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AN SAB REPORT: CONTINGENT VALUATION METHODOLOGY (CV 1)

REVIEW OF THE CONTINGENT VALUATION METHOD FOR THE PROPOSED RIA FOR RCRA CORRECTIVE ACTION RULE BY THE ENVIRONMENTAL ECONOMICS ADVISORY COMMITTEE

NOTICE

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ABSTRACT

The EEAC addressed the design, conduct, and results of the contingent valuation study (undertaken for the EPA Office of Solid Waste by Drs. McClelland, Schulze, *et al.*), focusing on a Charge organized around five major questions: a) the survey respondents' understanding of groundwater resources; b) selection of the best method for estimating non-use values from the survey responses; c) use of the Box-Cox econometric procedure to address large bids; d) the problems of embedding, non-bids, and scenario rejection; and e) the applicability of the valuations obtained in this study as a basis for EPA to determine the non-use values of groundwater. The Committee commends EPA staff for supporting exploratory research of this nature. There is little doubt that this study represents a substantive contribution, extending our understanding of the issues associated with contingent valuation estimation of non-market values. Addressing the last, but most encompassing element of the Charge first, the Committee can not endorse the McClelland *et al*. study as a means of generating valid and reliable estimates of the nonuse values associated with cleaning up contaminated groundwater. Specifically, the Committee has no confidence that the respondents were clear about what it is they were being asked to value. Although the study was innovative in a number of respects, this most basic failing gives the Committee no choice but to question the validity of the findings. Addressing other aspects of the Charge: a) The Committee does not believe that the pre-testing and survey design techniques offer convincing evidence that a well-defined groundwater commodity was understood properly by all the respondents; b) The Committee does not believe that any of the three possible methods for separating the non-use or passive use values from total values can be established as preferred at this time; c) the Committee deems it impossible to judge whether the Box-Cox econometric estimates alone provide an acceptable and defensible method for dealing with the scenarios and the large bids associated with them; and d) the Committee does not believe that the approaches for treating embedding, scenario rejection, and the potential effects of non-bidding responses can be assessed for their reliability on the basis of the information provided in the report. The EEAC feels that the problems in using the study results to meet the needs of the RIA effort arise from requirements imposed on the research by the EPA, including the need for separate estimate of nonuse value and for a method that abstracted from the specific features of the local conditions associated with each specific case of groundwater contamination. The approaches taken to deal with these requirements have no basis in the theory of non-market valuation, nor precedent in practice, and were never subjected to peer review. The Committee's report offers specific suggestions for further research to help resolve the questions raised by this study, including the criteria for deciding which households would be among the groups demanding increases in the amount available of specific commodities or values and study of the sensitivity of CV outcomes to the survey methods used

KEYWORDS: contingent valuation; groundwater; hedonic models; nonuse values; RCRA RIA

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
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TABLE OF CONTENTS

1 EXECUTIVE SUMMARY

The EPA Office of Solid Waste (OSW) has been developing methodologies to assess the benefits of cleaning up (corrective action) contamination at active hazardous waste facilities operating under the authority of the Resource Conservation and Recovery Act. OSW's definition of potential benefits includes non-use values of clean groundwater. The OSW (along with the Office of Policy, Planning, and Evaluation) has supported a Cooperative Agreement with the University of Colorado to conduct a contingent valuation study (McClelland *et al.*,1992) to estimate these non-use values.

The OSW requested that the SAB Environmental Economics Advisory Committee (EEAC) address the design, conduct and results of the contingent valuation study with particular attention to methodological limitations that have been identified in the literature on contingent valuation. The Committee was asked to review the study in the context of the state of the art for contingent valuation methodology, but to be aware of the practical constraints under which the effort had been carried out (e.g., budget limitations). The Committee devoted three meetings (in whole or in part) to this review -- December 18, 1992, April 30, 1993, and July 13, 1993, completing a detailed review of the research. The Charge for the EEAC review was organized around five major questions posed by the OSW, and summarized below:

a) Did survey respondents understand groundwater sufficiently to give a meaningful value to the commodity in question?

b) Which of three similar methods should be used for estimating non-use values from the survey responses?

c) Is the Box-Cox econometric procedure an acceptable and defensible method for addressing large bids?

d) Embedding has been identified as a problem in contingent valuation studies. Were the methods used to address the issue of non-bids, scenario rejection and embedding reasonable?

e) Are the valuations obtained in this study sufficiently accurate and reproducible so as to be used, in part, as a basis for EPA to determine the non-use values of groundwater? Can the SAB advise the Agency on

analyses of the survey results to improve the estimation of non-use values for groundwater?

Addressing the last, but most encompassing, element of the charge first, the Committee can not endorse the McClelland *et al.* study as a means of generating valid and reliable estimates of the non-use values associated with cleaning up contaminated groundwater. Moreover, the Committee questions the study's applicability within the context of the forthcoming RCRA Corrective Action Rule Regulatory Impact Analysis (RIA). This CV study design flows from the premise that the values people place on cleaning up groundwater that they are told will have no effect on their own water supplies can be measured independently of the specific circumstances associated with each contaminated groundwater resource. The benefits (or value) provided to people from cleaning up contaminated groundwater are measured by what people would be willing to give up to obtain that improvement. With most commodities, these "sacrifices" can be measured from market transactions. For many environmental commodities this is not possible. Indeed, in situations where people experience satisfaction from the knowledge that a resource is restored or preserved irrespective of any direct use they might make of it, there is a particular need for the type of innovative research strategies attempted in this McClelland *et al.* study. Their approach used survey methods to ask a representative sample of adult decision makers what they would be willing to pay to clean up a contaminated groundwater resource. While the survey approach is not accepted by all economists, it has been accepted in principle for natural resource damage assessment by the recent (Federal Register, January 15, 1993) report of the National Oceanographic and Atmospheric Administration (NOAA) panel of distinguished social scientists (including two Nobel Laureates) composed of five economists and a survey researcher.

The Committee's concerns about the McClelland *et al.* findings relate primarily to specific details of this study's application of the CV technique. It was apparent to Committee members that people answering the study's survey instrument could have interpreted the services provided by cleaning up contaminated groundwater in a number of different, conflicting ways. There is no way to know which of these multiple meanings these respondents adopted in answering the valuation questions.

