ELECTRIC POWER RESEARCH INSTITUTE

March 24, 2009

Dr. Holly Stallworth
Designated Federal Officer (DFO)
EPA Science Advisory Board (1400F)
U.S. Environmental Protection Agency
1200 Pennsylvania Avenue, NW.
Washington, DC 20460;

Dear Dr. Stallworth:

Attached please find comments on the "Particulate Matter National Ambient Air Quality Standards: Scope and Methods Plan for Urban Visibility Impact Assessment" prepared by the Electric Power Research Institute (EPRI). I have also attached an EPRI report that is cited in the comments and that can also be downloaded from www.epri.com.

Please contact me if there are any questions.

Sincerely,

Naresh Kumar, Ph.D.
Senior Program Manager
Electric Power Research Institute

COMMENTS ON THE PARTICULATE MATTER NATIONAL AMBIENT AIR QUALITY STANDARDS: SCOPE AND METHODS PLAN FOR URBAN VISIBILITY IMPACT ASSESSMENT

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March 24, 2009

EPRI Comments on "Scope and Methods Plan for Urban Visibility Impact Assessment"
March 24, 2009

EPA's document on "Scope and Methods Plan for Urban Visibility Impact Assessment" describes the scope and methods to conduct the urban visibility assessment (UVA) to support the review of the secondary PM NAAQS. Overall, the scope and methods planned for this assessment are described in a general sense and lack the specificity of the analyses needed to fully evaluate all the issues and obstacles discussed in the plan. In the last review, EPA used $PM_{2.5}$ concentrations as a surrogate for urban visibility impairment to develop the secondary PM NAAQS. In the current review, EPA is also planning to consider developing a PM light extinction standard addressing the effects of PM species composition and relative humidity. There are many aspects of relating ambient PM concentrations to PM light extinction that the agency has noted and that need to be evaluated. However, the lack of specificity of the analyses needed to be performed by the EPA calls into question whether the agency will have sufficient time to develop a comprehensive plan and to fully evaluate all the issues. Moreover, the methods suggested by EPA to address variability in PM composition as part of the visibility standard won't necessarily have the desired effect if average diurnal or hourly profiles (unless they are developed separately for specific regions and specific seasons) are used to convert measured 24-hr PM2.5 concentrations to hourly PM species concentrations. The major comments are:

1. Page 1-5 and throughout: Multiple terms related to visibility are used, but undefined, in this document. In some cases they appear to be used interchangeably. For example, "visual air quality" vs. "visibility." These terms should be clearly defined and their use made consistent throughout the document. While these may be defined in prior documents (e.g. 2008 PM Integrated Science Assessment; 2005 PM Staff Paper), this is difficult to trace. Similarly, often the term "light extinction" or "PM light extinction" is used, when the meaning is clearly intended to be "reconstructed light extinction". One example is page 1-7, line 20 when 'visibility' is used and 'reconstructed light extinction' is meant. This language should be clarified. This issue will become even more important if EPA follows one proposed methodology in particular in which transformations and assumptions are made to create hourly trends of PM2.5 mass from daily average mass, with subsequent assumptions as to hourly speciation profiles to apply to the hourly PM2.5 mass, and finishing with the use of speciated profiles to calculate reconstructed light extinction.
2. Page 1-5: The mention of the hygroscopicity, and subsequent change in scattering efficiency, of certain organic compounds, is an improvement upon the 2005 Staff Paper, which did not mention this issue (see also page 2-7). However, this issue should be addressed in much more detail, including summarizing the current available research, and requires inclusion in the development of new or revised visibility algorithms for reconstructing light extinction in urban or other environments.
3. Page 1-6, Line 13 starting with "In the last review, EPA concluded that fine particle mass concentrations could be used as a general surrogate for visibility impairment": EPA

proposed in the 2005 Staff Paper that fine particle mass could be used as a general surrogate; however, the Staff Paper actually demonstrates that PM2.5 mass is at best a mediocre predictor of light extinction. To make the leap from a "proposal" to "conclusion" in this section is misleading; EPA has failed to reach any such conclusion.

4. Page 1-7, Line 8: While positive relationships were found, the results from these studies did not show high correlations when actual relative humidity data were used. Rather a very large spread of points was observed in both the daily and sub-daily time periods. It is misleading to suggest otherwise, and to base such a statement only on the 10-year climatologically averaged relative humidity when actual RH data exist. This also highlights the importance of getting the composition correct (as this spread is likely due in part to hygroscopicity of certain components), and potential large sources of uncertainty that could result from assumed, rather than measured, speciation profiles.
5. Page 1-20, Lines 14-16: EPA is proposing to use "known relationships between PM mass and speciated components" at a site to calculate the reconstructed PM light extinction using an urban visibility algorithm at that site. The relationship between PM mass and speciated components will vary spatially, considerably from region to region, and seasonally. For an accurate assessment of visibility, EPA would need to develop different speciation profiles for different regions and for different seasons in the same region. It is not clear from the document whether EPA would consider these steps or not.
6. Page 2-4, Lines 19-20: EPA is planning to apply diurnal profiles to the measured 24-hour $PM_{2.5}$ mass concentrations to develop hourly mass concentrations and then to apply hourly speciation profiles to estimate hourly concentrations of each species affecting visibility. There are not enough monitoring data available at the hourly scale to develop robust diurnal and hourly speciation profiles for different parts of the country and for different seasons. The document should describe how EPA plans to overcome this deficiency in the data and still come up with credible profiles. Moreover, the application of two layers of profiles will result in large uncertainties in the creation of a national standard, on top of those uncertainties that result from various geographical areas. This approach will require substantial amounts of testing and analysis to understand the nature of the uncertainties, what drives them, and if they can be minimized. In addition, there are spatial gradients within urban areas (more so than in rural areas) and, possibly, along the sight path that add to the uncertainty if only a single monitoring value is used for an urban area. It may not be possible to minimize these uncertainties sufficiently (given the sparseness of the data) to create a national standard.
7. Page 2-5, Lines 23-24: "Thus, it may be necessary to assume that each hour in a day experiences the same adjustment (possibly by species) as does the day as a whole". This assumption is most likely false as different species may follow different patterns than the diurnal changes in total PM mass, as the individual components of PM are generally controlled by different sources, sinks, and chemistry. Morning and evening rush hour

traffic are example of source-based differentiation. The formation of secondary organic aerosol due to daytime photochemistry is an example based on photochemistry. The formation of nitrate aerosol during nighttime from N_2O_5 hydrolysis reactions is another example of the temporal dependence of chemistry. Moreover, hour-to-hour change in different species and the PM mass would most likely be very different from the average daily change in those concentrations. EPA should include in the scope to evaluate the validity of this assumption before such a methodology is applied.

8. Page 2-7, Lines 21-24: EPA plans to develop an urban optimized linear algorithm by starting with the IMPROVE algorithm and making adjustments to it, as necessary. However, there are not many urban sites available in the country to comprehensively evaluate the new algorithm. Only available urban sites with long-term PM speciation data and light extinction measurements seem to be in the SEARCH network in the southeast. Other urban sites with optical measurements are Washington, DC (IMPROVE site) and in Phoenix, AZ. The limited number of sites doesn't provide an adequate representative data base to evaluate new algorithms for reconstructing light extinction that may be developed. An algorithm that is adjusted to match the conditions in one region would most likely be inappropriate in other regions. When developing the new IMPROVE algorithm, it had become clear that an algorithm developed for one part of the country doesn't perform well in other parts of the country and some compromises had to be made to develop an algorithm that can predict light extinction relatively well in all regions. Conditions in urban areas are more variable than in rural areas, so it is more likely that an algorithm developed using data mainly from the southeast will not be applicable elsewhere. The lack of measured data at sufficient sites from which to create a reconstructed light extinction algorithm should indicate that an urban visibility algorithm is premature.
9. Page 3-5, Lines 14-24: Language in the document suggests that the different assessment scenarios for the visibility preference study have not been defined. Designing visibility valuation or preference studies can be time consuming if one were to attempt to address various biases that creep in these studies, so it is quite concerning that a draft study plan is not available for comment at this time. A recent visibility valuation study, albeit valuing regional haze changes, evaluated many of the issues related to contingent valuation (Smith et al., 2006a; Smith et al., 2006b, references cited below). Many of the conclusions from that study should be valuable in the design of any new study that EPA may be considering.
10. Throughout: The cases for which urban visibility might be studied appear to be numerous and undecided at this moment. For example, the text mentions visibility looking from inside to outside of urban areas, from outside to inside cities, and within cities. These potential cases should be listed explicitly, and the status of any recommendation as to which might be included should be listed.

Minor Comments:

1. Page 1-1: There is no U.S. EPA document (2009b) in the reference list.
2. Page 1-6, Line 8: There is an unnecessary comma after "constituent."
3. Page 1-6, Line 15: It seems this reference was intended to be EPA, 2005b, not EPA, 2005a.

References

1. Smith, A.E., Kemp, M.A., Taylor, C.L., Savage, T.H., and Bishay, M., 2006. Valuing Regional haze Changes: The Sensitivity of Contingent Valuation Results to Questionnaire Format. Final Report to EPRI by CRA International, Washington, DC.

2. Smith, A.E., Kemp, M.A., Savage, T.H., and Taylor, C.L., 2006. Methods and Results from a New Survey of Values for Eastern Regional Haze Improvements. *J. Air & Waste Manage. Assoc.* 55, 1767-1779.

ELECTRIC POWER RESEARCH INSTITUTE

Valuing Regional Haze Changes: The Sensitivity of Contingent Valuation Results to Questionnaire Format

Technical Report

Valuing Regional Haze Changes: The Sensitivity of Contingent Valuation Results to Questionnaire Format

1011852

Final Report, March 2006

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The report is a corporate document that should be cited in the literature in the following manner:

Valuing Regional Haze Changes: The Sensitivity of Contingent Valuation Results to Questionnaire Format. EPRI, Palo Alto, CA, American Electric Power, Dallas, TX, Duke Energy Corporation, Charlotte, NC, FirstEnergy Service Company, Akron, OH, Minnesota Power, Duluth, MN, Reliant Energy, Houston, TX, Southern Company, Birmingham, AL, and Tennessee Valley Authority, Chattanooga, TN: 2006. 1011852.

REPORT SUMMARY

In the past decade, efforts have intensified to enhance air quality by tightening current emissions regulations. Concern with visibility, or regional haze, has become a leading motivator – second only to concerns about possible health risks – for further regulatory action on the most commonly targeted air pollutants: sulfur dioxide (SO_2), nitrogen oxide (NO_x), particulate matter, and volatile organic compounds. Scientific understanding of the causal relationship between reductions in ambient pollution and improvements in regional haze conditions is remarkably reliable and predictable. Economic valuations of regional haze improvements have, however, been slow to evolve toward a more mature state. This report describes in detail an entirely new, large-scale survey of consumer willingness to pay (WTP) to control regional haze in the Eastern United States, with complete documentation of survey design and implementation, supporting development activities, and analysis and discussion of results.

Background

Economists often use the contingent valuation (CV) method to value non-market goods. Rather than analyzing observed consumption behavior to assess the public's value for a good or service (the so-called "revealed preference" information), CV relies on "stated preference" information whereby people state directly how much a good or service is worth to them. The new survey focused on exploring both the individual and cumulative effects of progressively introducing features lacking in earlier visibility CV surveys, for which they have been criticized. Documentation of this new survey will provide credible information for evaluating both the benefits of visibility improvement and the costs associated with emission control technologies required to improve visibility.

Objectives

- To provide improved estimates of the economic value that the general public holds for improvements in regional haze.
- To explore how methodological choices can affect estimates of regional haze value.
- To provide information that can be used to assess the credibility of available estimates.

Approach

The new survey designed for this project focused on the values people place on visibility improvements in the Eastern United States. This is the first major survey of regional haze WTP in 15 years, the last one being the "Preservation Values Study" of the Environmental Protection Agency and National Park Service, documented in Chestnut and Rowe (1990). Since that time, there have been significant advancements in methodologies and tools for surveys, representation

of visibility conditions, and elicitation of WTP data via survey questionnaires. This survey was designed to reflect such advancements.

Results

The new survey design provided insights on the probable quantitative significance of key technical concerns expressed with CV-based visibility WTP estimates over the years. Results of this survey made it clear that most of the U.S. public does indeed care about and assigns personal value to the amenity of good visibility conditions. Many respondents reflected a strong streak of altruism in their stated values, revealing attitudes consistent with there being a component of "existence value" in their responses. However, the distribution of those values is strikingly skewed. Even ignoring all stated values that were zero, there is a wide disparity in expressed values, with a majority ascribing small but positive value, and a minority expressing values so much higher that they end up dominating the sample's mean WTP.

This study found that the particular method of reminding respondents to consider their personal budgets and competing uses for their money when stating their WTP for visibility improvements was the largest and most statistically significant determinant of the resulting average WTP. WTP estimates from a questionnaire that had no budget reminder (as in the earlier CV studies) were six to eight times higher than WTP estimates from a questionnaire that provided budget reminders in multiple ways. Furthermore, follow-up questions revealed a substantial likelihood that even the lower average WTP estimates contain upward biases due to "embedding" of values for other non-visibility environmental benefits within the WTP survey, which in this case focused only on visibility improvements.

EPRI Perspective

The CV method has received much criticism since its introduction more than 30 years ago, and continued exploration of CV methods regularly uncovers concerns and weaknesses regarding their accuracy and reliability. The new survey was conducted to address a range of questions and criticisms regarding earlier estimates of WTP for changes in regional haze, used extensively in benefits assessments and public policy formation. Results obtained enhance the quality of WTP evidence for haze-related visibility improvements by introducing the advantages of modern survey methods developed in recent years.

The results of this study suggest that similar questionnaire advancements should become the standard for any future surveys on public preferences for regional haze improvements. This conclusion is of particular importance, as this study addressed values for visibility improvements in Eastern parks only. The demand for estimates of the national visibility benefits of regional haze and other air quality policies is strong, and this study has shown that earlier studies' estimates are likely to be affected by strong response biases. Without new surveys for other parts of the United States that better address budget constraints – particularly for the Western region – there will be no credible basis for national visibility benefits estimates.

Keywords

Visibility
Regional Haze
Contingent Valuation Method
Air Quality
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Willingness to Pay Surveys

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We wish to thank EPRI for its financial support in completing this project, and our project manager, Naresh Kumar, for his encouragement, support, and helpful comments.

EXECUTIVE SUMMARY

The past decade has been marked by growing public interest in preserving or improving environmental amenities, which has led to increased intensity of efforts to enhance air quality by tightening current emissions regulations. Justification of tighter, increasingly costly regulation intensifies the need for sound estimates of the potential benefits of such actions. Concern with visibility, or regional haze, has become a leading motivator – second only to concerns about possible health risks – for further regulatory action on the most commonly targeted air pollutants: SO_2, NO_x, PM, and VOCs.

Our *scientific understanding* of the causal relationship between reductions in ambient pollution and improvements in regional haze conditions is remarkably reliable and predictable. However, *economic valuations* of regional haze improvements have been slow to evolve toward a more mature state.

The goals of this project were to provide improved estimates of the economic value that the general public holds for improvements in regional haze; to carefully explore how methodological choices can affect such estimates of regional haze value; and to provide information that can be used to assess the credibility of available estimates (for example, whether survey responses are consistent with the theoretical concepts of consumer preferences that they are intended to capture). To accomplish these goals, the authors designed and conducted an entirely new, large-scale, national survey of willingness to pay (WTP) for regional haze in the Eastern U.S.

Visibility conditions due to haze differ substantially between the Eastern and Western United States. The typical type of vista, and potentially the aesthetic responses to that vista, also differs markedly between the two parts of the country. We decided to focus this survey on the values people place on visibility improvements in the Eastern U.S., defining this region as "east of the Mississippi River." This focus was selected so that we could concentrate project resources on exploring the sensitivity of WTP estimates to methodological choices. This approach was deemed preferable to obtaining WTP estimates that could be applied nationally, but the use of which would require uninformed acceptance of a single format for the WTP elicitation process.

This is the first major survey of regional haze WTP in fifteen years, the last one being the "Preservation Values Study" of the USEPA and National Park Service documented in Chestnut and Rowe (1990). Since that time, there have been significant advancements in methodologies and tools for surveys, representation of visibility conditions, and elicitation of WTP. The new survey format was designed to take advantage of the recent advancements, while also providing a clear linkage back to the earlier Chestnut and Rowe survey. This means that our survey applies the contingent valuation (CV) method of valuation, which directly elicits statements of WTP from the sampled population. This survey design allows our new WTP estimates to be compared

readily to the WTP estimates that have been used in visibility policy benefits analyses over the past decade, and also provides insights on the likely quantitative significance of some of the technical concerns that have been expressed over the years.

Economists often use the method of contingent valuation (CV) to value non-market goods. Rather than analyzing observed consumption behavior to assess the public's value for a good or service (the so-called "revealed preference" information), CV relies on "stated preference" information whereby people state directly how much a good or service is worth to them. This requires the use of randomized national surveys. Designing and conducting such a survey was a key element of our study.

The CV method has received much criticism since its introduction over thirty years ago, and continued exploration of CV methods regularly uncovers concerns and weaknesses regarding their accuracy and reliability. Our survey was conducted to address a range of questions and criticisms regarding earlier estimates of WTP for changes in regional haze that have been used extensively in benefits assessments and public policy formation. Our results improve the quality of evidence on WTP for haze-related visibility improvements in several important ways, by introducing the advantages of modern survey methods that have been developed in recent years.

The basic design of our study was one intended to explore both the individual and cumulative effects of progressively introducing some features that were lacking in earlier visibility CV surveys, and for which they have been criticized. We did this by conducting a sequence of five different versions of our survey, each one adding a methodological improvement that we had considered important to explore. We then studied the sensitivity of the CV-based WTP results to these various changes in the design of the CV questionnaire. Each of the five questionnaire versions was implemented with a full-scale survey sample size. These were conducted only after extensive pilot testing on smaller sample sizes.

Although we did use the Chestnut and Rowe (1990) questionnaire approach as a starting point, and the first version of our questionnaire was a near-replica of theirs, we introduced two major differences in our overall survey methods from those of C&R:

- *A different mode of survey administration*: We used an on-line, self-completion, computer-assisted questionnaire, whereas C&R employed a self-administered mail survey. The computer-assisted survey implementation enabled us to implement such features as randomized ordering of scenarios and response lists, real-time checking for internal consistency, and greater tailoring of question wording as a result of the respondent's answers to prior questions.
- *A different sample design*: We used a *nationally* representative panel drawn from members of a pre-recruited random panel maintained by a respected survey research firm, whereas C&R used a randomly selected sample recruited *ab initio* but limited to the residents of *five states*.

The methodological enhancements that we introduced in the course of the five independent surveys include:

- A detailed exploration of the potential for WTP estimates to be biased by lack of budget reminders, single-focus bias (focusing on a single good may induce respondents to ignore other competing demands on their budgets, and unknowingly overestimate their WTP for that single good), and part/whole bias ("embedding" or inclusion of values for other goods together with the value of the environment good that is the subject of WTP question).
- Greater detail and control of the characterization of visibility conditions, and changes to those conditions, for the survey respondents.
- Considerably expanded debriefing questions, allowing better *ex post* assessment of the credibility of the resulting WTP estimates.

Analysis of the responses to the various survey versions suggests intriguing issues for the use and interpretation of these or other CV results for visibility.

The survey respondents in all versions appeared to understand what was being explained, and most respondents seemed cognizant that their responses should reflect a personal willingness to accept cost-of-living increases. Additionally, there were a number of desirable attributes in the patterns of WTP, such as an ability to satisfy most forms of scope tests, and insensitivity to differences in ordering.

Overall, it was clear that most of the U.S. public does care about and assigns personal value to the amenity of good visibility conditions. Many respondents reflected a strong streak of altruism in their stated values, and also revealed attitudes consistent with there being a component of existence value in their responses. However, the distribution of those values is strikingly skewed. A substantial minority (10% to 20%) assigned zero value to the changes in visibility presented to them, without appearing to be offering "protest votes." More importantly, a majority expressed WTP values that were substantially less than the mean WTP across the sample. In the end, even ignoring all stated values that were zero, there is a wide disparity in expressed values, with a majority ascribing small but positive value, and a minority expressing values that are so much higher that they end up dominating the sample's mean WTP.

There were a couple of patterns that should be the subject of further discussion and analysis, because they could affect the overall credibility of using the WTP results from this and earlier surveys as the measures of compensating variation that contingent valuation methods seek to elicit:

- When shifting from a version of the survey that had much larger overall changes in visibility to one that started with much better baseline visibility, and for which there was only about half the amount of change in *any* of the three scenarios asked about, the total WTP remained effectively constant. Although internal and external scope tests were satisfied among the versions that all relied on the same baseline and range of visibility changes considered, the stated WTP may be quite invariant to large, absolute changes in the set of visibility conditions being compared.

- A majority of the respondents agreed that they relied in a moderate to large degree on their personal notions of reasonable charitable contribution sizes when stating their WTP. This could corroborate the pattern noted above – respondents may start from a notion of a fair charitable contribution, and then merely tailor their WTP to relative changes presented from there.

The potential presence of response biases in a CV-based estimate of WTP for visibility was a key concern that we structured our study to explore in some depth. We found substantial evidence of embedding and part/whole bias in the debriefing responses, even in the version of the survey that attempted to address this issue directly. The embedding that our survey detected includes (1) the inclusion of WTP for visibility changes even in urban and suburban areas that were not the subject of the survey, and (2) the inclusion of WTP for other environmental improvements expected to be concurrent with the asserted changes in visibility.

The survey also generated substantial evidence that efforts to get respondents to consider their personal budget constraints can dramatically alter the estimate of WTP that the survey will produce. A multivariate analysis of the results from multiple versions of the survey questionnaire indicates that adding reminders that one has a budget constraint cuts the estimated WTP by a factor of 2 to 4 compared to a comparable questionnaire that omits the reminders. Further, a questionnaire format that elicits a total value for a composite good (a limited "package" of three different air quality improvements), and then disaggregates the total WTP to infer the value of the visibility improvement alone, reduces the estimated WTP achieved with just budget reminders by *another* factor of 2 to 3.

The WTP for a given amount of visibility improvement thus varies by a factor of 6 to 8 from the version of our questionnaire that set out to replicate most closely (albeit not identically) the approach underlying the earlier estimates of Chestnut and Rowe (1990), to our most thorough attempt at addressing budget constraints. These observed effects are statistically significant at the 95% confidence level, and differences in the way budget reminders were offered were found to be, by far, the most important determinant of WTP.

These results reflect only a partial analysis of the data that our survey generated, and further analysis of the copious data that this survey produced could yield additional valuable results. At the same time, the results obtained so far make a compelling case that advancements similar to those that we have introduced should become the standard for any future surveys on public preferences for regional haze improvements. The latter conclusion is of particular importance, as this study addresses values for visibility improvements in Eastern parks only. The demand for estimates of the national visibility benefits of regional haze and other air quality policies is strong, and this study has shown that estimates from earlier studies are likely to be afflicted by strong response biases. Without new surveys for other parts of the U.S. that do a better job of addressing budget constraints – particularly for the Western region – there will be no credible basis for *national* visibility benefits estimates.

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1
INTRODUCTION AND REPORT OVERVIEW

1.1 Project Goals

The past decade has been marked by growing public interest in preserving or improving environmental amenities, and increased intensity of efforts to enhance air quality by tightening current emissions regulations. Justification of tighter, increasingly costly regulation intensifies the need for sound estimates of the potential benefits of such actions. Concern with visibility, or regional haze, has become a leading motivator – second only to concerns about possible health risks – for further regulatory action on the most commonly targeted air pollutants, SO_2, NO_x, PM, and VOCs. Indeed, the progress targets of the *Regional Haze Rule* that the U.S. Environmental Protection Agency (USEPA) promulgated in 1999 may ultimately become more costly to attain than the health-based National Ambient Air Quality Standards.[1] In terms of *scientific understanding* of the causal relationship between ambient pollution and physical effects, improvement in regional haze conditions is one of the most reliably predictable environmental improvements expected to occur as emissions are reduced. However, the *economic valuation* of regional haze improvements has been among the slowest of the environmental amenities to evolve towards a more mature state.

The goal of this project was to provide improved estimates of the economic value that the general public holds for improvements in regional haze, but also to carefully explore how methodological choices can affect such estimates of regional haze value, and to provide information that can be used to assess the theoretical credibility of available estimates.

1.2 Approach Used in Project

To accomplish these goals, this project designed and conducted an entirely new, large-scale, national survey of willingness to pay (WTP) for regional haze in the Eastern U.S. Visibility conditions due to haze differ substantially between the Eastern and Western United States. The typical type of vista, and potentially the aesthetic responses to that vista, also differ markedly between the two parts of the country. We decided to focus this survey on the values people place

[1] The Regional Haze Rule (CFR40 Sec.51.308) requires that visibility in national parks and wilderness areas be improved to natural conditions by 2064, with a plan for achieving continual progress towards that goal that must be re-formed every 15 years. The NAAQS for fine PM (CFR40 Sec.50.7), which is also the primary cause of regional haze, is currently 15 µg/m3 annual average, and a limit of 65 µg/m3 for the 98th percentile daily average. In December, 2005, EPA proposed to tighten the daily average standard to 35 µg/m3. Regardless of possible changes to the standard, the NAAQS are well above background conditions. Fine PM forms hundreds of miles from some of its sources, there is a strong likelihood that visibility degradation will remain in many national parks and wilderness areas even after the NAAQS are attained.

on visibility improvements in the Eastern U.S., defining this region as "east of the Mississippi River." This focus was selected so that we could concentrate project resources on exploring sensitivity of WTP estimates to methodological choices. It was deemed preferable to obtaining WTP estimates that could be applied nationally, but the use of which would require uninformed acceptance of a single format for the WTP elicitation process.

This was the first major survey of regional haze WTP in fifteen years, the last one being the "Preservation Values Study" of the USEPA and National Park Service documented in Chestnut and Rowe (1990). Since that time, there have been significant advancements in methodologies and tools for surveys, representation of visibility conditions, and elicitation of WTP. The new survey format was designed to take advantage of the recent advancements, while also providing a clear linkage back to the earlier survey. This allows our new WTP estimates to be readily compared to the WTP estimates that have been in use in visibility policy benefits analyses over the past decade, and also provides insights on the likely quantitative significance of some of the technical concerns that have been expressed over the years. Most notably, this meant that the survey would apply the contingent valuation (CV) method of valuation, which directly elicits statements of WTP from the sampled population.

This new survey was also designed to explore several different methodological options for the way information is provided to survey respondents, and the way the survey would elicit expressions of WTP from respondents. This allows an understanding of how sensitive estimates of WTP for regional haze can be to a number of important methodological decisions. These insights can be generalized to both the new WTP estimates produced in this project, and to earlier estimates based on a single methodological choice.

1.3 Overview of This Report

This report documents our survey design and implementation, its supporting development activities, and provides an analysis and discussion of survey results. The report is organized as follows. Section 2 summarizes briefly the key methods for assessing WTP, focusing on previous CV studies, and highlights the ways that our new survey advances that literature. Section 3 describes the development of the visibility scenarios that were the subject of the WTP questions in our survey. Section 4 describes each of the five versions of our questionnaire in more detail. Section 5 describes the survey implementation and summarizes the resulting sample's characteristics. Section 6 summarizes univariate measures of mean and median WTP responses, and discusses their sensitivities to questionnaire design. It also summarizes responses to debriefing questions and discusses the interaction between those responses and average WTP values. Section 7 provides a multivariate analysis of determinants of WTP, and also discusses possible use of more advanced "semiparametric" econometric techniques that might be helpful in further analysis of the survey responses. Section 8 concludes with a discussion of the implications of our findings and possible avenues for further research and data analysis.

Several appendices are also provided. Appendix A discusses how an error in the original C&R survey that we detected in the course of our own research has created an upward bias in all previous policy benefits estimates based on that study. Appendix B describes the extensive pilot studies that preceded the implementation of our actual survey. Appendix C provides copies of the exact script of each of the five versions of our questionnaire. Appendix D provides copies of

the cover letters sent to respondents to initiate the survey. Also enclosed as an insert to this report is an example of the visual displays that were used in the survey to characterize the scenarios for which they were asked to state their WTP.

2
ISSUES IN ASSESSING WILLINGNESS TO PAY FOR REGIONAL HAZE IMPROVEMENTS

2.1 Overview of Contingent Valuation Issues

Economists often use the method of contingent valuation (CV) to value non-market goods. Briefly, rather than analyzing observed (or reported) consumption behavior to assess the public's value for a good or service – so-called "revealed preference" information – CV relies on "stated preference" information whereby people state directly how much a good or service is worth to them in surveys. More comprehensive information on the CV method can be found in Mitchell and Carson (1989) and Bateman and Willis (1999). The method, while seemingly straightforward, has met with much criticism over the more-than 30 years it has been in use (see, for example, Hausman, ed., 1993). The continuous exploration of CV methods regularly uncovers concerns and weaknesses regarding their accuracy and reliability. A few of the concerns most commonly expressed are:

- One cause for concern in using CV studies is that some studies have failed to pass "scope tests." A CV study passes a scope test if the study provides higher willingness-to-pay (WTP) responses for larger provisions of an economic good such as environmental cleanliness. For example, Desvousges *et al.* (1993) conducted an experiment in which respondents provided WTP responses that were not sensitive to the amount of the environmental good being analyzed. This raises serious questions as to whether their stated values are for the good that is the subject of the WTP questions, or for some other concept that the survey questions bring to mind, but which does not depend on the actual *amount* of the amenity in question.
- Another cause for concern for CV surveys is "embedding," which occurs when respondents include values for other amenities or goods together with their values for the specific, though less expansive, environmental good that is the subject of the survey's WTP question. For example, respondents asked to value haze reduction may augment their stated WTP by including values for the health improvement that they believe also will occur as visibility improves (due to the general air quality improvements that underlie visibility improvements). This is sometimes called "part/whole bias."
- Critics of CV also emphasize that, because CV studies are only hypothetical payments elicited through surveys, respondents may overstate their true WTP. The incentive to state a greater-than-actual WTP might come from a "warm-glow" feeling that arises from expressing a positive attitude toward the environment, but which does not in any way reflect the specific forms of environmental change that are the subject of the survey question.

- Many have expressed concern with the potential for "single-focus bias" in most CV results. This could occur because most CV questionnaires discuss and ask WTP questions about only a single environmental good. The temporary focus on just that single good may induce respondents to ignore other competing demands on their budgets, and unknowingly overestimate their WTP for that single good.
- Even if "single-focus bias" were not a concern, critics have frequently commented on concerns that the hypothetical nature of CV surveys allows respondents to ignore (or forget) about their real-life budget constraints, possibly also resulting in overstatements of true WTP. Many CV questionnaires have not made efforts to remind respondents to consider their ability to pay when stating a monetary value that is supposed to reflect their willingness to pay.

Despite these and other concerns, policymakers continue to use benefit and value estimates derived from CV surveys because frequently there is no superior alternative, such as marketplace trading where relevant "revealed preference" behaviors can be observed.

2.2 Previous CV Studies for Visibility

Our survey took as its starting point a CV survey performed in 1988 that was funded by the U.S. Environmental Protection Agency (USEPA) and the National Park Service. The draft report from that study, "Preservation Values for Visibility Protection at the National Parks" by Chestnut and Rowe (1990), has been cited widely in analyses of public policies regarding the visibility impacts of regional haze. It has been used as support in many government reports that estimate the benefits associated with air quality programs, including the Regulatory Impact Analyses for fine PM and ozone NAAQS, for the Regional Haze Rule, and in a report to Congress on the costs and benefits of the entire Clean Air Act (USEPA 1997, 1999a, and 1999b). We refer to this earlier study as "C&R" henceforth in this report.

Although C&R has been used to develop quantitative visibility benefits estimates, USEPA's science advisors and the Office of Management and Budget (OMB) have expressed trepidation with a reliance on estimates from a report that is available only as an unpublished draft that lacks peer-reviewed status (USEPA Science Advisory Board, 1999). Other visibility valuation studies exist, but they have been criticized for various methodological problems, and many also lack peer review. McClelland *et al.* (1993) is the only other WTP study on visibility that has been used in recent EPA benefits estimates. It addressed WTP for improved visibility in urban settings that many people experience daily. On the other hand, C&R addressed WTP for improved visibility in national parks, including potential "non-use" or "existence" values. Separate benefits estimates have been frequently developed from both studies and subsequently summed, as if they were separate amenities.

Our study strived to address concerns about the lack of realistic budget constraints and the potential for single-focus bias in the typical CV interview by exploring how efforts to better address these concerns affect WTP estimates for regional haze improvements. In performing this exploration of the sensitivity of WTP results, we also link closely to the C&R survey design.

Thus, our findings of sensitivity in stated WTP can also be viewed as applicable to those reported by C&R.

To address the concerns about budget reminders, we built on an exploratory method described in Kemp and Maxwell (1993), influenced strongly by more recent and comprehensive work along similar lines by Bateman *et al*. (1999, 2003). In the context of the *Exxon Valdez* non-use damages, Kemp and Maxwell point out that copious analogous market research experience for market place goods strongly suggests that two basic characteristics of most CV research – the focus on a single commodity to the exclusion of all others and the *direct* elicitation of WTP values – are likely to induce serious response biases that inflate WTP estimates. To illustrate this point, they report a simple quantitative experiment in which they started with the valuation of a very large composite good, essentially all of the respondent's priorities for improvements in public policy, and asked respondents progressively to allocate their stated value for the composite good in a guided path along a tree structure that might have many tiers of branches. The resulting implicit values were much smaller than those obtained from a comparable single-focus CV questionnaire. For example, WTP was 290 times smaller in the case of protecting the Alaska coastline from marine oil spills.

The Kemp and Maxwell experiment has been criticized for, among other things, starting with a commodity that was too broad and ill-defined, not providing equally detailed explanations of all possible allocations in the tree structure, and more specifically not specifying the quantities and prices associated with the alternative budget allocations. In contrast, more recent empirical explorations of applying CV methods to composite and component goods by Bateman et al. have focused on more tightly-defined situations with highly constrained sets of choices among which to allocate the funds. This work, among other things, highlighted the importance of giving respondents a road map of all the valuation or allocation decisions to be made before starting to elicit values for any one of them. This lesson suggests adopting a more tightly constrained set of choices than in the Kemp and Maxwell (1993) experiment because without such a narrow structure it becomes impossible to inform respondents of all the information that one would ideally like them to know. It is arguable which survey construct most closely replicates the methods by which consumers make their real-world budget allocation decisions; or indeed, whether consumers are reasonably homogeneous in how they go about such tasks. While we suspect that quantity and price information for all alternative real-world choices is often deficient, we decided that to apply such concepts credibly in the case of WTP for visibility improvement required us to adopt a narrow focus for that part of our study that estimates WTP for visibility in a composite-goods setting.

