposed changes.

The third set of recommendations addresses the longer-term and ongoing challenges inherent in the efforts to measure the costs of environmental protection. Expanding the sampling frame to capture evolving trends (3.2, 3.3), matching the PACE data with emissions data from EPA (1.2), and focusing more attention on the questions of capital costs, offsets, and pollution prevention (2.4, 2.6) are all important goals. Many of these efforts are likely to require considerable effort, including further research and enhanced budgets. We believe that these issues should be considered in detail by the implementing agencies and the new advisory panel. Some of these items may be feasible within existing budgets; others may need to be factored into the annual budget processes of the relevant agencies.

The fourth and final recommendation concerns the need for timeliness in collecting current information on environmental expenditures. Particularly in light of the five-year interval since the last PACE survey, the overwhelming view of the workshop participants was that the 1999 survey should go to the field as soon as possible. Despite the importance of the proposed changes to the PACE survey, the gains to be achieved from modest delays in implementing the 1999 survey are almost certainly less than the information losses associated with the further passage of time since the last survey.

### ***Summary of Recommendations***

Create an ongoing panel to help design, evaluate, and regularly review survey questions in order to

- assess the validity and accuracy of the survey instrument (1.4.3, 1.4.6, 1.4.10),
- ensure consistency from year to year (2.1), and
- encourage and protect research access to the data (1.3).

Make near-term changes to the instrument, including the following:

- Make sure that any emphasis on detail in a particular question does not discourage responses (2.3).
- Consider replacing the single PACE survey with a short survey that could be sent to a broader sample of plants (1.5).
- Couple the shorter survey with supplements for particular industries and for periodic study of specific questions (1.5.1 and 1.5.2).
- Gauge the accuracy of responses, including feedback on outlying responses and follow-up interviews (1.4.2, 1.4.6).

Address the longer-term and ongoing challenges inherent in the efforts to measure the costs of environmental protection:

- Expand the sampling frame to capture evolving trends (3.2, 3.3).
- Match the PACE data with emissions data from EPA (1.2).
- Focus more attention on the question of capital costs and offsets (2.4, 2.6).

Resume the PACE survey in a timely manner and ensure consistent collection in future years.

**Table 1: Key Issues Identified by Workshop Participants**

**1. General Issues**

- 1.1. The 1999 version should go to the field in 2000. Suggestions for redesign address subsequent annual versions.
- 1.2. EPA emissions data should be compiled by facility and linked to the PACE survey and other BOC data sets.
- 1.3. Researcher access to microdata should be encouraged and protected by both BOC and PACE survey sponsors.
- 1.4. Verify and improve data accuracy.
  - 1.4.1. Encourage computer-based administration and data collection.
  - 1.4.2. Encourage feedback (preferably interactive, real-time) on outlying responses.
  - 1.4.3. Encourage comparison with other reported information and cost estimates, including case-controlled sample analysis.
  - 1.4.4. Create an Internet site for frequently asked questions.
  - 1.4.5. Conduct follow-up interviews.
  - 1.4.6. Conduct audits of responses to assess validity and accuracy.
  - 1.4.7. Ask respondents about uncertainty in responses (either in survey or in follow-up).
  - 1.4.8. Convene case studies of audit discrepancies with firm and industry representatives, BOC staff, auditors, and economists.
  - 1.4.9. Conduct case studies on capital cost allocation (environmental and nonenvironmental expenditures).
  - 1.4.10. Assess availability of information required for each question.
  - 1.4.11. Improve survey user-friendliness; consider using rewards and incentives to encourage accuracy and participation.
  - 1.4.12. Gauge and document the effect of new questions versus five-year gap (as part of 1999 survey for a subsample of plants).
- 1.5. Consider the use of a short form for some industries and small plants and polluters coupled with a long-form supplement.
  - 1.5.1. Vary the supplement by industry to address industry-specific issues.
  - 1.5.2. Vary the supplement periodically to address specific topics.
  - 1.5.3. Ask for more disaggregation (by pollutant or regulation) among a smaller random sample.
- 1.6. Create an advisory process.
  - 1.6.1. Create an ongoing panel to help design, evaluate, and regularly review survey questions.
  - 1.6.2. Hold annual public meetings and conferences to discuss survey results and future design.
- 1.7. Consider the issue of improved public access.

