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

OFFICE OF THE ADMINISTRATOR
SCIENCE ADVISORY BOARD

EPA-SAB-CAACAC-LTR-92-019

September 30, 1992

Honorable William K. Reilly
Administrator
U.S. Environmental Protection Agency
401 M Street, S.W.
Washington, D.C. 20460

Subject: Science Advisory Board's review of the Office of Policy, Planning, and Evaluation 's (OPPE) workplan for the retrospective study of the impacts of the Clean Air Act.

Dear Mr. Reilly:

On April 14, 1992, the Clean Air Act Compliance Analysis Council (CAACAC) met in Arlington, Virginia to review the OPPE's workplan to perform the Clean Air Act (CAA) retrospective impact analysis required by section 812 of the CAA amendments of 1990. Prior to the meeting, the OPPE had provided a Charge detailing primary and secondary issues, with specific questions for each issue. The CAACAC agreed with OPPE's suggestion that the primary issues identified in the Charge would be addressed via a report, and that the secondary topics would be covered through discussion at the meeting. Following the meeting, OPPE and the Office of Air and Radiation (OAR) jointly developed a somewhat revised Charge which better met their mutual needs, and which serves as the basis for this report.

The three primary questions posed by the Charge, and the Council's response follow.

a. ***Is EPA using an appropriate paradigm for conducting the retrospective assessment?***

The decision to employ macroeconomic general-equilibrium modeling is one that has both strengths and weaknesses. The primary strength is that it ensures a consistent accounting framework. Moreover, choosing a neoclassical approach

guarantees that the model is consistent with a wide variety of economic approaches and models, and with the philosophy of the underlying national income and product accounts. In addition, the approach chosen will allow the examination of time-dated costs and benefits rather than an oversimplified discounted present value calculation.

A major weakness is that the effort in the project will be skewed toward macroeconomic modeling and away from some of the major environmental issues that are raised in the assessment. Put differently, it would be a mis-allocation of scientific resources to spend a disproportionate amount of the analysis refining the macroeconomic model while many of the linkages in the economy-environment-exposure-damage chain are very weak. In particular, the benefits part of the study will depend critically on the assumptions about exposure (and therefore changes in exposure) to environmental risks. The linkage(s) between emissions and/or concentrations and exposures should be very carefully analyzed with respect to "conservative" assumptions that go into the relationship. Alternative "realistic" or "best-guess" estimates should be used, or a better foundation for the linkage should be made. An alternative approach, which avoids (in theory) the need to make guesses about the emissions-concentrations-exposure linkage would be the use of epidemiological results rather than extrapolations from dose-response functions.

In addition, it should be noted how limiting an aggregate model of this nature is for the problem at hand. Most air pollution regulations affect substances that produce highly localized damages. The relationship between emissions and damages is certainly not unique. Damage depends on stack heights, local meteorology, terrain, populations exposed, synergism with sunlight and other substances, sensitivity of the local ecology (such as with acid rain), as well as on the level of emissions at that site. No macro model, regardless of how ingenious, can capture these effects. Only a model with an enormous amount of spatial detail would be able to capture these subtleties. Yet, pragmatically speaking, a highly, disaggregated model would he unreasonably expensive to construct and to use in terms of both time and resources. A compromise is necessary and this model is not a bad compromise. Given that, it must be recognized from the beginning that it will always provide better information on the cost side than on the benefits side.

The choice of model in part determines the kind of questions that can ultimately be answered. An aggregate long run model such as this one cannot say anything about the timing of environmental policy. Short-run models would do a better job of

explaining how the costs relate to the business cycle. It also cannot say very much about short-term dislocations caused by an imbedded capital stock which may be rendered suboptimal by the regulations. Long-run models assume the mobility of capital, which is a correct assumption in the long run, but quite inaccurate in the short-run. One implication of these points is that, while it is useful to have time-date outputs, no one should make very much of the detailed inter-temporal pattern of costs and benefits.