2.3 Methodological Advancements in This Study

This new survey improves the quality of evidence on willingness-to-pay for regional haze-related visibility improvements in several important ways. Given the prominence and frequent current use of C&R within the limited and fragmented visibility valuation literature, our own research focused on that study as a starting point for producing updated and improved WTP estimates. We attempted both to replicate the C&R study and to improve on its methodology by incorporating new insights and the findings of CV research that have occurred since the C&R survey was conducted in 1988. This was done by use of five separate versions of our survey. Our basic approach was to assign members of our survey sample randomly into one of five subsamples,

each of which received a different version of the questionnaire. The first version was a near-exact replication of the C&R survey. From there, we added a sequence of modifications that cumulatively led to a more advanced methodology, particularly with regard to addressing concerns with respondent budget constraints and single-focus bias.

Following is a brief summary of several of the new elements included in the versions of our survey that move beyond the mere replication of C&R's questionnaire:

- Explicit budget reminders have been advocated as good practice in CV surveys, yet were lacking in earlier visibility surveys such as C&R. Respondents should be encouraged to view their WTP responses in the light of both their household financial resources and budgets for existing expenditure patterns (food, shelter, clothing, etc.) as well as competing priorities for other air quality improvements, for broader environmental policies, or for other public policy initiatives. Our study directly explores how alternative ways of adding such reminders may affect the quantitative results, using two alternative methods. One approach simply encouraged respondents to consider both their personal financial circumstances and other public policy priorities before asking them to state their WTP value in the same fashion that C&R had asked. This method still has a potential for single-focus bias but at least mentions budgets. Our second approach asked respondents to value a composite good of air quality improvements that included regional haze change. It then asked respondents to disaggregate that overall WTP into component parts, one of which was the regional haze change alone. This approach diverges from the single-focus approach, following the methods explored by Kemp and Maxwell (1993) and Bateman et al. (2003).
- Visibility improvement is difficult to define clearly in a survey context, creating controversy in the interpretation of WTP results and their extrapolation to actual policy proposals. The aesthetic experience that drives WTP for visibility improvement at national parks is an instantaneous event, and an annual WTP reflects the cumulative impact of many different, individual aesthetic experiences. Further, the change in visibility that a particular policy generates will vary substantially from day to day. C&R used a simplistic method to describe the change in visibility to be valued. Although four photographs were provided to depict the day-to-day *variability* in visibility conditions, the change that a policy would generate was described only in terms of how "average conditions" would change. This approach left the changes in the *distribution* of daily conditions completely unspecified. It is not possible to know what respondents assumed about how much change would occur on different parts of the distribution or to know how consistent respondents were in those assumptions. Our study moved to a more advanced method of describing visibility changes, wherein the questionnaire describes the scenario to be valued as explicit changes in the shape of the distribution, combining histograms with the four photographs. No mention is made of changes in average visibility at all. In addition, our enhanced characterization of visibility levels (unlike C&R) incorporates explicit recognition of the fact that a proportion of summer days are "poor weather days" on which rainy or misty weather conditions mask the aesthetic impacts of air pollution completely or partially. This more complete characterization of the visibility changes to be valued was used in all versions of our survey except the one intended to replicate the C&R approach.

- The C&R approach of describing only how average visibility would change necessarily forced those researchers to focus on very large scenarios of change in visibility. This further complicates efforts to extrapolate the WTP results to actual policy proposals. Our use of histograms allowed us to address more moderate policy changes. We assess WTP for a policy that would have minimal impact on the summertime *average*, less than 1.5 deciviews (dv),[2] while providing very large improvements on the worst visibility days. The added evidence on how the daily elements of a visibility change scenario affect the WTP for the policy is a first step towards developing a more credible basis to extrapolate the benefits of actual policy proposals from CV survey responses.
- Our survey uses a more accurate depiction of the baseline visibility distribution, and eliminates confounding aesthetic factors that were in C&R. For the same vista that we employed, C&R used four photographs of actual conditions taken on different days and in different years. As a result, the photographs had evident inconsistencies in elements of the scenery, coloration, and uniformity of haze, all of which could confound respondents' aesthetic responses to the changes in visual range from picture to picture. Our survey eliminates these potentially confounding factors by using a single base photograph and altering the visual range uniformly and precisely through digital techniques. In preparing the photographs for our survey, we also discovered that C&R's photographic depiction of baseline conditions was inaccurate. Our own study corrects this error, except for the one version of the questionnaire that was intended to replicate C&R's methods closely.
- Following the questions on WTP for haze reduction, all versions of our questionnaire included an extensive battery of debriefing questions to shed greater light on how to interpret the responses to our CV survey.

[2] A deciview (dv) is a measure of visibility impairment, defined such that each dv of changes in haziness causes a roughly constant perceived aesthetic change One dv roughly corresponds to a 10% increase in visual range. Psychometric studies have indicated that people cannot usually perceive changes of less than 1 dv, even under optimal viewing conditions; in many viewing conditions, changes of up to 2 or 3 dv may not be perceptible.

3
DEVELOPMENT OF SCENARIOS FOR THE VISIBILITY VALUATION SURVEY

This section discusses the issues considered in creating and describing specific scenarios of change in regional haze to be valued in the survey. Section 3.1 discusses how the real phenomenon of constantly varying regional haze would be described to the general public that would be the survey respondents through, visual displays, and explains our particular choice of photograph to represent Eastern parklands. Then, Section 3.2 documents the steps we took to construct a baseline visibility distribution from first principles; Section 3.3 documents the four scenarios of change in visibility conditions that were valued on our questionnaire; and Section 3.4 documents how we condensed the visibility baseline and scenarios into an integrated set of photographs, graphical displays, and text that were used in the actual survey.

3.1 Describing Visibility Conditions

In 1993, the Federal Register published a report by a panel of experts on good practices for producing reliable WTP estimates from CV.[3] One of the issues raised by the expert panel was the need to provide sufficient information to permit the respondents to understand precisely the nature of the commodity that they are being asked to value. Visibility is a notoriously difficult environmental commodity to define for a CV survey. To start with, the public has no experience assigning quantitative measures to various degrees of visibility impairment. The metrics that scientists use to characterize the degree of haze are nearly meaningless to the general public.

3.1.1 Metrics Used by Visibility Researchers

The fundamental metric for visibility that researcher use is "light extinction." Once explained, light extinction is a reasonably intuitive concept: it identifies the amount of a total quantity of light initially transmitted that would fail to reach a destination one million meters (Mm) away because it would be scattered or absorbed by airborne particles and gas molecules along the path of the light beam.[4] The units of light extinction are therefore stated as a fraction per Mm, denoted Mm^{-1}. Although the concept may be easily explained, only visibility researchers may have any idea what a favorite view might look like when the light extinction is, say, 300 Mm^{-1}.

[3] Federal Register, Vol 58, No. 10, January 15, 1993, pp. 4602-4614.
[4] 1 Mm is 1000 kilometers.

Light extinction is often converted to a metric called "visual range," which is usually stated in units of kilometers. This is a less precise concept because the actual distance that one can see depends on the contrast of the objects being viewed, the angle of the light, the altitude, and the physiological threshold for perception, which varies among humans. The metric that scientists call "visual range" assumes maximal contrast, optimal lighting conditions, altitude of 2000 m, and an average threshold of physiological perception.[5] Although respondents may be more able to interpret roughly what a visual range of 13 km would mean for their favorite view, it is an inherently imprecise descriptor and still not one that is familiar to many people. Finally, the ability to perceive an amount of change – and its aesthetic impact – is not *linearly* related to changes in visual range or light extinction. In efforts to express visibility changes in a metric that is roughly linear with the ability to perceive change, visibility scientists use the "deciview" (dv), which is a logarithmic transformation of visual range or light extinction.[6] While its supposedly linear relationship with the perception of changes in visibility renders it useful to benefits analysts, once a WTP has been obtained, the dv is as unfamiliar to the public as the other metrics of light extinction, and cannot be used to describe visibility in any actual survey that elicits public WTP for visibility changes.

3.1.2 Use of Photographs to Describe Visibility in Surveys

Lacking any meaningful way of describing visibility changes in *numbers or words* for use in a survey of the general public, CV surveys on visibility typically rely on *photographs*. Typically, a single vista is selected by the researchers, and two or more photographs of that vista are presented in their survey displaying different visibility conditions at the same location at different points in time. To avoid overly simplistic side-by-side comparisons, usually three to four photographs have been used to better reflect the range and variability in visibility over time, while hopefully avoiding information overload through too many photographs.

While they help to address the difficulties encountered in describing visibility conditions in a survey of the general public, photographs present other difficulties because (i) they can introduce confounding variations in other aesthetic attributes due to variations in (for example) coloration, focus, and elements of the scenery, and (ii) they narrow the focus to particular vistas at particular points in time.

The first problem, of confounding variations, now can be mitigated by using computer-based methods to generate precise amounts of haze against a common base photograph, and by maintaining quality control in the preparation of the visuals used in the survey instrument. Computer-generated photographs are a feature of our CV survey not used in C&R and other earlier visibility CV surveys. Digital imaging methods are not fully satisfactory, because visibility changes are not always uniform in space as the digital method simulates. Nevertheless, we feel that it is more important to estimate WTP in a controlled manner, where the changes being shown to the respondents are strictly related to well-defined regional haze levels and not confounded by any other aesthetic alterations of the vista.

[5] Visual range (km) = 3912 ÷ light extinction (Mm-1).
[6] dv = 10 x ln(light extinction/10).

The second problem, of a narrowed focus, can possibly be mitigated by use of more than a single vista from a given location. This has been done in some surveys, such as McClellan et al. (1993). C&R's original survey provided vistas for three different parks in different parts of the U.S. (i.e., Shenandoah, Yosemite, and Grand Canyon), but this was more to obtain separate values for haze changes in each park area than to broaden the focus when eliciting a single WTP. This does not address the fact that values for visibility in Shenandoah are likely formed by many different aspects of visual experience when in the park. In the end, the single vista used for the Shenandoah National Park is assumed to be emblematic of a range of types of vistas and visual experiences, and one must hope that respondents are able to extrapolate from vista(s) shown to the experience at large.[7]

3.1.3 Choice of Vista for This Survey

From the outset, our study was limited to consideration only of WTP for Eastern park lands, in order to focus our resources on understanding the impact of questionnaire format. However, one of our goals also was to provide a link to the widely used C&R WTP estimates, to provide a clear context for interpreting the alternative estimates that our study would also produce. A sudden shift to a different vista than C&R used could have had a significant impact on elicited values that we would find impossible to identify. Nevertheless, at the beginning of our study we did consider possible alternative vistas to the specific one used by C&R for an eastern park. In particular, there was some sentiment that the C&R vista, which was a location called "Rocky Mt" in the Shenandoah National Park, was not very aesthetically appealing. Further, we considered the suggestion that the location most appropriate for representing eastern parks should be one from the Great Smoky Mountains, which is by far the most visited park in the East.

We obtained several alternative photographs of Eastern park land vistas from National Park Service archives for consideration, including alternative Shenandoah vistas, Great Smoky Mountains vistas, and several other less renowned areas that provided different visual features. In all cases, the photographs had excellent visual ranges.[8] Informal but extensive interviews of colleagues, advisors, and friends revealed that there was no consensus at all on which vista seemed most appealing. In fact, there was a nearly uniform distribution in preferences across all of the photographs. Additionally, we found no literature offering objective methods for identifying a more appealing, or more representative vista. We did not want to risk having any aesthetic change that we could not justify as "better" in some objective or survey-based manner, intervene in our ability to determine the impact of alternative questionnaire formats on stated WTP. We therefore chose to proceed in our survey with the same Rocky Mt. vista that C&R used. Assessment of the representativeness of this particular vista for use in a CV survey for Eastern values must be the subject of future research, and we do not attempt to justify it here except as a way of benchmarking our results to those of C&R.

[7] Responses to some of our survey's debriefing questions suggest that most respondents did indeed think more broadly about visual experiences when providing their WTP. These responses can be reviewed in Section 6 of this report.

[8] We used a CD of photographs used in National Park Service haze research that was produced by Air Resource Specialists.

We also decided to use four photographs, as did C&R, to depict the range of visibility conditions across the summer, with each one reflecting a perceptibly different amount of haze. Each photograph's haze reflects a specific point along the current distribution of daily summertime visibility, and is *representative* of a continuous range of visibility along that distribution. The frequency of conditions over that range provides a discrete probability than is assigned to "conditions like those" in each photograph. When visibility conditions "change," this means that the entire distribution is changed. This could be summarized by altering the probabilities associated with each photograph, or it could be summarized by providing another set of four photographs with the same probabilities as in the baseline. The former is much more manageable, as it allows as many scenarios of change to be valued in one survey using only four photographs. This is the approach that C&R used, and that we also adopted.

C&R, however, limited their characterization of the distribution shift to text descriptors of the current frequency of each of the four photographs. For example, underneath each photograph (labeled A through D, with A being the clearest and D the haziest) C&R provided captions indicating that they occurred on 15%, 20%, 40% and 25% of summertime days, respectively. With these particular frequencies, photograph C would also be representative of "average conditions." Indeed, C&R told respondents that photograph C was typical of average conditions. Thereafter, C&R described the visibility commodity being valued in terms of deviations from average conditions. For example, respondents were asked to value policy changes that would improve average visibility to conditions like those of photograph B. In turn, they were also asked their WTP to improve the average visibility to that of photograph A or, separately, to avoid deterioration to average visibility like that of photograph D.[9] However, at no time did C&R's questionnaire alter the probability associated with each photograph in a way that would be consistent with B, A, or D becoming the new "average" condition. C&R's survey results must be interpreted in the absence of any information on what respondents may have been thinking about how day-to-day experiences would be altered under each scenario.

Thus, the C&R survey made a partial attempt to characterize its visibility change scenarios as the cumulative effect of many varying daily experiences. However, the lack of greater detail on the distribution shift has two undesirable impacts. (1) It implicitly encourages respondents to assign WTP values based on a side-by-side comparison of just two photographs (i.e., C versus B, C versus A, and C versus D, for the three respective scenarios). This could cause them to start to think of the choice as being "always like C" versus "always like B," thus losing sight of what might be the frequency of very clear and very hazy days. (2) This method limits the researchers to only elicit values for scenarios involving very large visibility changes. This makes it problematic to assess benefits of policies offering smaller or more subtle forms of improvement.

A CV-based estimate of WTP based on a more thorough and unambiguous description of how respondents should expect their daily experiences of visibility to be affected is likely to have greater credibility than the C&R approach, *ceteris paribus*, as long as the larger amount of information does not introduce new cognition problems. Our survey enhanced the characterization of policy impacts by adding more explicit information on the distribution and by specifically describing each scenario of change as a new distribution. This was done by

[9] All C&R survey versions presented these three change scenarios in this same order.

supplementing the photographs with a histogram reflecting the frequency of each photograph both for current conditions, and under the changed conditions of the scenario to be valued. Figure 3-1 provides an example of such a histogram, and an example of the actual pairing of photographs, histograms, and text is provided as an insert to this report. Versions of our questionnaire that used the histograms did not tell respondents the average in each new distribution and thus did not prompt respondents to make two-way comparisons of subsets of photographs.

McClelland *et al.* (1993) used histograms to describe the visibility shifts in a similar manner. In our case, however, we have used a more detailed histogram format. Rather than attempt to portray very simple changes on a single bar chart, as did McClelland *et al.*, we have shown the baseline and changed scenario in a side-by-side format.

The use of this more complex information was carefully piloted in face-to-face and on-line interviews, to ensure that respondents were able to understand what they were being told. Those pilot tests indicated that respondents could correctly interpret the histograms, and how they related to the photographs. Thus, we feel that this method of characterizing visibility changes provides results that are more readily used in benefits transfer.

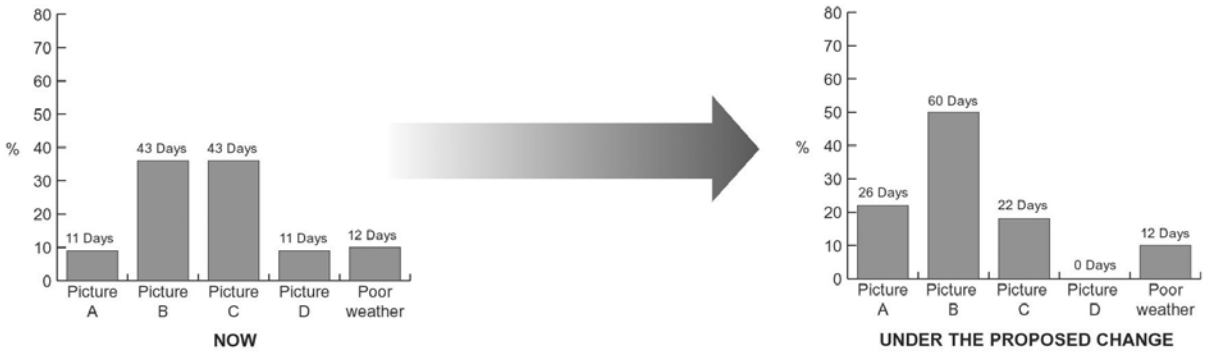

Figure 3-1
Example of Histogram Used to Illustrate a Change in the Visibility Distribution

3.2 Derivation of the Baseline Visibility Distribution

The description of current conditions, or "baseline" in a CV survey should be consistent with the current conditions that respondents actually experience, and which they will accept as realistic. Visibility has improved substantially since 1988 when C&R performed their survey. Thus, it was not considered wise to simply adopt their baseline for the new survey. We developed our own baseline , using current data. We also used this as an opportunity to review the basis for C&R's baseline.

To characterize the visibility distribution for the Shenandoah region, we performed an extensive analysis of a large record of air quality and weather data from the IMPROVE (Interagency Monitoring of Protected Visual Environments) monitoring network.[10] This monitoring network maintains a continuous record of ambient aerosol concentrations, weather conditions affecting light extinction, and directly-measured light extinction in many park locations throughout the U.S.[11] Given our use of the Shenandoah vista first chosen by C&R, we relied primarily on data from the Shenandoah National Park monitor (SHEN1), much of which dates back to 1988. We also reviewed data for other Eastern monitor locations in the IMPROVE network and found that the Shenandoah data are quite representative of Appalachian conditions generally. Most notably, they were similar to conditions measured in the most visited eastern park, the Great Smoky Mountains National Park.

Light extinction is caused by many different types of ambient aerosols and atmospheric gases, each with a different degree of extinction per unit of ambient concentration. Additionally, light extinction is enhanced by relative humidity, which makes some particles larger. Sulfates (SO_4) and nitrates (NO_3) are the sources of extinction most strongly affected by relative humidity. Although there is uncertainty in the specific parameters, researchers at the time used the following equation to estimate or "reconstruct" light extinction from information about ambient concentrations (measured in $\mu g/m^3$) of key aerosols:[12]

Light extinction = 10

+ 3*(concentration of ammonium sulfate + ammonium nitrate)*F_T(RH)
+ 4*(concentration of organic mass)
+ 1*(concentration of soil)
+ 0.6*(concentration of coarse matter)
+ 10*(concentration of light-absorbing carbon)

where F_T(RH) is a non-linear function of the relative humidity (RH) reflecting the fact that the extinction efficiency of sulfates and nitrates increases as RH increases, becoming particularly steep for RH above 80%:[13]

$$F_T(RH) = -0.18614 + 0.99211 * (100/(100-RH)).$$

[10] All data used, and further information on the IMPROVE data can be accessed from http://vista.cira.colostate.edu/improve/ .

[11] The two direct measures of light extinction are from nephelometers and transmissometers. However, nephelometers measure only a subset of aerosols and the IMPROVE website strongly cautions against using solely transmissometer data as a measure of visibility. Therefore we have opted to use reconstructed light extinction for our analysis. See http://vista.cira.colostate.edu/improve/Publications/GrayLit/TransDataUseWarning/TransDataUseWarning.htm.

[12] The equation is from IMPROVE (2003). The constant term, 10, is the light extinction associated with natural atmospheric gases, often called Rayleigh extinction.

[13] The specific form of the equation FT(RH) used here is the one for summer months provided in Table 3.1 of IMPROVE (2003), developed for use with daily average RH values, to be used in conjunction with daily average aerosol concentrations such as are reported in the IMPROVE data.

We developed our distributions by extracting from the IMPROVE 24-hour average aerosol concentration files all of the summer days in July through September with complete data for each of the aerosols in the light extinction equation.[14] We used the years 1997 through 2001, which were the five most recent years for which complete, quality-checked summertime data were available at the time. This produced 104 individual observations of daily aerosol concentrations (there were 428 for the entire year). Estimation of light extinction also requires data on RH. For regulatory purposes, the USEPA mandates use of a specific fixed set of average monthly RH values and these fixed values are used to produce a set of daily reconstructed light extinction values that IMPROVE reports with each of its daily aerosol concentration observations. However, RH varies widely across the days within a month, and the method of setting RH at a fixed value reduces the variance from that of the true, observable distribution of light extinction. For a CV survey, the baseline distribution should reflect all important sources of variation. For this reason, we used IMPROVE aerosol concentrations for each day, combining each observation with a distribution of possible RH levels. Data supporting our distribution of summertime daily average RH values were also taken from the IMPROVE data for the Shenandoah site.[15]

With these two sources of variance, we then created our own distribution of daily average light extinction, using the same equation that USEPA mandates for reconstructed light extinction, but also incorporating variance in daily average RH. This was done by translating the distribution of RH into a distribution of F_T, and then condensing that distribution down to three discrete probability-weighted values.[16] Each of the 428 observations of aerosol concentrations (of which 104 were summertime observations) was assigned equal probability, then combined with each of the three different F_T levels, to generate 1284 data points for the year-round distribution, and 312 data points for the summertime-only distribution. The probability weights for each data point was equal to 1/n times the probability of the data point's F_T value, where n was 428 for the year-round distribution, and 104 for the summertime-only distribution. We developed our estimate of the distribution of daily average visibility by treating each observation extracted in the above manner as an independent random draw from a "true" summertime distribution. All individual observations were retained as data points along the distribution, rather than attempting to fit a parameterized distribution. Distributions for visual range and dv were then derived from the light extinction distribution.

[14] The ASCII files of these data for all parks are available from http://vista.cira.colostate.edu/improve/Data/IMPROVE/AsciiData.aspx. We used the SHEN1 data file for Shenandoah National Park.

[15] RH data are available in data files for the transmissometer and nephelometer stations that are present at the same general location as the Shenandoah aerosol concentrations are collected. We used the RH data in the transmissometer files, as these appeared more complete. We used all good RH readings in the summer months between the hours of 5 am and 9 pm for 1994-2001. (We felt that RH should not be subject to the same temporal trends as aerosol concentrations, and so we used all years of data available. National Park Service warned against using RH data from before 1994, however, due to data quality concerns.) RH data are measured several times each day. A "good" RH observation was one where the validity codes were "0" for each of RH, bext, and temperature taken in that hour by that instrument (even though we only used the RH reading). After screening for all good values, we computed an average of all the values available for each day, to obtain an approximate daily average RH. These daily values were used to construct the distribution on RH that was combined with the daily aerosol concentration distribution. Note that our screening method will eliminate RH measures on rainy or foggy days. These days are addressed separately in our characterization of the distribution.

[16] The three discrete FT values were 2.5, 3.8 and 6.7, with probabilities of .4, .45 and .15, respectively. The FT values are associated with RHs of 63%, 75% and 86%, respectively.

Figure 3-2 shows the resulting distributions of visual range and dv for summertime, non-summer, and year-round average. It demonstrates the degree to which Shenandoah experiences more visibility degradation in the summer than other times of the year. We find that average visibility in the summertime is 31 km (25 dv). All other months have an average of 56 km (20 dv).

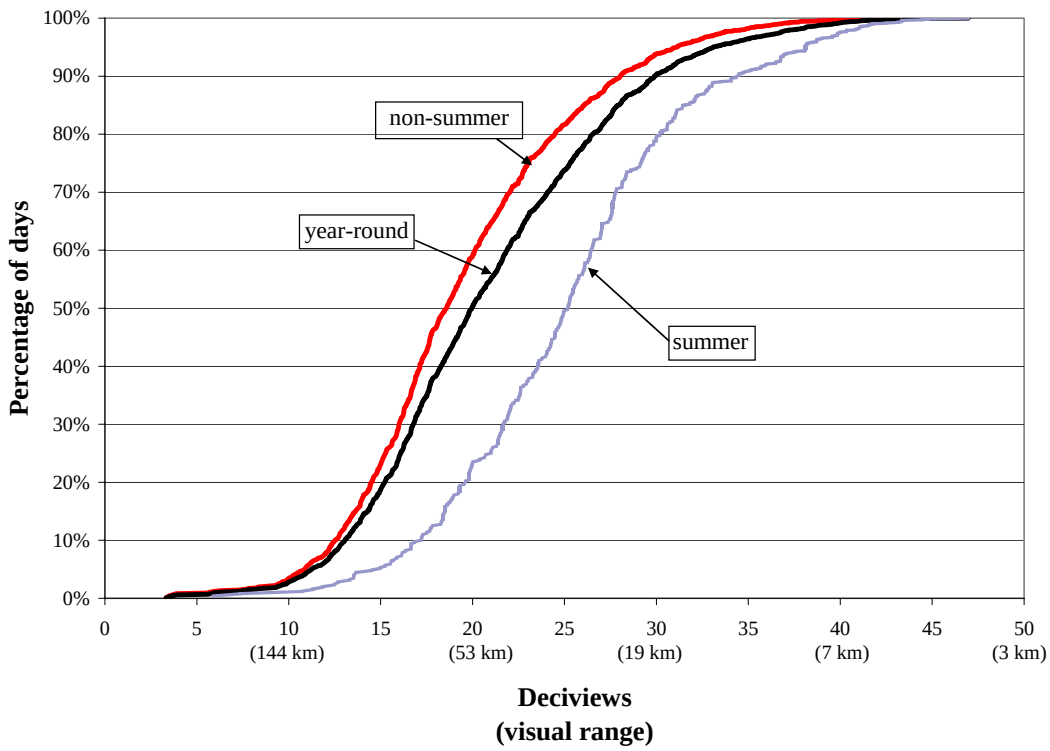

Figure 3-2
Full Distributions for Current Baseline Visibility Conditions by Season and Year-Round

Crucially, our method preserves the correlation in actual concentrations of different types of air pollution caused by the fact that most species of air pollution tend to move together in air masses. Although it assumes RH and aerosol concentrations are probabilistically independent, this method produces a greater and more realistic degree of variance in the baseline distribution of visibility than if we relied on the reconstructed light extinction estimates provided in the IMPROVE database. The 10th and 90th percentiles in our estimated distribution of non-rainy, summer daytime average RH are 60% and 80% respectively. In contrast, the USEPA formula for reconstructed light extinction assumes RH is a fixed value in each month with a low of about 72% in June and a high of 76% in August. Given the extreme non-linearity of the $F_T(RH)$ function, our method introduces a variation of about ±40% in sulfate and nitrate light extinction compared to calculations used to produce the reconstructed light extinctions reported in the IMPROVE data sets.

To understand how the baseline distribution has changed since the time of the C&R survey and to confirm C&R's reported baseline distribution, we applied the same methods to the Shenandoah data for 1988 through 1992. (1988 is the earliest year for which aerosol data are available for the Shenandoah site and C&R's survey was conducted in that year.) Figure 3-3 compares the current (1997-2001) summertime distribution to the comparably constructed distribution for the earlier period, 1988-1992. Figure 3-3 also shows the distribution that C&R reported in their 1988 survey.[17] An improvement in the visibility distribution between the earlier and current period is observable, reflecting the fact that the air pollution has been declining since the time of C&R's survey. Figure 3-3 also reveals that C&R's estimate of the baseline distribution was not unrealistic for that time. The average condition (Photograph C) is indeed the average of the distribution in Table 3-1, but it also falls very close to the average of the actual distribution for that approximate time that we estimated independently in our study.

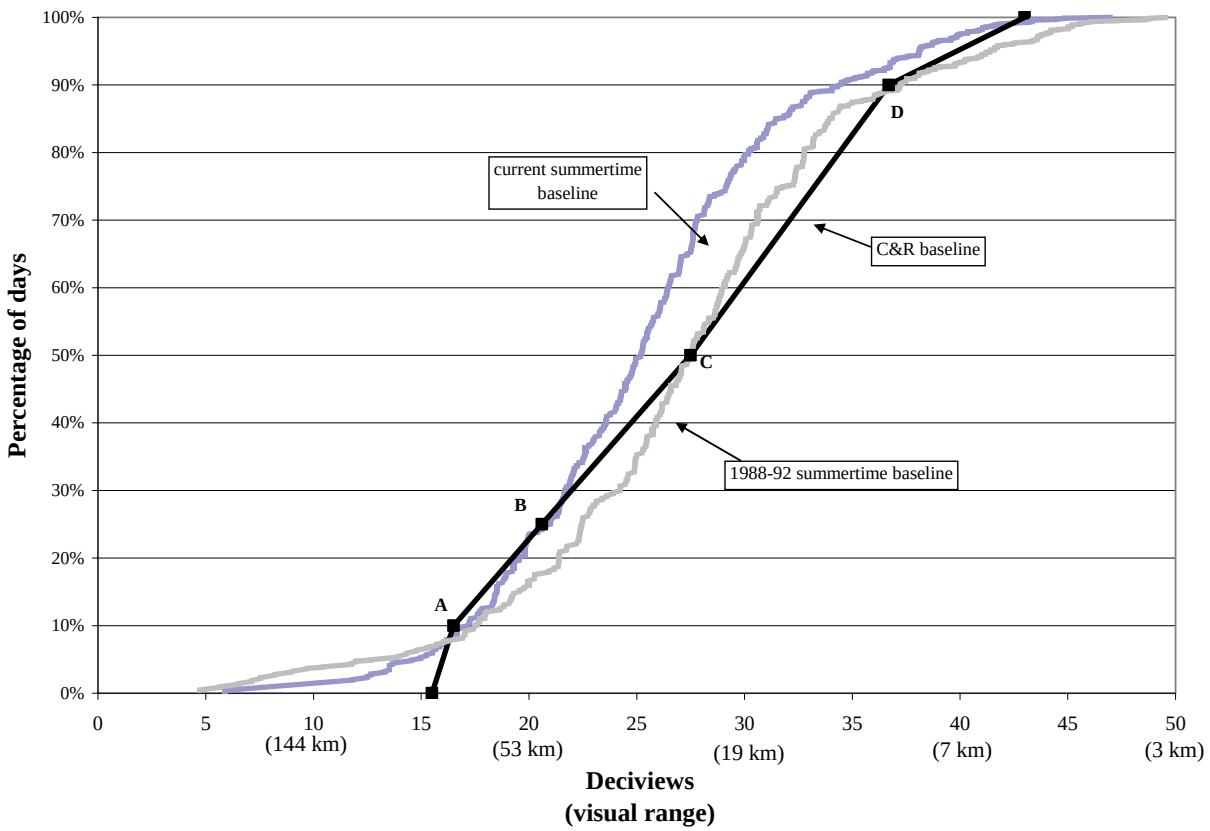

Figure 3-3
Comparison of Summer Baseline Distributions: IMPROVE Data for 1997-2001, 1998-1992, and Distribution Described in C&R

[17] C&R reported only four points on their distribution, which accounts for its piecewise-linear appearance in Figure 3-3. The squares on the distribution reflect the reported positions of each of their four photographs, A through D, and are labeled accordingly.

3.3 Scenarios of Changed Visibility

As noted previously, C&R's scenarios of visibility changes were not described in terms of how the baseline visibility distribution would shift. Rather, C&R provided a description of the current distribution in terms of four specific points and associated probabilities; then, alternative scenarios with changed visibility were described only in terms of their "average visibility" being like one of the other three photographs.

C&R valued three visibility scenarios in all, with respective shifts of the average from C to B, A, and D (always in that order). Table 3-1 summarizes the numerical visibility attributes of the four C&R photographs of the Shenandoah vista, which in turn summarizes the three scenarios of change in the C&R survey.[18] For example, the first scenario was to have average conditions shift from those of photograph C to those of B. This is a shift from an average of 27.5 dv to 20.6 dv (1 deciview of change is about a 10 percent change); in terms of visual range, the average visual range is doubled. This is the scenario with the smallest change in the C&R survey, and reflects a very large improvement in visibility, especially if respondents had viewed it as the amount of change that could be expected on every day of the season.

Table 3-1
Visibility Levels and Captions for the C&R Photographs

	C&R reported values	
	Visual range (km.)	Deciviews
A. Visibility on about 15% of days	75	16.5
B. Visibility on about 20% of days	50	20.6
C. Visibility on about 40% of days	25	27.5
D. Visibility on about 25% of days	10	36.7

As described in Section 2.1, our survey described each scenario to be valued as a complete distributional shift by combining histograms with the photographs. We elicited values for four scenarios. Three of the scenarios were devised to be comparable to those of C&R, but working from the more recent baseline distribution. The fourth was a substantially different scenario, being smaller than the other three in terms of its average change, but larger than the others in the underlying shifts on certain low-visibility days.

3.3.1 Manipulation of Baseline Distribution to Create Four Scenarios

First, we discuss how we developed three scenarios analogous to those of C&R. There are an infinite number of ways that a change in the average conditions could be accomplished, but the simplest is to assume that all days on the distribution would experience an equivalent proportional increase in visual range or decrease in dv as that of the average. This may not be

[18] The respondents saw only the captions, which are repeated in the first column of Table 3-1; they were not given the numerical information used in Table 1 to characterize the different visibility conditions.

very representative of actual policy impacts in the real world, but it is the simplest, and we think it is the most likely way that C&R's respondents thought about the changes, if they were cognizant of any distributional shift at all. We adopted this method for adjusting our current baseline to develop three scenarios roughly analogous to the three of C&R.

Using our summer baseline distribution (see Figure 3-2), we estimated the mean visibility in each of the percentile ranges that C&R used for their four photographs. Table 3-2 compares our baseline distribution's values to those of C&R within these segments. We then estimated the proportional shift from the visibility mean in the range that C&R's Photograph C represented to the visibility mean in each of the other three ranges. This became a "rollback factor" that we then applied to every point along our current baseline distribution to obtain new distributions for three of our scenarios. Table 3-3 summarizes the rollback factors used to accomplish the baseline distribution shifts consistent with each of the three average-change scenarios used by C&R.[19] Figure 3-4 displays the resulting distributions, which we labeled *beta* for the "C to B" improvement scenario analog, *gamma* for the "C to A" analog of improvement of all days to near-pristine levels, and *delta* for the "C to D" deterioration scenario analog.