Addressing other aspects of the Charge:

a) The Committee does not believe that the pre-testing and survey design techniques offer sufficient evidence to ensure that a well-defined groundwater commodity was understood properly by all the respondents. The sample sizes for the pre-tests were not large enough to permit

multivariate analysis that would allow evaluation of some of the judgments made by the principal investigators.

b) The Committee does not believe that any of the three possible methods for separating the non-use or passive use values from total values can be established as preferred at this time. Each should be regarded as an innovative research technique and not one of proven reliability for estimating non-use values from survey responses.

c) It is not possible to judge whether the Box-Cox econometric estimates alone provide an acceptable and defensible method for dealing with the scenarios and the large bids associated with them. Comparative evaluations of these results, and the results of other approaches for dealing with the skewness in the valuation responses across a number of surveys, should be undertaken before accepting the Box-Cox results. Because there are several different hypotheses about the source of large bids, the literature does not provide one set of criteria for discriminating among these approaches. Comparative evaluations provide one means of evaluating whether the specific approaches used to address skewed bid distribution influences the summary statistics used for policy analysis or the conclusions drawn or based on survey findings.

d) We do not believe that the approaches for treating embedding, dealing with scenario rejection, and reflecting the potential effects of non-biding responses can be assessed for their reliability on the basis of the information provided in the report.

The above problems notwithstanding, the Committee wishes to commend EPA staff for supporting exploratory research of this nature. There is little doubt that this report represents a substantive contribution, extending our understanding of the issues associated with contingent valuation estimation of non-market values. It provides new research insights to the evolving literature on contingent valuation. However, such innovation is not the criterion that the Committee was asked to use in evaluating the report, nor the foundation for use of the study by EPA. In many respects, the Committee feels that the problems in using the findings of the study to meet the needs of the RIA effort arise from requirements imposed on the research - the need for a separate estimate of non-use value and for a method that abstracted from the specific features of the local conditions associated with each specific case of groundwater contamination. After reviewing the full record, the Committee feels that this strategic decision on EPA's

part is the cause of many of the study's problems as well as the difficulties of implementing the research findings in the RIA context. The approaches taken to deal with these requirements have no basis in the theory of non-market valuation, nor precedent in practice, and were never subjected to peer review.

The Committee's report offers specific suggestions for further research to help resolve the questions raised by this study. Five general areas seem especially relevant for EPA's activities associated with the corrective action RIA:

a) For the most part, economic research has focused on developing estimates of the values of the typical or representative household demanding increases in the amount available of specific commodities (or improvements in them) and not the criteria for deciding which households would be among the groups having such demands or values. Addressing this question is fundamental to the task of measuring aggregate values for the cleanup of groundwater resources and may well have a much greater quantitative impact on these aggregate estimates than do refinements in estimates of the representative household's values for changes in some environmental commodities.[1]

b) Detailed study of the sensitivity of CV outcomes to the survey methods used - whether telephone, in-person, or mail surveys is needed. The evidence provided to the Committee suggests that there remains some questions in the profession about the results provided by telephone or mail surveys in comparison with in-person interviews. More research on this topic is clearly warranted.

c) Research addressing issues associated with defining changes in environmental commodities is central to understanding whether the contingent valuation responses are internally consistent. The recommended research would involve developing methods and practical protocols that could be used to understand how environmental commodities are best measured and how those measures relate to the descriptions offered in the framing of contingent valuation questions.

[1] Given the extremely limited nature of the available research on the value of groundwater cleanup, the Committee feels that in this case both types of research are exceptionally important.

d) Research on the need for, and the ability of, respondents separating their total value of increases in environmental commodities (such as the cleanup of contaminated groundwater) into use and non-use components.

e) Research on the development of methods for gauging the potential implications of using a hypothetical setting to elicit valuations in relationship to real choices is important to the ongoing development of the contingent valuation method. Research evaluating whether or not contingent valuation results can be transferred from one setting to others is also critical. The Committee believes this should be a central component of the future research that EPA undertakes in support of its policy evaluation.

The Committee assumes that there will be a continuing need to evaluate analyses intended to appraise household's willingness to pay for improvements in environmental commodities. There is simply not sufficient information on the proverbial "research shelf" to address in a meaningful way many of the questions that have been posed to the EEAC about specific decisions in the design of contingent valuation surveys and in the transfer of results from such surveys. EPA staff have attempted to do their best to meet policy needs in the presence of this limited information. Their Charge to the EEAC reflected a desire to have the Committee's judgement, based on its collective research experience, substitute for a documented research record on these issues. Our conclusions reflect the fact that the problem is not simply that EPA has been unable to sustain a research program to address these questions. Overall, there does not exist a set of research available for the Committee to use in forming its own judgements, EPA should begin to sponsor the research required to evaluate the methods used in its policy evaluations and to develop more experience in valuing changes to important environmental resources.

2 INTRODUCTION

2.1 Background

The EPA Office of Solid Waste (OSW) is working to complete a final rule requiring the clean-up of contamination of active hazardous waste facilities operating under the authority of the Resource Conservation and Recovery Act (RCRA). A significant area of benefits from the rule is expected to be the clean-up of groundwater contamination, as well as other environmental media. To provide decision makers with a complete assessment of the benefits of corrective action, OSW has adopted a broad definition of potential benefits that includes non-use values of clean groundwater.

The OSW has provided support to a Cooperative Agreement with the University of Colorado to conduct a contingent valuation study to estimate these non-use values. The contingent valuation study is moving toward completion, under the direction of Drs. McClelland, Schulze, Lazo, Waldman, Doyle, Elliot, and Irwin.

The OSW requested that the SAB address the design, conduct and results of the contingent valuation study. The researchers were aware of the need to cope with four potential sources of error that have been identified in the literature on contingent valuation. These sources include: (1) large bids not indicative of willingness-to-pay; (2) scenario rejection or refusals to bid; (3) embedding; and (4) effects of context on bids.

Although the study was conducted to place emphasis on pretesting, instrument design, sampling, and econometric analysis of CV survey data, there were also a number of practical constraints. The survey instrument length was limited to insure a reasonable response rate from a mail survey. A mail survey was used because estimates on a national scale were needed; the sample size had to be large enough to allow comparison among survey variants and tests of several key questions. Lastly, the budget was limited. The Committee was asked to review the study in the context of the state-of-the-art for contingent valuation methodology, but to be aware of the constraints noted above.