**Table 1: Key Issues Identified by Workshop Participants (continued)**

<b>2. Survey Design</b>
2.1. Recognize the importance of question consistency from year to year.
2.2. Employ cognitive interviews to review questions.
2.3. Design the survey to encourage detailed responses without discouraging general answers when the details are unavailable.
2.3.1. Ask binary questions when details are likely to be unavailable and/or as a prelude to detailed questions.
2.3.2. Ask for overall expenditures before disaggregation.
2.3.3. Create distinction between “zeros” and missing data.
2.4. Consider the allocation of capital costs between environmental and nonenvironmental purposes.
2.4.1. Include exclusively environmental capital.
2.4.2. Include remotely environmental capital.
2.4.3. Include primarily environmental capital.
2.4.4. Ask what fraction of an investment is environmentally motivated (possibly combine with questions on total capital expenditure).
2.5. Provide examples of costs to be included in operating or capital cost estimates (plant shutdowns, lost output).
2.6. Expand question on cost offsets to include measures (binary, percentage, or specific estimates) of other internal benefits associated with environmental efforts.
2.6.1. Direct savings.
2.6.2. Productivity gains.
2.6.3. Nonmarket benefits to firm.
2.6.4. Spillovers from learning.
2.7. Consider questions that may be more appropriate at the firm level (with attention to potential double-counting).
2.7.1. Transaction and search costs.
2.7.2. R&D expenses.
2.7.3. Sources of financing and hurdle rate for environmental capital expenditures.
2.7.4. Contingent liabilities.
2.7.5. Correct accounting of banked permits.
2.8. Include questions related to ASM.
2.8.1. Total capital expenditures.
2.9. Ask about fraction of emissions subject to New Source Requirements (e.g., New Source Performance Standards).

**Table 1: Key Issues Identified by Workshop Participants (continued)**

2.10. Disaggregate the data.

2.10.1. Disaggregate by pollutant.

2.10.2. Evaluate new, significant regulation.

2.10.3. Include both municipal and nonhazardous industrial waste.

2.10.4. Include radionuclides.

2.11. Redesign the question on tradable permits. Ask the quantity and value of permits used for programmatic compliance.

2.12. Include measures of environmental outputs.

2.12.1. Explore feasibility of collecting emissions data (or abatement or percentage reductions) especially if a link to EPA data is unlikely.

2.12.2. Programmatic participation (conservation, pollution prevention, other voluntary programs).

**3. Survey Coverage**

3.1. Match the PACE sample as closely as possible to the ASM sample.

3.1.1. Balance concerns about reporting burden with value of matched data.

3.2. Anticipate future trends and directions in expenditures in survey.

3.2.1. Anticipate newer plants.

3.2.2. Anticipate smaller plants.

3.2.3. Anticipate pollution equipment and service industry.

3.3. Include other industries, in addition to manufacturing.

3.3.1. Include mining.

3.3.2. Include utilities.

3.3.3. Include state and local facilities.

3.3.4. Include hospitals, schools, etc.

3.3.5. Include retail and wholesale.

3.4. Consider periodic geographic oversampling.

**Table 2: Rankings by Workshop Participants**

<i>Item number</i>	<i>Fraction saying important</i>	<i>Feasible as fraction of important</i>	<i>Overall importance ranking*</i>	<i>Number of responses</i>
<b>1</b>				
1.1	0.778	0.857	1.259	27
1.2	0.889	0.708	1.111	27
1.3	0.889	0.833	1.185	27
<b>1.4</b>				
1.4.1	0.593	0.750	1.333	27
1.4.2	0.704	0.737	1.259	27
1.4.3	0.815	0.455	1.111	27
1.4.4	0.593	1.000	1.370	27
1.4.5	0.741	0.700	1.222	27
1.4.6	0.778	0.333	1.185	27
1.4.7	0.731	0.526	1.231	26
1.4.8	0.667	0.278	1.296	27
1.4.9	0.667	0.278	1.333	27
1.4.10	0.778	0.619	1.148	27
1.4.11	0.593	0.688	1.444	27
1.4.12	0.654	0.471	1.308	26
<b>1.5</b>				
1.5.1	0.714	0.700	1.286	28
1.5.2	0.714	0.750	1.214	28
1.5.3	0.786	0.500	1.250	28
<b>1.6</b>				
1.6.1	0.889	0.750	1.111	27
1.6.2	0.821	0.826	1.143	28
1.7	0.464	0.846	1.643	28
<b>2</b>				
2.1	0.786	1.000	1.179	28
2.2	0.643	0.556	1.321	28
<b>2.3</b>				
2.3.1	0.815	0.773	1.148	27
2.3.2	0.778	0.857	1.074	27
2.3.3	0.889	0.958	1.074	27
<b>2.4</b>				
2.4.1	0.630	0.647	1.444	27
2.4.2	0.481	0.692	1.593	27
2.4.3	0.741	0.650	1.222	27
2.4.4	0.786	0.455	1.214	28
2.5	0.750	0.667	1.214	28

\*The lower the ranking, the greater the overall importance.