Table 3-2
Comparison of Baseline Visibility Distributions for C&R and the New Survey

Photograph	Description	Average visibility in C&R baseline	Average visibility in current baseline
A	Clearest 15% of days (0th to 15th percentile of days)	75 km (17 dv)	85 km (15 dv)
B	Next clearest 20% of days (15th to 35th percentile of days)	50 km (21 dv)	50 km (21 dv)
C	Next 40% of days (35th to 75th percentile of days)	25 km (28 dv)	30 km (26 dv)
D	Worst 25% of days (75th to 100th percentile of days)	10 km (37 dv)	13 km (34 dv)

[19] We performed all the proportional scaling on the deciview distribution. The rollback factor is equal to the ratio of the deciview of the new mean to the deciview of the original mean. Differences from this ratio using deciviews reported in the table are due to rounding of the deciviews reported in the table.

Table 3-3
Characterization of Distributional Shifts Commensurate With C&R Visibility Change Scenarios

Scenario	Proportional rollback factor applied to new baseline	Change in visual range (change in dv)
"Average" changes from C to B	0.61	+37% (–5 dv)
"Average" changes from C to A	0.82	+135% (–10 dv)
"Average" changes from C to D	1.35	–64% (+9 dv)

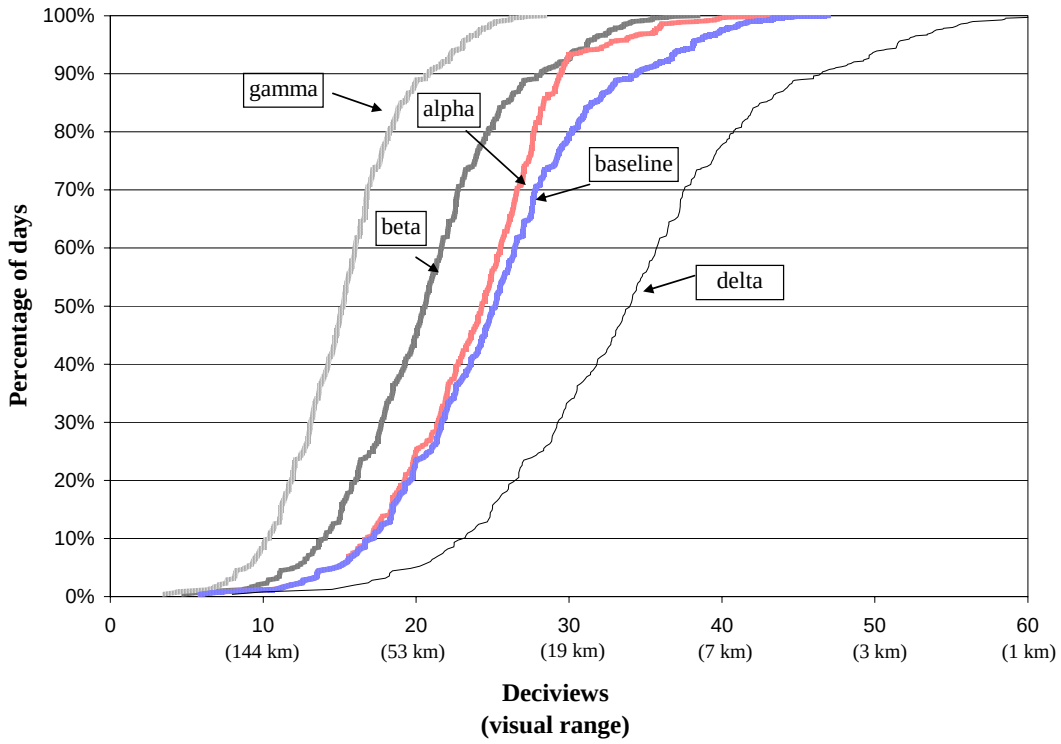

Figure 3-4
Full Distributions for Baseline and Four Scenarios of Changed Visibility Conditions in New Survey

Our fourth, smallest change scenario is also depicted in Figure 3-4 labeled as *alpha*. This fourth scenario lies outside of the envelope of changes considered by C&R and entails a non-proportional shift of the baseline distribution. In this fourth scenario, only the worst visibility days are improved. This scenario is of particular interest because it is much closer in design to the literal requirements of the Regional Haze Rule.

To construct the *alpha* scenario, the days in the top 20th percentile of the distribution were rolled back by a dv amount randomly selected from the range of 0 to 15 dv. This represents a very large potential improvement on a relatively small portion of the days. For example, the 80th percentile day has a 30-dv degradation, which is a 19 km visual range. A 15-dv improvement on such a day implies a 350% increase in visual range to 87 km. On the other hand, these large improvements do not occur every day, and summertime average visibility is reduced by only 1.4 dv. (The annual average is reduced by less than 1 dv.)

C&R's method of asking only about average changes could not have addressed such a small change because its average visibility would not be perceptibly different from that of C&R's photograph C. However, in a survey that depicts the entire distributional shift explicitly such as ours, the WTP for scenarios like this become possible to explore.

3.3.2 Representation of the Four Scenarios in the Survey Format

As documented above, the four scenarios were estimated as the complete distributions graphed in Figure 3-4. However, to describe them in the survey as histograms, we needed to restate them as probabilities associated with four unchanging photographs. This involved, first, selecting the visibility levels for the four photographs. Our use of histograms had an added benefit in this matter: we were no longer constrained to set the photographs' visibility conditions so that each would be representative of one of the scenarios. (This is also why we are able to have more than three scenarios in our survey while still using only four photographs.) We therefore chose to set the visibility conditions for our four photographs to be spaced in a way that they were more evenly distributed over the distribution, and so that the associated histogram would reflect its symmetry (i.e., with larger probability for the two middle photographs, and with lesser probability for the best and worst conditions, thus better capturing the tails of the distribution). Accordingly, the photographs were set with visibility conditions of 96 km, 45 km, 23 km, and 8 km (14 dv, 22 dv, 28 dv and 38 dv, respectively). Note that the mean of our current summertime baseline, which is 25 dv, lies *between* the photographs B and C, and is not associated with any specific photograph. With these choices of visibility levels for the photographs, we then could assess the probability associated with each one against each of the underlying distributions.

However, first we also introduced another new element to the characterization of the scenarios, to address to some of the criticisms of earlier CV work on visibility. The criticism was that respondents needed to also be reminded that on many days of the year, they cannot observe the visibility changes in the photographs at all, because of fog, rain or other weather conditions. Our survey added explicit information on the incidence of foggy or rainy days where changes in air

pollution concentrations would have no effect on visibility throughout the entire daytime.[20] Our visual displays of the four photographs added a fifth "blank" of a grey box in the sequence to reflect these weather-impacted days, and the histograms included a fifth bar to represent their frequency (which does not change with changing visibility conditions).

Table 3-4 summarizes the incidence of days consistent with each photograph in the baseline and in each of the scenarios that were valued in our survey. These percentages were used to develop the histograms used in all versions of our questionnaire except for the one that replicated the C&R survey. For that one version, we used the probabilities and photographs with the same visual ranges used by C&R (Table 3-1), and did not include the blank for days of bad weather.

Table 3-4
Summary of Baseline and Alternative Visibility Distributions

	Photo A 96 km 14 dv	Photo B 45 km 22 dv	Photo C 23 km 28 dv	Photo D 8 km 38 dv	Blank depicting rain or fog conditions
Baseline	9%	36%	36%	9%	10%
Alpha	9%	39%	40%	2%	10%
Beta ("C to B")	22%	50%	18%	0%	10%
Gamma ("C to A")	72%	18%	0%	0%	10%
Delta ("C to D")	3%	5%	37%	45%	10%

Neither C&R nor the new survey provided any information to respondents about the visual range or dv levels associated with any of the photographs. The purpose of the data in Tables 3-1 and 3-4 is only to document the quantitative conditions represented in the photographs and histograms describing each visibility scenario in our survey.

[20] To assess the fraction of days with such poor weather, we analyzed IMPROVE nephelometer and transmissometer data files, both of which provide codes indicating weather-interference. We identified the fraction of days for which weather-interference existed for *all* of the hours from 10 a.m. through 4 p.m., inclusive. This revealed that about 30 percent of summer days in the Appalachians are rainy, not just in at the Shenandoah site, but at other Appalachian IMPROVE sites. This was generally confirmed by review of Weather Service data on precipitation, although those offered a less precise way of assessing degree of visibility impairment by weather. Deciding to err on the side of understatement, our survey indicates that only 10 percent of days would have such poor weather that visibility conditions due to air pollution could not be observed at all. We also assumed that bad weather days are not correlated with bad air quality days. This also may result in understatement of how weather undermines the ability to benefit from improved regional haze levels.

3.4 Photographic Representations of Conditions

The previous sections have explained how we chose the vista and visibility levels for the photographs that we used in our survey. This section explains some of the other technical issues that we faced and addressed in preparing the photographs.

The photographs used by C&R were reproductions of photographs taken on days that exhibited different visibility conditions. Since each photograph was taken on a different day, they also exhibited differences due to such extraneous factors as weather, coloration, and even features in the photographs. They also displayed variations in haze conditions. We decided to rely on a single base photograph, and to use computer imaging to alter the visual ranges to create photographs depicting other levels of haze, thereby providing greater accuracy and uniformity in our representation of haze-related visibility conditions. Moreover, all the visual aids printed for use in this study were reproduced with uniform coloration, both across the four photographs seen by any one respondent and across all of the sets of visual aids that were printed.

To prepare the photographs for this survey, we obtained the original slide of C&R's photograph A and had it converted to a digital format.[21] We started the process using photograph A because it has the best visibility conditions of all the four original slides used by C&R. This made it the best basis for simulating different levels of visibility digitally, because all other alternative would be *reductions* in visual range from the base photo. Each of the four photographs presented in the survey were created from this base photograph with computer-imaging software to reflect precisely the four specific levels of visibility with uniform changes in the light extinction that are shown in Table 3-4. An example of a visual display used in our survey is provided as an insert to this report.

One of the five versions of our survey was intended as a near-exact replication of the C&R survey. One change from their original methods, however, was that we decided to use computer-generated photographs, although still using the visual ranges of 75, 50, 25, and 10 km that they reported (as compared to the levels of 96, 45, 23, and 8 km, respectively that we used for all other versions of our questionnaire). However, in preparing these photographs, we discovered that they did not match the appearance of haze in the original set of four photographs that C&R used. We used the imaging software to find the best possible match to the haziness in each original photograph and determined that C&R's photographs had actually been much closer to 150, 50, 17, and 5 km, respectively, as shown in Table 3-5.[22] Figure 3-5 illustrates the substantial difference between the distribution C&R purported to use and the distribution actually presented to respondents in their photographs. The actual distribution against which WTP statements were formed has a much greater variance, and the changes in averages were much larger than C&R reported.

[21] This work was performed by John Molenar of Air Resource Specialists, Inc. of Fort Collins, CO, the contractor who developed these techniques and continues to apply them for the National Park Services IMPROVE program.

[22] Although the photographs used in our survey were generated by Air Resource Specialists, Inc. using their highest-precision software, these initial explorations were performed using WinHaze Version 2.9.1. We conferred with John Molenar of ARS, Inc. to make sure we were making correct and appropriate comparisons to the original photograph. He confirmed our findings and provided additional evidence based on elements in the scene and their known distances from the viewing point confirming that C&R had assigned incorrect visual ranges to their photographs.

Table 3-5
Visibility Levels and Captions for the C&R Photographs

	C&R reported values		Actual values	
	Visual range (km.)	Deciviews	Visual range (km.)	Deciviews
Photograph A (15% of days)	75	16.5	150	9.6
Photograph B (20% of days)	50	20.6	50	20.6
Photograph C (40% of days)	25	27.5	17	31.4
Photograph D (25% of days)	10	36.7	5	43.6

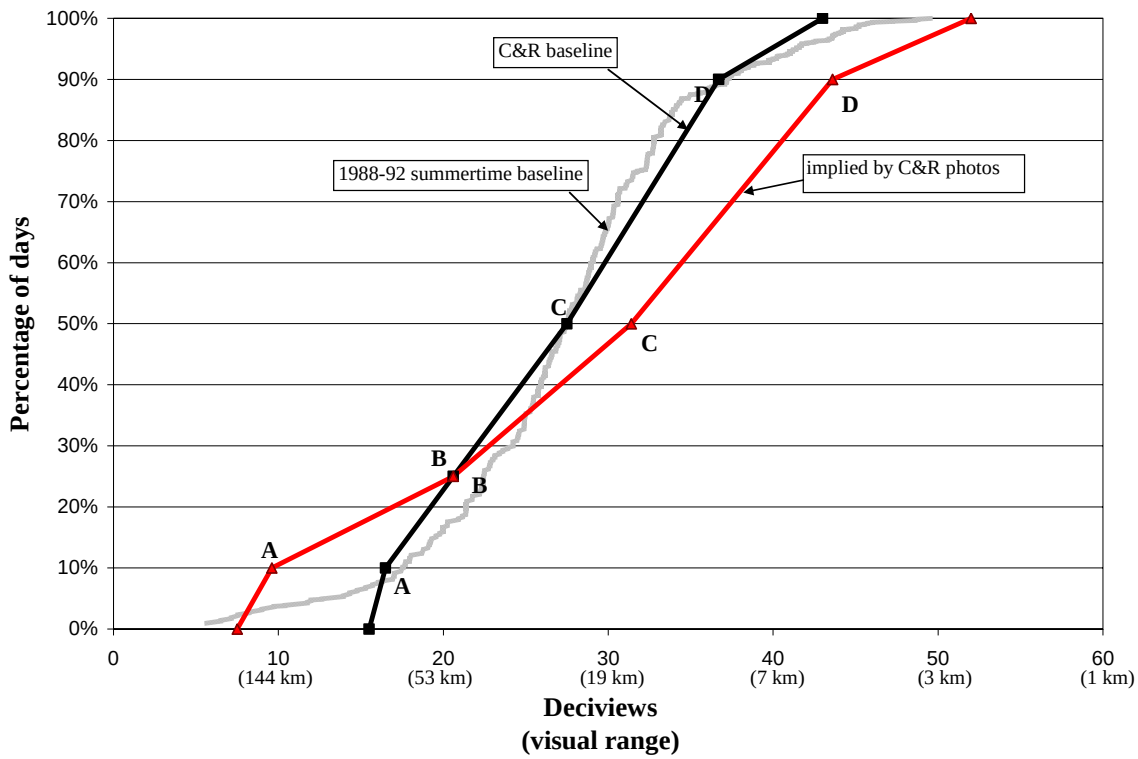

Figure 3-5
Comparison of Baseline Conditions (current survey, purported C&R, and actual C&R)

For the version of our survey that replicated C&R, we used the set of photographs that best matched what the original survey respondents had considered. Since the C&R questionnaire itself never mentioned any numerical metrics describing the visual ranges in the photographs, the best replication would be to show the same set of visual ranges.

This error has two implications for the quality of the C&R WTP estimates. First, it means that the C&R survey inaccurately described baseline conditions, overstating the variance of the then-current distribution. This might have induced respondents to express a greater WTP for a given amount of change in visibility. More importantly, it created an unambiguously *upward* bias in subsequent interpretations of the C&R WTP estimate when used in a benefits function for extrapolation to real policy proposals, which we estimate to be about 70%. Appendix A describes this bias calculation in detail.

4
SURVEY DESIGN AND DEVELOPMENT

4.1 Pilot Surveys

Three rounds of pre-testing and a peer panel review significantly influenced the development of our survey instrument. The first round of pre-testing observed a relatively small number of one-on-one interviews with respondents "recruited" from Boston's streets in early March 2003. The second round of pre-testing observed 80 respondents taking the computerized version of the survey at a dedicated survey facility in Atlanta in mid-May 2003. A panel of experts reviewed the results of the pilot work in July 2003 and suggested additional refinements to our survey. The refined survey was tested on a relatively large, nationally representative random sample from the *Knowledge Networks* panel. We selected a subset of the respondents for follow-up debriefing interview via telephone. That version of the survey, with only minor adjustments, was used as the final survey for this study. Details of each of the pilot survey phases are provided in Appendix B.

The primary foci of this development work were on:

- Identifying any problems with respondent comprehension or ability to complete the tasks required of respondents;
- Specifically, observing the respondent use of the draft visual aids, to facilitate design improvements;
- Monitoring the value and respondent acceptance of proposed design innovations (such as the use of histograms to display changes in frequency distributions, or the addition – in on-line administration – of "voice over" reading of relatively long pieces of text);
- Analyzing the responses to questions in the pilot surveys, to see whether they indicated that adjustments in wording or approach might be advantageous.

Debriefing of respondents immediately after completing a pilot interview reassured us that the histogram representations of frequency distribution shifts were working well, even for respondents with relatively low levels of educational achievement. And while the planned visual aid design resulted in a large sheet of paper (in order to show all change scenarios simultaneously) which, when unfolded, was somewhat cumbersome, the respondents we observed were able to cope well with it.

However, the originally-intended use of audio "voice over" reading in on-line administration was judged less successful, and abandoned. Also, analysis of the responses to the dichotomous choice form of WTP elicitation used for some questionnaire versions in the first two pilot phases

produced results that we judged anomalous, and we decided instead to retain the "payment card" method throughout all versions of the questionnaire. Finally, in a version of the questionnaire intended to employ the "disaggregation approach" to adding budget context (*Version 5* of the different questionnaire versions to be described in the next section), we decided – in consultation with our advisory panel – to use a more sharply restricted set of alternative environmental changes than we had piloted in the second pre-test. Each of these changes made as a result of the questionnaire development work are discussed in greater detail later in this report.

4.2 Summary of Each Version

The basic design of our study was one intended to explore the individual and cumulative effects of progressively introducing various changes to a baseline questionnaire that followed closely in the footsteps of C&R, but capitalizing on some advantages of modern survey methods. Overall, we conducted independent surveys for five different versions of the questionnaire. Appendix C provides the actual wording of each version. Appendix D provides copies of the cover letters that were sent to respondents in advance of the survey, and which also contained the graphical displays that were a core component of the survey. An example of a graphical display actually used in our survey is also included as an insert to this report.[23]

Although we did use C&R as a starting point, and the first version of our questionnaire was a near-replica of theirs, there were two major differences in our overall survey methods from those of C&R:

- *A different mode of survey administration*: We used an on-line, self-completion, computer-assisted questionnaire, whereas C&R employed a self-administered mail survey.[24]
- *A different sample design*: We used a *nationally* representative panel drawn from members of a pre-recruited random panel maintained by a respected survey research firm, whereas C&R used a randomly selected sample recruited *ab initio* but arbitrarily limited to the residents of *five states*.

4.2.1 Version 1

In the baseline *Version 1* of our survey, we adhered closely to the actual wording of the C&R questionnaire, cover letter, and advance notification materials but restricted our attention solely to visibility in Eastern national parks. The valuation questions, in particular, followed C&R closely. Additionally, the photographs of Version 1 depicted the same visibility levels as the ones used in 1988 by C&R (although they were developed with digital imaging), and the questionnaire only described the visibility changes in terms of "average visibility" shifts from

[23] The only differences among the visual displays were the specific scenarios reflected in the questionnaire, which were randomized in our samples. An exception was for version 1 (the C&R replication), which had only their four photographs and captions, and no histograms reflecting alternative scenarios.

[24] The visual displays of visibility conditions and the scenarios to be valued, however, were mailed in hard copy form to the on-line respondents before they started the survey. This was done to ensure uniformity in what each on-line respondent was observing. None of the graphics or photographs was displayed in the on-line portion of the questionnaire.

one photograph to another, as did C&R. The three change scenarios were identical to the C&R ones, and were always asked in the same order, as did C&R. (Randomized ordering is desirable, and was used in all our other versions.)

As with C&R, valuation responses were selected from a pre-coded list of, in our case, 29 values, starting with zero and progressing to "more than $1,000." Such a pre-coded list is often referred to in the CV literature as the "payment card method" of value elicitation. Our list had one more entry than that of C&R (their highest value option had been "more than $750") and included an explicit "I don't know" response whereas their list did not; otherwise, it was laid out identically to that used by C&R in seven columns across the page or screen.

4.2.2 Version 2

Our *Version 2* followed Version 1 in adhering closely to C&R wordings and elicitation methods, and mainly differed in how and what visibility was presented. The sole changes were: (i) the visibility conditions represented in the four photographs became those of the current baseline that we developed; (ii) we used the *Beta*, *Gamma*, and *Delta* scenarios analogous to those in C&R, but consistent with the new baseline conditions; (iii) changes in visibility to be valued were described by frequency distribution shifts in place of C&R's "average visibility" shifts; and (iv) the ordering of the *Beta* and *Gamma* scenarios was alternated for the two randomly selected halves of the sample.

4.2.3 Versions 3 and 4

Version 3 of the questionnaire moved away from the C&R language and conventions. We designed a questionnaire more to our own tastes, style, and importantly, using insights from our questionnaire development work. The primary, most noticeable changes for Version 3's wording were all concerned with giving the respondent a greater budgetary context for framing his or her valuation responses. The survey was introduced as being concerned with setting national priorities, and an initial context setting question listed eight macro-level domestic "social concerns" (such as education, housing, environmental protection, medical research, etc.). It asked whether "our country as a whole should be doing *more* about" or "*less* about" each one, or whether current efforts are "about right." Then a second question in the same format asked the respondent to indicate whether current efforts should be expanded or contracted for each of ten major environmental concerns.

Respondents were led to believe that, in an attempt to address micro policy concerns in a survey of tractable length, they had been selected to focus progressively on, first, air quality issues, and secondly, haze-related visibility issues, while other respondents were being questioned about micro issues in other areas of public policy. The C&R base text describing visibility issues was expanded upon and clarified where necessary, without significantly changing the basic tenor of the explanations.

The questionnaire text frames the WTP question to include both recreational use and non-use values, but does not suggest that the changes in visibility illustrated in this single vista would not also be experienced in a similar fashion outside of the parks. Indeed, by telling respondents that the changes described for the Shenandoah vista would be experienced in national parks throughout the East, they may reasonably expect similar changes to visibility in the non-park areas of the East as well. While we followed C&R in suggesting that other benefits of air quality improvements or any concomitant haze reductions outside the parks were being valued by other respondents, we know both from the C&R results and from our own survey development work that it is difficult to persuade all respondents to focus solely on visibility effects in national parks. Accordingly, our large battery of debriefing questions, following the WTP questions, explored the extent to which respondents were interpreting the commodity in more expansive ways - including over geography, time, other pollutants, and other benefits - that might be judged to present a part/whole bias.

In framing the valuation questions themselves, new language was added to provide a stronger budget context for the responses:

> "As you think about that question, please bear the following things in mind. The extra amount that you and the rest of the country would pay would be through increases in the prices and taxes for things you buy, particularly for energy and transportation. The extra money would be paid to improve the summertime visibility in national parks (and other scenic areas) just in the Eastern U.S. There are other air pollution impacts that you might also like to see improved; there are other environmental improvements that you might also like to see made; and there are other areas of national public policy that you might also like to influence, all of which might also imply increases in your cost of living if they were put into effect. And when your cost of living increases, that might require you to spend less on other things, or put less money into savings."

At this stage in the changes being progressively introduced to the baseline questionnaire, we had originally intended to switch from C&R's "payment card" method of WTP elicitation to the dichotomous choice method (sometimes referred to as the "referendum method") endorsed by the NOAA Blue Ribbon Panel (NOAA, 1993). However, our use of that method in early pilot studies produced some anomalous results; we consequently decided to retain C&R's payment card method throughout all versions of our questionnaire.

Version 4 of the questionnaire is identical to Version 3 except that scenario *Alpha* is substituted for scenario *Beta*. The *Alpha* scenario is the new type of scenario that C&R's method could not have addressed: one where the average change in visibility is in the imperceptible ranges, but where there are actually large, perceptible changes on certain days (see Figure 3-4 and associated discussion).

4.2.4 Version 5

Version 5 was designed to add a more clearly defined budget constraint by obtaining a value first for a meaningful composite good, and then disaggregating that value by allocation across various complementary (non-mutually exclusive) components, one of which was the visibility change. Accordingly, we chose as our composite good the improvement of air quality, generally. The questionnaire described three deleterious effects of poor air quality: impacts on human health, impacts on trees and plants, and impacts on the visibility of scenic vistas. After opening the questionnaire identically to Versions 3 and 4, we described in some detail each of the three component goods, each represented as a proposal for new legislation designed to achieve specified quantitative outcomes. The description indicated that each type of impact (and each associated policy) would entail controls on different types and sources of the air pollution, in order to deter views that all three policy options could be achieved for a common set of expenditures. In the case of the visibility improvements, the scenarios and their descriptions and visual aids were identical to those of Version 3, and randomly ordered.

When the respondent had been exposed to the details of each of the three component goods, presented in random order, he was asked to express a maximum WTP for all three goods together, again employing a payment card method of elicitation. The respondent was then asked to allocate that total amount across the three potential programs, considered in terms of the number of cents to be assigned to each program from each incremental dollar increase in the cost of living. The allocation arithmetic was then shown to the respondent and he or she was given an opportunity to adjust either the total or any of the three component amounts.[25]

4.2.5 Debriefing Questions in All Versions

For all five versions of the questionnaire, we asked C&R's debriefing questions designed to ascertain whether respondents' WTP values for visibility improvements were in part intended to benefit the national parks system more generally. However, in all versions we also augmented the C&R debriefing with a more comprehensive set of questions designed to explore other potential response biases in the way that respondents had answered the WTP questions. These additional debriefing questions took two forms: (i) explicit exploration of motives and thought processes regarding some key "part/whole" concerns; and (ii) a battery of 18 statements about the survey which respondents were asked to rate on a five-point scale in which "5" denoted "describes me perfectly" and "1" denoted "doesn't describe me at all."

4.2.6 The Ordering of Scenarios

The use of computer-assisted survey methods creates an ability to explore or to obviate questionnaire ordering effects to a much greater extent than was often feasible, convenient, or cost-effective with the precursor pencil-and-paper survey methods. Where appropriate, list

[25] Version 5 subsequently included a second visibility scenario (*Beta* or *Gamma*, whichever was not used earlier), along with an associated opportunity for the respondent to review (and possibly adjust) both the total WTP across the three programs and each component element. However, in our analysis reported here we have used data only for the *first* visibility scenario presented to Version 5 respondents.

elements can be randomized or orderings of more extensive segments of the questionnaire can be reversed for alternate respondents without a need to print and handle myriad versions of a hard copy instrument. In our survey we took advantage of this technological advance in several places, but most importantly in whether we asked about the smaller improvement before the larger, or *vice versa*. Within each of our questionnaire versions (excepting Version 1), half of the sample was asked about scenario *Beta* (or scenario *Alpha* in the case of Version 4) before being asked about the larger improvement scenario *Gamma*, and for the other half of the sample this ordering was reversed. For Version 1 replicating C&R, the smaller change is always followed by the larger change. The deterioration scenario *Delta* always comes last in the versions (1 through 4) in which it is included.

4.3 Design of the Final Survey's Visual Aids

We used two basic variants of hard copy visual aids. The first, used solely for our Version 1 replication of the C&R survey, is a simple layout showing just four photographs (each 4″ x 6″ in size) laid out in a horizontal row. The photograph captions are identical to those used by C&R and shown in Table 3-5.[26] The visual ranges displayed in each photograph matched those in the actual C&R original photographs (see "Actual values" in Table 3-5).

The second type of visual aid was used for Versions 2 through 4 of the study. It displays photographs with a different set of visual ranges (see Table 3-4) and contains more information. Like the visual for Version 1, the 4″ x 6″ photographs are laid out horizontally, with baseline frequencies (the number and percentage of summer days) indicated below each one. On the far right, a grayed-out box of the same size depicts poor weather days.

In three distinct rows below, the photographs and their captions are descriptions of three environmental goods that the respondent was asked to value. We chose to place all the change scenarios on a single sheet of paper in response to concerns expressed in the CV literature that the survey should alert respondents to all of the types of changes to be asked about before posing a WTP question for any one scenario.[27] This tactic also ensured that respondents did not have to shuffle through various sheets of paper and possibly confuse which photograph was associated with which bar on a histogram. In addition to the histograms, the scenarios are described with text reporting the changes in the number and percentage of days that exhibit the visibility conditions of each of the photographs. Regardless of which of our four different scenarios is being presented first, the two topmost scenarios on each visual are labeled "Proposed change X" and "Proposed change Y" respectively. The last row, which always depicts the *Delta* deterioration scenario, is labeled "If the law doesn't change." The visual aids used in connection with Version 5 of the questionnaire are identical to those used for Versions 2 through 4 except that the third scenario, *Delta*, is not included at the bottom of the sheet.

An actual specimen of the second type of visual display is provided as an insert to this report.

[26] However, the visual layout used by C&R was somewhat different. It presented different visibility conditions for each of three national parks on a single sheet of paper. The photographs for each of the three different vistas were aligned vertically with the clearest day at the top. Additionally, the photograph dimensions were 3″ x 5″.

[27] See, for example, Smith (1992) and Bateman *et al.* (2003).

5
SURVEY IMPLEMENTATION

5.1 Survey Administration

The new visibility survey was administered primarily as an on-line interview, except that the visual aids were mailed in advance in hard copy to ensure that all respondents are given controlled, identical visual stimuli. Photographs displayed on the respondents' computer monitors or *MSN TV* screens would be of variable resolution, coloration, and contrast, thereby introducing uncontrollable sources of variation.

The sample for this survey is drawn from the national panel maintained by *Knowledge Networks*, which (unlike other established panels) does not accept volunteers but uses random-digit dial telephone survey methods to screen and recruit participants to the panel. *Knowledge Networks*' surveys are designed for on-line administration. The company provides free *MSN TV* units[28] to recruited panel members, or alternatively (a recent development) allows them to use their own Internet-accessible equipment to complete a survey for which they have been selected.

The advantages of using a pre-recruited panel are primarily twofold: (i) the ability to match total population demographic and socioeconomic characteristics very closely in the achieved sample, by virtue of the availability of very large numbers of pre-screened respondents and substantial experience in anticipating response rates for respondents of different types; and (ii) a relatively high response rate as measured by the ratio of the achieved sample to the issued sample for any specific survey of panel members,[29] thereby reducing the risk of non-response biases.

5.2 Sample Design and Achievement

The sample, of residents of the 48 contiguous states, was designed to reflect key Census household population distributions by age, sex, race and ethnicity, highest level of education, and Census region. After substantial development work that included three pilot rounds of in-person or on-line interviews combined with qualitative debriefing discussions, the survey was fielded to 2,770 panel members commencing on October 30, 2003 and ending three weeks later. Of these, a total of 2,020 panel members (73% of the issued sample) commenced the survey. After eliminating respondents who did not fit our sole screening criterion as a head of household,

[28] These units were originally known under the brand name *WebTV*.

[29] Of course, the *overall* response rate, when the effects of sample losses at the panel recruitment stage are also taken into account, is somewhat less impressive. However, on the available evidence, the overall response rate appears to be at least as good as that we could reasonably expect from any other *ab initio* method of administration for this survey.

which we defined as "one of the people who makes most of the decisions about major purchases and other financial matters," we obtained 1,863 completed questionnaires (67% of the issued sample). The achieved sample was weighted independently by questionnaire version to more closely mirror the sample universe by education, age, sex, and region of residence.

Table 5-1 summarizes the response to the survey by questionnaire version.

Table 5-1
Summary of Survey Response by Questionnaire Version

	Issued sample		Started survey		Eligible & interview completed	
	no.	%	no.	%	no.	%
All versions	2,770	100.0	2,020	72.9	1,863	67.3
Version 1	394	100.0	301	76.4	273	69.3
Version 2	388	100.0	291	75.0	267	68.8
Version 3	668	100.0	477	71.4	445	66.6
Version 4	665	100.0	482	72.4	443	66.6
Version 5	655	100.0	469	71.6	435	66.4

Approximately one week before the survey was fielded; each panel member received a U.S. priority mail envelope containing an introductory letter alerting him or her to the imminent survey and its potential importance to public policymakers. For sample members selected to receive Versions 1 or 2 of the questionnaire, the letter followed C&R's cover letter in explicitly mentioning national parks as the focus, whereas the letter to the samples for the remaining versions spoke more generally of a survey about "national priorities." Note that our sample design, like our method of survey administration, differed markedly from that of C&R. Our survey universe covered all 48 contiguous states, while C&R's covered only five states with no discussion of why they might be considered to be nationally representative.[30]

5.3 Our Designation of "Households" and "Family Units"

Our screening method paid greater attention to diverse household types than is often customary. The screener questionnaire explicitly addressed living situations in which multiple "family units"

[30] In C&R's questionnaire for the Southeast, 35% of the responses were from residents of Virginia, the location of the Shenandoah National Park vista used to illustrate visibility changes. The mean WTP over all C&R's samples is unduly influenced by the Virginia residents' responses that on average were 91% higher than those from the other four sampled states. In a paper using the C&R data, Chestnut and Dennis (1997) report two values, one for Virginia residents and one for the four other states combined, and imply that the nationwide average would fall somewhere between those two values. However, in these computations the values from Arizona and Missouri (medium sized states) are accorded roughly the same weight as the considerably more populous states of California and New York. Moreover, the authors present no evidence to support the implicit assumption that the four states will yield estimates that fully represent the 47 contiguous states excluding Virginia.

that make independent economic decisions occupy a single residence together. When initial screening indicated a need to draw such a distinction, we described a family unit as one where the adult members "largely pool their possessions and money, and make decisions together about most major purchases" as opposed to situations where some adult members "live their own lives but just share the living space." From the responses, we estimated that there are on average 1.13 family units per household, which when extrapolated to the estimated 108 million households in the 48 contiguous states at the time of this survey implies a total of approximately 122 million family units.

5.4 Demographic and Socioeconomic Characteristics of Resulting Sample

Table 5-2 summarizes the proportions, means and medians of the demographic and socioeconomic characteristics of our achieved sample. We present the sample using two different constructions. The first defines the achieved sample as all respondents who completed the survey, while the second comprises just those respondents who gave at least one valid WTP response.[31] We find virtually no difference between the two constructions in terms of socioeconomic characteristics.