2.2 Charge

The specific charge was organized around five questions. They are summarized below:

a) The survey instrument design was developed through focus groups using a cognitive survey design approach and different survey variants. Two levels of context were included among the survey variants to test the effect of context. This was particularly important because groundwater is an exotic commodity. There was concern during pretesting that groundwater would not be understood well enough by respondents to properly give a value. **Were the pretesting and subsequent survey design techniques reasonable methods to use? Does OSWER have sufficient evidence and support, after using these methods, to insure that groundwater was understood enough to properly give a value?**

b) The survey was designed to allow estimation of non-use values for groundwater by three possible methods. The three methods produced similar results. **Does the SAB have a preference regarding which method should be used for estimating non-use values from the survey responses?**

c) The study used the econometric technique of Box-Cox transformations to address large bids. OSWER believes that the information content of large bids needs to be considered in the results. **Is the Box-Cox econometric procedure an acceptable and defensible method for addressing large bids?**

d) The survey had to address the issue of non-bids or scenario rejection by using careful survey design techniques. Scenarios that people would accept were pretested extensively. The cognitive survey design approach was instrumental in facilitating the pretesting. Embedding has also been identified as a problem in contingent valuation studies. Embedding was addressed by posing explicit questions that ask the respondent to rethink a previous answer and reduce their bid based on how much the values previously given for groundwater cleanup were actually for other environmental problems. **Were the methods used to address the issue of non-bids, scenario rejection and embedding reasonable?**

e) In developing regulations under its several legislative mandates, the Agency is required to produce analyses that determine the benefits of regulations intended to protect groundwater. **Are the valuations obtained in this study sufficiently accurate and reproducible so as to**

be used, in part, as a basis for EPA to determine the non-use values of groundwater? Can the SAB advise the Agency on analyses of the survey results to improve the estimation of non-use values for groundwater?

3 DETAILED DISCUSSION

3.1 Organization of the Report

The Committee's report on the review of this contingent valuation study is organized into three sections. In the first section we describe our evaluation process. We include this section because the steps we took in our review are quite relevant to our judgment on the report

In the second section, we discuss the implications of the NOAA Contingent Valuation Panel's Report for the evaluation of McClelland, *et al.*, as well as several issues that were not addressed in the charge. We summarize our conclusions with respect to each of the issues identified in the charge. And we present our overall reactions to this report.

In the third section, we identify three major areas of substantive research concerning the use of contingent valuation methods for the valuation of nonmarket resources such as groundwater. We recommend that EPA initiate a program of research in each of these areas.

3.2 Outline of Committee's Review Procedures for the Preparation of this Report.

The McClelland *et al.* contingent valuation study of groundwater reviewed was prepared as part of the research necessary for EPA's Regulatory Analysis for its Corrective Action Rule for RCRA sites. Our review was undertaken in several stages. A detailed review was required because the Office of Solid Waste did not provide any information indicating that the McClelland *et al.* contingent valuation report had been subjected to a peer review process prior to submitting it to the Committee.[2] Indeed, it is our understanding that the research design for the benefit transfers planned as part of the Regulatory Impact Analysis was not subjected to a comprehensive external review. We believe this was a mistake. It had a significant effect on the design of the McClelland *et al.* research, and therefore we will return to it below. In the absence of a documented peer review of the draft final report, the Committee believed it was essential to conduct a detailed peer review of the research as well as to evaluate the issues associated with the Charge given to the Committee.

[2]Subsequent to the preparation of this report, peer review materials were provided to one of the Committee Chairs. These materials addressed an interim report, not the draft final report. Moreover, there was no indication of how the research design was modified to respond to the comments.

The first stage of our review consisted of a briefing on December 18, 1992 by EPA staff on the goals specified for the contingent valuation study. In this presentation EPA staff outlined its needs in relationship to the Regulatory Impact Analysis. The staff identified a pre-defined set of research goals that were imposed on the principal investigators and that conditioned their decisions concerning research strategies. One of the goals was to obtain an estimate of the non-use values (or "passive use" value, using the terminology of the 1989 Court of Appeals decision and the NOAA Contingent Valuation Panel Report) for the cleanup of groundwater resources that could be applied as a separate component to any use values estimated separately on a site specific basis. It is our understanding, based on that briefing, that this goal was specified by EPA staff. It was not based on a recommendation of the principal investigators as a component of their research design. Nor was it a goal that was developed as a result of existing research findings on the measurement of use and non-use values (i.e., the earlier Mitchell-Carson (1989) study using focus groups to evaluate how people conceived of groundwater resources and whether they might have non-use values for them).

Following the overview of EPA goals, the Committee Co-Chair (Smith) presented an overview of contingent valuation methods and an initial summary of the key elements in the McClelland *et al.* contingent valuation survey. Because the Committee was aware of the ongoing NOAA Contingent Valuation Panel's assessment of the CV method, the Committee decided to wait until the report of that panel was available before undertaking a detailed review of the McClelland *et al.* study (The report was subsequently published in the *Federal Register* for January 15, 1993).

The second stage of our review process involved assembling a detailed set of questions for the principal investigators of the CV study. These questions summarized the issues that arose in the Committee's initial review of the McClelland *et al.* study.[3] The questions posed to the authors also outlined the concerns that the Committee felt needed to be addressed by the principal investigators in a subsequent meeting.

As part of the preparation of the equivalent of a peer review, the Committee requested three sets of consultative activities. First, the Committee asked Dr. Robert C. Mitchell to evaluate the background information forming the basis for the design of the contingent valuation survey. Mitchell, along with Dr. Richard T. Carson, had conducted for EPA qualitative research on the issues associated with attempting to

[3]The questions were transmitted to the authors in a memorandum from Kerry Smith and Allen Kneese to William Schulze January 11, 1993.

measure non-use or existence values for groundwater prior to the McClelland *et al.* report cited above). The McClelland *et al.* report indicates that it intended to build upon the findings of the Mitchell-Carson study. The charge given to Mitchell (Smith and Kneese memorandum, March 23, 1993) proposed that his review focus on the interpretation given to this earlier Mitchell-Carson work by McClelland *et al.*

The Committee asked Drs. Richard Bishop and Gregory Poe to evaluate the implications of their recent study of the influence of information on individual's valuation of groundwater cleanup. These researchers were asked to consider their findings in relation to the information that was provided to respondents in the McClelland *et al.* contingent valuation study. Finally, Dr. Kevin Boyle was asked to prepare a detailed review of the literature including the McClelland *et al.* study. This review was to include a comparative evaluation of all aspects of the earlier literature on the contingent valuation method to value cleanup of groundwater resources (K. J. Boyle, 1993).

The third stage in the Committee's review process involved a second meeting of the Committee (a) to: discuss the report of the NOAA Panel on contingent valuation methods; (b) to allow the principal investigators to describe their research design in more detail and to provide detailed responses to the January comments and questions; and (c) to hear the reports of the three groups of commissioned consultants to the Committee. Following this meeting, a draft report of the Committee was prepared and circulated to the Committee members. The Committee's third and final meeting evaluated and revised this report and finalized the Committee's recommendations about the study. During the final meeting, Dr. William Schulze presented some clarifying information to the Committee. A summary of the authors' written responses to Committee questions (McClelland, Schulze, and Lazo, June 23, 1993) was circulated shortly before the final meeting.

