

**ITEM NO.:** 2  
**DATE:** May 26, 2000  
**PROPOSAL NO.:** 2451-214

**STAFF EVALUATION OF AN INTERAGENCY RESEARCH PROPOSAL**

**TITLE:** Economic Value of Hospitalizations Associated with Particulate and Ozone Air Pollution

**CONTRACTOR:** San Diego State University

**PRICIPAL INVESTIGATOR:** Dr. Mark Thayer

**AMOUNT:** \$249,230

**DURATION:** 18 Months

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**I. SUMMARY**

The Air Resources Board's (ARB) primary role is to protect public health by reducing air pollutants through regulatory actions. However, the availability of information on the economic value of health benefits is limited. Currently, proposed regulations are generally analyzed in terms of the cost and cost effectiveness, but the economic impact of health benefits is especially important when the Board is determining the date a new regulation will take effect or considering the advisability of variances for existing regulations. This study will develop comprehensive cost-of-illness (COI) and willingness-to-pay (WTP) estimates for the economic value of hospitalizations and doctor visits that have been linked to particulate matter and ozone air pollution exposures.

Results from this study will extend both the empirical and methodological basis for economic benefit valuation of air quality control measures and will increase the ARB's ability to assess the benefits of particulate and ozone exposure. This study will also provide a very important input to our benefit analysis and help us develop the in-house capability to perform benefit analyses in the future.

## II. TECHNICAL SUMMARY

### **Objective**

The objective of this study is to estimate the economic value of hospitalizations and doctor visits that have been linked to particulate matter and ozone air pollution exposures, using both the COI and WTP estimation methods.

### **Background**

Recently, Kaiser Permanente conducted a study funded by the South Coast Air Quality Management District (SCAQMD) investigating how daily changes in ambient air pollution are related to hospitalization for cardiovascular and respiratory problems. The study accessed extensive air quality data at multiple sites and correlated it with hospital admissions among 1.6 million Kaiser members in the South Coast District. The results indicate that increases in daily levels of ozone and fine particle pollution are closely correlated with increases in the number of people admitted to hospitals for air pollution-related illness.

The study provides an excellent opportunity to collaboratively evaluate the economic impact of particulate and ozone pollution on individuals and families. To estimate the monetary value of avoided incidences of health effects, several methods have been accepted by the economic community. One method is the cost of illness measure. This method looks at actual medical care costs and lost wages attributable to pollution-related illness. It does not place a value on non-pecuniary losses such as pain, suffering, and the inconvenience associated with an illness, an underestimate of the true economic benefits. A second method is the contingent valuation method that is based on an individual's stated willingness to pay to eliminate or reduce a hazard. This method attempts to estimate a total economic value, rather than just components of that total value.

Currently, there are no WTP estimates, or even very good COI estimates, for air pollution related hospitalizations from any U.S. study. Previous health benefit analyses have estimated COI values for hospitalizations, based on medical costs and work loss

during the hospitalization period. However, no account has been made for costs that may be incurred before or after hospitalization or that may have an effect on the patients' quality of life. Hospitalizations in these categories (cardiovascular and respiratory) represent very serious, and in some cases, life altering health events, including heart attack, stroke, asthma attack, pneumonia and flu, or exacerbation of chronic bronchitis or emphysema. The economic significance of reducing these events (or reducing their severity such that hospitalization is not necessary), in terms of the monetary value of the total effect on the well-being of the affected individuals, is probably significantly understated by the monetary estimates currently used in health benefit analysis.

Additionally, previous WTP studies did not focus on the population that has direct knowledge of the impacts of air pollution related illness on their well-being, the patients. As a result, the estimate from these WTP studies may be biased. These shortcomings have not been previously addressed empirically with the patient population.

### **Proposal Summary**

In this project, data on direct medical expenditures for the types of hospitalizations and doctor visits associated with air pollution will be collected and analyzed through Kaiser Permanente. A survey instrument will be developed to collect data on direct and indirect costs to patients who have experienced hospitalizations potentially related to air pollution and to measure WTP to avoid future similar health events. The focus of the survey instrument will be on capturing costs not reflected in the costs of medical services. These include, but are not limited to, the loss of productive work time, work loss of other family members while caring for the patient, and non-pecuniary losses such as pain, suffering, inconvenience, and other losses. The survey will be conducted among the Kaiser Permanente patients in Northern California.

The investigator proposes to conduct the following tasks:

- Review all relevant literature on the evaluation of health effects.