Table 5-2
Respondent Demographic and Socioeconomic Descriptors, All Versions

	U.S.Census	Full weighted sample (*n*=1,863)	At least one valid WTP response (*n*=1,689)
Ethnicity			
White, non-hispanic	69%	74%	75%
Black/African American, non-Hispanic	12%	11%	10%
Other, non-Hispanic	6%	4%	4%
Hispanic	13%	11%	11%
Educational achievement level			
Less than high school	20%	16%	14%
High school	29%	32%	31%
Some college	27%	27%	27%
Bachelor's degree or higher	24%	25%	27%
Marital status			
Married	57%	56%	56%
Single, never married	23%	20%	21%
Divorced	10%	15%	16%
Widowed	7%	5%	5%
Separated	2%	2%	3%
Employment status			
Employed	60%	63%	64%
Unemployed	4%	5%	5%
Not in labor force	36%	31%	31%

[31] Valid responses include any non-"Don't Know," non-protest value

Table 5-2 (continued)
Respondent Demographic and Socioeconomic Descriptors, All Versions

	U.S.Census	Full weighted sample (*n*=1,863)	At least one valid WTP response (*n*=1,689)
Annual gross household income			
Less than $10,000	10%	9%	9%
$10,000 to $49,999	49%	53%	53%
$50,000 and above	42%	38%	38%
Age			
18 to 24	11%	7%	7%
25 to 34	17%	20%	20%
35 to 44	21%	23%	23%
45 to 54	19%	20%	21%
55 to 64	14%	15%	15%
65 to 74	8%	9%	10%
75 and over	9%	5%	4%
median		44	44
Sex			
Male	48%	47%	49%
Female	52%	53%	51%
Housing type			
Detached single family house	62%	63%	62%
Attached single family house	6%	8%	9%
Complex, two or more units	26%	19%	19%
Manufactured or mobile home	7%	8%	8%
Other types	<1%	2%	2%
Mean household size	2.55	2.23	2.21
Number of household members 18+			
1		41%	41%
2		46%	46%
3		9%	8%
4		3%	3%
5		<1%	<1%
6		<1%	<1%
7		<1%	<1%
8		<1%	<1%
Number of household members <18			
0		74%	74%
1		13%	13%
2		8%	8%
3		3%	3%
4		1%	1%
5		<1%	<1%
6		<1%	<1%
7		<1%	<1%
8		<1%	<1%

Table 5-2 (continued)
Respondent Demographic and Socioeconomic Descriptors, All Versions

	U.S.Census	Full weighted sample (*n*=1,863)	At least one valid WTP response (*n*=1,689)
Region			
New England		4%	4%
Mid-Atlantic		14%	14%
East-North Central		15%	15%
West-North Central		8%	7%
South Atlantic		20%	21%
East-South Central		6%	6%
West-South Central		10%	10%
Mountain		8%	8%
Pacific		15%	15%
Type of place (respondent classified)			
Large metropolitan area (>1 million)		19%	20%
Large city (100,000 to 1million)		22%	23%
Small city/town (10,000 to 99,999)		31%	32%
Small town and rural (<10,000)		23%	22%
Unknown		4%	3%
Miscellaneous characteristics			
Dual income households		35%	34%
Ever visited a National Park		72%	73%
Lives east of the Mississippi		60%	60%
Breathing problems in immediate family		44%	44%

Notes:

Due to rounding, percentages may not add to exactly 100%.

Valid WTP responses include all except "Don't know" responses and those judged "protest zeroes."

Comparable statistics from the C&R survey are as follows:

Median age: 44

Mean household size: 2.77

Males: 59%

Ever visited a National Park: 81%

Annual household income <$10,000: 7%

Annual household income $10,000 to $49,999: 63%

Annual household income $50,000+: 30%

U.S. Census values are based on the 2000 Census of Population, as reported at www.census.gov, American FactFinder Detailed Tables. Values based on total population for the 48 contiguous states, excluding the District of Columbia, unless otherwise noted below:

Census age and marital status statistics are based on the population age 18 and over.

Census education statistics based on the population age 25 and over.

Census employment statistics based on the population age 16 and over.

Table 5-2 also presents the corresponding information from the U.S. census. We find that our weighted sample is very similar in almost all aspects to the general U.S. population as reflected in the 2000 U.S. Census. It reveals that our sample has slightly more white, non-Hispanic respondents than the U.S. average, and a slightly higher proportion of respondents with a bachelor's degree or higher, while it also slightly under-represents those with a less-than-high school education. Nevertheless, it does not over-represent higher income groups. In other dimensions our sample is very typical of U.S. averages, including in its geographic representation.

Another exception is that the number of people per household is somewhat lower in our sample (2.23 compared to 2.59 in the Census). Our more explicit definition of a household, specifically addressing the issue of people sharing the same living space but making independent economic decisions, is likely to be responsible for at least a part of this difference.

The attitudinal questions used in the early part of the questionnaires were included solely to set the subject of visibility and haze within the broader context of environmental issues and public policy more generally. The responses, however, also provide some insight about the make up of the sample, and are provided in Table 5-3 through Table 5-6. The representativeness of these replies cannot be directly ascertained, as we do not have comparable responses for the U.S. population at large.

Table 5-3
The Nation's Level of Effort in Addressing Social Concerns, Versions 3–5

Below is a list of some social concerns that are often in the news. In regards to each, do you think…	***the nation should***		***Current efforts about right***	***Can't say***	***Refused***
	do more	***do less***			
Medical research on life-threatening illnesses (such as cancer, AIDS, or heart disease)	59%	2%	34%	5%	0%
Housing and feeding the poor or homeless	59%	7%	27%	7%	<1%
Ensuring adequate medical care for all, regardless of the ability to pay	77%	4%	15%	4%	<1%
Protecting the country from further terrorist attacks	52%	4%	36%	7%	1%
Reducing and solving crimes	54%	2%	39%	4%	<1%
Protecting the environment, including preserving our natural resources	56%	6%	35%	4%	0%
Improving the education of children and young people	73%	2%	23%	2%	<1%
Reducing the use of illegal drugs	54%	11%	30%	6%	<1%

Notes: Unweighted sample size=1,323; Effective sample size= 739

Table 5-4
The Nation's Level of Effort in Addressing Environmental Concerns, Versions 3–5

Below is a list of the types of things that other people have told us are their most important concerns about the environment and natural resources. In regards to each, do you think…	***the nation should***		***Current efforts about right***	***Can't say***	***Refused***
	do more	***do less***			
Developing renewable sources of energy, like solar and wind power	77%	2%	15%	7%	<1%
Reducing global warming	49%	7%	29%	15%	<1%
Protecting types of animals and plants that are endangered	42%	10%	42%	6%	0%
Protecting the quality of groundwater	68%	1%	23%	8%	<1%
Improving the disposal of radioactive wastes	65%	1%	21%	12%	<1%
Improving the disposal of household and industrial waste products, and encouraging recycling	60%	1%	34%	4%	<1%
Protecting wilderness areas and wildlife	52%	5%	39%	4%	1%
Reducing air pollution (other than the gases that contribute to global warming)	62%	2%	29%	6%	<1%
Protecting the rain forests in those parts of the world where they are threatened	58%	5%	26%	11%	1%
Protecting the ozone layer	57%	4%	29%	10%	1%

Notes: Unweighted sample size=1,323; Effective sample size= 739

Table 5-5
The Importance of Improved Visibility, Versions 1–4

"Less than average haze during my visit to a national park would increase my enjoyment . . .		
	Not at all	25%
	Somewhat	33%
	Very much	31%
	I'm not sure"	11%
	Refused	<1%
"To me, improving the visibility at some or all of the parks in the East region is . . .		
1	Not at all important	3%
2		6%
3		29%
4		27%
5	Extremely important	34%
X	I don't know"	2%
	Refused	<1%
"To me, preventing the visibility from getting any worse at some or all of the parks in the East region is . . .		
1	Not at all important	2%
2		3%
3		16%
4		24%
5	Extremely important	52%
X	I don't know"	2%
	Refused	<1%

Notes: Percentages may not add to 100% due to rounding.
Unweighted sample size=1,428; Effective sample size=649.

Table 5-6
Respondent Visits to National Parks, All Versions

National Park	Ever Visited	Visited in the Last Two Years
Grand Canyon National Park	32%	7%
Great Smoky Mountains National Park	32%	10%
Shenandoah National Park	21%	5%
Yellowstone National Park	26%	4%
Yosemite National Park	23%	3%
None of these	25%	7%
I'm not sure	3%	1%

Notes: Percentages do not add to 100% because more than one response was allowed.

6
UNIVARIATE ANALYSES OF WTP RESULTS

In this section, we provide a univariate analysis of the means and medians of WTP responses. This is done following the methods used by C&R, involving screening and adjustment of responses to remove outliers and protest votes. It thus provides the most direct basis for comparison of our new results to those earlier results. This section also provides a discussion of the debriefing responses, including sensitivity of WTP groups that ranked themselves differently. A more sophisticated multivariate analysis of determinants of WTP, which is considered the state-of-the-art but which cannot be compared to C&R results, is provided in the following section of this report.

6.1 Pre-Analysis Adjustments of Raw WTP Responses

6.1.1 Editing of WTP Responses

The completed response records were edited in ways that are customary in CV surveys, the primary focus being on the questions asking for WTP values. As always, some respondents are unable or unwilling to answer these questions. C&R report that, across all their questionnaire versions, about 7 to 8% of their respondents omitted WTP responses. Our comparable statistics were 15% omissions for Versions 1 and 2 (which provided no budget reminders, as in C&R), and 7% for Versions 3, 4, and 5. This might be because our innovations in the latter versions provide more information on the nature of the visibility changes. Also, our on-line questionnaire provided an explicit "I don't know" option for WTP responses while the C&R self-completion mail questionnaire did not. It was, of course, possible for C&R's respondents to write in a "don't know" or just skip any question with which they were uncomfortable.

6.1.2 Treatment of Outliers

Following C&R, we chose an arbitrary mean WTP value for the relatively small number of respondents choosing the highest pre-coded amount of "more than $1,000" in Versions 1 through 4 of our questionnaire or "more than $2,000" in Version 5.[32] Our choice of $1,300 for these respondents ($2,600 in the case of Version 5) is roughly proportionate to C&R's choice of $1,000 for their respondents answering "more than $750."

[32] From Version 3 onwards, respondents opting for the highest pre-coded category were asked to indicate directly their maximum WTP in a subsequent open-ended question. When they provided a value it was used, but a portion gave "don't know" answers at this stage and in those cases we supplied a number consistent with the discussion in the text.

We also followed C&R in eliminating seemingly abnormally high WTP amounts that might be the result of strategic bidding. C&R flagged 3% of their respondents who either gave an adjusted WTP value greater than 1% of their reported annual pre-tax income or selected the highest pre-coded WTP value for all three WTP questions. However, after examining the responses to an open-ended question posed to the high-end respondents, C&R decided to eliminate only four of the flagged responses. Our own high-end filtering is somewhat different. We provide two sensitivity analyses for measures of WTP. The first method, which we characterize as an "income trim," eliminates all responses greater than 1% of the reported pre-tax income, reducing the sample sizes of key subgroups by 4 to 8%. The second method, a "5% trim," removes the highest 5% of WTP responses.

6.1.3 Treatment of "Protest Zeroes"

We scrutinized zero WTP responses to identify those judged to be "protest zeroes." The respondents may have chosen an explicit $0 response for reasons other than that they place no value on the environmental good. A respondent might not fully understand the question being asked. He might object to details of the described payment scenario, such as cost-of-living increases deriving from higher prices and taxes. He might not believe that the described change in visibility was feasible. Finally, he might doubt that government would manage the program effectively. As in C&R, zero values given for any of the above reasons were designated as protest zeroes and recoded as missing. C&R retained slightly less than 70% of the zero bid amounts they received, while we retain about 81%.

6.1.4 Adjustment for Part/Whole Bias

At the time, the C&R study was innovative in that it included debriefing questions intended to gauge explicitly the extent to which respondents may have overestimated their WTP values by envisaging a subject commodity larger than the one under investigation; that is, C&R sought respondent estimates to help correct for any so-called "part/whole" bias. While we have some serious concerns about how far respondents can be expected to provide meaningful *quantitative* answers to this type of debriefing question, we included such questions and closely followed their use of the responses to adjust the raw WTP estimates. C&R hypothesized that the respondent might be valuing general protection or improvement for national parks, rather than focusing solely on visibility. Accordingly, they asked questions intended to identify what fraction of the reported WTP was specifically for visibility. The mean of C&R's adjustments through this procedure was 62% of the raw WTP estimates. In our survey, the comparable statistic ranges from 80% to 85% for Versions 1 through 4, and is 61% for Version 5.

6.2 Comparisons of WTP Across the Five Versions

We first assess the quantitative impact of our incremental changes of method on estimates of annual WTP for summertime visibility improvements at national parks and other scenic areas in the East. Version 1 of our questionnaire aimed to establish a baseline replicating the C&R survey as closely as possible, given the two major differences of a different survey mode and a nationally-representative sample. Nonetheless, it is instructive to ask how our Version 1 responses compare with those of C&R. Table 6-1 summarizes the mean and median WTP values, trimmed and untrimmed, from each version of our questionnaire and with comparable estimates from the C&R study.[33]

[33] The C&R comparables are derived from the Shenandoah vista responses from Arizona, California, Missouri, and New York residents only, omitting the (generally higher) responses from the Virginia-resident sample. They have been inflated from 1988 dollars to 2003 dollars using a factor of 1.55. No attempt was made to adjust for real income growth.

Table 6-1
Mean and Median Willingness-to-Pay Estimates, by Survey Version ($2003)

	A. C&R survey	B. Version 1 (Replication of C&R)	C. Version 2 (Add histograms)	D. Versions 3,4 (Add budget context)	E. Version 5 (Disaggre-gation)
Alpha change					
mean deciview change				1 dv	
respondents (*n*)				394	
mean (untrimmed)				$42±$13	
mean (5% trim)				$21±$5	
mean (income trim)				$27±$7	
median (untrimmed)				$4	
median (5% trim)				$3	
median (income trim)				$3	
Beta change					
mean deciview change	11 dv	11 dv	5 dv	5 dv	5 dv
respondents (*n*)	226	217	225	387	186
mean (untrimmed)	$48	$77±$22	$69±41	$59±$17	$24±$7
mean (5% trim)		$55±$14	$35±$8	$33±$7	$12±$3
mean (income trim)		$58±$17	$31±$8	$40±$12	$22±$7
median (untrimmed)	$19	$35	$10	$10	$7
median (5% trim)		$34	$10	$10	$5
median (income trim)		$30	$8	$9	$7
Gamma change					
mean deciview change	22 dv	22 dv	10 dv	10 dv	10 dv
respondents (*n*)	226	222	231	784	177
mean (untrimmed)	$75	$118±$55	$106±$67	$76±$15	$30±$10
mean (5% trim)		$70±$20	$52±$14	$39±$6	$18±$5
mean (income trim)		$72±$22	$39±$10	$50±$9	$30±$10
median (untrimmed)	$25	$50	$20	$13	$9
median (5% trim)		$35	$18	$10	$8
median (income trim)		$35	$10	$10	$9
Delta change					
mean deciview change	–12 dv	–12 dv	–9 dv	–9 dv	
respondents (*n*)	223	223	222	764	
mean (untrimmed)	$66	$91±$25	$84±$34	$57±$14	
mean (5% trim)		$62±$18	$40±$15	$28±$6	
mean (income trim)		$66±$21	$51±$25	$38±$8	
median (untrimmed)	$23	$50	$11	$5	
median (5% trim)		$35	$8	$5	
median (income trim)		$35	$8	$5	

Notes: Mean values from the new survey show the 95% confidence interval. Values from the non-Virginia sample of the C&R survey have been inflated to 2003 dollars using a factor of 1.55. Average deciview change is computed from the full distribution which is more complete than the histogram representation.

Examining first the untrimmed estimates for our baseline Version 1 (column B), the WTP values appear to be higher in real terms than those derived by C&R fifteen years previously (column A). Our untrimmed values for improvements *Beta* and *Gamma* are roughly 60% greater than the comparable C&R values, while those for the deterioration *Delta* change are about 40% higher. Income effects may be one possible contributor to this difference.[34] (Another contributor might be the adjustment for part/whole bias, which involved an average reduction in stated WTP of about 40% in C&R's results, but only by about 20% in our results for Version 1. This does not fully explain the difference, however, and it should be noted that the adjustment factor is in itself a survey result.) Our trimmed values are much closer to the C&R (less aggressively trimmed) amounts.

The comparison between Version 2 and Version 1 of our questionnaire (columns C and B respectively in Table 6-1) shows the quantitative impact of the important enhancements introduced in Version 2, which were:

- Defining the improved visibility in terms of a change in the distribution of days, rather than as a change in "average visibility" conditions, and
- Correcting the photographs to represent the shift that C&R purported to be valuing, a smaller change than was actually represented by the C&R photographs (also used, in digitally constructed form, for our Version 1).[35]

From Table 6-1 we can see that moving to a more informative representation of how visibility would change has lowered the estimated WTP values modestly: by about 10% for the two improvement scenarios and by 8% for the deterioration scenario. This impact is magnified if we focus on comparing the trimmed values. The reduction then ranges from 25 to 50%, with the income trim generally producing the larger reduction for any specific scenario. However, the WTP *per deciview* of change is actually greater when moving from Version 1 to Version 2. This is because the baseline of visibility is much cleaner than the baseline in C&R's era, and so a shift of the distribution analogous to that in C&R (and still used in Version 1) is a much smaller shift in average deciviews in Version 2. The fact that the WTP actually is quite stable even though the quantitative magnitude of change is halved could indicate that the respondents are not providing a response that is dependent on the amount of change, but might be more indicative of "warm glow" effects. On the other hand, debriefing questions do not seem to support that

[34] A caveat possibly relevant in this comparison is that the C&R values are for the Southeastern US while our own values are for the Eastern half of the US, a much larger land area.

[35] For the *Beta* change, Version 1 shows an 11 deciview average improvement and Version 2 is a 5 deciview average improvement. For the *Gamma* change, Version 1 is a 22 deciview average improvement, while Version 2 is a 10 deciview average improvement. One might be tempted to compare the two scenarios that depict an 10 and 11 deciview changes in average visibility across versions, since in that lexicon the scenarios would be considered very similar. However, information provided to the respondent on the nature of the *distribution* of days between those survey scenarios is not comparable. The histograms show exactly how many days will be affected by the changes, but there is no information available on the nature of the shift in the questions relating to changes in "average visibility." Additionally, the information about which photograph depicts an average day is conflicting. Version 1 *Beta* states that the average summer day will be like photograph B, whereas the histograms provided in Version 2 imply that the average summer day in the Version 2 *Gamma* scenario would be like photograph A (although there is no explicit mention of "average conditions" in the wording of the Version 2 WTP questions). In summary, comparisons are best drawn between the different scenarios *within* (rather than *across*) versions, as we do here.

interpretation (to be discussed later in this section), and other internal and external scope tests seem to be satisfied.

As we have described, in moving from Version 2 to Versions 3 and 4 more substantial modifications were made to the original structure and wording of the C&R questionnaire, which we summarize by characterizing the differences as "adding budget context" to the questionnaire. Examination of columns C and D in Table 6-1 shows that, with a few exceptions, this incremental change further reduces the estimates of WTP. For the *Beta* change, the untrimmed value and the 5%-trimmed value yield modestly lower estimates. However, the income-trimmed value yields an estimate that is almost 30% *higher* than the Version 2 value. Likewise, the values for the *Gamma* change are reduced for the untrimmed estimate and the 5% trimmed estimate, but the income trimmed value increases by about 28%. For the *Delta* deterioration, all of the estimates produce lowered results with the additional budget context. For the *Alpha* change scenario of Version 4, of course, no similar comparisons can be drawn.

Version 5 is a more radical departure from the previous versions, introducing a valuation for air quality improvement more generally and then allocating that amount among three different and complementary policies of which one addresses visibility issues. In that the visibility scenarios (and the corresponding visual aids) used for Version 5 mirror the *Beta* and *Gamma* changes of Version 3, it is appropriate to compare column E of Table 6-1 with column D. Such a comparison shows that the WTP values for visibility improvements derived by disaggregating a value for air quality improvements generally are markedly lower than the estimates derived from the previous versions. They are 40 to 60% below the values estimated from Version 3.

The cumulative effect of the progression of incremental modifications to the C&R form of the questionnaire is summarized in Figure 6-1 through 6-3. The estimates of mean WTP for visibility improvements from Version 5 of our questionnaire are 50 to 60% lower for the untrimmed improvement scenarios, 75 to 76% lower for the 5% trimmed estimates, and 54 to 60% lower for the income trimmed estimates. The values for the deterioration scenario change by slightly less. Obviously, these changes in WTP are substantial, serving to highlight the sensitivity of CV results to the degree to which budget reminders are included in the questionnaire.

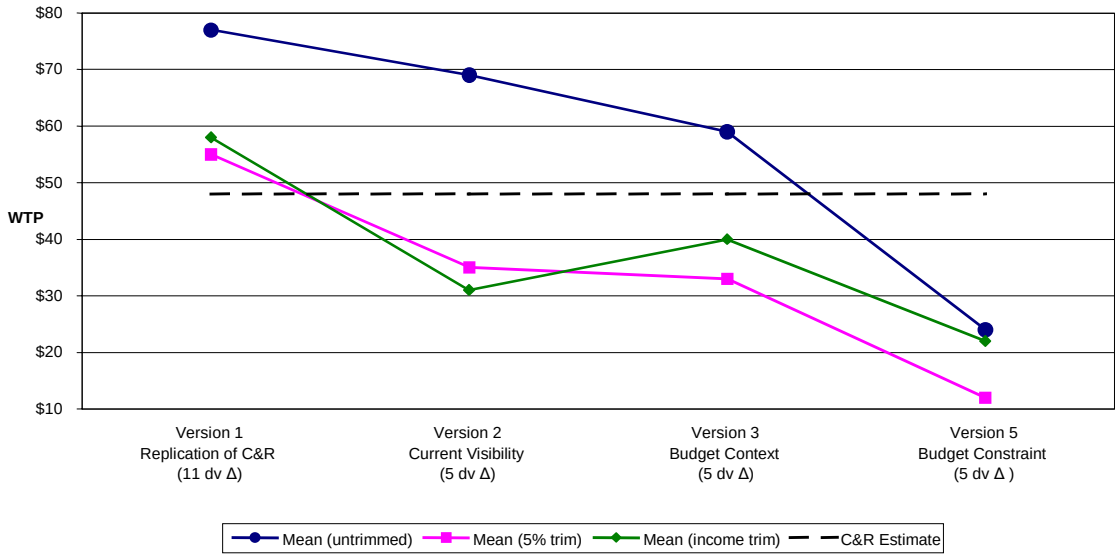

Figure 6-1
WTP for Beta Change, by Survey Version

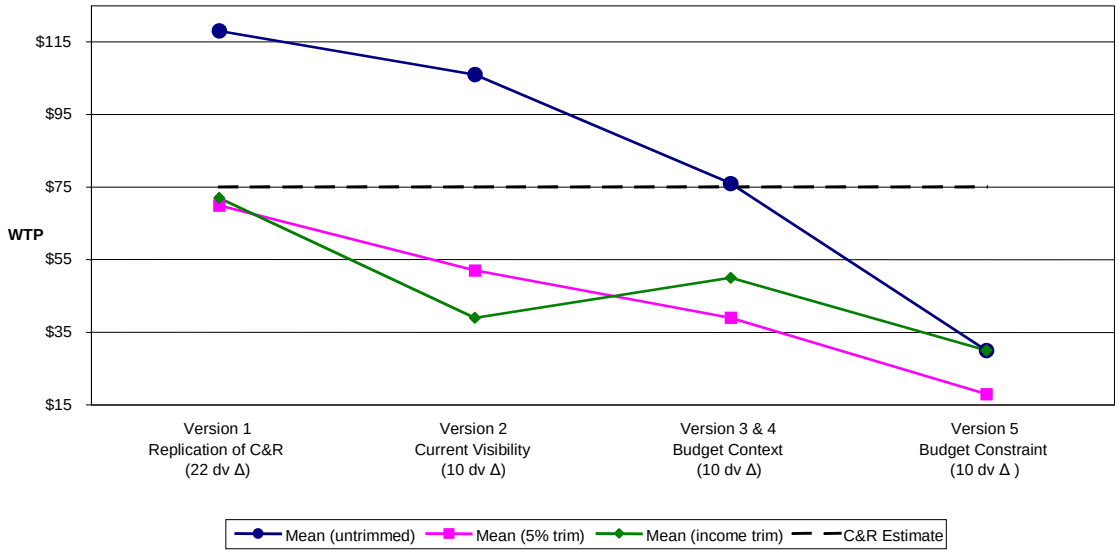

Figure 6-2
WTP for Gamma Change, by Survey Version

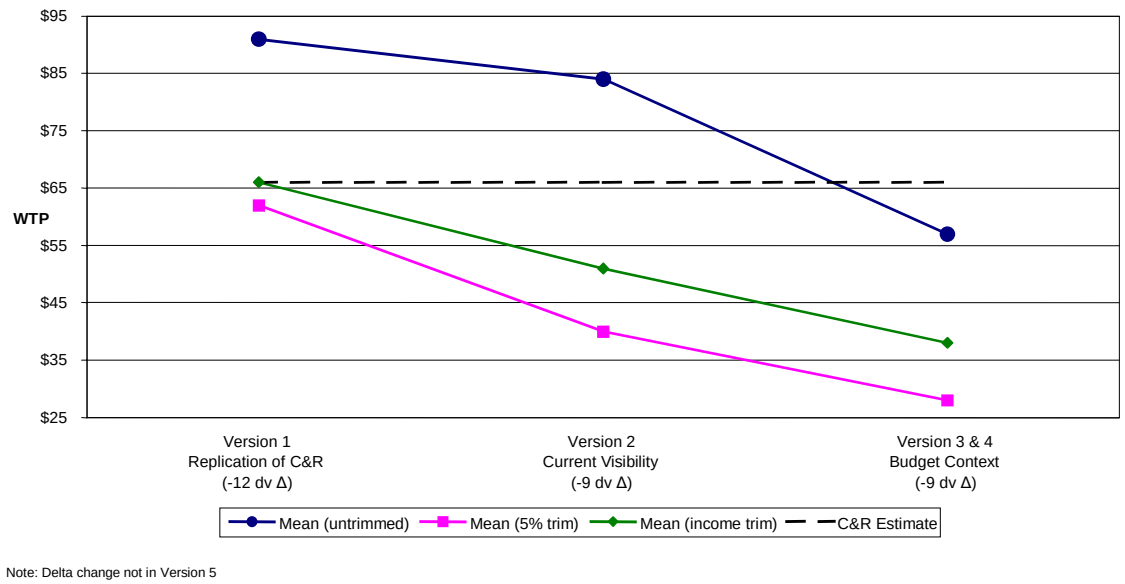

Figure 6-3
WTP for Delta Change, by Survey Version

6.3 Comparisons of WTP Across the Scenarios

Comparing the valuation differences between visibility improvements of different magnitudes can potentially provide insight into the nature of the public's preferences regarding visibility improvements. First, it is worth noting that Table 6-1 shows that our findings pass all of the internal and external scope tests that can be performed using the different scenarios.

The *Alpha* change is quite small compared to the *Beta* change. The *Alpha* change basically removes nine of the 11 worst summer days (photograph D) and makes them moderately good (shifting them to days like photograph C or, in some cases, even like B), whereas the *Beta* changes eliminates all eleven of the worst condition days and also reduces the number of photograph C days by half, increases the number of days like photograph B, and more than doubles the very best days pictured in photograph A. Measured by average change, however, the *Alpha* scenario is only a 1-dv improvement compared to a 5-dv improvement for the *Beta* scenario.

Despite the modest nature of the improvements of the *Alpha* scenario, our respondents valued it at almost three-quarters the value of the *Beta* scenario: an untrimmed mean of $42 compared with $59 for the *Beta* change.[36] This finding is consistent with a hypothesis that the public places more value on reducing the number of the worst days, with comparatively little additional benefit gained from improving moderately clear days to pristine conditions. It also calls into question the use of average change as the appropriate metric for assessing changes in visibility. Recall that C&R described the visibility changes by showing two different photographs, one described as typifying current average conditions and another described as representing average visibility conditions under the proposed change. If such photographs were produced to depict an average

[36] The values for the Alpha and Beta scenarios are statistically different at the 86% confidence level.

change of 1 dv corresponding to our *Alpha* scenario, the visual difference would hardly be perceptible and the change would (presumably) receive a valuation very close to zero. Using a frequency distribution to describe visibility changes allows the researcher to communicate to the respondents more specific and finely tuned information on the nature of the change being valued.

The *Gamma* scenario improves on the *Beta* scenario by moving each set of days up one visibility level. The days that were like photograph C become like photograph B and the days that were like photograph B become like photograph A. There are no more days with the visibility conditions of the bottom half of the current distribution. The change in average summertime visibility is approximately doubled, from a 5-dv change in the *Beta* scenario to a 10-dv change in the *Gamma* scenario. However, the mean valuation increases by just $17 (or 29%) relative to the *Beta* valuation.[37]

The *Delta* (deterioration) scenario has inherently less policy-relevance than the improvement scenarios, but we find that in practically all survey versions, the value placed on avoiding a massive deterioration is greater than the values placed on the *Alpha* and *Beta* improvement scenarios, but is less than the value of the large *Gamma* change scenario. This finding agrees with the C&R result.

6.3.1 Ordering Effects

We also tested for systematic differences between responses depending on the ordering of the three WTP scenarios. Although the estimated mean WTP values did differ between the different orderings, the differences were not statistically significant except in one case: for the *Alpha* scenario explored in Version 4. However, it is difficult to say which of the available estimates for the *Alpha* scenario is the more accurate, or which should be used for policy decisions. Therefore, in Table 6-2 we show the pooled estimates for the *Alpha* scenario, making use of all of the available information, and also the estimates for each of the two different orderings. In examining the ordering effects, we detected no consistent direction of the difference between the orderings. We do not find that when a particular scenario is asked first, it always or never receives a higher value than when it is asked second.

[37] The values for the *Beta* and *Gamma* scenarios are statistically different at the 85% confidence level.

Table 6-2
Willingness-to-Pay for the Alpha Change, by Question Order

	Pooled Data	*Alpha* Change Asked Before *Gamma*	*Alpha* Change Asked After *Gamma*
Alpha change			
mean deciview change	1 dv	1 dv	1 dv
respondents (*n*)	394	195	199
mean (untrimmed)	$42±$13	$60±$23	$25±$11
mean (5% trim)	$21±$5	$33±$11	$14±$4
mean (income trim)	$27±$6	$37±$13	$18±$5
median (untrimmed)	$4	$6	$3
median (5% trim)	$3	$5	$2
median (income trim)	$3	$5	$3

Note: Mean values show the 95% confidence interval.

6.4 The Distribution of Expressed WTP Values

Consistent with the experience of most CV studies, we found the distribution of the respondents' stated WTP to be highly skewed, with a large number of respondents expressing a very low WTP and a small minority of respondents providing relatively large WTP values. As a result, the median and mean values of WTP shown in Table 6-1 differ substantially. An indicative metric describing the distribution of WTP values is the proportion of respondents who, it is inferred, would reject a referendum-type question that offers the estimated mean value as the bid amount. For Versions 3 and 4, 70 to 80% of our respondents would reject the estimated mean value. This finding mirrors the C&R study where the mean values fall similarly between the 70th and 80th percentiles of the distribution. For policy purposes it may be advisable to consider the trimmed values, to diminish the influence of a small minority. The NOAA Blue Ribbon Panel, for example, made the case for such conservatism in this situation (NOAA, 1993).

6.5 Debriefing Responses and Their Implications

Our survey included a fairly extensive set of debriefing questions that were asked after the WTP responses had all been supplied. Summaries of the responses to these questions are provided in Table 6-3 and Table 6-4. Table 6-5 provides details of the WTP allocation responses. The overall responses provide some interesting suggestions about the quality of the WTP estimates obtained through this survey. (These same comments also may apply to the C&R results, as we added the same set of debriefing questions to our Version 1, as these questions were not viewed as affecting the respondents' perceptions of the WTP-relevant parts of the questionnaire.) In this

section, we also provide some more specific examples of how one's responses to these questions appeared to be correlated to one's stated WTP.

One the positive side, a large majority of respondents expressed confidence in their stated responses, and in their understanding of the visibility scenarios described to them. (At the same time, a large fraction expressed some trepidation in setting a value on visibility at all, ranking themselves high on the statement "I'm in favor of some cost-of-living increase to help reduce haze in national parks and other scenic areas, "but I just can't judge what a fair amount would be.") Only a small fraction expressed boredom or frustration with the length of the survey.

Table 6-3
Responses to Selected Debriefing Questions, All Versions

"Which of these phrases best describes the money amounts you answered to the questions about your willingness to pay through cost of living increases?"	
Very accurate	14%
Within the ballpark	68%
Somewhat inaccurate	7%
Probably very inaccurate	2%
Not Sure	9%
"Which of these phrases best describes the dollar amounts you gave in reply to our questions about the four photographs? The dollar amounts were . . .	
basically for the stated changes in visibility in the national parks	55%
somewhat for the stated changes in visibility and somewhat to help with other needs at the national parks	28%
basically to help the national parks, and are not related to the stated changes in visibility	8%
none of the three statements above really describes my answers"	9%
Refused	0%
"What is the most important reason you would be willing to pay more in higher prices or taxes to help reduce haze in and around national park areas?"	
So my household and I could enjoy conditions as natural as possible on visits to national parks in the East region	7%
So others, now and in the future, could enjoy conditions as natural as possible on visits to national parks in the East region	46%
To have conditions as natural as possible at national parks in the East region, even if no one were ever to visit them	46%
Refused	1%
"Which one of these statements best describes how you personally expect to benefit, directly or indirectly, from the reduction of haze in national parks and other areas of scenic beauty in the Eastern United States?"	
Not at all, because I do not ever expect to visit those areas, or anywhere else where the visibility might improve as the result of reducing the haze in those areas	16%
A little, because sometimes I do or might travel to places where the program you have described would reduce the amount of haze	49%
Quite a lot, because I live in an area where I expect the air would be clearer as the result of a program to reduce haze in Eastern national parks and scenic areas	25%
I'm not sure	10%
Refused	<1%
"Which one of these statements best describes the types of areas in the Eastern United States where you thought that visibility would improve in the way described by the photographs, when you were answering the questions about cost of living increases? I thought that the visibility would improve in . . ."	
national park areas only	15%
all rural areas with scenic vistas, whether in a national park or not	37%
some urban and suburban areas, as well as rural areas with scenic vistas	48%
Refused	1%

Notes: Percentages may not add to 100% due to rounding.