3.3 Committee Evaluation and Response to the EPA Charge

3.3.1 Comparison with the NOAA Panel Guidelines.

The Committee decided to delay its review of the McClelland *et al.* report until after the NOAA Panel's report on the contingent valuation method was available. This was done because the Committee did not have the resources or time to undertake its own review of the CV method. The NOAA Panel concluded that "contingent valuation studies can produce estimates reliable enough to be the starting point for a judicial or administrative determination of natural resource damages - including lost passive use value." After reviewing the objectives of the NOAA Panel and its recommendations, the

EEAC acknowledges that the mandate requested of the NOAA panel differs from that associated with using the results of a CV analysis for general policy purposes. Moreover, the Committee does not intend to endorse or agree with all aspects of the NOAA report. Rather, we have simply used the NOAA Panel's guidelines as one of several starting points for an evaluation of the McClelland *et al.* study.

The NOAA Panel's guidelines for the design and implementation of CV survey methods included[4]: use of in-person interviews; use of a referendum (or discrete choice) format in asking contingent valuation questions; obtaining a high response rate to the questions; investigating the responsiveness of the "willingness to pay responses" to changes in the amount of the environmental commodity offered to respondents;[5] attempting to determine whether respondents understood the tasks, considered their budgets in the process of answering contingent valuation questions, and believed the scenario presented to them. With discrete choice questions, the NOAA Panel recommended a follow-up to any *yes/no* questions with specific attempts to identify responses that indicated concern over available resources to make the stated payments. Scenarios should demonstrate that respondents considered seriously the private and public substitutes for the commodities offered as well as these budget constraints.

Because the McClelland *et al.* study was conducted long before the NOAA report was available, it is unrealistic to expect a direct correspondence between the procedures used in the McClelland *et al.* report and the NOAA Panel's recommendation. It also should be noted that not all of the members of this Committee fully endorse all of the NOAA Panel's guidelines. Nonetheless, the EEAC started its evaluation by

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[4]These comments paraphrase the specific requirements identified in the NOAA Panel's summary of conditions required to satisfy their burden-of-proof requirement. They also include the recommendations made about specific implementation procedures. The specific citation for text of the report is: *Federal Register,* January 15, 1993, Vol. 58, #10, pp. 4601-4614.

[5] The NOAA Panel report uses the term "scope" to refer to changes in the environmental commodities that are intended to represent the injuries to one or more specific environmental resources. It is identified as "scope" in their burden of proof requirements and that specific patterns of responsiveness in willingness to pay acknowledges that the predictions from economic theory about the properties of the willingness to pay are limited. This is especially true when there may be more than one environmental resource affected and the reductions in injuries (i.e., increases in the environmental commodities involved) that are being valued may be different across resources. The specific text of the NOAA Panel's report that seems to be identified as being associated with the scope requirement describes the condition as follows: *Rationality in its weakest form requires certain kinds of consistency among choices made by individuals. For instance, if an individual chooses some purchases at a given set of prices and income, then if some prices fall and there are no other changes, the goods that the individual would now buy make him or her better off. Similarly, we would expect an individual's preferences over public goods (i.e. bridges, highways, air quality) to reflect the same kind of consistency.*

Common notions of rationality impose other requirements which are relevant in different contexts. ***Usually, though not always, it is reasonable to suppose that more of something regarded as good is better so long as an individual is not satiated. This in general translated into a willingness to pay somewhat more for more of a good as judged by the individual. Also, if marginal or incremental willingness to pay for additional amounts does decline with the amount already available, it is usually not reasonable to assume that it declines very abruptly*** (emphasis added) pp 4604.

considering the McClelland *et al.* study's design in relationship to the NOAA Panel recommendations. Several notable differences were identified. McClelland *et al.* used mail surveys and not in-person interviews, a fact that was a concern of some members of the Committee. The interview format did not allow evaluation of whether the questionnaires were understandable to respondents of the final survey and did not incorporate a test for the effects of changes in the scope of the commodity offered respondents, as recommended by the NOAA panel. While considerable attention was paid to a specific set of substitutes, the set of substitutes for contaminated groundwater was narrowly defined and the set of substitutes available with scenario rejection was not made clear. The NOAA Panel did not discuss the procedures employed in the McClelland *et al.* report for dealing with disembedding and for partitioning the total willingness to pay into use and passive use components. Additionally the study did not utilize the close-ended or referendum format for the contingent valuation questions, using instead a payment card approach. While the discussion of the pre-test results suggests that a closed-ended contingent valuation was evaluated, the questions used were not in the same format as recommended by the NOAA Panel (based on information given in the report, the principal investigator's comments, and the Boyle (1993) review). The authors' pre-test did not evaluate the discrete choice approach recommended by the NOAA Panel. Thus, the questioning format did not correspond to that recommended by the NOAA Panel.

Overall, the McClelland *et al.* study does not satisfy the burden-of-proof standards described by the NOAA Panel for reliable CV assessments of the passive use values associated with natural resource damages. It is important to acknowledge, however, that the NOAA Panel report did not describe these features of CV studies as absolute criteria for reliability. The report acknowledges that reliable estimates could be realized without full adherence to all the recommendations. As the NOAA Panel report clearly indicates, it is possible for CV studies to achieve comparable levels of reliability without adhering to their recommendations, but the burden of proof must be satisfied by other means. Accordingly, given the Committee's position that it does not necessarily endorse the NOAA Panel's recommendations, our evaluation of reliability and validity was based on the general definitions of these concepts as they have been used in the CV literature (R. C. Mitchell and R. T. Carson, 1989). As such, this evaluation is a professional judgment that took the comparison with the NOAA criteria as an approximate template in the Committee's first stage review of the McClelland *et al.* study.

The McClelland *et al.* report exhibited several commendable features. Although

it used mail questionnaires, it did achieve a relatively high response rate (63.4 percent of total questionnaires were returned; 43.7 percent of the total were available for regression analysis). The report included an extensive amount of qualitative analysis associated with the design of their survey instrument and several pre-tests to evaluate its performance. At the early design stage of questionnaire development, there was extensive attention to verbal protocol analysis, focus groups, and other qualitative approaches to evaluate the extent to which individuals were comprehending the commodity that was being offered to them. Equally important, a series of pre-tests were used to evaluate the sensitivity of responses to the structuring of the valuation questions. While concerns were raised about the relative sizes of the samples underlying these pre-tests, the Boyle (1993) appraisal and other reviewers suggested that this amount of work was among the most extensive ever conducted in a contingent valuation study for groundwater cleanup. Unfortunately, there does not appear to have been evaluation of the final survey instrument to determine whether the judgements from the pretests were consistent with an independent set of respondent's understanding of the CV questions.

3.3.2 Specific Issues of Concern

The Committee found difficulties with several elements of the design and analysis presented in the McClelland *et al.* report. Some of these are highlighted in brief terms in our summary judgment. We discuss a few of them in more detail below.