The Jorgenson-Wilcoxen model employed for the analysis appears to be (with one major exception) the best available model for the task. This model has developed an impressive and internally consistent data base and the conceptual basis for the data and model are consistent with the neoclassical assumptions of the general-equilibrium approach. The model has a proven track record in integrating economic issues with energy and environmental questions. The major shortcoming is that the model has usually employed an assumption of endogenous technological change, where the cost or productivity coefficients depend upon factor prices. This assumption may produce misleading results since the specification is not generally accepted nor, unlike the balance of the model, is the microeconomic foundation of the endogenous technological change sub-model consistent with prevailing microeconomic thinking on the economics of technological change. **It is recommended that the baseline run be made with the technological change coefficients determined in the base run and then set as exogenous for comparison runs. As an alternative approach, a sensitivity run should be used to test for the importance of the endogeneity assumption.** Because of the centrality of technological change in the growth of real incomes, failure to handle this issue correctly could potentially vitiate the entire study.

A number of important implementation issues arise when employing the macroeconomic model which suggest caution. It will be important to ensure that the costs and damages are entered correctly into the model. A preliminary suggestion that costs be entered as non-distorting taxes seems clearly incorrect. Moreover, while the macroeconomic model may be useful in identifying inter-industry flows, the first-order welfare effects in a neoclassical model will be estimated from the costs and damages themselves. To the extent that the general-equilibrium effects differ from the direct effects, it is necessary to determine whether the differences are mistakes, genuine second-round effects, or due to endogeneity of the technological change coefficients.

Great care should be taken to ensure that the "bottom line" of the assessment is correctly chosen. In principle, some welfare measure should be chosen, such as real national income. Gross National Product is definitely the incorrect measure as it includes capital consumption. Moreover, to the extent that labor force participation is endogenous, a correction for changes in leisure should be made. Another approach would be to go back to the utility functions, with a correction for the change in the net capital stocks, but this has the disadvantage of being opaque for policy makers.

b. ***Within the context of a general equilibrium macroeconomic framework, what is the appropriate way to measure the costs of air regulations?***

Estimation of the direct costs of compliance involves several conceptual problems. In its discussions, the Council expressed some concern about exactly how these problems affect the survey data available to EPA. The Council noted that treating sector-specific direct costs as taxes on output was likely to distort estimates of macroeconomic incidence -- if only because environmental regulation has applied mainly to new assets. Regulatory impact analysis may suggest superior alternative assumptions -- as well as providing useful information on costs. In addition, the specific model to be employed in the EPA analysis embodies the assumption that plant and equipment can be shifted from sector to sector quickly and with no cost. This assumes away potentially significant frictional costs. Finally, while the proposed focus on changes in GNP has the merit of properly reflecting the cumulative impact of changes in investment incentives, it must be kept clearly in mind that GNP is not a welfare measure. For instance, a reduction in pollution may raise welfare but lower GNP by making mitigation expenses unnecessary. **The Council recommends that the EPA attach a high priority to producing robust results that are not driven by special features of the general equilibrium model employed.**

c. ***What are appropriate techniques for valuing the physical effects estimated in this assessment?***

Monetary values of physical effects should be based on estimates of individuals' willingness to pay or changes in consumers' and producers' surpluses. For some types of effects, it may be appropriate to use Initial values derived from microeconomic studies of revealed behavior. Examples include estimates of the value of reducing the risk of death derived from studies of the wage vs. risk relationship, and estimates

of the value of increases in water-based recreation derived from travel cost recreation demand studies. In other cases, it may be necessary to use models of supply and demand to estimate changes in consumers' and producers' surpluses. An example is the effects of ozone reductions on agricultural crops, farm revenues, and crop prices.

These techniques have already been used by the Agency in Regulatory Impact Analyses and in other economic analyses of environmental policies. The major questions about the use of these techniques have to do with the choices of unit values and the quality of the economic studies on which they are based.