Table 6-4
Responses to Debriefing Questions, All Versions

	Describes Me Perfectly			Doesn't Describe Me At All		I'm Not Sure	Refused
	5	4	3	2	1		
"I feel that I understood completely the different levels of visibility changes described in this survey."	51%	30%	12%	3%	1%	3%	<1%
"When I answered about how large a cost-of-living increase I would be willing to bear to reduce haze in areas of great scenic beauty, I was consciously thinking that reducing haze would probably help reduce other types of air pollution as well."	41%	30%	16%	7%	3%	3%	<1%
"When I answered about how large a cost-of-living increase I would be willing to bear to reduce haze in areas of great scenic beauty, I was consciously thinking that cleaner air there might also mean fewer breathing problems (and other medical benefits) for people who live in the region."	43%	26%	17%	6%	5%	2%	<1%
"When I answered about how large a cost-of-living increase I would be willing to bear to reduce haze in areas of great scenic beauty, I was consciously thinking that reducing haze in those areas probably means reducing haze over a much greater region as well."	38%	31%	17%	7%	4%	3%	<1%
"When I answered about how large a cost-of-living increase I would be willing to bear to reduce haze in areas of great scenic beauty, I was consciously thinking that reduced haze there would not only improve visibility but it would probably benefit the animal and plant life there as well."	44%	24%	17%	7%	6%	3%	<1%
"I think it's a worthwhile goal to reduce summer haze in areas of great natural beauty in the East region, but I can't afford an increase in my cost – of living just for that purpose."	23%	33%	22%	9%	7%	7%	<1%
"I'm in favor of some cost-of-living increase to help reduce haze in national parks and other scenic areas, but I just can't judge what a fair amount would be."	29%	29%	21%	9%	7%	4%	<1%
"When I answered about how large a cost-of-living increase I would be willing to bear to reduce summertime haze in areas of great scenic beauty, I was consciously thinking that there is a very real possibility that my cost of living may increase next year as a result of the policies described."	29%	29%	20%	8%	9%	5%	<1%
"When I answered about how large a cost-of-living increase I would be willing to bear to reduce summertime haze in areas of great scenic beauty, I was consciously thinking that reducing haze in the summer might mean less haze there at other times of the year as well."	26%	26%	21%	11%	11%	4%	<1%
"When I answered about how large a cost-of-living increase I would be willing to bear to reduce haze in areas of great scenic beauty, I was consciously thinking that reducing haze in those areas might have a good effect on water pollution or soil pollution as well."	24%	27%	20%	15%	11%	3%	<1%

Table 6-4 (continued)
Responses to Debriefing Questions, All Versions

	Describes Me Perfectly			Doesn't Describe Me At All		I'm Not Sure	Refused
	5	4	3	2	1		
"I believe that my answers to this survey will help government decision makers to make better decisions about air pollution matters."	21%	27%	25%	10%	5%	12%	<1%
"I believe that my answers to this survey will help government decision makers to make better decisions about national parks and other areas of outstanding natural beauty."	21%	27%	24%	9%	6%	13%	<1%
"I support a reduction of air pollution, but improving visibility in scenic areas is not among my most important reasons for doing so."	21%	27%	25%	15%	10%	3%	<1%
"I think it's a worthwhile goal to reduce summer haze in areas of great natural beauty in the East region, but I can't afford an increase in my cost of living just for that purpose."	16%	22%	27%	17%	16%	2%	<1%
"When I answered about how large a cost-of-living increase I would be willing to bear to reduce the effects of air pollution, I was consciously thinking about the amounts I typically give when asked to donate to a good cause that I believe in."	13%	22%	20%	13%	28%	4%	<1%
"I don't think that my cost of living should increase to reduce haze in scenic areas, since other people or organizations have caused the problem, not me."	5%	12%	17%	23%	40%	3%	<1%
"By the time I answered questions about cost-of-living increases to help reduce haze in areas of great scenic beauty, I was a little tired of this survey and wanted to get it finished."	6%	6%	17%	21%	48%	2%	<1%
"Unless I or my family are likely to visit a national park or other area of great scenic beauty in the East region, I'm not really willing to have my cost-of-living increase to pay for better visibility there."	4%	8%	16%	23%	45%	3%	<1%

Notes: Percentages may not add to 100% due to rounding.

Unweighted sample size= 1,422; Effective sample size=684.

Table 6-5
Responses to WTP Allocation Questions, by Questionnaire Version

	Questionnaire version				
	1	**2**	**3**	**4**	**5**
"About what percent of your dollar answers is for visibility at national parks in the East region?"					
Unweighted sample size	89	85	136	142	213
Effective sample size	34	49	66	83	150
0%	2%	2%	4%	3%	5%
10%	4%	6%	10%	7%	10%
20%	5%	7%	9%	10%	10%
30%	4%	13%	6%	12%	26%
40%	12%	4%	4%	1%	8%
50%	17%	32%	17%	21%	15%
60%	5%	7%	2%	7%	6%
70%	8%	10%	16%	12%	5%
80%	31%	16%	11%	13%	6%
90%	2%	1%	5%	1%	0%
100%	4%	0%	5%	2%	1%
I'm not sure	6%	3%	12%	10%	8%
Refused	0%	0%	0%	1%	0%
"About what percent of your dollar answers was for visibility at national parks and rural areas, as distinct from urban and suburban areas?"					
Unweighted sample size	90	102	159	154	203
Effective sample size	40	48	65	89	141
0%	1%	4%	3%	2%	4%
10%	7%	8%	4%	5%	10%
20%	5%	2%	9%	11%	11%
30%	7%	2%	4%	9%	14%
40%	4%	3%	4%	3%	8%
50%	17%	18%	17%	19%	18%
60%	1%	2%	3%	1%	4%
70%	5%	9%	9%	4%	8%
80%	33%	9%	6%	9%	7%
90%	1%	12%	3%	4%	2%
100%	15%	29%	26%	19%	7%
I'm not sure	4%	2%	13%	14%	8%
Refused	0%	0%	0%	0%	0%
"About what percent of your dollar answers should be spent to control haze in and around the park in the photographs, Shenandoah National Park?"					
Unweighted sample size	212	211	338	334	N/A
Effective sample size	68	96	149	199	
0%	2%	2%	1%	2%	
10%	14%	10%	13%	11%	
20%	12%	14%	13%	9%	
30%	12%	14%	10%	13%	
40%	4%	3%	2%	2%	
50%	10%	15%	12%	9%	
60%	3%	1%	3%	4%	
70%	4%	4%	3%	2%	
80%	7%	4%	4%	4%	
90%	0%	0%	2%	2%	
100%	4%	6%	13%	4%	
I'm not sure	30%	27%	24%	37%	
Refused	0%	0%	1%	0%	

Notes: Percentages may not add to 100% due to rounding.

The debriefing responses also indicate that a majority of respondents were aware that their responses would mean they would accept increases in their own personal cost-of-living, although a substantial share did feel that others should have to bear the cost, not them. Also, 35% felt that they answered by "thinking about the amounts I typically give when asked to donate to a good cause that I believe in" and another 20% felt that "somewhat described them" (i.e., ranked this statement a 3 on a scale of 1 to 5).

Additionally, the respondents generally indicated that there was an altruistic motive to their stated WTP, with only 7% suggesting that their WTP did not consider the enjoyment of others, now and in the future. Indeed, 46% expressed a significant existence value, "to have conditions as natural as possible at national parks in the East region, even if no one were ever to visit them."

At the same time, the debriefing responses make it quite clear that respondents were providing WTP values that included benefits well beyond just regional haze improvements in national parks and other scenic areas. Only 15% felt their values applied only to improvements with national parks, and fully 48% said they have been thinking about how there would also be visibility improvements in "urban and suburban, as well as rural areas with scenic vistas." Additionally, responses to the second of the WTP allocation questions (Table 6-5) indicate that between 35% and 65% of respondents would assign less than 50% of their stated WTP to "visibility at national parks and rural areas, as distinct from urban and suburban areas." These responses, as a group, suggest that results from a survey such as this inextricably combine "residential value" (e.g., for suburban and urban settings) with "recreational value" (e.g., use and non-use value in national parks and rural settings). This means it is probably inappropriate for benefits analyses to separately estimate "recreational" and "residential" benefits, and then to aggregate them. The fact that such estimates come from studies providing different types of vistas does not keep the respondents from realizing and considering the likelihood that regional haze improvements will indeed be experienced on a regional basis beyond the scope of the specific vista presented.

Of more concern is the fact that a large majority of respondents were valuing the visibility improvements shown in the questionnaire while "consciously thinking that reducing haze in the summer might mean less haze there at other times of the year as well." This is a serious concern because there is substantially less scope for the size of improvements shown for the summer during any other season of the year. (This is clearly the case from the information provided in Figure 3-2 of this report. In the non-summer periods, about 90% of the days are like the better two photographs, the remaining 10% are associated with days like the third photograph, and almost 0% are associated with the worst photograph. About two-thirds of the year has this much lesser chance for improvement to be observed. Thus, this response suggests that an upward bias may exist in WTP estimates based on changes to a summer-only distribution.

Finally, and most importantly, the debriefing responses reflect a substantial degree of part/whole bias with regard to the presence of other types of benefits from air pollution reduction that were presumed by the respondents when presented with information only regarding visibility changes. This is corroborated in the responses to WTP allocation questions in Table 6-5, where between 45% and 65% of respondents would attribute less than 50% of their stated WTP to "visibility at the national parks in the East region."

Given these debriefing responses, and given our concerns about directly using responses in Table 6-5 to adjust WTP values to correct for part/whole bias, as C&R did, we feel it useful to provide a sensitivity analysis of the WTP means as a function of the responses. Table 6-6 and Table 6-7 together summarize the results of such sensitivity tests.

6.5.1 Sensitivity to Part/Whole Bias

One debriefing question asked whether respondents thought that the described improvements would affect only rural areas or whether they might affect suburban or urban areas as well. We decided to include this question in part because we understand that in the past policymakers have summed the valuations from the C&R study to independent estimates from other studies, such as McClelland *et al*. (1993) that value visibility improvements in urban areas. It seems likely that at a minimum such an approach would suffer from double counting. Even though the visibility changes are explained in terms of what would happen at national parks and other scenic areas, it is easy to imagine that respondents might assume some sort of improvement in non-park areas as well. Our respondents' debriefing answers support this view. Across survey Versions 1 through 4, respondents reported that only 82 to 86% of their WTP values for visibility were actually for the rural areas alone. For Version 5, which incorporated explicit reminders of other air quality environmental goods, the proportion allocated to rural areas is just 66%.

Table 6-6
Effects of Screening Out Potential Response Biases (Beta change, Version 3)

"When I answered about how large a cost-of-living increase I would be willing to bear to reduce haze in areas of scenic beauty, I was consciously thinking . . .	**Mean score [5=Describes me perfectly; 1=Doesn't describe me at all]**	**Mean WTP**	
		Omitting score 5	**Omitting scores 3–5**
that reduced haze there would not only improve visibility but it would probably benefit the animal and plant life there as well."	4.07	$48	$30
change from full sample WTP		–19%	–49%
respondents, *n*		255	114
that reducing haze would probably help reduce other types of air pollution as well."	4.03	$51	$24
change from full sample WTP		–13%	–59%
respondents, *n*		258	107
that reducing haze in those areas probably means reducing haze over a much greater region as well."	4.00	$50	$18
change from full sample WTP		–15%	–70%
respondents, *n*		258	109
that cleaner air there might also mean fewer breathing problems (and other medical benefits) for people who live in the region."	3.97	$53	$28
change from full sample WTP		–11%	–52%
respondents, *n*		249	112
that reducing haze in the summer might mean less haze there at other times of year as well."	3.51	$50	$41
change from full sample WTP		–16%	–31%
respondents, *n*		302	150
that reducing haze in those areas might have a good effect on water pollution or soil pollution as well."	3.41	$54	$32
change from full sample WTP		–9%	–46%
respondents, *n*		299	150
about the amounts that I typically give when asked to donate to a good cause I believe in."	2.86	$59	$59
change from full sample WTP		0%	0%
respondents, *n*		343	192

Note: For the full sample (*n*=387) the untrimmed mean WTP is $59±$17.

Table 6-7
Effects of Screening Out Potential Response Biases (Beta change, Version 3)

Other debriefing responses	Mean score [5=Describes me perfectly; 1=Doesn't describe me at all]	Mean WTP	
		Omitting score 5	Omitting scores 3–5
"I feel that I understood completely the different levels of visibility changes described in this survey."	4.40	$59	$59
change from full sample WTP		0%	0%
respondents, *n*		381	336
"When I answered about how large a cost-of-living increase I would be willing to bear to reduce the effects of air pollution, I was consciously thinking that there is a very real possibility that my cost of living may increase next year as a result of the policy changes described."	3.74	$63	$56
change from full sample WTP		+7%	–5%
respondents, *n*		356	269
"I'm in favor of some cost-of-living increase to help reduce haze in national parks and other scenic areas, but I just can't judge what a fair amount would be."	3.71	$64	$29
change from full sample WTP		+8%	–51%
respondents, *n*		283	134
"I believe that my answers to this survey will help government decision makers to make better decisions about air pollution matters."	3.55	$60	$61
change from full sample WTP		+2%	+3%
respondents, *n*		364	255
"I believe that my answers to this survey will help government decision makers to make better decisions about national parks and other areas of outstanding natural beauty."	3.44	$61	$61
change from full sample WTP		+3%	+3%
respondents, *n*		360	257
"I support a reduction of air pollution, but improving visibility in scenic areas is not among my most important reasons for doing so."	3.23	$58	$59
change from full sample WTP		–2%	0%
respondents, *n*		323	155
"I think it's a worthwhile goal to reduce summer haze in areas of great natural beauty in the East region, but I can't afford an increase in my cost of living just for that purpose."	2.94	$63	$70
change from full sample WTP		+7%	+19%
respondents, *n*		330	178
"I don't think that my cost of living should increase to reduce haze in scenic areas, since other people or organizations have caused the problem, not me."	2.08	$61	$63
change from full sample WTP		+3%	+7%
respondents, *n*		367	281
"By the time I answered questions about cost-of-living increases to help reduce haze in areas of great scenic beauty, I was a little tired of this survey and wanted to get it finished."	1.91	$61	$65
change from full sample WTP		+3%	+12%
respondents, *n*		372	280
"Unless I or my family are likely to visit a national park or other area of great scenic beauty in the East region, I'm not really willing to have my cost-of-living increase to pay for better visibility there."	1.91	$61	$66
change from full sample WTP		+3%	+12%
respondents, *n*		376	295

Note: For the full sample (*n*=387) the untrimmed mean WTP is $59±$17.

In other new debriefing questions, we explore whether respondents are considering possible positive spillover effects on other types of air pollution, plant and animal life, human health, other regions outside the East, water and soil pollution, and haze during other times of the year. The results shown in the two tables are intended to be merely illustrative of the extent to which our estimates are affected by factors outside the explicit framework of the scenario, but they do permit some generalizations. First, a significant proportion of respondents admit to considering such spillovers while answering the visibility valuation questions. Moreover, the respondents who acknowledge considering external factors or benefits offer higher WTP amounts than do other respondents, and removing such responses dramatically lowers the WTP estimates. Removing just those respondents for whom descriptions implying biased responses "describe me perfectly" (score 5 on a five-point scale) lowers WTP by 9 to 19%. When removing people with a score of 3 or higher on the scale, the estimates are reduced by 30 to 70%. This finding illustrates that even though a CV survey may clearly and repeatedly enunciate the limited nature of the environmental good being valued, a sizable portion of respondents may find it difficult to limit their valuations to just the good being described.[38] Additionally, we find evidence that this difficulty is not innocuous. People who admit to considering other potential impacts indeed appear to be increasing their WTP values accordingly.

6.5.2 Other Potential Forms of Response Bias

In our qualitative debriefing of respondents carried out as part of our questionnaire development work, we found that when asked to describe their thought processes for valuation questions, many people spoke in terms of the amounts they felt that they could "give." Despite our stressing a rise in the general cost of living as the payment mechanism for this survey and illustrating how both prices and taxes might increase as a result of the hypothetical public policies under consideration, people are unaccustomed to being asked to sanction cost-of-living increases in advance. Indeed, for some, the idea of a charitable donation is the only meaningful context in which they can interpret such a question. Therefore, in our debriefing questions we explicitly asked respondents if they were thinking about how much they typically give to charitable causes. This sentiment received a modest level of agreement, evidenced by a mean score of 2.8 on a scale where "1" means "Doesn't describe me at all" and "5" means "Describes me perfectly." But the last entry in Table 6-6 illustrates that removing responses from people who strongly or even modestly agreed with the sentiment did not much affect the estimate of the average WTP.

6.5.3 Filters and the Reasonableness of Our Findings

A final component of our tabular analysis of these survey responses has been to examine the general reasonableness of our results by, for example, looking for any internal inconsistencies or examining how valuations vary with demographic or socioeconomic variables. That is, we ask whether our respondents are answering in ways that we would reasonably expect. Indeed, those respondents who appear likely to benefit most from the haze reductions, at least in terms of use

[38] We note that this finding is completely consistent with the lowered values deduced from Version 5 of the questionnaire, when visibility improvements were explicitly placed in the context of other major goals for air quality amelioration.

value, offer higher WTP values. Table 6-8 shows that the people who expect considerable benefits, because they themselves live in rural areas where the changes would be most evidence on a daily basis, had considerably higher willingness-to-pay than others. Similarly, people who stated that an improvement in visibility would increase their enjoyment of a visit to national park had higher WTP than others, and residents of the East gave higher mean WTP values than did residents of the West. Those who have experienced breathing problems personally or had an immediate family member who has such problems expressed WTP values that on average were about 10% higher than those of the full sample. Respondents who have earned at least bachelor's degree gave answers roughly 15% above the full sample mean. Having visited a national park in the past did not noticeably affect the expressed WTP values; perhaps because the vast majority of our sample, 81%, had visited a national park at some time in their lives (see Table 5-6).

Table 6-8
Mean Willingness-to-Pay Estimates (Beta change, Version 3), by Respondent Characteristics

	Mean WTP	Change From Full Sample WTP	Respondents, *n*
"The dollar amounts I gave were . . .			
very accurate	$78	+32%	51
very accurate or within the ballpark"	$76	+29%	265
"I expect to benefit personally . . .			
not at all, because I do not live there or visit	$31	–48%	51
a little, because I sometimes visit	$68	15%	168
quite a lot, because I live there"	$88	49%	81
"Less than average haze during my visit to a national park would increase my enjoyment . . .			
not at all	$21	–64%	120
somewhat	$52	–12%	131
very much"	$121	+104%	104
Residence location			
East of the Mississippi	$65	+10%	228
West of the Mississippi	$50	–16%	159
Respondent has ever visited a national park	$59	0%	303
Respondent has a bachelor's degree	$68	+15%	100
Respondent or immediate family member has experienced chronic breathing problems	$65	+10%	169

Note: For the full sample (n=387) the untrimmed mean WTP is $59±$17.

7
MULTIVARIATE ANALYSIS

After analyzing the univariate statistics derived from the survey data in the ways just described, we then undertook various multivariate analyses of the WTP responses. We adopt the multivariate framework as a more sophisticated alternative to dealing with identifying protest zeroes and unreasonably high values of WTP. Following a convention in the literature,[39] we have used censored regression techniques as to identify outliers and protest zeros, as well as to examine the influence of budget reminders on the expected WTP.

7.1 Parametric Tobit Analysis

As with other standard empirical analyses, the nature of WTP has guided our choice of regression specification. Because there is a significant number of WTP responses clustered at zero, we adopt a "Tobit" specification for dealing with censored observations. This approach hypothesizes that there are individuals who would have provided negative responses to our WTP questions if the survey form had allowed it; that is, individuals who would have to be *compensated* to improve visibility in national parks. Under this assumption, we are in effect missing information on the complete distribution of WTP values because our observations are censored from the left at zero. Using a censored form of linear regression adjusts the intercept and slope coefficients to account for the missing information. Because one of our interests is identifying *which* of the zero responses are "protest" zeroes, we might interpret the Tobit results as (i) identifying the likelihood that a respondent, conditional on his or her covariates, would provide a non-protest response, and (ii) predicting the level of the non-protest response.

In the statistical software package that we use, *Stata*, there are three ways to accomplish a censored regression depending on how the sample is censored. The different methods are identified as *cnreg* (censored normal), *tobit*, and *intreg* (interval regression). We use the *svyintreg* command, which estimates the interval regression Tobit model with survey weights. We coded the variables to interpret zeros as censored values.[40]

Multivariate regression analysis allows us to examine whether budget reminders reduce the average WTP by statistically significant amounts, while taking into account the demographic

[39] John M. Halstead, Bruce E. Lindsay, and Cindy M. Brown, "Use of the Tobit Model in Contingent Valuation: Experimental Evidence from the Pemigewasset Wilderness Area," Journal of Environmental Management, 1991, 33, 79-89. Also, Rafael Rob and Joel Waldfogel, "Piracy on the High C's: Music Downloading, Sales Displacement, and Social Welfare in a Sample of College Students," NBER Working Paper, No. 10874.

[40] All of the computer code used to generate the results presented in this section has been preserved on a CD-ROM, along with the data files of responses to which they were applied. Researchers interested is further information should contact EPRI.

(and other relevant) attributes of respondents. However, WTP is censored at zero, and the statistical specification should explicitly reflect that feature. Following other WTP research, we use a Tobit specification to evaluate the effects of budget reminders. For these analyses, we pooled the data across versions within a given scenario, and included so-called "protest" bids. We used indicator (or dummy) variables for the version of questionnaire and included in these regression models measures of the respondents' income, age, education, location, family breathing problems, and prior visits to national parks. The signs of the coefficients are generally consistent with theory. For example, income has a positive effect on WTP. While the coefficients are jointly significant, we find that the predictive power of the respondents' measures is low. As such, examining the simple trimmed means may be equally informative.

Table 7-1 reports the average of the predicted WTP values from the Tobit specifications, with negative predicted values set to zero but included in the calculation of the means. To assess statistical significance, we use standard bootstrapping techniques with 1,000 replications to calculate 95% confidence intervals. We find that the use of budget reminders reduces the average WTP by statistically significant amounts. For example, for the *Beta* scenario, the average WTP falls from $54 for Version 2 to $33 for Versions 3 and 4, and further to $9 for Version 5. Based on the 95% confidence intervals, the decline from $54 to $9 is statistically significant. For the *Gamma* scenario, the average WTP falls from $84 for Version 2 to $34 for Versions 3 and 4, and to $14 for Version 5. Again, the decline from $84 to $14 is statistically significant.

Table 7-1
Mean WTP Values Predicted by Tobit Regressions

	Version 1 (replication of C&R)	Version 2 (add histograms)	Versions 3,4 (add budget context)	Version 5 (disaggregation)
Alpha scenario				
number of observations			401	
mean willingness-to-pay			$16±$10	
Beta scenario				
number of observations	1,017	1,017	1,017	1,017
mean willingness-to-pay	$62±$25	$54±$40	$33±$15	$9±$8
Gamma scenario				
number of observations	1,418	1,418	1,418	1,418
mean willingness-to-pay	$101±$56	$84±$66	$34±$13	$14±$10
Delta scenario				
number of observations	1,215	1,215	1,215	
mean	$72±$28	$55±$37	$12±$11	

Notes: Values reported are means of the predicted values of each record. Negative predicted values have been replaced with zero. Mean values show the 95% confidence interval.

7.2 Semiparametric Analysis As a Future Analysis Option

The Tobit specification, which is considered to be a "parametric" statistical approach, makes specific statistical assumptions for estimation purposes. These assumptions may be overly restrictive when there is considerable clustering or "heterogeneity" of the WTP responses because they assume continuous variation of WTP which is not apparent in the data and that may not, in fact, adequately characterize the WTP distribution. For this reasons, the Tobit specification may insufficiently weight individuals with zero WTP. Accordingly, we suggest two possible "semiparametric" statistical procedures to analyze the data, although implementation of these analyses is left as a future endeavor.

The first semiparametric technique, so-called "discrete factor integration," was originally proposed by Heckman and Singer (1984) for single-equation models and was later extended to multiple-equation models by Mroz (1999). It has been used to analyze data in a variety of settings, including the returns to marriage (see Mroz, 1999), the long-term effects of early unemployment (see Mroz and Savage, forthcoming), and the effects of maternal work on child outcomes (see Aughinbaugh and Gittleman, 2004). This technique simultaneously estimates the probability that the WTP is positive and the value of the WTP *given* that it is positive. It would directly account for potential clustering in the data, but the technique is more data-intensive than the more conventional approaches we have undertaken thus far. It also requires the construction of variables that can be viewed as "instruments" that shift the probability of WTP without affecting its level conditional on that probability. We believe that there are questions in the survey instrument that can serve this function.

The second semiparametric technique, so-called "conditional density estimation," relies on a more recently-derived statistical procedure that has been applied in health economics (see Gilleskie and Mroz, 2004). Similar to the parametric Tobit analysis, this semiparametric technique specifically models the structure of the data, namely the zero responses (for example, for physician visits in the Gilleskie and Mroz case).

For both of these nonparametric techniques, goodness-of-fit measures will allow us to compare whether the approach fits the survey response data more closely than the Tobit model reported above.

8
CONCLUSIONS

This report has documented a major new contingent valuation survey to explore WTP for regional haze improvements in the Eastern region of the U.S. This survey was conducted to address a range of questions and criticisms regarding earlier estimates of WTP for regional haze changes that have been used extensively in benefits assessments and public policy formation.

The methodological enhancements included:

- A detailed exploration of the potential for WTP estimates to be biased by lack of budget reminders, single-focus bias, and part/whole bias.
- Full-scale survey implementation of several different CV questionnaire versions, providing a direct assessment of the sensitivity of the resulting WTP estimates to key variations in questionnaire design.
- Use of a random, nationally-representative sample of the general population resident in the 48 contiguous states.
- Greater detail and control of the characterization of visibility conditions, and changes to those conditions, for the survey respondents.
- Computer-assisted survey implementation, providing such features as randomized ordering of scenarios and response lists, real-time checking for internal consistency, and greater tailoring of question wording as a result of the respondent's answers to prior questions.
- Considerably expanded debriefing questions, allowing better *ex post* assessment of the credibility of the resulting WTP estimates.

Analysis of the responses to the various survey versions has indicated several key findings. The respondents appeared to understand what was being explained, and most respondents seemed cognizant that their responses should reflect a personal willingness to accept cost-of-living increases. Additionally, there were a number of desirable attributes in the patterns of WTP, such as an ability to satisfy most forms of scope tests, and insensitivity to differences in ordering.

Overall, it was clear that most of the U.S. public does care about and assigns personal value to the amenity of good visibility conditions. However, the distribution of those values is strikingly skewed. A substantial minority (10% to 20%) did assign zero value to the changes presented without appearing to be offering "protest votes." But more importantly, a majority expressed WTP values that were substantially less than the mean WTP across the sample. In the end, even ignoring all stated values that were zero, there is a wide disparity on expressed values, with a majority ascribing small but positive value, and a minority expressing values that are so much higher than they end up dominating the sample's mean WTP. Many respondents reflected a

strong streak of altruism in their stated values, and also revealed attitudes consistent with there being a component of existence value in their responses.

On the other hand, there were a couple of patterns that should be the subject of further discussion and analysis. They could affect the overall credibility of using the WTP results from this and earlier surveys as the measures of compensating variation that contingent valuation methods seek to elicit:

- When shifting from a version of the survey that had overall much larger changes in visibility to one that started with much better baseline visibility, and for which there was only about half the amount of change in *any* of the three scenarios asked about, the total WTP remained effectively constant. Although internal and external scope tests were satisfied among the versions that all relied on the same baseline and range of visibility changes considered, the stated WTP may be quite invariant to large, absolute changes in the set of visibility conditions being compared.
- A majority of the respondents agreed that they relied in a moderate to large degree on their personal notions of reasonable charitable contribution sizes when stating their WTP. This could corroborate the pattern noted above – respondents may start from a notion of a fair charitable contribution, and then merely tailor their WTP to relative changes presented from there.

The potential presence of response biases in CV surveys was a key concern of our study design. We found substantial evidence of embedding and part/whole bias in the debriefing responses, even in the version of the survey that attempted to address this issue directly. Embedding includes the addition of WTP for visibility changes even in urban and suburban areas that were not the subject of the survey, and the addition of WTP for other environmental improvements expected to be concurrent with the asserted changes in visibility.

The survey also generated substantial evidence that efforts to get respondents to consider their personal budget constraints can dramatically alter the estimate of WTP that the survey will produce. A multivariate analysis of the results from multiple versions of the survey questionnaire indicates that adding reminders that one has a budget constraint cuts the estimated WTP by a factor of 2 to 4 compared to a comparable questionnaire that omits the reminders. Further, a questionnaire format that elicits a total value for a composite good (a limited "package" of three different air quality improvements), and then disaggregates the total WTP to infer the value of the visibility improvement alone, reduces the estimated WTP achieved with just budget reminders by *another* factor of 2 to 3.

The WTP thus varies by a factor of 6 to 8 from the version of our questionnaire that set out to replicate most closely (albeit not identically) the approach underlying the earlier estimates of Chestnut and Rowe (1990), to our most thorough attempt at addressing budget constraints (i.e., comparison of estimated WTP from Version 2 to Version 5). These observed effects are statistically significant at the 95% confidence level, and differences in the way budget reminders were offered were found to be, by far, the most important determinant of WTP.

Given the dramatic additional effects of our final questionnaire format (Version 5), some criticisms of this particular approach merit discussion. One criticism of the "disaggregation" approach is that changing the level of multiple goods simultaneously (as does a scenario of change in a composite good) introduces "wealth effects." That is, if we see a lower value for the described visibility scenario in Version 5, this could be in part because we have altered a respondent's basket of goods and made him or her better off by providing greater levels of other amenities such as human health and plant and animal health. This might cause individuals, facing diminishing returns, to be unwilling to pay as much for the improvements to visibility.

While this is a possible effect in theory, we feel that it is unlikely to be so dominant that it would account for a majority of the incremental reduction in stated WTP that the composite good approach elicits. The impact of any such wealth effects should be relatively small: the other two "goods" added to the respondents' wealth represent relatively small changes in the comparison of their existing endowment of market and non-market goods. At the same time, there is overwhelming economic evidence that the existence of substitutes reduces the price of any good, and this survey version, on the most basic level, can be interpreted as a forceful reminder of substitute goods. We believe, therefore, that the bulk of any difference in the estimates can be attributed to reminders of substitutes, rather than to wealth effects.

This criticism of the method in Version 5 also seems to be a proverbial case of "not seeing the forest for the trees." The policy approaches that presumably will be used to enact the types of visibility changes we discuss in the survey will also have spillover impacts on human health and plant and animal health. To value each amenity in isolation, for the sake of theoretical purity of the resulting WTP estimate, would lead to even more erroneous policy conclusions. In fact, the NOAA Blue Ribbon Panel (NOAA, 1993, p. 13) notes the possibility that the sum of the individual average WTP values to avoid each of many possible types of environmental damage (oil spills or groundwater contamination in a variety of places, visibility impairment around the country and so on) "could easily become a very large fraction of one's income or perhaps even exceed it." Furthermore, there is so much evidence of other, probably more problematic, theoretical limitations in the interpretation of the WTP estimates from this and other CV surveys, that we feel there are other, more important avenues of criticism that should become the focus of further analysis and review.

To conclude, the results of this study suggest there is much value both in further analysis of the copious data that this survey produced, and also that similar advancements should become the standard for any future surveys on public preferences for regional haze improvements. The latter conclusion is of particular importance, as this study addressed values for visibility improvements in Eastern parks only. The demand for estimates of the national visibility benefits of regional haze and other air quality policies is strong, and this study has shown that earlier studies' estimates are likely to be afflicted by strong response biases. Without new surveys for other parts of the U.S. that do a better job of addressing budget constraints – particularly for the Western region –, there will be no credible basis for *national* visibility benefits estimates.

9
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A

APPENDIX A. BIAS IN BENEFITS ESTIMATES DUE TO ERROR IN VISUAL RANGES ESTIMATED FOR PHOTOGRAPHS USED BY C&R

As described in Section 2, C&R used photographs that had substantially different visual ranges than they reported (and which were consistent with the then-current baseline visibility distribution). Although this makes little difference to the mean WTP reported from their survey, it does affect the later interpretations of the WTP for various increments in visibility improvements, creating an upward bias in the latter. This appendix shows the magnitude of those benefits estimates biases.

This upward bias only affects ex-post interpretations of the WTP results. For example, the values reported for changing average visibility from that depicted in photograph C to that in photograph B was reported as a 25 km change, a 100% increase in visual range, when it was actually a 33 km change, a 200% increase in visual range. Table A-1 reports summertime average visibility change before and after the error is corrected, a simple inspection of which indicates that benefits estimates based strictly on the data reported in C&R have probably been overstated by 50 to 100%. This is true whether assessed on the basis of percent changes in visual range, the manner in which the C&R results have been interpreted in the benefits literature, or in term of numbers of dv changed, a more recent way of considering the "amount" of change in visibility conditions.

Table A-1
Discrepancies in the Visual Range Changes Used and Claimed in the C&R Survey [41]

	Changes in VR *reported* in C&R	**Changes in VR *actually used* in C&R**
Average changes from C to B	+100% (–7 dv)	+190% (–11 dv)
Average changes from C to A	+200% (–11 dv)	+780% (–22 dv)
Average changes from C to D	–60% (+9 dv)	–70% (+12 dv)

[41] This comparison is based on C&R's WTP estimates for the Southeast.

The degree of overstatement can be more precisely calculated, however, by turning to Chestnut and Dennis (1997). This report used the Shenandoah vista WTP results from C&R to extrapolate to benefits in the Eastern U.S. attributable to the Title IV sulfur dioxide reductions. It introduced a method of extrapolation in which a benefits function was statistically fitted to the WTP results for the three scenarios of average visibility changes valued in C&R:

$$WTP = B^* \ln (VR2/VR1),$$

where VR2 is the average visual range after the change and VR1 is the average visual range in the baseline.