3.3.2.1 Definition of the Commodity

The first of these concerns the definition of the commodity to be valued by respondents. The Committee found that there were multiple interpretations of what was offered to respondents based on the information conveyed by the questions comprising the valuation task. The most direct explanation of the Committee's reasons for concern stems from the reactions of Committee members to the questionnaires. Careful readings of the survey instrument by several members of the Committee resulted in different interpretations of the commodity that was being valued. These differences (along with similar questions about the survey instruments associated with the experimental variations included as different versions) raised questions about the ability of lay persons to understand the nature of the commodity they were being asked to value.

The Committee found that the sample sizes and evaluation of the information materials and pre-testing and design techniques were not sufficient to statistically test

whether respondents had enough information and understood the commodities offered to them. Equally important, it was not possible to discriminate between the various interpretations of the commodity offered to respondents. In order to present a comprehensible choice to respondents, the CV survey instrument must clearly specify the nature of the environmental commodity they will receive if they choose not to purchase what is offered and the modifications to that commodity, the access conditions and the nature of payment(s) if they choose to purchase what is offered. The no-purchase condition will be referred to as the *default condition* and all aspects of the change in the commodity as the *commodity change.*

There is a basic problem in interpreting the valuation question (Q11), primarily associated with an ambiguity in the problems that can arise from the contaminated water. In the base scenario, forty percent of the water used by the community was described as coming from groundwater contaminated as a result of a leaking public landfill. In the discussion of the context for the commodity, contamination increased the risk of dying from cancer by about ten additional deaths per million per year among people who drink the water. An event with comparable risk was described for respondents.[6] However, it is subsequently stated that the water must not be used for drinking and cooking. Thus, individuals may not perceive health risk to be a feature of the default conditions of water supply and risk perception may not enter into the individual's decision process. In this case the only implication of contamination is the possibility of water shortage.

In fact, it is not clear what respondents view as the default scenario for their valuation. That is, in order to place a value on the primary scenario of complete cleanup, respondents must clearly understand the reference point for their valuation, that is, the condition of their water supply if complete cleanup did not occur. This is important because acceptance/rejection of a proposed clean-up plan relative to a default option characterizes the commodity purchased. The scenario could be interpreted as describing an increased risk and the prospect that a substantial fraction of their water supply would be contaminated. But since the scenario also specified that it could not be used for drinking or cooking, it is not clear that those answering this question would perceive any risk as being present. Furthermore no information was provided on alternative supplies or response patterns. Other options are described before the contingent valuation scenario. But there is no statement about whether these alternatives would be able to be used for the particular groundwater

[6]The term *risk* is used here to mean the lifetime probability of death.

contamination being valued. Under the most optimistic interpretation of questions Q6 through Q10, individuals might have selected one of four alternative base cases to define the default scenario in considering their valuation of complete cleanup. The default scenario constitutes the reference point for their valuation estimate. The difficulty is that we do not know which of these alternatives (if any) would function as the method of choice for any particular respondent would choose in the event that they did not select complete cleanup.

In the base survey instrument, the respondent must somehow judge whether the uncontaminated 60% of the water supply will be adequate. There seems to be an implicit assumption that the community must find an additional water source. This implication appears to arise from Q10 and is not stated elsewhere. If the respondent perceives a water shortage, all that is being asked is the demand for water. Of course, this interpretation makes the further assumption that respondents have accepted the conclusion offered in the instrument that risk has been precluded by the water policy in effect.

Respondents' satisfaction ratings for each of the alternative approaches (i.e., containment, public treatment, home treatment, or water rationing) do not help resolve the ambiguities because they do not provide a complete description of the adjustments to their values associated with each of these reference points. Versions C and D of the questionnaire allow comparison of public treatment with complete treatment, and Version D elicits valuation adjustments in response to varying percentages of domestic water supply contamination. Nonetheless, this would not allow us to completely decompose (by scenario comparisons) the values that were offered for anyone who did not receive one of these questionnaires.

The method of eliciting valuation estimates from some versions of the questionnaire as a percentage of the complete cleanup valuation caused some concern. When individuals are offered changes in the scenario, they are offered adjustments to the base case (i.e. a complete cleanup scenario) with specific percentages of value offered as the responses. Where we have *a priori* expectations that the values given should be larger, the percentages are scaled at a larger rate; where there are *a priori* expectations that the values should be smaller, the percentages are scaled over a smaller range. This formatting of the questions preconditions responses that individuals can give. The literature provides no basis for judging the reliability of these percentage adjustments. Moreover, there does not appear to have been a test of

using alternatives to determine whether the formatting influenced the plausible

response.

3.3.2.2 Embedding

Another source of concern is the question associated with disembedding. Embedding is a term that has had a variety of interpretations in the economics literature, with widespread use of the concept generally associated with research reported by Kahneman and Knetsch (1992). In the context of this report, we have interpreted embedding as a situation where survey respondents report values for commodities that are more inclusive than what is desired by those analysts or policy makers intending to use their responses. This can arise because respondents interpret the commodity differently from the analyst or because they assume that other commodities would be provided along with the one that has been offered (even though the survey instrument does not imply this to be the case). The McClelland *et al.* disembedding question (Q12) asks individuals to reconsider the dollar amount they stated (in response to the preceding question, Q 11) they would be willing to pay for complete groundwater cleanup and asks them to characterize this amount as: (a) "Just for the stated groundwater program;" (b) "somewhat for the groundwater program and somewhat a general contribution to all environmental causes;" (c) "basically a contribution to all environmental or other worthwhile causes;" or (d) "other. " In question 13, a percent of a dollar amount is requested. If individuals are asked in question 11 to describe the most they would be willing to pay each month on top of their current water bill for each of the next ten years for complete groundwater cleanup program, the Committee wondered why they would immediately thereafter be willing to admit that this response was actually for other things. It would be difficult to interpret how any household would respond to this question if they did not know it in advance, i.e. if the questions were conducted at an in-person interview or a telephone interview where respondents do not know what is coming next in the question sequence. When these questions are presented in a mailed questionnaire (where it is assumed that respondents can read ahead), the response to this type of question is even more difficult to interpret and there is no basis in the literature for assessing this issue. Thus the methods used in this study to adjust for embedding have not been evaluated in the literature.

3.3.2.3 Partitioning of Total Values

One of the objectives of the study was to estimate the non-use values of cleaning up groundwater contamination. These estimates were to be used in the benefit assessment required for the Regulatory Impact Analysis of RCRA corrective

action rule. The Committee concludes that the report does not provide evidence that respondents adequately distinguished the use and non-use values for cleaning up contaminated groundwater. Three methods were used to estimate non-use values: direct questions requiring allocation of total bids over composite categories; comparison of "willingness to pay" (WTP) responses for different commodity scenarios; and extrapolation by fitting an assumed functional form to WTP bids for different levels of water shortage.