**Table 2: Rankings by Workshop Participants (continued)**

<i>Item number</i>	<i>Fraction saying important</i>	<i>Feasible as fraction of important</i>	<i>Overall importance ranking*</i>	<i>Number of responses</i>
<b>2.6</b>				
2.6.1	0.769	0.550	1.192	26
2.6.2	0.731	0.474	1.231	26
2.6.3	0.615	0.375	1.423	26
2.6.4	0.577	0.400	1.500	26
<b>2.7</b>				
2.7.1	0.667	0.278	1.333	27
2.7.2	0.667	0.500	1.296	27
2.7.3	0.667	0.333	1.296	27
2.7.4	0.593	0.188	1.407	27
2.7.5	0.593	0.375	1.370	27
<b>2.8</b>				
2.8.1	0.769	0.800	1.192	26
2.9	0.577	0.600	1.423	26
<b>2.10</b>				
2.10.1	0.643	0.444	1.357	28
2.10.2	0.679	0.421	1.286	28
2.10.3	0.357	0.600	1.786	28
2.10.4	0.286	0.500	1.857	28
2.11	0.643	0.556	1.357	28
<b>2.12</b>				
2.12.1	0.607	0.294	1.429	28
2.12.2	0.429	0.667	1.607	28
<b>3</b>				
<b>3.1</b>				
3.1.1	0.704	0.842	1.222	27
<b>3.2</b>				
3.2.1	0.630	0.824	1.407	27
3.2.2	0.630	0.824	1.407	27
3.2.3	0.630	0.588	1.407	27
<b>3.3</b>				
3.3.1	0.778	0.810	1.222	27
3.3.2	0.778	0.905	1.222	27
3.3.3	0.630	0.647	1.444	27
3.3.4	0.462	0.583	1.615	26
3.3.5	0.385	0.400	1.731	26
3.4	0.500	0.714	1.607	28

\*The lower the ranking, the greater the overall importance.

**Attachment A: PACE Workshop Agenda**

**Pollution Abatement Costs and Expenditures (PACE)  
Workshop on Survey Design**

**Resources for the Future**

**March 9–10, 2000**

**March 9**

8:00–8:30 Breakfast

8:30–8:45 Welcome and Introductions (Paul Portney)

8:45–10:15 Uses and Clients of the PACE Survey

- What are the potential uses of the PACE survey?
- Who are the potential users?
- How are the uses and users changing over time?
- Do these uses compete with one another?
- Are there limitations on uses and clients?

Moderator: Richard Morgenstern (RFF)

Speakers: Albert McGartland (EPA), Art Fraas (OMB), Jim Democker (EPA), Byron Swift (ELI), Linda Bui (Boston University)

Discussion

10:15–10:45 Break

10:45–12:15 Scope of the Survey

- What pollutants, source categories, and programs should be included in the survey? For example, should the survey include toxics, greenhouse gases, ozone-depleting substances, habitat protection, leak/spill cleanup, small businesses, and voluntary, state-level, or other programmatic areas?



- What industries should be sampled? Should other areas of economic activity be included, for example, agriculture or retail?
- Should the survey include basic service items, such as trash pickup? Should costs associated with worker health and safety issues be included?

Moderator: Dallas Burtraw (RFF)

Speakers: Skip Laitner (EPA), Howard Gruenspecht (DOE), Karen Brown (EPA), Alan Krupnick (RFF), Bob Parker (BEA)

Discussion

12:15–1:15 Lunch

Topic: Proposed Design for Y2K PACE Survey

Speaker: David J. Gromos, Section Chief, Special Studies Branch, Manufacturing and Construction Division of the U.S. Census Bureau

1:15–2:45 Cost Measurement

- What are the appropriate areas of emphasis?
- Should process and design changes be measured?
- Can costs be linked to particular regulations and/or voluntary action?
- To what degree should abatement costs be disaggregated by pollutant?
- Should cross-media controls and effects be reported?
- Can productivity changes that accompany or precipitate pollution changes be reported?
- How should capital costs be measured?
- Can costs be disaggregated by factor or expenditure category?
- Does the concept of life-cycle cost or life-cycle accounting provide a useful paradigm for measuring cost in the survey?
- Can we measure the cost of pollution prevention and efficiency improvement?

Moderator: Winston Harrington (RFF)

Speakers: William Pizer (RFF), Wayne Gray (Clark University), Arik Levinson (Georgetown University), Chris Knopes (EPA, invited), Scott Mathews (CMU)

Discussion

2:45–3:15 Break

3:15–4:45 Sample Design and Survey Administration:

- How do the different emphases on pollutants and cost types affect sample design?
- Who should fill out the survey?
- What validation procedures can be used to verify costs?
- How can private sector costs in filling out the survey be reduced?
- Can the Internet be used?
- What kind of reporting guidance should be provided to establishments? What postprocessing analyses should be conducted?
- Should the survey be an annual activity? Biannual?
- Should the survey be tailored to specific industries?
- What are other sources of data that are used along with the PACE data and how, if at all, should PACE be linked to these sources? For example, Toxic Release Inventory (TRI) data provide some overlap in terms of industries sampled.

Moderator: Ray Kopp

Speakers: John Haltiwanger (UMD), Kevin Swift (CMA), Kerry Smith (NCSU), Seema Arora (Vanderbilt), Elinor Champion (BOC)

Discussion

4:45–5:45 Consensus Working Group Discussion (free participation):

Summarizing panels' discussion

**March 10**

8:30–9:00 Breakfast

9:00–10:00 Summary of Previous Day's Discussion

Discussion

10:00–10:30 Break

10:30–12:00 Proposed Conclusions and Recommendations/Next Steps

Discussion

**Attachment B: PACE Workshop Participants**

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**Resources for the Future**

**Burtraw and others**

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