Note that the term VR2/VR1 is equal to the percent change in Table A-1 plus 100%. Using the percent changes reported in C&R (column 2 of Table A-1), Chestnut and Dennis estimated a value of 50 for B for non-Virginians and 85 for Virginians. However, when we re-estimate B using the percent changes associated with the actual photographs used in C&R (column 3 of Table A-1), we obtain a value of 30 for non-Virginians and 50 for Virginians. Thus, the benefits that Chestnut and Dennis estimated for visibility improvements in national parks of the East under the Title IV program were biased upwards by about 70 %.

The Chestnut and Dennis method was also used in major visibility benefits studies by USEPA (e.g., USEPA, 1997). More recently, USEPA shifted to a more complex benefits function based on a CES utility function (e.g., USEPA, 1999a and 1999b). However, this benefits function's parameters also have been calibrated to C&R WTP results using the incorrect visual range change for each WTP estimate. Thus, all of these other important benefits analyses are similarly affected by the error in the C&R photographs. Their estimated dollar benefits are also probably overstated by a similar magnitude as by Chestnut and Dennis.

B
APPENDIX B. DETAILS OF PILOT SURVEYS AND OTHER SURVEY DEVELOPMENT

Three rounds of pre-testing and a peer panel review significantly impacted the development of our survey instrument. The first round of pre-testing involved observing a relatively small number of one-on-one interviews from respondents recruited "off the street" in Boston in early March 2003. The second round of pre-testing involved observing 80 respondents taking the computerized version of the survey at a dedicated survey facility in Atlanta in mid-May, 2003. A panel of experts reviewed the results of the pilot work in July 2003 and suggested further refinements to our survey. The refined survey was tested on a relatively large nationally representative random sample from the *Knowledge Networks* panel using the internet. A subset of the respondents was selected for follow-up debriefing interview over the telephone. That version of the survey with only minor adjustments was used as the final survey for this study. Details of each of the pre-testing rounds are given below.

B.1 First Pilot Survey: Observing Personal Interviews in Boston

The first round of pre-testing took place on Thursday March 6, 2003 at the *Performance Plus* purpose-dedicated facility at Quincy Market in Boston.[42] The purpose of this exercise was to test out, in a closely-observed manner, the draft questionnaire innovations of our study. We wanted to see how well typical *interviewers* could cope with the draft questionnaire in a "pencil-and-paper" personal interview, and also what problems *respondents* have in trying to answer our questions. We were particularly concerned to test out the questions that posit a changed *frequency distribution* of different visibility levels (by percentage of days) as the result of hypothetical pollution control policies.

We had a target of fifteen completed interviews, which we quoted by sex and three broad age categories to be generally representative of national population distributions. We also specified that, of the fifteen, at least five should have visited a national park area at some time in their lives. We achieved nine of the target fifteen interviews. Several factors contributed to the shortfall. Most importantly, between approximately 10:30 and 15:00, Boston had about 5 inches of snow, which proved very slippery underfoot in the open areas of Quincy Market; this slowed

[42] This area combines historical buildings with one of the earliest implementations of the Rouse "festival marketplace" concept, with a large number of indoor small food outlets and boutiques alongside restaurants and major mid-market chain stores (e.g., Crate & Barrel, Victoria's Secret) in flanking buildings around a substantial open courtyard area. Located on "the freedom trail," for much of the year (although hardly at the time of our pilot) the area is a magnet for tourists as well as a popular lunch spot and retail market for people working nearby.

down recruitment significantly and limited our ability to continue recruiting into the evening hours.

The nine respondents were not fully representative of the demographic quotas set with a total of 15 interviews in mind. Seven of the nine were female. The group was biased somewhat towards women in their 20s and 30s, with politically "liberal" leanings. Only one member of the group was not Caucasian, and she was the only one without a four-year college degree. Only one member of the group was over 50. Nonetheless, we learned a good deal. All interviews were videotaped (although there were problems with the equipment during one of the interviews).

One of the main findings of this work was that respondents had little difficulty understanding the bar charts and that the bar charts helped them assimilate the information. While our sample was hardly a fully representative distribution of educational attainment, even the least-educated member (who apparently had never heard of global warming) didn't appear troubled by this question. In addition, we continued to probe respondent comprehension of the questions in the additional pilot work. The other major finding of the work was that further testing of the survey using pencil and paper methods was untenable. Even our very experienced interviewer continued to have problems with the instrument throughout the day and became impatient with the somewhat lengthy text portions of the survey. Hence we decided to transition the survey to a computer-based version for the second round the pilot work.

B.2 Second Pilot Survey: Observing On-Line Responses in Atlanta

Mid-America Research, Inc. administered 80 computer-based interviews at their *Lenox Square Mall* location in Northeast Atlanta during the period May 13-17, 2003. Most of the 80 respondents were recruited by intercepting them inside the mall while 30 were pre-recruited to ensure that a sufficient number of respondents were personally familiar with vistas in national park-like areas.

The information gathered from the qualitative debriefing questions supported our findings from the first pre-test that respondents were not having problems understanding our survey questions or the histograms.

Still, the results of the second pre-test resulted in significant changes to the survey instrument. With the migration to the computerized version of the questionnaire, we added audio files that read certain key portions of the survey aloud. The survey firm *Knowledge Networks* had been cool to the idea, stating their respondents were accustomed to reading lengthy portions of text that the audio portions increased the time needed to download the questionnaire, and that respondents sometimes became impatient with the repetitive nature of a voice reading the same material on the screen. The results of our pilot confirmed that received wisdom and we decided to abandon the voice recordings.

Analysis of the results of this survey and further discussions with the peer review panel formed the basis for the decision to abandon the doubly-bounded dichotomous choice (DBDC) format we had used in the first two pre-tests. The reasons for the change were multiple. First, keeping all the survey versions in the payment card introduced multiple sources of change, making

comparisons to the original C&R work difficult. We could have introduced both a histogram and a new elicitation format in one jump but it would have been impossible to ascribe any differences in resulting estimates to one cause or the other. Alternatively, we could have introduced both changes sequentially but that would have necessitated either a larger sample size (at increased cost) or decreased the sample size assigned to each version which would have affected the statistical power of our results. Second, we found it challenging to incorporate Kemp and Maxwell's disaggregation approach to the dichotomous choice format. Because the DBDC approach resulted in only a "yes" or "no" response from the respondent rather than a dollar amount, making a meaningful allocation of the value among different environmental goods was difficult. Finally, it was our feeling the body of work in literature describing methods for developing the appropriate initial bid levels is not sufficiently developed to ensure a robust experimental design.

Our discussions with the independent expert panel produced another significant change to the survey in the version dealing with the allocation exercise. The original allocation exercise involved allocating a value generated for a general environmental good into several (eleven) specific environmental issues. The exercise lacked specificity and we decided to limit the number of specific environmental goods to a number that could be adequately described in a reasonable length of time. Hence we limited the exercise to just three well-defined environmental issues. In addition, we presented the information on all three goods to the respondent before the first valuation question, responding to the issues raised by Bateman in numerous studies.

B.3 Third Pilot Survey: National On-Line Sample

After incorporating the refinements from the previous work, we performed the final pretest using a nationally representative sample of *Knowledge Networks* respondents. Version 3 was taken by 99 respondents and version 5 was taken by 38 respondents. We then conducted twenty qualitative debriefing interviews (10 for each version) via telephone with respondents after they completed the survey.

Again, we confirmed that the respondents (of varying educational achievement levels and ages) had easily understood the bar graphs and the questionnaire in general, although some complained that the questionnaire was "wordy." Further, the respondents did not notice any particular bias in the wording of the questions. We did encounter people who felt the changes were unrealistic, that the government couldn't be trusted to make the changes efficiently, or that they should not have to pay for environmental goods. We note that these types of issues are present in most, if not all, CV surveys and in our analysis of the data we attempt to minimize the effect of such responses on our results. We encountered no logistical issues during the pretest and made no significant changes to the survey instrument after this final pretest.

C

APPENDIX C. FULL TEXT OF FIVE QUESTIONNAIRES USED IN THIS SURVEY

This appendix contains the precise final text of the survey questions, and the sequencing of the questions. The questionnaire was implemented on-line, and so there are no actual hard copies of the survey that can be printed out. What is provided here are the specifications of the text and the Q&A sequencing rules that were coded by Knowledge Networks, Incorporated, and implemented over its web interface. Depending on the respondents' specific responses, the specific questions asked of each individual would tend to vary.

There are five different versions, although all five share some common elements, such as introductory statements and debriefing questions. The common content is presented only once in this appendix.

The questionnaire asks respondents to consider a graphical display depicting the visibility scenarios. These graphical elements were *not* provided on-line; hard copies were mailed to individuals who had agreed to participate in this survey before they could initiate the on-line questionnaire. An example of one of the graphical displays is provided as an insert to this report. Copies of the cover letter that was enclosed with that mailing are in Appendix D.

Survey about visibility in national parks and similar areas
Introductory section for all versions

The sample will be drawn to represent, by US Census characteristics (age, sex, race and ethnicity, highest level of education, and census region), all households in the 48 contiguous states. The mailing of visual aids will be to a person identified in *Knowledge Network* records as a (self-classified, but otherwise undefined) "Head of Household." These opening questions are intended (i) to identify situations where the household, as defined by the dwelling unit occupants, contains more than one economic unit; (ii) to confirm that the selected person is one reasonably able to speak for the household on financial matters; and (iii) to help word subsequent questions in a way most appropriate to the respondent's household situation.

This questionnaire format follows the convention that any skip patterns are indicated immediately to the right of the code for each response. When no question number is indicated to the right of a code, the interview just proceeds to the next-numbered question. Instructions *in italics* are shown to the respondent, while **subheads like this** and instructions ***in bold italics*** are intended for the programmer alone; like the question numbers, they do not appear on the screen.

Note that the survey is titled and introduced slightly differently depending on whether it is *Versions V1* or *V2*, or all other versions. *Versions V1* and *V2* will be titled "Survey about conditions in national parks and similar areas," while all other versions will be titled "Survey about national priorities, 2003."

Introduction

Several days ago, we wrote to tell you about an up-coming survey about ***[Versions V1,V2:*** conditions in national parks and other similar areas of great natural beauty. ***/ all other versions:*** national priorities.***]*** This is that survey. It will take you approximately ***[insert version-specific range estimate]*** minutes to complete, and we recommend that you don't start it until you know that you will have enough time to spare. At one specific point in the survey, you will be asked to open the sealed envelope that was sent to you with our letter and to look at the contents. Please have the envelope available before you begin the survey, but do not open it until you are asked to do so.

But first, we need to ask you a few questions about your own household situation to help us ask our questions in the way that's most appropriate for you.

Household classification section

1) Which one of the following statements best describes your own household living arrangements? *[Check one only.]*

I live alone	**1**	**[below]**
I share living space with at least one other person	**2**	**[Q.2]**

If Q.1:1, set FLAG1=1 and skip straight to the first question of the appropriate questionnaire version.

Ask all who share their living space [Q.1:2]:

2) Do all the adult members of your household largely pool their possessions and money, and make decisions together about most major purchases, or do some adult members of the household mostly live their own lives but just share the living space? *[Check one only.]*

Adult household members all pool their possessions and money	**1**	**[Q.4]**
Some adult household members "live their own lives"	**2**	**[Q.3]**

Ask all in households with more than one economic unit [Q.2:2]:

3) When two or more people live together, sharing their possessions and money and making decisions together about major purposes, we can call them a "family unit." When the household consists of (or includes) individuals who live

their own lives but just share their living space, then such a person counts as a separate "family unit." In total, how many different "family units" are there in your own household?

(3a) *Enter the number of separate "family units" in your own household:* ____

(3b) *And how many people are there in your own "family unit"?* ____ **[below]**

If Q.3(b) is 1, set FLAG1=1 and skip straight to the first question of the appropriate questionnaire version.
If Q.3(b) is greater than 1, continue with Q.4.

Ask all living in multi-person economic units [Q.2:1 or Q.3(b)>1]:

4) Are you one of the "heads" of your ***[Q.1:2 or Q.2:1:*** household / ***Q.3(b)>1:*** "family unit"***]*** – that is, one of the people who makes most of the decisions about major purchases and other financial matters? *[Check one only.]*

Yes, I participate in making most of the major decisions **1 [below]**
No, I am not one of the people making the major decisions **2 [Q.5]**

If Q.4:1, set FLAG1=2 and skip straight to the first question of the appropriate questionnaire version.

Show to all respondents not qualifying for further interview [Q.4:2]:

5) We're sorry, but you do not qualify for this survey.

Questionnaire version V1 [“Replication of C&R”]

This version of the questionnaire aims to be a “straight” replication of the Chestnut & Rowe 1989 interview, but using various “updates” in language that will also permeate C&R replication questions wherever they appear in other versions of the questionnaire. For comparison purposes, the original C&R language for a question, where it differs from ours, is shown in boxes like these throughout the *Version V1* text.

The question numbers in this version are not sequential but are aligned to correspond with the sequential numbering of the equivalent question in the longest version, *Version V3*.

National parks orientation section

C3) Because national parks and other scenic areas are usually owned or protected by governments, issues about their preservation and management affect all of us, even if we rarely or ever visit such areas ourselves. In order to reflect the priorities of *all* people in the country, it is important to get answers from everybody, not just from the people who are most interested in a particular topic. So **please complete this survey whether or not you have ever visited any national parks or other areas of great natural beauty**. Your opinion is important, and what you and other people tell us in this survey will help influence future government policies.

The federal government’s National Park Service is responsible for looking after a wide range of different types of places, including historical buildings or sites, historical areas, battlefields, cemeteries, monuments, and recreation areas. But this survey is about the national parks themselves, and just those located in the continental United States, not counting Alaska and Hawai’i. These parks are usually large natural areas, often wilderness or semi-wilderness, where the federal government places restrictions on how the land can be used and on hunting and mining. The national parks usually have an admission charge.

Have you personally *ever* visited a national park within the continental United States? *[Check one only.]*

Yes, I have visited at least one national park	**1**	**[Q.C4]**
No, I have never visited a national park	**2**	**[Q.10]**
I’m not sure	**9**	**[Q.C4]**

C&R language:

Q.1) Have you personally ever visited any national park (including monuments and seashores)? *[No response option for “unsure.”]*

Ask all who have definitely or possibly visited a national park [Q.C3:1,9]:

C4) Please check (in the left column) any of the following national parks that you have personally *ever* visited. In the right column, please check any of these parks that you have visited *in the last two years*, that’s since November 2001. *[Check as many as you have visited.]* ***[Randomize the display order, except that the last two options always appear last.]***

	Ever visited	Visited in *last 2 years*
Grand Canyon National Park in Arizona	**1**	**1**
Great Smoky Mountains National Park in Tennessee and North Carolina	**2**	**2**
Shenandoah National Park in Virginia	**3**	**3**
Yellowstone National Park in Wyoming	**4**	**4**
Yosemite National Park in California	**5**	**5**
I have not visited *any* of those parks	**6**	**6**
I’m not sure	**9**	**9**

C&R language:

Q.3) Have you personally ever visited the following national parks? *[List excludes Yellowstone. No response options for "unsure."]*

C&R also include questions about regions of the country in which parks have been visited (Q.2); likelihood of visiting parks in three specified regions in the next five years (Q.4); scaled importance of six specified reasons for visiting national parks (Q.5); willingness of tax support for national parks "if you personally could never visit" (Q.6); scaled importance of six specified reasons for tax support for national parks "if you personally could never visit" (Q.7); and scaled priorities for prevention of six specified deleterious effects in national parks (Q.8).

Haze orientation section

10) Throughout the United States, air pollution that results mostly from activities in cities and industrial areas can cause a range of different problems. In some climatic conditions, air pollution can be fairly harmless. In other places, it can cause health problems for some people and animals, and it can also harm trees and plants.

Another result of air pollution is an increased amount of haze in the air, which can affect how well and how far a person can see the scenery in and around national parks and other areas of great natural beauty, particularly during the summer months.

At this stage, please open your sealed envelope. Unfold and look at the sheet you will find inside. When you have unfolded the sheet, please place it down somewhere where you can see it well, with good light. When you are ready to move on, click on the *Continue* button.

C&R language:

Throughout the U.S., air pollution from outside the parks causes haze that reduces how well a person can see in national parks and into scenic vistas outside park boundaries.

12) The four photographs on the sheet show the effects of different levels of air pollution on a typical view in the Shenandoah National Park in Virginia. All of the photographs show summer days without any rain or natural fog. They are typical of conditions between June and September in and around the national parks in the Appalachian chain of mountains. At other times of the year, air pollution does not affect the view as much.

Photograph **A** shows almost no haze. That occurs on about *18* summer days each year; that's about *15%* of all summer days.

Photograph **B** shows a little haze. That occurs on about *24* summer days each year, or about *20%* of all summer days.

Photograph **C** shows average visibility conditions. They occur on about *48* days each summer; that's about *40%* of all summer days.

And finally, Photograph **D** shows a lot of haze. That occurs on about *30* days each summer, that's about *25%* of all summer days.

If you were to visit this area in the summer months, you would be most likely to have average visibility like Photograph **C.** How do you think that having *less than average haze* due to air pollution, like Photograph **B** rather than Photograph **C**, would affect your enjoyment of the visit? Do you think that it would . . . *[check one only]*

have *no effect* on your enjoyment,	**1**
or increase your enjoyment *somewhat,*	**2**
or increase your enjoyment *very much*?	**3**
I'm not sure	**9**

C&R language:

The enclosed photographs show different levels of air pollution at three national parks on days without rain or natural fog. The conditions at these parks are typical of summertime conditions at the national parks throughout the region in which each park is located.

The descriptions of each photograph were very similar to the wording shown here, as was the wording of the question (C&R Q.9). There was no "unsure" option.

Questions about photographs

13) In fact, the photographs show typical summer visibility conditions in the national parks in the Eastern region – that's all parts of the country east of the Mississippi river. In the future, the visibility at these national parks could improve or worsen depending on how much we try to control air pollution. I'm going to read some possible goals for protecting the national parks in the East. Using a scale of 1 to 5, where 1 means "Not at all important," 3 means "Somewhat important," and 5 means "Extremely important," what number between 1 and 5 best represents how important you think it is to . . .

improve the visibility at some or all of the parks in the East region?

prevent the visibility from getting any worse at some or all of the parks in the East region?

Not at all Important		*Somewhat important*		*Extremely important*	*I don't know*
1	**2**	**3**	**4**	**5**	**X**

C&R language:

C&R had a Q.10 which introduced the idea of paying for haze reduction measures and asked about willingness to pay on a five-point scale (before exploring WTP amounts in Qs.12ff.). Their Q.11 (below) appeared to be out of logical order, and we have brought it before the introduction of specific haze reduction policies.

Q.11) The photographs for Grand Canyon National Park show typical visibility conditions in the national parks of the Southwest. In the future, the visibility at these national parks could improve or worsen depending on how much air pollution control is undertaken. How important do you think the following goals are for protecting visibility at national parks in the Southwest? Improving visibility at some or all parks; Preventing visibility from getting worse at some or all parks.

17) To protect and improve visibility in and around national parks, federal and state governments are considering changes to air pollution control laws. These changes could affect all of us throughout the United States, including the people who do not ever visit national parks, because more air pollution controls could mean that we have to pay higher prices for electricity, transportation, home heating, and many other goods and services. It could also mean higher taxes.

Please remember that we're talking only about *visibility* and only for the national parks in the *East region*. Please assume that there will be no change in visibility in national parks in any other region of the country. Other households and other people are being asked similar questions about the effects of air pollution on human health and on plant life, or the effects on visibility in urban areas or at national parks in other parts of the country. So again, we'd like you to focus only on *visibility effects* in the summer months, and only for the national parks in the *East*. At other times of the year, there's a much lower chance of finding hazy conditions.

Also, please assume that you could be sure that any changes we talk about would take place next year, in 2004, and continue forever. Assume that all other households in the country would face a comparable increase in their cost of living as a result of the new air pollution controls.

With additional controls on air pollution, the average visibility conditions in and around all national parks in the East could improve. What is the *most* that ***[FLAG1=1:*** you / ***FLAG1=2:*** your household***]*** would be willing to pay *every year* in higher prices and taxes to have the average visibility in the summer improve from Photograph **C** to Photograph **B** at all national parks in the East region? Please click on the one amount that best indicates your answer.

$0.00	$2	$8	$25	$60	$150	$400
$0.50	$3	$10	$30	$75	$200	$500
$1.00	$4	$15	$40	$100	$250	$750
$1.50	$5	$20	$50	$125	$300	$1,000
						more than $1,000

I don't know

C&R language:

Q.10) Federal and state governments are considering changes to air pollution control laws to protect and improve visibility in and around national parks. These changes could affect everyone, even those who do not visit the parks, because more air pollution controls could mean higher prices for electricity, transportation, home heating, and for many other goods and services, and could mean higher taxes . . .

These questions concern only visibility at national parks in the Southwest and assume there will be no change in visibility in national parks in other regions. Other households are being asked about visibility, human health and vegetation protection in urban areas and at national parks in other regions. For these questions, assume you could be sure that any change would occur next year ad continue forever, and all households now and in the future would also pay the most it is worth to them to protect visibility.

Q.12) With additional air pollution controls, average visibility conditions in and around all national parks in the Southwest could improve. What is the most your household would be willing to pay every year in increased prices and taxes to have average visibility improve from Grand Canyon Photograph C to Photograph B at all national parks in the Southwest?

Ask all who give a zero (not DK) response to Q.17:

19) What are the main reasons why you would not be prepared to have an increase in your cost of living to improve the average visibility in the summer from Photograph **C** to Photograph **B** at all national parks in the East region? Please tell us all of your reasons.

_____

_____

_____

_____

Ask all:

21) Next, let's suppose that there was a greater change to the air pollution control laws so that the average visibility in the summer improved from Photograph **C** to Photograph **A** at all national parks in the East region. What is the *most* that ***[FLAG1=1:*** you / ***FLAG1=2:*** your household***]*** would be willing to pay *every year* in higher prices and taxes to have the average visibility in the summer improve from Photograph **C** to Photograph **A** at all national parks in the East region? Please click on the one amount that best indicates your answer.

$0.00	$2	$8	$25	$60	$150	$400
$0.50	$3	$10	$30	$75	$200	$500
$1.00	$4	$15	$40	$100	$250	$750
$1.50	$5	$20	$50	$125	$300	$1,000
						more than $1,000

I don't know

Ask all who give a zero (not DK) response to Q.21:

23) What are the main reasons why you would not be prepared to have an increase in your cost of living to improve the average visibility in the summer from Photograph **C** to Photograph **A** at all national parks in the East region? Please tell us all of your reasons.

_____

_____

_____

_____

Ask all:

25) It is also possible that some additional air pollution controls may be needed just to keep visibility at national parks in the East from *getting worse*. What is *the most* that ***[FLAG1=1:*** you / ***FLAG1=2:*** your household***]*** would be prepared to pay every year in higher prices or taxes to prevent the average visibility in the summer at all national parks in the East region from becoming like Photograph **D** rather than like Photograph **C**? Please click on the one amount that best indicates your answer.

$0.00	$2	$8	$25	$60	$150	$400
$0.50	$3	$10	$30	$75	$200	$500
$1.00	$4	$15	$40	$100	$250	$750
$1.50	$5	$20	$50	$125	$300	$1,000
						more than $1,000

I don't know

Ask all who give a zero (not DK) response to Q.25:

27) What are the main reasons why you would not be prepared to have an increase in your cost of living to prevent the average visibility in the summer at all national parks in the East region from becoming like Photograph **D** rather than like Photograph **C**? Please tell us all of your reasons.

_____

_____

_____

_____

If a non-zero and non-DK response has been given to any of Qs.17, 21, or 25, set FLAG2=1.

Continue with the Debriefing for Versions V1 through V4 section.

Questionnaire version V2 ["C&R plus distribution of days"]

The question numbers in this version are not sequential but are aligned to correspond with the sequential numbering of the equivalent question in the longest version, *Version V3*.

National parks orientation section

C3) Because national parks and other scenic areas are usually owned or protected by governments, issues about their preservation and management affect all of us, even if we rarely or ever visit such areas ourselves. In order to reflect the priorities of *all* people in the country, it is important to get answers from everybody, not just from the people who are most interested in a particular topic. So **please complete this survey whether or not you have ever visited any national parks or other areas of great natural beauty**. Your opinion is important, and what you and other people tell us in this survey will help influence future government policies.

The federal government's National Park Service is responsible for looking after a wide range of different types of places, including historical buildings or sites, historical areas, battlefields, cemeteries, monuments, and recreation areas. But this survey is about the national parks themselves, and just those located in the continental United States, not counting Alaska and Hawai'i. These parks are usually large natural areas, often wilderness or semi-wilderness, where the federal government places restrictions on how the land can be used and on hunting and mining. The national parks usually have an admission charge.

Have you personally *ever* visited a national park within the continental United States? *[Check one only.]*

Yes, I have visited at least one national park	**1**	**[Q.C5]**
No, I have never visited a national park	**2**	**[Q.10]**
I'm not sure	**9**	**[Q.C5]**

Ask all who have definitely or possibly visited a national park [Q.C3:1,9]:

C4) Please check (in the left column) any of the following national parks that you have personally *ever* visited. In the right column, please check any of these parks that you have visited *in the last two years*, that's since November 2001. *[Check as many as you have visited.]* ***[Randomize the display order, except that the last two options always appear last.]***

	Ever visited	Visited in *last 2 years*
Grand Canyon National Park in Arizona	**1**	**1**
Great Smoky Mountains National Park in Tennessee and North Carolina	**2**	**2**
Shenandoah National Park in Virginia	**3**	**3**
Yellowstone National Park in Wyoming	**4**	**4**
Yosemite National Park in California	**5**	**5**
I have not visited *any* of those parks	**6**	**6**
I'm not sure	**9**	**9**

Haze orientation section

10) Throughout the United States, air pollution that results mostly from activities in cities and industrial areas can cause a range of different problems. In some climatic conditions, air pollution can be fairly harmless. In other places, it can cause health problems for some people and animals, and it can also harm trees and plants.

Another result of air pollution is an increased amount of haze in the air, which can affect how well and how far a person can see the scenery in and around national parks and other areas of great natural beauty. The differences are most noticeable on days during the summer months when there is no rain or natural fog.

At this stage, please open your sealed envelope. Unfold and look at the sheet you will find inside. When you have unfolded the sheet, please place it down somewhere where you can see it well, with good light. Don't bother to read it yet; we'll explain it in a moment. When you are ready to move on, click on the *Continue* button.

12) Please look first at the four photographs set out across the top of the sheet. These show the effects of different levels of air pollution on a typical view in the Shenandoah National Park in Virginia. All of the photographs show summer days without any rain or natural fog. They are typical of conditions on good weather days between June and September in and around the national parks in the Appalachian chain of mountains. At other times of the year, air pollution does not affect the view as much.

Photograph **A** (in the top left corner) shows almost no haze. That occurs on about *11* summer days each year; that's about *9%* of all summer days.

Moving across the page from left to right, Photograph **B** shows a little haze. That occurs on about *43* summer days each year, or about *36%* of all summer days.

Photograph **C** shows more haze. That occurs on about *43* days each summer; that's about *36%* of all summer days.

Photograph **D** (furthest to the right) shows a lot of haze. That occurs on about *11* days each summer, that's about *9%* of all summer days.

Finally, there's also a box **E** to represent "poor weather days." On about *12* days each summer, that's about *10%* of all summer days, there is rain or natural fog, and on those days the amount of haze has no effect on how far you can see.

If you were to visit this area in the summer months, you would be most likely to have visibility like either Photograph **B** or Photograph **C.** How do you think that having *less than average haze* due to air pollution, like in Photograph **A**, would affect your enjoyment of the visit? Do you think that it would . . . *[check one only]*

have *no effect* on your enjoyment,	**1**
or increase your enjoyment *somewhat,*	**2**
or increase your enjoyment *very much*?	**3**
I'm not sure	**9**

Questions about photographs

13) In fact, the photographs show typical summer visibility conditions in the national parks in the Eastern region – that's all parts of the country east of the Mississippi river. In the future, the visibility at these national parks could improve or worsen depending on how much we try to control air pollution. I'm going to read some possible goals for protecting the national parks in the East. Using a scale of 1 to 5, where 1 means "Not at all important," 3 means "Somewhat important," and 5 means "Extremely important," what number between 1 and 5 best represents how important you think it is to . . .

improve the visibility at some or all of the parks in the East region?

prevent the visibility from getting any worse at some or all of the parks in the East region?

Not at all Important		*Somewhat important*		*Extremely important*	*I don't know*
1	**2**	**3**	**4**	**5**	**X**

14) To protect and improve visibility in and around national parks, federal and state governments are considering some specific changes to air pollution control laws. These changes could affect all of us throughout the United States, including the people who do not ever visit national parks, because more air pollution controls could mean that we have to pay higher *prices* for electricity, home heating, transportation, and many other goods and services, They could also mean higher federal or state *taxes*.

Please remember that we're talking only about *visibility* and only for the national parks in the *East region*. Please assume that there will be no change in visibility in national parks in any other region of the country. Other households and other people are being asked similar questions about the effects of air pollution on human health and on plant life, or the effects on visibility in urban areas or at national parks in other parts of the country. So again, we'd like you to focus only on *visibility effects* in the summer months, and only for the national parks in the *East*. At other times of the year, there's a much lower chance of finding hazy conditions.

Also, please assume that you could be sure that any changes we talk about would take place next year, in 2004, and continue forever. Assume that all other households in the country would face a comparable increase in their cost of living as a result of the new air pollution controls.

16) One new federal policy that is currently under consideration is represented on the sheet by the row that is just below the row of photographs, labeled (over at the left hand side) **Proposed change X**. Please read that row carefully, from left to right across the page. For the moment, ignore the two rows beneath it, the ones labeled **Proposed change Y** and **If the law doesn't change**.

As a result of a proposed new policy that would place tighter controls on the activities that cause haze, the number of summer days represented by each of these photographs would change.

[Continue (same paragraph) for odd serial numbers only:]
There would no longer be any days at all with conditions like Photograph **D**; the number of days like Photograph **C** would also go down; conditions like Photograph **B** would become the most likely; and the number of days like Photograph **A** would also increase.

[Continue (same paragraph) for even serial numbers only:]
There would no longer be any days at all with conditions like Photographs **C** or **D**; the number of days like Photograph **B** would also go down; and conditions like Photograph **A** would become the most likely.

[Continue for all serial numbers:]
Please take your time to read about the changes summarized in the bar charts for **Proposed change X**. The chart on the left shows the *current* percentages of summer days like each of the four photographs. Assume that if **Proposed change X** is not made, the visibility conditions will stay as they are now. The chart on the right shows the percentages of days if the proposed change in the law were made. When you have understood this proposed change and are ready to move on, please click on the *Continue* button.

17) If **Proposed change X** becomes the new law, it would result in an increase in the cost of living for you and for all other households in the United States. What is the *most* that ***[FLAG1=1:*** you / ***FLAG1=2:*** your household***]*** would be willing to pay *every year* in higher prices and taxes to have the visibility in the summer at all national parks in the East

region improve in the way described for **Proposed change X**? Please click on the one amount that best indicates your answer.

$0.00	$2	$8	$25	$60	$150	$400
$0.50	$3	$10	$30	$75	$200	$500
$1.00	$4	$15	$40	$100	$250	$750
$1.50	$5	$20	$50	$125	$300	$1,000
						more than $1,000

I don't know

Ask all who give a zero (not DK) response to Q.17:

19) What are the main reasons why you would not be prepared to have an increase in your cost of living to improve the visibility in the summer at all national parks in the East region in the way that **Proposed change X** would? Please tell us all of your reasons.

_____

_____

_____

_____

Ask all:

20) Next, please look at the next row down on the sheet, the one labeled **Proposed change Y** over at the left-hand side. Please read across that row carefully, from left to right. It describes a different new federal policy that is currently under consideration, one that would place ***[odd serial numbers:*** *more* / ***even serial numbers:*** *less****]*** *strict* controls on the activities that cause haze than the first proposed change that you considered. As before, if this new law were passed, the number of summer days represented by each of the four photographs would change.

[Continue for odd serial numbers only:]
There would no longer be any days at all with conditions like Photographs **C** or **D**; the number of days like Photograph **B** would also go down; and conditions like Photograph **A** would become the most likely.

[Continue for even serial numbers only:]
There would no longer be any days at all with conditions like Photograph **D**; the number of days like Photograph **C** would also go down; conditions like Photograph **B** would become the most likely; and the number of days like Photograph **A** would also increase.

[Continue for all serial numbers:]
Please take your time to read about the changes summarized in the bar charts for **Proposed change Y**. Again assume that if **Proposed change Y** is not made, the visibility conditions will stay as they are now. When you have understood this proposed change and are ready to move on, please click on the *Continue* button.

21) If **Proposed change Y** becomes the new law, it would result in an increase in the cost of living for you and for all other households in the United States. What is the *most* that ***[FLAG1=1:*** you / ***FLAG1=2:*** your household***]*** would be willing to pay *every year* in higher prices and taxes to have the visibility in the summer at all national parks in the East region improve in the way described for **Proposed change Y**? Please click on the one amount that best indicates your answer.

$0.00	$2	$8	$25	$60	$150	$400
$0.50	$3	$10	$30	$75	$200	$500
$1.00	$4	$15	$40	$100	$250	$750
$1.50	$5	$20	$50	$125	$300	$1,000
						more than $1,000

I don't know

Ask all who give a zero (not DK) response to Q.21:

23) What are the main reasons why you would not be prepared have an increase in your cost of living to improve the visibility in the summer at all national parks in the East region in the way that **Proposed change Y** would? Please tell us all of your reasons.

_____

_____

_____

_____

Ask all:

24) It is also possible that some additional air pollution controls may be needed just to keep visibility at national parks in the East from *getting worse*. Please look at the last row on the sheet, the one labeled **If the law doesn't change**. If there were no change to the laws and existing regulations are allowed to expire, the number of summer days represented by each of these photographs would change in the way shown in that row. Conditions like Photograph **D** would become the most likely, and the number of days like Photograph **C** would also increase. The numbers of days with conditions like Photographs **A** and **B** would go down.

Again take your time to read about the changes expected if no new policies are adopted, and look to see how they are summarized in the two bar charts at the bottom.

25) What is the *most* that ***[FLAG1=1:*** you / ***FLAG1=2:*** your household***]*** would be willing to pay *every year* in higher prices and taxes to prevent the visibility in the summer at all national parks in the East region from getting worse in the way described for **If the law doesn't change**? Please click on the one amount that best indicates your answer.