The first method was implemented through Question 14 which asked respondents to decompose their complete groundwater cleanup bid into motivational categories. A limited number of investigators have used this approach to isolate use and non-use values, but there is no evidence in the literature about the method's performance.[7] The maintained hypothesis that respondents to CV questions can decompose their bids into constituent parts is difficult to accept and there is little evidence to support its use. For example, it seems reasonable to suggest that people would have difficulty decomposing their willingness to pay for something as familiar as an ice cream sundae into percentages they would associate with texture, temperature, looks, taste, etc. At the minimum we would expect that this type of detailed information would need to be elicited very carefully -- in effect "coaxed" from them in a very detailed but logical way. The reliability of the second method is questionable due to confusion over the definition of the commodity and default scenarios, as discussed above. With regard to the third method, we have no past experience with the relationship between this method and the tasks requested of respondents, nor any reason to believe that the intercept of a fitted function can be interpreted as a non-use value. Finally, there is little basis provided in the study for gauging the transferability of such results from other situations requiring the estimation of non-use values for cleaning up contaminated groundwater resources .

By criticizing the techniques used in this study to separate use from non-use values, the Committee does not intend to address the broader issue of the validity of that distinction. Some members of the Committee questioned whether it is appropriate to ask respondents to partition their willingness to pay into discrete elements that were associated with components of those respondents' total values. This should be a matter for further research.

[7] See Boyle [1993] for discussion and evaluation.

3.3.2.4 Consistency with Mitchell-Carson Existence Value Study

The Committee found some inconsistency between the lessons learned from the earlier Mitchell-Carson evaluation of existence values as reported by Mitchell and the McClelland *et al.* interpretation of these results. For example, McClelland *et al.* summarize the objectives of their study:

> *The aim of our current study is to estimate non-use values for groundwater cleanup. This commodity, of great interest to the U.S. EPA, also appeared to be ideal for a methodology study since in early development work undertaken for U.S. EPA by Mitchell and Carson, it was apparent that (1) people were generally poorly informed about groundwater contamination, and (2) people resisted non-use scenarios used for evaluation in which groundwater was preserved but never used. In other words, the scenario was rejected by respondents. Delighted with our exotic commodity, groundwater cleanup, our strategy was to apply two new methods in designing this survey instrument* (page 22).

By contrast, the Mitchell-Carson report concluded somewhat differently from what the authors indicated. It notes:

> *We believe it is possible to use the contingent valuation method to obtain a credible dollar measure of the existence values of groundwater by using a scenario of the type described in this chapter. The device of having people evaluate hypothetical GNN* (groundwater not needed for human use) *groundwater (aquifer) that can be plausibly isolated from other aquifers and which lies at a great distance from those who are being interviewed should effectively eliminate any use values. The concrete barrier plan promises to provide a credible protective option for the GNN aquifers so that those who choose it will be stating how much they would be willing to pay to preserve the aquifer defined as GNN from contamination. These containment features should minimize any influence on people's willingness to pay that might result if they continue to believe that contamination in groundwater travels at a much higher velocity than is actually the case. . . . Given the difficulty of convincing people that the aquifer will never be needed for human use, a portion of the values will include the utility people get from vicarious protection. The vicarious protection values will be minimized by the scenario features that are intended to protect others from inadvertently using groundwater in the*

> *basin. . . .* ***There is no valid way to obtain separate measures of the several types of existence value in this study.*** *First, it is too difficult to overcome people's belief about future use by others to design a scenario that would only capture stewardship values. Likewise, we see no way to design a scenario that would only capture bequest or inherent values for groundwater. Second, it is cognitively unrealistic to ask respondents to state what proportion of the total value they ascribe to each of these three types of existence values. However, it will be possible to assess in a qualitative fashion the degree to which respondents are influenced by these several types of value by using the follow-up motivational questions* (pp 83-85, emphasis added).

Both studies identify difficulties in separating use and non-use values. In part because of the Mitchell-Carson work, and in part because of their own pre-test and verbal protocol analysis, it was clear to the principal investigators that it would be extraordinarily difficult to explain the nature of groundwater resources that would not have any foreseeable uses to them or other people, to respondents. Mitchell and Carson recommended a separation by distance as well as an identification of other aquifers to try to deal with this problem. McClelland *et al.* adopted a different frame-work. Concern about substitutes in the form of alternative aquifers and about the importance of describing plans for protecting groundwater that would be believable to respondents did not appear to influence the way in which McClelland *et al.* structured their scenarios. The allocation format used in the McClelland *et al.* report does not conform to the follow-up motivational questions as described by Mitchell and Carson.

3.3.2.5 Box-Cox Estimation and Treatment of Zero Bids

The Box-Cox regression methods analyzed what is referred to as the "reduced willingness to pay," the willingness to pay bid for complete groundwater cleanup adjusted by the reported disembedding percentage. The results reported by McClelland-Schulze in the second of the Committee meetings suggest that the Box-Cox modelling approach used to deal with a skewed bid distribution was quite sensitive to the authors' treatment of zero bids. The magnitude of the Box-Cox parameter exhibited substantial variation with the substitutions imposed for the zero values of the willingness to pay bids. Despite the sensitivity to zero values, there was no discussion of the treatment of zero bids or scenario rejection in the present report. Moreover, the Box-Cox transformation is only one of a number of ways of dealing with skewed error distributions and no comparative evaluation of the methods was undertaken. Thus, the Committee concludes (in response to the third question of the Charge) that the report

does not provide clear-cut evidence that the Box-Cox procedure adequately addresses the issues posed by large bids, zero bids, and scenario rejection. In addition, an evaluation of the zero responses, non-responses, large bids, and non-responses to the valuation scenarios in total are essential for judging the reliability of the analysis. The existing contingent valuation literature offers an array of possibilities for dealing with each of these issues, and no single method has been identified as preferred. In view of this work, it seems reasonable to suggest that comparative evaluations of the different methods for treating outlying observations, zero responses, and non-responses would be important for gauging the comparative performance of the contingent valuation scenarios offered in this study.

The Committee recognizes that there are a variety of statistical methods that can be used to address large bids, zero bids, and other anomalies. For example, one might employ some robust regression approach. Using a statistical procedure to address extreme observations does not, however, solve the more fundamental problem of why such extreme responses arose. Do these responses reflect legitimate heterogeneity in valuations, or do they reflect a failure by respondents to understand the survey and give meaningful responses? Choice of the appropriate statistical solution depends largely on the factors generating these extreme responses. As a result, the Committee views these extreme bids as a matter of continuing concern that would warrant further research in future studies.