- Refine the research plan to accommodate recent developments in the health valuation field and account for the availability and reliability of *direct* cost data.
- Obtain and analyze medical cost and diagnosis information from the Kaiser Permanente database for hospitalizations and doctor visits for illnesses potentially related to air pollution.
- Develop a survey instrument to obtain WTP estimates for preventing future hospitalizations and information on direct and indirect costs and activity restriction associated with a previous hospitalization.
- Pre-test the survey design on several convenient groups. These will include focus groups and small sub-samples of the Kaiser Permanente patient population.
- Conduct the survey on a set of Kaiser Permanente patients (approximately 1,000) who have been hospitalized for cardiovascular or respiratory illness within the past year; 400 completed surveys will be obtained. The sample will be selected to be representative of the distribution of patient ages, sex, and discharge diagnoses for the categories of hospitalization that have been statistically associated with air pollution exposure.
- Undertake detailed econometric analysis of the survey data. Statistical tests and modeling will be conducted to assess the reliability and validity of the estimated WTP. The WTP will be compared with the direct medical costs (COI) obtained in the previous task.
- Prepare the final report. The report will include presentation of research methodology, description of data collected, analysis, discussions, and results for all preceding tasks. The results of the study will include a table that summarizes the range of COI and WTP per incidence, consisting of the mean, median, standard deviations, and upper and lower bounds. To the extent possible, the results will also be extrapolated to the California population.

### **III. STAFF COMMENTS**

There are no previous studies that have focused on hospitalized patients when valuing air pollution related health effects. The proposed study provides a unique opportunity to monetarily quantify the significant air pollution-related health effects with a patient

population that has direct knowledge of the impact of their illness events on their well-being.

Furthermore, working with Kaiser Permanente will offer many advantages, including:

- Provide more accurate COI estimates for air pollution related hospitalizations and doctor visits
- Reduce information bias and improve WTP estimates by surveying a population that has previous experience with the illness that has been linked to air pollution
- Cost-effectively identify a patient population from which to sample for the survey implementation
- Lend credibility to the research effort in the eyes of the patients and help ensure a cooperative response from a large share of the patients who are contacted

The research team assembled for this project includes investigators with extensive experience and expertise in econometrics, environmental and resource economics, economic valuation, WTP survey instrument design, and the health effects of air pollution. The principal investigator, professor Mark Thayer, and his subcontractors, Drs. Laurie Chestnut and Bob Rowe of Stratus Consulting, have each published extensively in the area of environmental economics and non-market good valuation research using survey instruments. They have conducted comprehensive assessments of human health and welfare benefits of pollution control in many states. Dr. Rowe is a member of the U.S. Environmental Protection Agency's (USEPA's) Clean Air Science Advisory Committee. Dr. Stephen Van Den Eeden, epidemiologist at Kaiser Permanente, has more than 10 years of experience in the area of epidemiologic research and has published numerous articles in the public health field. He was the principal investigator of the study funded by SCAQMD that linked daily changes in ambient air pollution to hospitalization for cardiovascular and respiratory problems.

We believe the study will extend both the empirical and methodological basis for economic benefit valuation of air quality control measures and will increase the ARB's ability to assess the benefits of particulate and ozone exposure.

Although the contractor will provide a technical memo after each task (except task 6), a detailed interim report should also be provided following each of the two major project milestones: Task 3 (medical cost data collection) and Task 6 (WTP survey data collection). The reports should include a description of the data collected and the data collection process, diagnosis of the data, and preliminary findings.

The main goal of this study is to provide inputs to economic benefit analysis of air quality control regulations in California. Recently, USEPA completed a study that assessed the nationwide benefits and costs of the entire Clean Air Act from 1970 to 2010. The study employed a sequence of complex modeling and analytical procedures. The ARB intends to use the USEPA's health effects model – the Criteria Air Pollutant Modeling System (CAPMS) – for our future in-house benefit analysis. The model is a state-of-the-art tool for evaluating health and welfare benefits of air quality improvements. To make the results of this study useful in the CAPMS model, the data should be compared with the parameters used in the model. In addition, because CAPMS was used at a national level, the assumptions and details of the USEPA study should be carefully examined to determine the relevance of the CAPMS model to California-based data analysis.

To ensure the creditability and usefulness of this study, staff recommend the contractor perform the following additional tasks:

- Review the USEPA benefits model (CAPMS) in terms of study selection and approach for quantification and valuation of health and welfare benefits of air quality improvements, focusing on human health and visibility benefits related to PM and ozone.
- Compare COI estimates developed in this study with the USEPA's national assessment. Link COI and WTP estimates from this study to their corresponding endpoints in the CAPMS model.

The costs of the additional tasks including overhead would be approximately \$35,000.

#### **IV. STAFF RECOMMENDATION**

Staff recommend the Research Screening Committee approve this proposal for a total amount not to exceed \$284,230 (which includes \$35,000 for the additional staff-recommended study parameters), subject to inclusion of appropriate additions and revisions in response to the staff comments, and any changes and additions specified by the Committee.