$0.00	$2	$8	$25	$60	$150	$400
$0.50	$3	$10	$30	$75	$200	$500
$1.00	$4	$15	$40	$100	$250	$750
$1.50	$5	$20	$50	$125	$300	$1,000
						more than $1,000

I don't know

Ask all who give a zero (not DK) response to Q.25:

27) What are the main reasons why you would not be prepared to have an increase in your cost of living to prevent the visibility in the summer at all national parks in the East region from getting worse in the way we have described? Please tell us all of your reasons.

_____

_____

_____

_____

If a non-zero and non- DK response has been given to any of Qs.17, 21, or 25, set FLAG2=1.

Continue with the Debriefing for Versions V1 through V4 section.

Questionnaire version V3 [“Greater budget context”]

National priorities orientation section

6) Our nation spends a lot of money trying to solve problems, such as reducing crime, protecting the environment, training people for jobs, and so on. The money is often spent by *governments* (for example, on public education or on health care, or social services for the people unable to pay for them), or by *private corporations* (for example, on reducing workplace risks or ensuring that factories do not hurt the environment). But whether it is governments or private companies that provide the funds for social programs and concerns like this, it is the general public who has to pay for them in the end.

We pay through
- higher *prices* for the goods or services we buy, to cover the costs that private companies bear, and
- higher *taxes*, to support federal, state, and local government spending.

We also sometimes pay directly, through any *donations* that we make to charitable causes set up to work on social problems.

Ask all:

7) Below is a list of some social concerns that are often in the news. For each one, we’d like you to tell us whether you think that our country as a whole should be doing *more* about that concern, should be doing *less* about that concern, or whether you think that the current level of effort for that concern is *about right*.

	The nation should		Current efforts about right	Can’t say
	do more	do less		
Medical research on life-threatening illnesses (such as cancer, AIDS, or heart disease)	1	2	3	9
Housing and feeding the poor or homeless	1	2	3	9
Ensuring adequate medical care for all, regardless of the ability to pay	1	2	3	9
Protecting the country from further terrorist attacks	1	2	3	9
Reducing and solving crimes	1	2	3	9
Protecting the environment, including preserving our natural resources	1	2	3	9
Improving the education of children and young people	1	2	3	9
Reducing the use of illegal drugs	1	2	3	9

8) Next, we want you to focus on just *one* of the issues on that list: protecting the environment-and preserving our natural resources. Below is a list of the types of things that other people have told us are their most important concerns about the environment and natural resources. Just as before, for each one we’d like you to tell us whether you think that our country as a whole should be doing *more* about that issue, should be doing *less* about that issue, or whether you think that the current level of effort for that issue is *about right*.

	The nation should		Current efforts about right	Can't say
	do more	do less		
Developing renewable sources of energy, like solar and wind power	1	2	3	9
Reducing global warming	1	2	3	9
Protecting types of animals and plants that are endangered	1	2	3	9
Protecting the quality of groundwater	1	2	3	9
Improving the disposal of radioactive wastes	1	2	3	9
Improving the disposal of household and industrial waste products, and encouraging recycling	1	2	3	9
Protecting wilderness areas and wildlife	1	2	3	9
Reducing air pollution (other than the gases that contribute to global warming)	1	2	3	9
Protecting the rain forests in those parts of the world where they are threatened	1	2	3	9
Protecting the ozone layer	1	2	3	9

9) In this survey of national priorities, we are choosing just one issue to focus on for each of the participating members of the *Knowledge Networks* panel. In your case, we are going to ask for your opinions about:

Reducing air pollution (other than the gases that contribute to global warming)

Because federal, state, and local governments make regulations and decisions about the activities that create air pollution, this issue affects *all* of us, whether or not we experience much air pollution ourselves. In order to reflect the priorities of *all* people in the country, it is important to get answers from *everybody*, not just from the people who are most interested in a particular topic. So **please complete this survey whether or not you personally experience air pollution or know much about it**. Your opinion is important, and what you and other people tell us in this survey will help influence future government policies.

As you answer the questions that follow, please keep in mind the several other issues which you told us in the previous questions are equally or more important to you personally. Please remember that the problem of air pollution is only one of the environmental problems facing our nation.

Haze orientation section

10) Throughout the United States, air pollution that results mostly from activities in cities and industrial areas can cause a range of different problems. In some climatic conditions, air pollution can be fairly harmless. In other places,

- it can cause health problems for some people and animals,
- it can harm trees and plants, and
- it can cause an increased amount of haze in the air, which can affect how well and how far people can see scenery.

To keep the survey from being too long, we will be focusing on just one of these possible effects of air pollution. In your case, we are going to ask for your opinions about:

The effects of haze on visibility in national parks and similar scenic areas in the Eastern half of the United States

We will focus on possible changes in the law that are currently under consideration and which could affect you, even if you rarely or never visit national parks or other scenic areas. In order to reflect the priorities of *all* people in the country, it is important to get answers from *everybody*, not just from the people who are most interested in a particular topic. So **please complete this survey whether or not you have ever visited any national parks or other areas of great natural beauty**. Your opinion is important, and what you and other people tell us in this survey will help influence future government policies.

As you answer the questions that follow, please remember that the problem of haze affecting visibility is only one of the problems that air pollution can potentially cause.

11) One possible result of air pollution is an increased amount of haze in the air, which can affect how well and how far a person can see the scenery in and around national parks and other areas of great natural beauty. The differences are most noticeable during the summer months, on days when there is no rain or natural fog.

At this stage, please open your sealed envelope. Unfold and look at the sheet you will find inside. When you have unfolded the sheet, please place it down somewhere where you can see it well, with good light. Don't bother to read it yet; we'll explain it in a moment. When you are ready to move on, click on the *Continue* button.

12) Please look first at the four photographs set out across the top of the sheet. These show the effects of different levels of air pollution on a typical view in the Shenandoah National Park in Virginia. All of the photographs show summer days without any rain or natural fog. They are typical of conditions on good weather days between June and September in and around the national parks in the Appalachian chain of mountains. At other times of the year, air pollution does not affect the view as much.

Photograph **A** (in the top left corner) shows almost no haze. That occurs on about *11* summer days each year; that's about *9%* of all summer days.

Moving across the page from left to right, Photograph **B** shows a little haze. That occurs on about *43* summer days each year, or about *36%* of all summer days.

Photograph **C** shows more haze. That occurs on about *43* days each summer; that's about *36%* of all summer days.

Photograph **D** (furthest to the right) shows a lot of haze. That occurs on about *11* days each summer, that's about *9%* of all summer days.

Finally, there's also a box **E** to represent "poor weather days." On about *12* days each summer, that's about *10%* of all summer days, there is rain or natural fog, and on those days the amount of haze has no effect on how far you can see.

If you were to visit this area in the summer months, you would be most likely to have visibility like either Photograph **B** or Photograph **C.** How do you think that having *less than average haze* due to air pollution, like in Photograph **A**, would affect your enjoyment of the visit? Do you think that it would . . . *[check one only]*

have *no effect* on your enjoyment,	**1**
or increase your enjoyment *somewhat,*	**2**
or increase your enjoyment *very much*?	**3**
I'm not sure	**9**

Questions about photographs

13) In fact, the photographs show typical summer visibility conditions in the national parks in the Eastern region – that's all parts of the country east of the Mississippi river. In the future, the visibility at these national parks could improve or worsen depending on how much we try to control air pollution. We're going to show you some possible goals for protecting the national parks in the East. Using a scale of 1 to 5, where 1 means "Not at all important," 3 means "Somewhat important," and 5 means "Extremely important," what number between 1 and 5 best represents how important you think it is to . . .

improve the visibility at some or all of the parks in the East region?

prevent the visibility from getting any worse at some or all of the parks in the East region?

Not at all Important		*Somewhat important*		*Extremely important*	*I don't know*
1	**2**	**3**	**4**	**5**	**X**

14) To protect and improve visibility in and around national parks, federal and state governments are considering some specific changes to air pollution control laws. These changes could affect all of us throughout the United States, including the people who do not ever visit the national parks in the East. That is because more air pollution controls could mean that we have to pay higher *prices* for electricity, home heating, transportation, and many other goods and services. And they could also mean higher federal or state *taxes*.

Please remember that we're talking only about *visibility* and only for the national parks in the *East region*. Please assume that there will be no change in visibility in national parks in any other region of the country. Other households and other people are being asked similar questions about the effects of air pollution on human health and on plant life, or the effects on visibility in urban areas or at national parks in other parts of the country. So again, we'd like you to focus only on *visibility effects* in the summer months, and only for the national parks in the *East*. At other times of the year, there's a much lower chance of finding hazy conditions.

Also, please assume that you could be sure that any changes we talk about would take place next year, in 2004, and continue forever. Assume that all other households in the country would face a comparable increase in their cost –of living as a result of the new air pollution controls.

15) Please look again at the sheet that we sent to you. Beneath the row of photographs are three rows of additional information that we're going to ask you about in turn. The first two rows describe the effects of possible new federal policies that are currently under active consideration. Both of these different policies would place tighter controls on the activities that cause haze in scenic areas in the East, and would result in improvements to visibility. The ***[odd serial numbers:*** second / ***even serial numbers:*** first***]*** possible policy, labeled (over at the left hand side) **Proposed change *[odd serial numbers:* Y / *even serial numbers:* X*]***, is more strict than the ***[odd serial numbers:*** first / ***even serial numbers:*** second***]*** one, labeled **Proposed change *[odd serial numbers:* X / *even serial numbers:* Y*]***, and it would lead to a greater improvement in visibility. Both of the new policies would cause an

increase in the cost of living for US households, and we will be asking you what level of increase, if any, you would be prepared to consider for each of the two changes. If no changes are made, visibility conditions will stay as they are now.

But it is also possible that current regulations might be allowed to expire and some additional air pollution controls may be needed just to keep visibility at national parks in the East from *getting worse*. The last row on the sheet, labeled **If the law doesn't change**, describes how visibility in national parks in the East region will get worse if there is no change to the laws and current regulations are allowed to expire. We will be asking you what level of increase to your cost of living, if any, you would be prepared to consider to prevent this from happening.

The results of this survey are very likely to influence what the US Congress decides to do in choosing whether to make no changes to the current laws or to make changes like one of the two policies described on the sheet. When you have looked at the sheet and are ready to hear more about the first possible change, click on the *Continue* button.

16) One new federal policy currently under consideration is represented by the row just below the row of photographs, labeled **Proposed change X**. Please read that row carefully, from left to right across the page.

As a result of a proposed new policy that would place tighter controls on the activities that cause haze, the number of summer days represented by each of these photographs would change.

[Continue (same paragraph) for odd serial numbers only:]
There would no longer be any days at all with conditions like Photograph **D**; the number of days like Photograph **C** would also go down; conditions like Photograph **B** would become the most likely; and the number of days like Photograph **A** would also increase.

[Continue (same paragraph) for even serial numbers only:]
There would no longer be any days at all with conditions like Photographs **C** or **D**; the number of days like Photograph **B** would also go down; and conditions like Photograph **A** would become the most likely.

[Continue for all serial numbers:]
Please take your time to read about the changes summarized in the bar charts for **Proposed change X**. The chart on the left shows the *current* percentages of summer days like each of the four photographs. Assume that if **Proposed change X** is not made, the visibility conditions will stay as they are now. The chart on the right shows the percentages of days if the proposed change in the law were made. When you have understood this proposed change and are ready to move on, please click on the *Continue* button.

17) If **Proposed change X** becomes the new law, it would result in an increase in the cost of living for you and for all other households in the United States. What is the *most* that ***[FLAG1=1:*** you / ***FLAG1=2:*** your household***]*** would be willing to pay *every year* in higher prices and taxes to have the visibility in the summer at all national parks in the East region improve in the way described for **Proposed change X**?

As you think about that question, please bear the following things in mind. The extra amount that you and the rest of the country would pay would be through increases in the prices and taxes for things you buy, particularly for energy and transportation. The extra money would be paid to improve the summertime visibility in national parks (and other scenic areas) just in the Eastern US. There are other air pollution impacts that you might also like to see improved; there are other environmental improvements that you might also like to see made; and there are other areas of national public policy that you might also like to influence, all of which might also imply increases in your cost of living

if they were put into effect. And when your cost of living increases, that might require you to spend less on other things, or put less money into savings.

Please click on the one amount that best indicates the *most* you would be willing to pay *every year* in higher prices and taxes to have the visibility in the summer at all national parks in the East region improve in the way described for **Proposed change X**. It's OK to click on zero ($0.00) if you like.

$0.00	$2	$8	$25	$60	$150	$400
$0.50	$3	$10	$30	$75	$200	$500
$1.00	$4	$15	$40	$100	$250	$750
$1.50	$5	$20	$50	$125	$300	$1,000
						more than $1,000

I don't know

Ask all who have Q.17="more than $1,000":

18) What *is* the most that ***[FLAG1=1:*** you ***/ FLAG1=2:*** your household***]*** would be willing to pay *every year* in higher prices and taxes to have the visibility in the summer at all national parks in the East region improve in the way described for **Proposed change X**?

Maximum amount (more than $1,000) that you would be prepared to pay in cost-of-living increases: **$** _____

I'm not sure **A [Q.20]**

All respondents with Q.17="more than $1,000" now skip to Q.20.

Ask all who give a zero (not DK) response to Q.17:

19) What are the main reasons why you would not be prepared to have an increase in your cost of living to improve the visibility in the summer at all national parks in the East region in the way that **Proposed change X** would? Please tell us all of your reasons.

_____

_____

_____

_____

Ask all:

20) Next, please look at the next row down on the sheet, the one labeled **Proposed change Y** over at the left-hand side. Please read across that row carefully, from left to right. It describes a different new federal policy that is currently under consideration, one that would place ***[odd serial numbers:*** *more* ***/ even serial numbers:*** *less****]*** *strict* controls on the activities that cause haze than the first proposed change that you considered. As a result, **Proposed change Y** would improve the visibility by a ***[odd serial numbers:*** *greater* ***/ even serial numbers:*** *lesser****]*** amount than would **Proposed change X.** As before, if this new law were passed, the number of summer days represented by each of the four photographs would change.

[Continue for odd serial numbers only:]
There would no longer be any days at all with conditions like Photographs **C** or **D**; the number of days like Photograph **B** would also go down; and conditions like Photograph **A** would become the most likely.

[Continue for even serial numbers only:]
There would no longer be any days at all with conditions like Photograph **D**; the number of days like Photograph **C** would also go down; conditions like Photograph **B** would become the most likely; and the number of days like Photograph **A** would also increase.

[Continue for all serial numbers:]
Please take your time to read about the changes summarized in the bar charts for **Proposed change Y**. Again assume that if **Proposed change Y** is not made, the visibility conditions will stay as they are now. When you have understood this proposed change and are ready to move on, please click on the *Continue* button.

21) If **Proposed change Y** becomes the new law, it would result in an increase in the cost of living for you and for all other households in the United States. What is the *most* that ***[FLAG1=1:*** you / ***FLAG1=2:*** your household***]*** would be willing to pay *every year* in higher prices and taxes to have the visibility in the summer at all national parks in the East region improve in the way described for **Proposed change Y**? As before, please remember that you may have additional priorities for improvements in air quality, in the environment more generally, and in other public policy issues like education and healthcare, all of which could also affect your cost of living if they were put into effect. You might need to reduce your spending on other things, or your savings, by the amount you specify.

Please click on the one amount that best indicates your answer. It's OK to click on zero ($0.00) if you like.

$0.00	$2	$8	$25	$60	$150	$400
$0.50	$3	$10	$30	$75	$200	$500
$1.00	$4	$15	$40	$100	$250	$750
$1.50	$5	$20	$50	$125	$300	$1,000
						more than $1,000

I don't know

Ask all who have Q.21="more than $1,000":

22) What *is* the most that ***[FLAG1=1:*** you / ***FLAG1=2:*** your household***]*** would be willing to pay *every year* in higher prices and taxes to have the visibility in the summer at all national parks in the East region improve in the way described for **Proposed change Y**?

Maximum amount (more than $1,000) that you would be prepared to pay in cost-of-living increases: **$** _____

I'm not sure **A [Q.24]**

All respondents with Q.21="more than $1,000" now skip to Q.24.

Ask all who give a zero (not DK) response to Q.21:

23) What are the main reasons why you would not be prepared have an increase in your cost of living to improve the visibility in the summer at all national parks in the East region in the way that **Proposed change Y** would? Please tell us all of your reasons.

_____

_____

_____

_____

Ask all:

24) It is also possible that some additional air pollution controls may be needed just to keep visibility at national parks in the East from *getting worse*. Please look at the last row on the sheet, the one labeled **If the law doesn't change**. If there were no change to the laws and existing regulations are allowed to expire, the number of summer days represented by each of these photographs would change in the way shown in that row. Conditions like Photograph **D** would become the most likely, and the number of days like Photograph **C** would also increase. The numbers of days with conditions like Photographs **A** and **B** would go down.

Again take your time to read about the changes expected if no new policies are adopted, and look to see how they are summarized in the two bar charts at the bottom. When you are ready to move on, please click on the *Continue* button.

25) What is the *most* that ***[FLAG1=1:*** you / ***FLAG1=2:*** your household***]*** would be willing to pay *every year* in higher prices and taxes to prevent the visibility in the summer at all national parks in the East region from getting worse in the way described for **If the law doesn't change**? As before, please remember that you may have additional priorities for improvements in air quality, in the environment more generally, and in other public policy issues like education and healthcare, all of which could also affect your cost of living if they were put into effect. You might need to reduce your spending on other things, or your savings, by the amount you specify.

Please click on the one amount that best indicates your answer. It's OK to click on zero ($0.00) if you like.

$0.00	$2	$8	$25	$60	$150	$400
$0.50	$3	$10	$30	$75	$200	$500
$1.00	$4	$15	$40	$100	$250	$750
$1.50	$5	$20	$50	$125	$300	$1,000
						more than $1,000

I don't know

Ask all who have Q.25="more than $1,000":

26) What *is* the most that ***[FLAG1=1:*** you / ***FLAG1=2:*** your household***]*** would be willing to pay *every year* in higher prices and taxes to prevent the visibility in the summer at all national parks in the East region from getting worse in the way described for **If the law doesn't change**?

Maximum amount (more than $1,000) that you would be prepared to pay in cost-of-living increases: **$** _____

I'm not sure **A [Q.28]**

All respondents with Q.25="more than $1,000" now skip to Q.28.

Ask all who give a zero (not DK) response to Q.25:

27) What are the main reasons why you would not be prepared to have an increase in your cost of living to prevent the visibility in the summer at all national parks in the East region from getting worse in the way we have described? Please tell us all of your reasons.

_____

_____

_____

_____

If a non-zero and non-DK response has been given to any of Qs.17, 21, or 25, set FLAG2=1.
Continue with the Debriefing for Versions V1 through V4 section.

Questionnaire version V4 ["Alternative peak reduction case"]

Note that this version is completely identical to *Version V3*, except that (i) the wording of Q.16 (odd serial numbers) and Q.20 (even serial numbers) has changed, and (ii) a different visual aid will be used.

National priorities orientation section

6) Our nation spends a lot of money trying to solve problems, such as reducing crime, protecting the environment, training people for jobs, and so on. The money is often spent by *governments* (for example, on public education or on health care or social services for the people unable to pay for them), or by *private corporations* (for example, on reducing workplace risks or ensuring that factories do not hurt the environment). But whether it is governments or private companies that provide the funds for social programs and concerns like this, it is the general public who has to pay for them in the end.

We pay through
- higher *prices* for the goods or services we buy, to cover the costs that private companies bear, and
- higher *taxes*, to support federal, state, and local government spending.

We also sometimes pay directly, through any *donations* that we make to charitable causes set up to work on social problems.

Ask all:

7) Below is a list of some social concerns that are often in the news. For each one, we'd like you to tell us whether you think that our country as a whole should be doing *more* about that concern, should be doing *less* about that concern, or whether you think that the current level of effort for that concern is *about right*.

	The nation should		Current efforts about right	Can't say
	do more	do less		
Medical research on life-threatening illnesses (such as cancer, AIDS, or heart disease)	1	2	3	9
Housing and feeding the poor or homeless	1	2	3	9
Ensuring adequate medical care for all, regardless of the ability to pay	1	2	3	9
Protecting the country from further terrorist attacks	1	2	3	9
Reducing and solving crimes	1	2	3	9
Protecting the environment, including preserving our natural resources	1	2	3	9
Improving the education of children and young people	1	2	3	9
Reducing the use of illegal drugs	1	2	3	9

8) Next, we want you to focus on just *one* of the issues on that list: protecting the environment and preserving our natural resources. Below is a list of the types of things that other people have told us are their most important concerns about the environment and natural resources. Just as before, for each one we'd like you to tell us whether you think that our country as a whole should be doing *more* about that issue, should be doing *less* about that issue, or whether you think that the current level of effort for that issue is *about right*.

	The nation should		Current efforts about right	Can't say
	do more	do less		
Developing renewable sources of energy, like solar and wind power	1	2	3	9
Reducing global warming	1	2	3	9
Protecting types of animals and plants that are endangered	1	2	3	9
Protecting the quality of groundwater	1	2	3	9
Improving the disposal of radioactive wastes	1	2	3	9
Improving the disposal of household and industrial waste products, and encouraging recycling	1	2	3	9
Protecting wilderness areas and wildlife	1	2	3	9
Reducing air pollution (other than the gases that contribute to global warming)	1	2	3	9
Protecting the rain forests in those parts of the world where they are threatened	1	2	3	9
Protecting the ozone layer	1	2	3	9

9) In this survey of national priorities, we are choosing just one issue to focus on for each of the participating members of the *Knowledge Networks* panel. In your case, we are going to ask for your opinions about:

Reducing air pollution (other than the gases that contribute to global warming)

Because federal, state, and local governments make regulations and decisions about the activities that create air pollution, this issue affects *all* of us, whether or not we experience much air pollution ourselves. In order to reflect the priorities of *all* people in the country, it is important to get answers from *everybody*, not just from the people who are most interested in a particular topic. So **please complete this survey whether or not you personally experience air pollution or know much about it**. Your opinion is important, and what you and other people tell us in this survey will help influence future government policies.

As you answer the questions that follow, please keep in mind the several other issues which you told us in the previous questions are equally or more important to you personally. Please remember that the problem of air pollution is only one of the environmental problems facing our nation.

Haze orientation section

10) Throughout the United States, air pollution that results mostly from activities in cities and industrial areas can cause a range of different problems. In some climatic conditions, air pollution can be fairly harmless. In other places,

- it can cause health problems for some people and animals,
- it can harm trees and plants, and
- it can cause an increased amount of haze in the air, which can affect how well and how far people can see scenery.

To keep the survey from being too long, we will be focusing on just one of these possible effects of air pollution. In your case, we are going to ask for your opinions about:

The effects of haze on visibility in national parks and similar scenic areas

in the Eastern half of the United States

We will focus on possible changes in the law that are currently under consideration and which could affect you, even if you rarely or never visit national parks or other scenic areas. In order to reflect the priorities of *all* people in the country, it is important to get answers from *everybody*, not just from the people who are most interested in a particular topic. So **please complete this survey whether or not you have ever visited any national parks or other areas of great natural beauty**. Your opinion is important, and what you and other people tell us in this survey will help influence future government policies.

As you answer the questions that follow, please remember that the problem of haze affecting visibility is only one of the problems that air pollution can potentially cause.

11) One possible result of air pollution is an increased amount of haze in the air, which can affect how well and how far a person can see the scenery in and around national parks and other areas of great natural beauty. The differences are most noticeable during the summer months, on days when there is no rain or natural fog.

At this stage, please open your sealed envelope. Unfold and look at the sheet you will find inside. When you have unfolded the sheet, please place it down somewhere where you can see it well, with good light. Don't bother to read it yet; we'll explain it in a moment. When you are ready to move on, click on the *Continue* button.

12) Please look first at the four photographs set out across the top of the sheet. These show the effects of different levels of air pollution on a typical view in the Shenandoah National Park in Virginia. All of the photographs show summer days without any rain or natural fog. They are typical of conditions on good weather days between June and September in and around the national parks in the Appalachian chain of mountains. At other times of the year, air pollution does not affect the view as much.

Photograph **A** (in the top left corner) shows almost no haze. That occurs on about *11* summer days each year; that's about *9%* of all summer days.

Moving across the page from left to right, Photograph **B** shows a little haze. That occurs on about *43* summer days each year, or about *36%* of all summer days.

Photograph **C** shows more haze. That occurs on about *43* days each summer; that's about *36%* of all summer days.

Photograph **D** (furthest to the right) shows a lot of haze. That occurs on about *11* days each summer, that's about *9%* of all summer days.

Finally, there's also a box **E** to represent "poor weather days." On about *12* days each summer, that's about *10%* of all summer days, there is rain or natural fog, and on those days the amount of haze has no effect on how far you can see.

If you were to visit this area in the summer months, you would be most likely to have visibility like either Photograph **B** or Photograph **C.** How do you think that having *less than average haze* due to air pollution, like in Photograph **A**, would affect your enjoyment of the visit? Do you think that it would . . . *[check one only]*

have *no effect* on your enjoyment,	**1**
or increase your enjoyment *somewhat,*	**2**
or increase your enjoyment *very much*?	**3**
I'm not sure	**9**

Questions about photographs

13) In fact, the photographs show typical summer visibility conditions in the national parks in the Eastern region – that's all parts of the country east of the Mississippi river. In the future, the visibility at these national parks could improve or worsen depending on how much we try to control air pollution. We're going to show you some possible goals for protecting the national parks in the East. Using a scale of 1 to 5, where 1 means "Not at all important," 3 means "Somewhat important," and 5 means "Extremely important," what number between 1 and 5 best represents how important you think it is to . . .

improve the visibility at some or all of the parks in the East region?

prevent the visibility from getting any worse at some or all of the parks in the East region?

Not at all Important		*Somewhat important*		*Extremely important*	*I don't know*
1	**2**	**3**	**4**	**5**	**X**

14) To protect and improve visibility in and around national parks, federal and state governments are considering some specific changes to air pollution control laws. These changes could affect all of us throughout the United States, including the people who do not ever visit the national parks in the East. That is because more air pollution controls could mean that we have to pay higher *prices* for electricity, home heating, transportation, and many other goods and services, and it could also mean higher federal or state *taxes*.

Please remember that we're talking only about *visibility* and only for the national parks in the *East region*. Please assume that there will be no change in visibility in national parks in any other region of the country. Other households and other people are being asked similar questions about the effects of air pollution on human health and on plant life, or the effects on visibility in urban areas or at national parks in other parts of the country. So again, we'd like you to focus only on *visibility effects* in the summer months, and only for the national parks in the *East*. At other times of the year, there's a much lower chance of finding hazy conditions.

Also, please assume that you could be sure that any changes we talk about would take place next year, in 2004, and continue forever. Assume that all other households in the country would face a comparable increase in their cost-of-living as a result of the new air pollution controls.

15) Please look again at the sheet that we sent to you. Beneath the row of photographs are three rows of additional information that we're going to ask you about in turn. The first two rows describe the effects of possible new federal policies that are currently under active consideration. Both of these different policies would place tighter controls on the activities that cause haze in scenic areas in the East. The ***[odd serial numbers:*** second / ***even serial numbers:*** first***]*** possible policy, labeled (over at the left hand side) **Proposed change *[odd serial numbers:* Y / *even serial numbers:* X*]***, is more strict than the ***[odd serial numbers:*** first / ***even serial numbers:*** second***]*** one, labeled **Proposed change *[odd serial numbers:* X / *even serial numbers:* Y*]***, and it would lead to a greater improvement in visibility. Both of the new policies would cause an increase in the cost of living for US households, and we will be asking you what level of increase, if any, you would be prepared to consider for each of the two changes. If no changes are made, visibility conditions will stay as they are now.

But it is also possible that current regulations might be allowed to expire and some additional air pollution controls may be needed just to keep visibility at national parks in the East from *getting worse*. The last row on the sheet, labeled **If the law doesn't change**, describes how visibility in national parks in the East region will get worse if there is no change to the laws and current regulations are allowed to expire. We will be asking you what level of increase to your cost of living, if any, you would be prepared to consider to prevent this from happening.

The results of this survey are very likely to influence what the US Congress decides to do, in choosing whether to make no changes to the current laws or to make changes like one of the two policies described on the sheet. When you have looked at the sheet and are ready to hear more about the first possible change, click on the *Continue* button.

16) One new federal policy currently under consideration is represented by the row just below the row of photographs, labeled **Proposed change X**. Please read that row carefully, from left to right across the page.

As a result of a proposed new policy that would place tighter controls on the activities that cause haze, the number of summer days represented by each of these photographs would change.

[Continue (same paragraph) for odd serial numbers only:]
There would be very few days with conditions like Photograph **D**; the number of days like Photographs **B** and **C** would both increase slightly; and the number of days like Photograph **A** would not change.

[Continue (same paragraph) for even serial numbers only:]
There would no longer be any days at all with conditions like Photographs **C** or **D**; the number of days like Photograph **B** would also go down; and conditions like Photograph **A** would become the most likely.

[Continue for all serial numbers:]
Please take your time to read about the changes summarized in the bar charts for **Proposed change X**. The chart on the left shows the *current* percentages of summer days like each of the four photographs. Assume that if **Proposed change X** is not made, the visibility conditions will stay as they are now. The chart on the right shows the percentages of days if the proposed change in the law were made. When you have understood this proposed change and are ready to move on, please click on the *Continue* button.

17) If **Proposed change X** becomes the new law, it would result in an increase in the cost of living for you and for all other households in the United States What is the *most* that ***[FLAG1=1:*** you / ***FLAG1=2:*** your household***]*** would be willing to pay *every year* in higher prices and taxes to have the visibility in the summer at all national parks in the East region improve in the way described for **Proposed change X**?

As you think about that question, please bear the following things in mind. The extra amount that you and the rest of the country would pay would be through increases in the prices and taxes for things you buy, particularly for energy and transportation. The extra money would be paid to improve the summertime visibility in national parks (and other scenic areas) just in the Eastern US. There are other air pollution impacts that you might also like to see improved; there are other environmental improvements that you might also like to see made; and there are other areas of national public policy that you might also like to influence, all of which might also imply increases in your cost of living if they were put into effect. And when your cost of living increases, that might require you to spend less on other things, or put less money into savings.

Please click on the one amount that best indicates the *most* you would be willing to pay *every year* in higher prices and taxes to have the visibility in the summer at all national parks in the East region improve in the way described for **Proposed change X**. It's OK to click on zero ($0.00) if you like.

$0.00	$2	$8	$25	$60	$150	$400
$0.50	$3	$10	$30	$75	$200	$500
$1.00	$4	$15	$40	$100	$250	$750
$1.50	$5	$20	$50	$125	$300	$1,000
						more than $1,000

I don't know

Ask all who have Q.17="more than $1,000":

18) What *is* the most that ***[FLAG1=1:*** you ***/ FLAG1=2:*** your household***]*** would be willing to pay *every year* in higher prices and taxes to have the visibility in the summer at all national parks in the East region improve in the way described for **Proposed change X**?

Maximum amount (more than $1,000) that you would be prepared to pay in cost-of-living increases: **$** _____

I'm not sure **A [Q.20]**

All respondents with Q.17="more than $1,000" now skip to Q.20.

Ask all who give a zero (not DK) response to Q.17:

19) What are the main reasons why you would not be prepared to have an increase in your cost of living to improve the visibility in the summer at all national parks in the East region in the way that **Proposed change X** would? Please tell us all of your reasons.

_____

_____

_____

_____

Ask all:

20) Next, please look at the next row down on the sheet, the one labeled **Proposed change Y** over at the left-hand side. Please read across that row carefully, from left to right. It describes a different new federal policy that is currently under consideration, one that would place ***[odd serial numbers:*** *more* ***/ even serial numbers:*** *less****]*** *strict* controls on the activities that cause haze than the first proposed change that you considered. As a result, **Proposed change Y** would improve the visibility by a ***[odd serial numbers:*** *greater* ***/ even serial numbers:*** *lesser****]*** amount than would **Proposed change X.** As before, if this new law were passed, the number of summer days represented by each of the four photographs would change.

[Continue for odd serial numbers only:]
There would no longer be any days at all with conditions like Photographs **C** or **D**; the number of days like Photograph **B** would also go down; and conditions like Photograph **A** would become the most likely.

[Continue for even serial numbers only:]
There would be very few days with conditions like Photograph **D**; the number of days like Photographs **B** and **C** would both increase slightly; and the number of days like Photograph **A** would not change.

[Continue for all serial numbers:]
Please take your time to read about the changes summarized in the bar charts for **Proposed change Y**. Again assume that if **Proposed change Y** is not made, the visibility conditions will stay as they are now. When you have understood this proposed change and are ready to move on, please click on the *Continue* button.

21) If **Proposed change Y** becomes the new law, it would result in an increase in the cost of living for you and for all other households in the United What is the *most* that ***[FLAG1=1:*** you ***/ FLAG1=2:*** your household***]*** would be willing

to pay *every year* in higher prices and taxes to have the visibility in the summer at all national parks in the East region improve in the way described for **Proposed change Y**?

As before, please remember that you may have additional priorities for improvements in air quality, in the environment more generally, and in other public policy issues like education and healthcare, all of which could also affect your cost of living if they were put into effect. You might need to reduce your spending on other things, or your savings, by the amount you specify.

Please click on the one amount that best indicates your answer. It's OK to click on zero ($0.00) if you like.

$0.00	$2	$8	$25	$60	$150	$400
$0.50	$3	$10	$30	$75	$200	$500
$1.00	$4	$15	$40	$100	$250	$750
$1.50	$5	$20	$50	$125	$300	$1,000
						more than $1,000

I don't know

Ask all who have Q.21="more than $1,000":

22) What *is* the most that ***[FLAG1=1:*** you ***/ FLAG1=2:*** your household***]*** would be willing to pay *every year* in higher prices and taxes to have the visibility in the summer at all national parks in the East region improve in the way described for **Proposed change Y**?

Maximum amount (more than $1,000) that you would be prepared to pay in cost-of-living increases: **$** _____

I'm not sure **A [Q.24]**

All respondents with Q.21="more than $1,000" now skip to Q.24.

Ask all who give a zero (not DK) response to Q.21:

23) What are the main reasons why you would not be prepared to have an increase in your cost of living to improve the visibility in the summer at all national parks in the East region in the way that **Proposed change Y** would? Please tell us all of your reasons.

_____

_____

_____

_____

Ask all:

24) It is also possible that some additional air pollution controls may be needed just to keep visibility at national parks in the East from *getting worse*. Please look at the last row on the sheet, the one labeled **If the law doesn't change**. If there were no change to the laws and existing regulations were allowed to expire, the number of summer days represented by each of these photographs would change in the way shown in that row. Conditions like Photograph **D** would become the most likely, and the number of days like Photograph **C** would also increase. The numbers of days with conditions like Photographs **A** and **B** would go down.