3.3.2.6 Statistical Analysis of Pre-test and Final Samples

The design of the McClelland *et al.* survey instrument was intended to include a set of activities that would evaluate the amount of information that respondents needed to value groundwater cleanup. These activities included the verbal protocol analyses and pretests conducted in the initial stage of the research to permit judgments about the final success of the form of the survey instruments in communicating the information people required to decide about a groundwater cleanup policy offered to them. Because the pretests played a key role in the survey instrument's design, the Committee considered the nature of the empirical analyses undertaken to develop the conclusions on the instrument used in the final survey.

The empirical analysis included summary statistics, primarily means and standard deviations, and some frequency plots of responses to the willingness to pay questions against a few of the attitudinal variables for the pre-test and full samples together. There were also comparable statistics for a variety of subsets of the full sample. There was little multivariate analysis of the other willingness to pay questions.

While there is a much smaller sample associated with each of these variations in the questions, a comparative evaluation of multivariate functions estimated for each of the willingness to pay responses using the final sample would contribute information to help assess the reliability of the valuation estimates. It would provide indirect evidence on the effects of changes in the scope of the commodity; for example, larger percentage shortfalls would be expected to be associated with greater use-related motives, where scenario changes from complete cleanup to containment or public treatment would be regarded as smaller amounts of the "cleanup" commodity.

Table 7.5 in the McClelland *et al.* report provides suggestive evidence, both in the full sample and the regression sample, of a response to variations in the commodity design . However, it is not clear whether these differences are associated with the actual characteristics of the commodities or with particular features of the sub-sample (i.e. lower income level, socio-economic status, or other factors), so that these factors would need to be taken into account in appraising whether these were consistent differences in the valuation responses across scenarios. The McClelland *et al.* evaluation of the effects of changes in the commodity (across the versions of the survey questionnaire) did not independently evaluate the change in respondents' willingness to pay to the features of the commodities. It was conditioned on accepting the Box-Cox model (and its predictions) as a maintained hypothesis. These predictions were then used, together with the percentage responses to commodity changes elicited from each respondent based on which version of the questionnaire they received. No attempt was made to model the adjustments and to incorporate this in a broader description of the adjusted valuations. The Committee believes that such models, both for the base case valuation and for other valuation responses that relate them to the characteristics of the respondent, would provide indirect evidence of the reliability of the survey methods.

Concerns were also raised with respect to the responsibility variable (Q 15). While the briefing from the principal investigators suggested that the results are not markedly changed by removing this variable from the willingness to pay models, the performance of the variable as a gauge of acceptance of the scenario and its relation-ship to other characteristics of respondents could be quite important.

More complete treatment of the sub-samples that include a) individuals living in areas with sites on the National Priority List; b) individuals who do not receive water bills - i.e. individuals with private wells; and c) individuals with varying experience with groundwater contamination, would offer opportunities for additional insights into the reliability of the responses. Because this work was not undertaken as part of the

analysis of the survey and remains to be done, it is difficult to reach an overall conclusion on the reliability of the willingness to pay responses interpreted as total values for groundwater cleanup. Preliminary analysis undertaken by Committee members suggests that there may be further insights from this type of empirical evaluation.

3.3.3 Responses to Specific Charges

The Committee's response to each of the specific questions associated with the charge is as follows:

a) We do not believe that the pre-testing and survey design techniques used in this study offer sufficient evidence to ensure that a well-defined groundwater commodity was understood properly by all the respondents. The results of these analyses support the conclusion that groundwater issues were important to respondents. However, the sample sizes for the pre-tests were not large enough to permit multivariate analysis that would allow evaluation of some of the judgments made by the principal investigators. In particular, the process of reducing the information set that was provided to individuals, the decisions on eliminating the risk information, the selection of a valuation payment card over alternative methods, and the definition of the commodity itself were not sufficiently tested in the pre-test and verbal protocol analysis in a way that would enable us to judge whether these were the most understandable approaches for dealing with these issues.

b) The Committee does not believe that any of the three possible methods for estimating the total willingness to pay for non-use or passive use values can be established as most preferred on the basis of the evidence that is currently available in the literature. This is not to suggest that the methods are incorrect or that they might not ultimately provide a basis for estimating non-use values in some cases. The evidence to date however provides no basis for judging them. They should be regarded as innovative research techniques and not verified methods for estimating non-use values from survey responses.

The Committee remains skeptical of the method of asking respondents to decompose reported total values into use versus non-use or various motivational categories. These procedures have not been verified in the

literature. There fore we recommend the principal focus of the analysis be on the total willingness to pay estimates for the complete containment scenario only.

c) The Box-Cox econometric transformation as applied in this study is one of several methods for dealing with large bids and outliers. The estimates appear sensitive to the treatment of zero bids. Comparative evaluations of other approaches for dealing with the skewness in the valuation responses should be undertaken before accepting the Box-Cox results. In the absence of such comparative evaluations and detailed analysis of all the possible outcomes of the valuation questions, it is not possible to judge whether the Box-Cox econometric estimates alone provide an acceptable and defensible method for dealing with the scenarios and the large bids associated with them.

d) We do not believe that the approaches for treating embedding, dealing with scenario rejection, and reflecting the potential effects of non-bids can be assessed for their reliability on the basis of the information provided in the report. The procedures described in the McClelland *et al.* report are research innovations that have not been evaluated in the literature and were not evaluated as part of their study. Further, multivariate modelling of determinants of the disembedding responses and of the factors influencing whether individuals provided no bids, zero bids, or large bids would be essential to answer the fourth question in the EPA charge. Because this information was not provided as part of the report, it is impossible for the Committee to make the judgment required to address question four of the charge.

e) The valuation responses in the survey for non-use value have not been demonstrated to be accurate and reliable enough for the EPA to estimate the non-use values for groundwater contamination. It is not clear that any of the three decomposition methods provides a basis for estimating non-use values accurately and in a reproducible manner. The literature does not provide specific documentation indicating that these methods are capable of separating the total values, especially for a situation where the commodity definition involves water rationing, risk, and groundwater protection as part of the complete containment scenario. Disaggregating the components of the total value on the basis of motives alone would not necessarily assure that the values are exclusively associated with non-

use values or that they could be transferred to another hypothetical situation with distinctly different features.

Improving the estimates of non-use values will require a composite scenario that includes the recommendations earlier provided by Mitchell-Carson along with the insights provided in this study. That is, it will require an evaluation that attempts to control the respondents' perceptions of uses for the groundwater by identifying other sources for their water and localizing the effects of contamination to deposits that were not now (or not thought to be) likely resources for future use. Because these alternatives were part of what was recommended from the Mitchell-Carson report and were identified as possible alternatives in the Boyle (1993) summary of existing literature, it seems they should have been part of the experimental design.