In general, based on the information available to it, the Council finds that the workplan developed by the OPPE is basically sound. In a complex project of this sort, however, the initial workplan is a very imperfect predictor of the soundness of the final product. Accordingly, since the CAACAC will be required by statute to evaluate the final product, we feel that it would be desirable for us to be briefed on a regular basis regarding the status of the retrospective study (and, in due course, the prospective study) and the major technical issues and problems that have been encountered. **We should be able to respond in a timely fashion to such briefings without having to wait for a clear Charge to be produced after the fact.** Nobody would be well-served by a negative evaluation of the completed study; we all have an interest in uncovering potential problems as quickly as possible.

From the perspectives of science development and impact on future legislation, the Council observes that:

- The value of the retrospective (1970-1990) study of the cost-benefit of the original Clean Air Act (CAA) is two-fold; it both evaluates the efficacy of the CAA provisions and develops procedures for planned prospective studies of the CAA Amendments of 1990 (CAAA). Since resources are limited and the CAA already has been superseded, the latter effort should receive more emphasis. The retrospective study accordingly could be trimmed by making it qualitative (provided that the Congress would approve of this strategy).

- The first prospective study (due November 15, 1992) on the efficacy of the CAAA provisions should be started as soon as possible to allow proper periodic review by the CAACAC.

- The primary goal should be to complete the second prospective study (due November 15, 1994) on time and with minimum scientific uncertainty as to the key standards studied. This will be helpful when reauthorization of the CAAA comes up (perhaps in 1995).

The approach outlined above stresses science development with qualitative results in the beginning and then best quantitative results when needed. It should assist EPA in developing a high-value document on time with the resources available.

We appreciate the opportunity to review this subject, and look forward to receiving your response to the major points raised in this report.

Dr. Richard Schmalensee
Chair
Clean Air Act Compliance Analysis Council

ENCLOSURE

# U.S. ENVIRONMENTAL PROTECTION AGENCY
# SCIENCE ADVISORY BOARD
# CLEAN AIR ACT COMPLIANCE ANALYSIS COUNCIL

## CHAIR

**Dr. Richard Schmalensee**
Professor
Department of Economics
Massachusetts Institute of Technology
Room E52-456
Cambridge, MA 02139-4307

## MEMBERS

**Dr. Ronald Cummings**
Department of Economics
University of New Mexico
Albuquerque, NM 87131

**Dr. Daniel Dudek**
Environmental Defense Fund
257 Park Avenue South
New York City, NY 10010

**Dr. A. Myrick Freeman**
Professor, Department of Economics
Bowdoin College
Brunswick, ME 04011

**Dr. Robert Mendelsohn**
Yale School of Forestry
360 Prospect Street
New Haven, CT 06511

**Dr. William Nordhaus**
Professor, Dept. of Economics
Yale University
New Haven, CT 06520

**Dr. Wallace E. Oates**
Professor, Department of Economics
University of Maryland
College Park, MD 20742

**Dr. Paul R. Portney**
4228 N. Old Glebe Road
Arlington, VA 22207

**Dr. Thomas H. Tietenberg**
Professor, Dept. of Economics
Colby College
Waterville, ME 04901

**Dr. W. Kip Viscusi**
Professor, Department of Economics
Duke University
Durham, NC 27706

## SAB COMMITTEE LIAISONS

Dr. William Cooper (EPEC)
Mr. Richard Conway (EEC)
Dr. Morton Lippmann (IAQC)
Dr. Roger McClellan (CASAC)

## NOTICE

This report has been written as a part of the activities of the Science Advisory Board, a public advisory group providing extramural scientific information and advice to the Administrator and other officials of the Environmental Protection Agency. The Board is structured to provide balanced, expert assessment of scientific matters related to problems facing the Agency. This report has not been reviewed for approval by the Agency and, hence, the contents of this report do not necessarily represent the views and policies of the Environmental Protection Agency, nor of other agencies in the Executive Branch of the Federal government, nor does mention of trade names or commercial products constitute a recommendation for use.

## Distribution List

Administrator
Deputy Administrator
Assistant Administrators
Deputy Assistant Administrator for Research and Development
Deputy Assistant Administrator for Water
EPA Regional Administrators
EPA Laboratory Directors
EPA Headquarters Library
EPA Regional Libraries
EPA Laboratory Libraries