4 CONCLUSIONS AND RECOMMENDATIONS

4.1 Summary

It is possible to evaluate the report from a number of different perspectives. From the perspective of contributions to methodology and the practice of contingent valuation analysis, there is little doubt that this report represents a substantive contribution, extending our understanding of the issues associated with contingent valuation estimation of non-market values. Its progressive development of information treatments, innovative experimental design, and attention to comparative analysis of the values provided by alternative methods of separating use from non-use or passive use values should be treated as new research insights to evolving literature on contingent valuation. However, this is not the criterion that the Committee was asked to use in evaluating the report. In many respects, the Committee feels that the problems in using the study results to meet the needs of the RIA charge arise from requirements imposed on the research - the need for a separate estimate of non-use value and for a method that abstracted from the specific features of local conditions. After reviewing the full record, the Committee feels that this strategic decision on EPA's part is the cause of many of the study's problems as well as the difficulties of implementing the research findings in the RIA context. The approaches taken to deal with these requirements have no basis in the theory of non-market valuation, nor precedent in practice.

Finally, because of our criticisms of the definition of the commodity being valued and our concerns about whether respondents fully understood what was being valued, we are unable to make a judgement as to whether the estimates of total value for groundwater cleanup are too high or too low. Thus, the Committee concludes the study does not offer evidence that the survey has in fact developed estimates of non-use (or passive use) values. Moreover, there is no basis for believing that estimates of the representative household's non-use values (or the total values) could be developed for groundwater cleanup independent of the particular circumstances associated with the groundwater that has been contaminated.

As noted below, this conclusion does not imply that further research with the survey would not yield valuable insights into how households evaluate groundwater cleanup.

4.2 Recommended Research

The Committee would like to commend EPA for supporting innovative policy research of this type. Environmental commodities have distinctive characteristics in that they are often not the object of explicit or implicit market transactions. In this instance, there are no readily available economic data to enable economists to precisely assess the value of removing groundwater contamination to those who will not be using the potentially contaminated water. To obtain such values, original economic research is needed. Research frequently will not completely resolve all of the uncertainties with respect to benefit assessment in these controversial areas. However, beginning the process of exploring the appropriate value to attach to these problematic benefit components should be a high priority for future EPA funding.

As the above comments indicated, the Committee believes that there are a number of ways in which this specific research effort could be enhanced. For example, providing respondents with a better understanding of the commodity and ensuring that the responses isolate the non-use value of environmental damage are clearly of paramount concern. Indeed, had such a program existed, prior to the McClelland *et al.* report, it would have been possible to provide more specific answers to the methodological questions posed in the Charge to this Committee.

The research issues associated with developing aggregate estimates of the total value households place on groundwater cleanup are much too detailed to discuss completely in this report. Five general areas that are identified from the McClelland *et al.* report and seem especially relevant for EPA's activities associated with the corrective action RIA will be discussed. It is, of course, also true that further multivariate analysis with the survey data from the McClelland *et al.* survey along with research investigating the survey mode, role of substitute groundwater resources, and other features of the commodity described in their survey instrument would be very desirable and seems likely to enhance our ability to interpret the findings from the study.

The first of these has received very limited research attention. It concerns the extent of the market for environmental commodities like groundwater. For the most part, economic research has focused on developing estimates of the typical or representative household values for specific commodities and not on the criteria for determining how many households can be expected to hold these values. The McClelland, Schulze, Lazo report (1993) includes some very preliminary and therefore limited discussion of these issues. Addressing this question is fundamental to the task

of measuring aggregate values for the cleanup of groundwater resources and may well have a much greater quantitative impact on these estimates than would refinements in estimates of the representative household's values for changes in some environmental commodities.[8]

The second area of research would involve a detailed study of the sensitivity of CV outcomes to the survey methods used - whether telephone, in-person, or mail surveys. The evidence provided to the Committee by Professor Dillman (letter, March 31, 1993) when compared with the recommendations of the NOAA Panel suggested that there is not a consensus in the profession about the superiority of in-person interviews over mail surveys. More research on this topic is clearly warranted. Such research would consider not only the implications of the method used to implement the survey but also the elicitation procedure and the role of information in the design of the survey questions. It would require parallel efforts conducting the same valuation exercise with at least two, and preferably all three, of the methods available. It would be important not to compromise the evaluation by requiring that it provide "definitive" answers for an ongoing policy issue. Rather it would be important to have the commodity offered be a "real one" that is of some significance to the households that are interviewed, while the goal of the evaluation be clearly identified as generic research, **not** estimates to be used in a specific subsequent RIA.

A third area of research would address issues associated with defining changes in environmental commodities. This research is central to understanding whether the contingent valuation responses are internally consistent. The recommended research would involve developing methods and protocols for practice that could be used to understand how environmental commodities are best measured and how those measures relate to the descriptions offered in the framing of contingent valuation questions. Consideration of the differences that might arise in circumstances when total values are dominated by use-related components in comparison with those when non-use related services dominate should be an important component of this design. Equally important, to the extent that consideration of risk is an important element in the ongoing activity of EPA policy evaluations, some component of perceived risk should be incorporated as an additional factor in understanding commodity definition for CV work.

[8]Given the extremely limited nature of the available research on the value of groundwater cleanup, the Committee feels that in this case both types of research are exceptionally important.

The fourth area of research arises from an implicit strategy for benefit transfer that influenced the design of the CV study. Based on the introduction to the study (as well as earlier interim study reports and EPA staff briefings), it is clear that the study was intended to be used as a basis for estimating national non-use values that would be combined with separately computed estimates of components of the use values resulting from groundwater cleanup. This strategy implicitly accepts the validity of separating the use from non-use value. Before this approach can be adopted, there is a clear need for research on whether respondents can understand this task in a meaningful way.

The final high priority area for research concerns the desirability of evaluating the potential of these methods developed in marketing research for calibration of CV estimates and the development of methods for gauging the potential implications of using a hypothetical setting to elicit valuations in relationship to real choices. Is calibration a meaningful concept in the relationship to contingent valuation responses? What would be the mechanism for developing calibration adjustments? These are issues that are important to the ongoing development of the contingent valuation method. Research evaluating whether or not contingent valuation results can be transferred from one setting to others is also critical. The Committee believes this should be a central component of the future research that EPA undertakes in support of its policy evaluation.

This research should not be regarded as peripheral to policy evaluations, but instead central to the ability of the EEAC to respond to the specific types of questions posed by EPA staff about this study and the associated RIA analysis. The Committee assumes that there will be a continuing need to evaluate analyses intended to appraise household's willingness to pay for improvements in environmental commodities. There is simply not sufficient information on the research shelf to address in a meaningful way many of the questions that have been posed to the EEAC about contingent valuation and its use. EPA should begin to sponsor research required to evaluate the methods used in its policy evaluations and to develop a greater set of experience in valuing changes to important economic resources.

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