Again take your time to read about the changes expected if no new policies are adopted, and look to see how they are summarized in the two bar charts at the bottom. When you are ready to move on, please click on the *Continue* button.

25) What is the *most* that ***[FLAG1=1:*** you / ***FLAG1=2:*** your household***]*** would be willing to pay *every year* in higher prices and taxes to prevent the visibility in the summer at all national parks in the East region from getting worse in the way described for **If the law doesn't change**? As before, please remember that you may have additional priorities for improvements in air quality, in the environment more generally, and in other public policy issues like education and healthcare, all of which could also affect your cost of living if they were put into effect. You might need to reduce your spending on other things, or your savings, by the amount you specify.

Please click on the one amount that best indicates your answer. It's OK to click on zero ($0.00) if you like.

$0.00	$2	$8	$25	$60	$150	$400
$0.50	$3	$10	$30	$75	$200	$500
$1.00	$4	$15	$40	$100	$250	$750
$1.50	$5	$20	$50	$125	$300	$1,000
						more than $1,000

I don't know

Ask all who have Q.25="more than $1,000":

26) What *is* the most that ***[FLAG1=1:*** you / ***FLAG1=2:*** your household***]*** would be willing to pay *every year* in higher prices and taxes to prevent the visibility in the summer at all national parks in the East region from getting worse in the way described for **If the law doesn't change**?

Maximum amount (more than $1,000) that you would be prepared to pay in cost-of-living increases: **$ _____**

I'm not sure **A [Q.28]**

All respondents with Q.25="more than $1,000" now skip to Q.28.

Ask all who give a zero (not DK) response to Q.25:

27) What are the main reasons why you would not be prepared to have an increase in your cost of living to prevent the visibility in the summer at all national parks in the East region from getting worse in the way we have described? Please tell us all of your reasons.

_____

_____

_____

_____

If a non-zero response has been given to any of Qs.17, 21, or 25, set FLAG2=1.

Continue with the Debriefing for Versions V1 through V4 section.

Debriefing section for versions V1 through V4

All of *Versions V1* through *V4* come here immediately after Q.27.

Respondents' rating of prior WTP responses (following C&R)

Respondents with *FLAG2=0*, skip to the classification section.
Ask all with *FLAG2=1*:

28) We understand that it may be difficult for you to decide what is the most that ***[FLAG1=1:*** you / ***FLAG1=2:*** your household***]*** would be prepared to pay for changes in visibility at the national parks. Which of these phrases best describes the money amounts you answered to the questions about your willingness to pay through cost-of-living increases? *[Check one only.]*

Very accurate	**1**
Within the ballpark	**2**
Somewhat inaccurate	**3**
Probably very inaccurate	**4**
I'm not sure which one best describes my answers	**9**

C&R language:

Q.16) We understand it may be difficult to determine the most you are willing to pay for changes in visibility at national parks. Would you say your answers to Questions 12, 13, and 14 are very accurate, within the ballpark, somewhat inaccurate, or probably very inaccurate?

29) Next, which of these phrases best describes the dollar amounts you gave in reply to our questions about the four photographs? *[Check one only.]*

"The dollar amounts were basically for the stated changes in visibility at the national parks"	**1**	**[Q.32]**
"The dollar amounts were somewhat for the stated changes in visibility and somewhat to help with other needs at the national parks"	**2**	**[Q.31]**
"The dollar amounts were basically to help the national parks, and are not related to the stated changes in visibility"	**3**	**[Q.31]**
"None of the three statements above really describes my answers"	**4**	**[Q.30]**

Ask all coded Q.29:4:

30) How would you describe in your own words what you hope the dollar amounts would do?

_____

_____

_____

_____

> *C&R language*:
>
> Q.17) Would you say the dollar amounts you gave in answer to Questions 12, 13 and 14 are basically for the stated changes in visibility at the national parks, somewhat for the stated changes in visibility and somewhat to help with other needs at the national parks, basically to help the national parks and are not related to the stated changes in visibility, or some other reason (please specify)?

Ask all coded Q.29:2–4:

31) About what percent of your dollar answers is for visibility at national parks in the East region? *[Check one only.]*

None		*Some*			*Half*		*Most*			*All*	*I'm not sure*
0%	**10%**	**20%**	**30%**	**40%**	**50%**	**60%**	**70%**	**80%**	**90%**	**100%**	**X**

> *C&R language was essentially identical, but without a "not sure" option.*

Ask all with *FLAG2=1*:

32) Of the money that ***[FLAG1=1:*** you / ***FLAG1=2:*** your household***]*** would be willing to pay to control haze in and around national parks in the East region, about what percent do you think should be spent to control haze in and around the specific park in the photographs, the Shenandoah National Park? *[Check one only.]*

None		*Some*			*Half*		*Most*			*All*	*I'm not sure*
0%	**10%**	**20%**	**30%**	**40%**	**50%**	**60%**	**70%**	**80%**	**90%**	**100%**	**X**

> *C&R language:*
>
> Of the money you would be willing to pay to control haze in and around national parks in the Southwest, about what percent do you think should be spent to control haze in and around Grand Canyon National Park?

33) Listed below are some of the reasons that other people have mentioned why they would be willing to pay more in higher prices or taxes to help reduce haze in and around national park areas.

Please select the one reason that is *most important* to you personally.

"So *my household and I* could enjoy conditions as natural as possible on visits to national parks in the East region"	**1**
"So *others*, now and in the future, could enjoy conditions as natural as possible on visits to national parks in the East region"	**2**
"To have conditions as natural as possible at national parks in the East region, even if no one were ever to visit them"	**3**

34) Of the two reasons remaining, which one is more important to you personally? ***[Repeat the code list from Q.33, omitting the selected item.]***

35) Please enter any other reasons that influenced your answers but were not already mentioned on the most recent screens:

_____

_____

_____

_____

> *C&R language:*
>
> About what percent of the dollar amount (*sic.*) you stated you would be willing to pay for improving visibility conditions in and around national parks in the Southwest can be explained by the following reasons? (Answers should total to 100%.)?
>
> *Prespecified reasons were essentially identical, except that the third reason read ". . . even if no one were to ever visit."*

Additional (non-C&R) debriefing questions

36) Which one of these statements best describes how you personally expect to benefit, directly or indirectly, from the reduction of haze in national parks and other areas of scenic beauty in the Eastern United States? *[Check one only.]*

"Not at all, because I do not ever expect to visit those areas, or anywhere else where the visibility might improve as a result of reducing the haze in those areas"	**1**
"A little, because sometimes I do or might travel to places where the program you have described would reduce the amount of haze"	**2**
"Quite a lot, because I live in an area where I expect the air would be cleaner as the result of a program to reduce haze in Eastern national parks and scenic areas"	**3**
"I'm not sure"	**9**

37) Which one of these statements best describes the types of areas in the Eastern United States where you thought that visibility would improve in the way described by the photographs, when you were answering the questions about cost of living increases? *[Check one only.]*

"I thought that the visibility would improve in . . .

National Park areas only"	**1**	**[Q.39]**
all rural areas with scenic vistas, whether in a National Park or not"	**2**	**[Q.39]**
some urban and suburban areas, as well as rural areas with scenic vistas"	**3**	**[Q.38]**

Ask all coded Q.37:3:

38) In fact, the visibility would not improve noticeably in any urban or suburban areas as a result of the new efforts to reduce the haze in national parks and other rural areas of great natural beauty. Bearing that fact in mind, about what percent of your dollar answers was for visibility at national parks and rural areas, as distinct from urban and suburban areas? *[Check one only.]*

None		*Some*			*Half*		*Most*			*All*	*I'm not sure*
0%	**10%**	**20%**	**30%**	**40%**	**50%**	**60%**	**70%**	**80%**	**90%**	**100%**	**X**

39) On the screens that follow, there will appear a number of statements that describe how different people might go about answering our questions about paying more, in higher prices and taxes, to reduce the haze in and around areas of great natural beauty in the East region of the country. When each statement appears, please select a number between **1** and **5** to indicate how well that statement describes the way in which you personally thought about your own answers to those questions. A "**5**" answer means that the statement "describes me perfectly," and a "**1**" answer means the statement "doesn't describe me at all." ***[Randomize the order of the list.]***

Doesn't describe me at all				*Describes me perfectly*	*I'm not sure*
1	**2**	**3**	**4**	**5**	**X**

a. "When I answered about how large a cost-of-living increase I would be willing to bear to reduce haze in areas of great scenic beauty, I was *consciously* thinking that reducing haze in those areas probably means reducing haze over a much greater region as well."
b. "When I answered about how large a cost-of-living increase I would be willing to bear to reduce haze in areas of great scenic beauty, I was *consciously* thinking that reduced haze there would not only improve visibility but it would probably benefit the animal and plant life there as well."
c. "When I answered about how large a cost-of-living increase I would be willing to bear to reduce haze in areas of great scenic beauty, I was *consciously* thinking that cleaner air there might also mean fewer breathing problems (and other medical benefits) for people who live in the region."
d. "When I answered about how large a cost-of-living increase I would be willing to bear to reduce haze in areas of great scenic beauty, I was *consciously* thinking that reducing haze in those areas might have a good effect on water pollution or soil pollution as well."
e. "When I answered about how large a cost-of-living increase I would be willing to bear to reduce haze in areas of great scenic beauty, I was *consciously* thinking that reducing haze would probably help reduce other types of air pollution as well."
f. "Unless I or my family are likely to visit a national park or other area of great scenic beauty in the East region, I'm not really willing to have my cost-of-living increase to pay for better visibility there."
g. "I think it's a worthwhile goal to reduce summer haze in areas of great natural beauty in the East region, but I can't afford an increase in my cost of living just for that purpose."
h. "I think it's a worthwhile goal to reduce summer haze in areas of great natural beauty in the East region, but I'm not sure that government policies will be able to achieve the levels of changes shown in the photographs."
i. "I support a reduction of air pollution, but improving visibility in scenic areas is not among my most important reasons for doing so."
j. "I don't think that my cost of living should increase to reduce haze in scenic areas, since other people or organizations have caused the problem, not me."
k. "I'm in favor of some cost-of-living increase to help reduce haze in national parks and other scenic areas, but I just can't judge what a fair amount would be."
l. "When I answered about how large a cost-of-living increase I would be willing to bear to reduce haze in areas of great scenic beauty, I was *consciously* thinking about the amounts I typically give when asked to donate to a good cause that I believe in."
m. "I believe that my answers to this survey will help government decision makers to make better decisions about air pollution matters."
n. "I believe that my answers to this survey will help government decision makers to make better decisions about national parks and other areas of outstanding natural beauty."

o. "By the time I answered questions about cost-of-living increases to help reduce haze in areas of great scenic beauty, I was a little tired of this survey and wanted to get it finished."
p. "I feel that I understood completely the different levels of visibility changes described in this survey."
q. "When I answered about how large a cost-of-living increase I would be willing to bear to reduce summertime haze in areas of great scenic beauty, I was *consciously* thinking that reducing haze in the summer might mean less haze there at other times of the year as well."
r. "When I answered about how large a cost-of-living increase I would be willing to bear to reduce summertime haze in areas of great scenic beauty, I was *consciously* thinking that there is a very real possibility that my cost of living may increase next year as a result of the policy changes described."

Continue with the Classification data section.

Questionnaire version V5 ["Budget constraints"]

The question numbers in this version are not sequential but are aligned to correspond with the sequential numbering of the equivalent question in the longest version, *Version V3*.

National priorities orientation section

6) Our nation spends a lot of money trying to solve problems, such as reducing crime, protecting the environment, training people for jobs, and so on. The money is often spent by *governments* (for example, on public education or on health care or social services for the people unable to pay for them), or by *private corporations* (for example, on reducing workplace risks or ensuring that factories do not hurt the environment). But whether it is governments or private companies that provide the funds for social programs and concerns like this, it is the general public who has to pay for them in the end.

We pay through
- higher *prices* for the goods or services we buy, to cover the costs that private companies bear, and
- higher *taxes*, to support federal, state, and local government spending.

We also sometimes pay directly, through any *donations* that we make to charitable causes set up to work on social problems.

Ask all:

7) Below is a list of some social concerns that are often in the news. For each one, we'd like you to tell us whether you think that our country as a whole should be doing *more* about that concern, should be doing *less* about that concern, or whether you think that the current level of effort for that concern is *about right*.

	The nation should		Current efforts about right	Can't say
	do more	do less		
Medical research on life-threatening illnesses (such as cancer, AIDS, or heart disease)	1	2	3	9
Housing and feeding the poor or homeless	1	2	3	9
Ensuring adequate medical care for all, regardless of the ability to pay	1	2	3	9
Protecting the country from further terrorist attacks	1	2	3	9
Reducing and solving crimes	1	2	3	9
Protecting the environment, including preserving our natural resources	1	2	3	9
Improving the education of children and young people	1	2	3	9
Reducing the use of illegal drugs	1	2	3	9

8) Next, we want you to focus on just *one* of the issues on that list: protecting the environment and preserving our natural resources. Below is a list of the types of things that other people have told us are their most important concerns about the environment and natural resources. Just as before, for each one we'd like you to tell us whether you think that our country as a whole should be doing *more* about that issue, should be doing *less* about that issue, or whether you think that the current level of effort for that issue is *about right*.

	The nation should		Current efforts about right	Can't say
	do more	do less		
Developing renewable sources of energy, like solar and wind power	1	2	3	9
Reducing global warming	1	2	3	9
Protecting types of animals and plants that are endangered	1	2	3	9
Protecting the quality of groundwater	1	2	3	9
Improving the disposal of radioactive wastes	1	2	3	9
Improving the disposal of household and industrial waste products, and encouraging recycling	1	2	3	9
Protecting wilderness areas and wildlife	1	2	3	9
Reducing air pollution (other than the gases that contribute to global warming)	1	2	3	9
Protecting the rain forests in those parts of the world where they are threatened	1	2	3	9
Protecting the ozone layer	1	2	3	9

9) In this survey of national priorities, we are choosing just one issue to focus on for each of the participating members of the *Knowledge Networks* panel. In your case, we are going to ask for your opinions about:

Reducing air pollution (other than the gases that contribute to global warming)

More specifically, we will be asking you about programs to reduce pollution in the *Eastern half* of the United States – that's all parts of the country east of the Mississippi river. Other people are being asked about programs to reduce pollution levels in other parts of the country, but the sources of pollution, the types of impacts, and the types of remedies are different there. So please answer the following questions with your opinions about *Eastern* air pollution only, even if you live somewhere else.

Because federal, state, and local governments make regulations and decisions about the activities that create air pollution, this issue affects *all* of us, whether or not we experience air pollution ourselves. In order to reflect the priorities of *all* people in the country, it is important to get answers from *everybody*, not just from the people who are most interested in a particular topic. So **please complete this survey whether or not you personally experience such air pollution, or know much about it**. Your opinion is important, and what you and other people tell us in this survey will help influence future government policies.

As you answer the questions that follow, please keep in mind the several other issues which you told us in the previous questions are equally or more important to you personally. Please remember that the problem of air pollution is only one of the environmental problems facing our nation.

Air pollution orientation section

10) Throughout the United States, elevated levels of air pollution can cause a range of different problems. In some places, air pollution can be fairly harmless. In other places,

- it can cause health problems for some *people*,
- it can create stresses on the health of *trees* and *plants*, and
- it can cause an increased amount of *haze* in the air, which can affect how well and how far people can see scenery.

By and large, these three effects of air pollution are caused by different processes or different types of chemicals in the air, and different policies are needed to reduce the various types of air pollution. While there is some overlap, policies focused on (for example) reducing the types of chemicals that cause human health problems will not necessarily reduce harmful effects on plant life or reduce haze in areas of great natural beauty.

Federal and state governments are considering some specific changes to air pollution control laws. These changes could affect all of us throughout the United States, including the people who are not much affected by air pollution problems or do not live in areas where they are most noticeable. This is because more air pollution controls could mean that we all have to pay higher *prices* for electricity, home heating, transportation, and many other goods and services, and it could also mean higher federal or state *taxes*.

40) In the questions that follow, we are going to ask your opinions about three specific proposals that are under active consideration. Each one is meant to address a particular aspect of air pollution in the Eastern part of the country – that is, east of the Mississippi river. Any, all, or none of the proposals might be voted into law independently. The cost of any one of the proposals does not depend on whether the other proposals get adopted also.

Each of the new policies would cause an increase in the cost of living for US households. After we have described the three proposals to you, we will be asking you what level of increase in your own ***[FLAG1=2:*** household's***]*** cost-of-living expenses, if any, you would be prepared to consider for all three proposals together. We will then ask you to allocate that amount among each of the three proposals, and give you an opportunity to adjust your answers if you are not comfortable with them after we have broken the total amount down in that way.

The results of this survey are very likely to influence what the US Congress decides to do in choosing whether to make no changes to the current laws or to make changes like any of the three proposals that we will describe.

Randomize the order of Q.41, Q.42, and (Qs.12-16).

Human health proposal description

41) The effects of air pollution on human health

The bad effects that air pollution can have on human health are greatest in urban areas. This is for two basic reasons:

- A large proportion of the nation's population lives in cities, and
- A significant proportion of the air pollution is generated by the concentrations of traffic and manufacturing that occur in urban areas.

The potential health effects of urban air pollution span a wide range from increased coughing to lung cancer. The most vulnerable groups include infants, the elderly, and those already suffering from long-term breathing conditions

like asthma, bronchitis, and emphysema. Many of the health effects of air pollution − such as wheezing, tightness in the chest, and bronchitis −are short-term in nature and can be reversed if the exposure to pollution decreases. But other conditions − lung cancer and heart disease − are long-term and may not be reversible.

Over the last 30 years, the United States has done a remarkable job of cleaning up the air in cities, but many people propose that the nation do more, because urban pollution continues to be high enough in many areas to cause continued concern about the health effects.

One such proposal currently under active consideration − which we will call **Proposed change H** − would place tighter controls on the sources that cause high urban pollution levels in the Eastern half of the continental United States. Such a change in federal laws would increase our costs of living because prices for vehicles, electricity, and fuels would rise, as would transportation and all those goods that use energy in their manufacture or transportation to reach us. The effect of this proposal on health is difficult to predict with any certainty, but some estimates forecast that premature deaths, illness, and disability rates in large urban areas of the Eastern U.S. could fall by up to 2% on average.

Vegetation proposal description

42) The effects of air pollution on trees and plants

Some air pollutants, such as ozone, can put stress on the health of plants, or can damage plant tissue directly. Ozone in particular reduces the level to which crops can be grown in some parts of the country, and is thought to contribute to a decline in the health of some of our nation's forests. Most of these effects are in rural areas because that is where most of the crops and forests are located, and ozone can occur at elevated levels even in rural areas.

There is a proposal currently under active consideration − which we will call **Proposed change P** − that would reduce the emissions that contribute to high ozone levels in the Eastern half of the continental United States. As a result, the costs of living will increase throughout the nation because many types of manufacturing processes become more expensive. The effects of **Proposed change P** will be a reduction of about 15% to 30% in the levels of the pollutants that play the largest role in these plant stresses. The level of improvement in plant health is less certain, but it will probably be smaller than the amount by which the pollution levels change.

Haze proposal description

12) The effects of air pollution on haze in scenic areas

Some non-urban air pollutants (other than ozone) are visible, and are responsible for a haze that can form over a broad area, obscuring vistas and making it difficult to see long distances. This can occur even in remote areas of the East, such as in national parks or wilderness areas, which many people visit to enjoy the views. It is easier to use pictures to describe these haze conditions than it is to describe them in writing. At this stage, please open your sealed envelope. Unfold and look at the sheet you will find inside. When you have unfolded the sheet, please place it down somewhere where you can see it well, with good light.

Please look first at the four photographs set out across the top of the sheet. These show the effects of different levels of non-urban air pollution on a typical view in a national park in the Eastern United States. All of the photographs show summer days without any rain or natural fog. They are typical of conditions during the summer months between June and September in and around a number of national parks and other scenic areas in various parts of the Eastern United States. The differences are most noticeable on summer days when there is no rain or natural fog. At other times of the year, air pollution does not affect the view as much.

Photograph **A** (in the top left corner) shows almost no haze. That occurs on about *11* summer days each year; that's about *9%* of all summer days.

Moving across the page from left to right, Photograph **B** shows a little haze. That occurs on about *43* summer days each year, or about *36%* of all summer days.

Photograph **C** shows more haze. That occurs on about *43* days each summer; that's about *36%* of all summer days.

Photograph **D** (furthest to the right) shows a lot of haze. That occurs on about *11* days each summer, that's about *9%* of all summer days.

Finally, there's also a box **E** to represent "poor weather days." On about *12* days each summer, that's about *10%* of all summer days, there is rain or natural fog, and on those days the amount of haze has no effect on how far you can see.

16) Beneath the row of photographs are two rows of additional information that we're going to ask you about in turn. They describe the effects of two possible new federal policies that are currently under active consideration. Both of these different policies would place tighter controls on the activities that cause haze in scenic areas in the East, and would result in improvements to visibility.

The first new federal policy currently under consideration is represented by the row just below the row of photographs, labeled **Proposed change X**. Please read it carefully, from left to right across the page.

As a result of the proposed new policy that would place tighter controls on the activities that cause haze, the number of summer days represented by each of these photographs would change.

[Continue (same paragraph) for odd serial numbers only:]
There would no longer be any days at all with conditions like Photograph **D**; the number of days like Photograph **C** would also go down; conditions like Photograph **B** would become the most likely; and the number of days like Photograph **A** would also increase.

[Continue (same paragraph) for even serial numbers only:]
There would no longer be any days at all with conditions like Photographs **C** or **D**; the number of days like Photograph **B** would also go down; and conditions like Photograph **A** would become the most likely.

[Continue for all serial numbers:]
Please take yo anges summarized in the bar charts. The chart on the left shows the *current* percen ach of the four photographs. Assume that if **Proposed change X** is not made, the visit ney are now. The chart on the right shows the percentages of days if the proposed chan When you have understood this proposed change and are ready to move on, please clic

Valuing all three c

43) Now that we have described all of the three proposals that are under active consideration to reduce the effects of air pollution in the Eastern United States, we want to find out what you think about them. Again, please keep in mind that these proposals address Eastern air pollution only, and give us your opinions about changes for that region only,

even if you do not live east of the Mississippi. Other respondents are answering questions about proposals to reduce air pollution in other parts of the country, where the effects are different and require other types of control actions.

If all three of the proposals become the new law, they would result in an increase in the cost of living for you and for all other households in the United States. What is the *most* that ***[FLAG1=1:*** you / ***FLAG1=2:*** your household***]*** would be willing to pay *every year* in higher prices and taxes to improve air quality in *all three* of the different ways that we have described?

As you think about that question, please bear the following things in mind. The extra amount that you and the rest of the country would pay would be through increases in the prices and taxes for things you buy, particularly for energy and transportation. The extra money would be paid to improve the quality of air in the Eastern U.S. locations described in each proposal. There are other environmental improvements that you might also like to see made, and there are other areas of national public policy that you might also like to influence, all of which might also imply increases in your cost of living if they were put into effect. And when your cost of living increases, that might require you to spend less on other things, or put less money into savings.

What is the *most* that ***[FLAG1=1:*** you / ***FLAG1=2:*** your household***]*** would be willing to pay *every year* in higher prices and taxes to have the air quality improve in all of the three different ways that we have described? Please click on the one amount that best indicates your answer. It's OK to click on zero ($0.00) if you like.

$0.00	$2	$8	$25	$60	$150	$400	$1,250
$0.50	$3	$10	$30	$75	$200	$500	$1,500
$1.00	$4	$15	$40	$100	$250	$750	$2,000
$1.50	$5	$20	$50	$125	$300	$1,000	more than $2,000

I don't know

Ask all who have Q.43="more than $2,000":

44) What *is* the most that ***[FLAG1=1:*** you / ***FLAG1=2:*** your household***]*** would be willing to pay *every year* in higher prices and taxes to have the air quality improve in al ent ways that we have described?

Maximum amount (more than $2,000) *l to pay in cost-of-living increases:* **$** _____

I'm not sure **A [Q.46]**

All respondents with Q.43="more than $

Ask all who have Q.43=0 (not DK):

45) What are the main reasons why you would not be prepared to pay higher prices or taxes to make the air quality improvements that have been described? Please tell us all of your reasons.

_____

_____

_____

_____

All respondents with Q.43=0 now skip to the <u>Classification data</u> section.

Ask all except Q.43=0:

46) Next we want to ask you about your preferences between the three different proposals. Out of every *additional dollar* − that's 100 cents − that ***[FLAG1=1:*** you / ***FLAG1=2:*** your household***]*** might have to pay through higher prices or taxes to help pay for improved air quality, how many cents should go towards each of the three proposals we've described?

Assume that achieving the goals described for each of the three proposals would cost roughly equal amounts. So assign your amounts as a way of indicating how important you think it is to try to achieve each of the three goals. Please enter a number of cents in each box, but it is perfectly OK to enter "0" in any box if you think that that proposal should not get any of the extra money that you have to pay.

As you enter your amounts, you can see the total of your entries in the "Total" box each time you press the *Calculate* button. Continue to adjust your entries until the total is exactly 100 cents. When you are comfortable with the amounts, click on the *Next Question* button.

[Entries should be listed in the same order as the three proposals were described (see the box before Q.41).]

Proposed change H, to address health problems for people	___
Proposed change P, to address harm to trees or plants	___
Proposed change X, to address haze in areas of scenic beauty	___
Total	**calc**

Respondents with "Don't know" or omitted at Q.43, now skip to the <u>Classification data</u> section.
Continue for all respondents except those with zero or "Don't know" or omitted at Q.43:

47) If your own cost of living were to increase by the most that you told me you were willing to pay each year to support all three air quality proposals, and if that amount were allocated between the proposals in the proportions you have just indicated, you would be paying the amounts shown below towards each of the three proposals.

Please look at the amounts indicated for each of the three proposals. Is that a correct indication of the *most* that ***[FLAG1=1:*** you / ***FLAG1=2:*** your household***]*** would be willing to pay to support that proposed change, assuming that all the other changes would be made as well? As you review your numbers, please remember again that there may be other environmental improvements that you might like to see made as well, and there are other areas of national public policy that you might also like to influence, which might also imply increases in your cost of living. And when your cost of living increases, that might require you to spend less on other things, or put less money into savings.

If, after thinking about each line of this table, you would like to make any changes to any line of the table, go ahead and enter a revised amount in the column at the right. As before, you can see the total of your entries in the "Total" box each time you press the *Calculate* button. You should continue to make changes until you feel comfortable that the amounts you show for each of the three proposed changes are the *most* ***[FLAG1=1:*** you / ***FLAG1=2:*** your household***]*** would be willing to pay to support that proposed change, and that you are also comfortable with the "Total" amount. Then click *Next Question*

[Entries should appear in the same order as the three proposals were described (see the box before Q.41). For respondents with Q.44:A, insert "more than" before each of the computed amounts in the left column.]

		Enter any revised amounts
Proposed change H, to address health problems for people and animals	**calc**	$
Proposed change P, to address harm to trees or plants	**calc**	$
Proposed change X, to address haze in areas of scenic beauty	**calc**	$
Total	**Q.43/44**	$ **calc**

Where no changes have been made, record the calculated amounts in the table as Q.47 responses.

If the Q.47 amount for Proposed change X is greater than zero, skip to Q.49.
Ask all respondents with a zero amount for Proposed change X after Q.47:

48) We see that you have indicated that ***[FLAG1=1:*** you / ***FLAG1=2:*** your household***]*** would not be willing to pay anything to support the proposal to reduce haze in national parks and other areas of great scenic beauty in the Eastern United States. Is that what you intended?

Yes, that is what I intended	**1**	**[Q.49]**
No, I didn't intend that, and would like to change it	**2**	**[Q.47]**

The following questions in green (Qs.49-54) were not programmed as part of the pilot test, but were present in the previous version of the questionnaire script.

Ask all respondents except those with zero or "Don't know" at Q.43:

49) Next, please look at the next row down on the sheet that we sent you, the one labeled **Proposed change Y** over at the left-hand side. Please read across that row carefully, from left to right. It describes a different new federal policy that is currently under consideration, one that would place ***[odd serial numbers:*** *more* / ***even serial numbers:*** *less**]*** *strict* controls on the activities that cause haze than the first proposed change that you considered. As a result, **Proposed change Y** would improve the visibility by a ***[odd serial numbers:*** *greater* / ***even serial numbers:*** *lesser**]*** amount than would **Proposed change X.** As before, if this new law were passed, the number of summer days represented by each of the four photographs would change.

[Continue for odd serial numbers only:]
There would no longer be any days at all with conditions like Photographs **C** or **D**; the number of days like Photograph **B** would also go down; and conditions like Photograph **A** would become the most likely.

[Continue for even serial numbers only:]
There would no longer be any days at all with conditions like Photograph **D**; the number of days like Photograph **C** would also go down; conditions like Photograph **B** would become the most likely; and the number of days like Photograph **A** would also increase.

[Continue for all serial numbers:]
Please take your time to read about the changes summarized in the bar charts for **Proposed change Y**. Again assume that if **Proposed change Y** is not made, the visibility conditions will stay as they are now. When you have understood this proposed change and are ready to move on, please click on the *Continue* button.

50) If **Proposed change Y** becomes the new law, it would result in an increase in the cost of living for you and for all other households in the United States. What is the *most* that ***[FLAG1=1:*** you / ***FLAG1=2:*** your household***]*** would be willing to pay *every year* in higher prices and taxes to have the visibility in the summer at all national parks in the East region improve in the way described for **Proposed change Y**? As before, please remember that you may have additional priorities for improvements in air quality, and you should assume that your cost of living would increase by

the amount you have already indicated for **Proposed changes H** and **P**. You may also have additional priorities for improvements in the environment more generally, and in other public policy issues like education and healthcare, all of which could also affect your cost of living if they were put into effect. You might need to reduce your spending on other things, or your savings, by the amount you specify.

When earlier you were asked about the highest increase in your cost of living that you would bear to achieve a visibility improvement (**Proposed change X**) that would be somewhat ***[odd serial numbers:*** *less* ***/ even serial numbers:*** *greater****]*** than the one you're now considering (**Proposed change Y**), you told us the amount was ***[Q.47:Proposed change X]***. Please click on the *most* that ***[FLAG1=1:*** you ***/ FLAG1=2:*** your household***]*** would be willing to pay *every year* in higher prices and taxes to have the visibility in the summer at all national parks in the East region improve in the way described for **Proposed change Y**. It's OK to click on zero ($0.00) if you like.

$0.00	$2	$8	$25	$60	$150	$400
$0.50	$3	$10	$30	$75	$200	$500
$1.00	$4	$15	$40	$100	$250	$750
$1.50	$5	$20	$50	$125	$300	$1,000
						more than $1,000

I don't know

Ask all who have Q.50="more than $1,000":

51) What *is* the most that ***[FLAG1=1:*** you ***/ FLAG1=2:*** your household***]*** would be willing to pay *every year* in higher prices and taxes to have the visibility in the summer at all national parks in the East region improve in the way described for **Proposed change Y**?

Maximum amount (more than $1,000) that you would be prepared to pay in cost-of-living increases: **$** _____

I'm not sure **A [Q.53]**

All respondents with Q.50="more than $1,000" now skip to Q.53.

Ask all who have Q.50=0:

52) What are the main reasons why you would not be prepared to pay higher prices or taxes to make the air quality improvements that have been described? Please tell us all of your reasons.

_____

_____

_____

_____

All respondents with "Don't know" or omitted at Q50 now skip to Q28.

If Q.50/51 response is the same as Q.47:Proposed change X skip now to Q.28.

Ask all with Q.50/51 response different from Q.47:Proposed change X including Rs where Q46 or A51 is DK:

53) We see that you told us a different amount for **Proposed change Y** than for **Proposed change X**. If **Proposed change Y** were made rather than **Proposed change X**, would that affect how much ***[FLAG1=1:*** you / ***FLAG1=2:*** your household***]*** would be willing to pay *every year* in higher prices and taxes to support **Proposed change H** (addressing the *health problems* of air pollution) or **Proposed change P** (addressing air pollution's effects on *trees and plants*)?

No, I would still be willing to pay the same amounts as I previously stated for each of **Proposed changes H** and **P**	**1**	**[Q.28]**
Yes, the amounts I would be willing to pay for the other policies would change	**2**	**[Q.54]**
I'm not sure	**9**	**[Q.28]**

Ask all with Q.53:2:

54) Below we show the amounts that you have told us that you would be willing to pay for the three different proposals, assuming that the haze reduction proposal would be **Proposed change X** (in the first column of dollar amounts) and that the haze reduction program would be **Proposed change Y** (in the second column of dollar amounts)..

Please look at the amounts indicated for each of the three proposals in the second column . Is that a correct indication of the *most* that ***[FLAG1=1:*** you / ***FLAG1=2:*** your household***]*** would be willing to pay to support that proposed change, assuming that all the other changes would be made as well? As you review your numbers, please remember again that there may be other environmental improvements that you might like to see made as well, and there are other areas of national public policy that you might also like to influence, which might also imply increases in your cost of living if they were put into effect. And when your cost of living increases, that might require you to spend less on other things, or put less money into savings.

If, after thinking about each line of column 2, you would like to make any changes to any line of the table, go ahead and enter a revised amount in the column at the right. As before, you can see the total of your entries in the "Total" box each time you press the *Calculate* button. You should continue to make changes until you feel comfortable that the amounts you show for each of the three proposed changes are the *most* ***[FLAG1=1:*** you / ***FLAG1=2:*** your household***]*** would be willing to pay to support that proposed change, and that you are also comfortable with the "Total" amount. Then click *Next*.

[Entries should appear in the same order as the three proposals were described (see the box before Q.41), with the row for change Y immediately beneath that for change X. "more than" should be used if Q51 or Q44 indicate]

	Column 1, *with* ***Proposed change X***	***Column 2*** *with* ***Proposed change Y***	*Enter any revised amounts*
Proposed change H, to address health problems for people and animals	**from Q.47**	**from Q.47**	$
Proposed change P, to address harm to trees or plants	**from Q.47**	**from Q.47**	$
Proposed change X, to address haze in areas of scenic beauty	**from Q.47**	**–**	–
Proposed change Y, to address haze in areas of scenic beauty	**–**	**from Q.50/51**	$
Total	**from Q.47**	**calc**	$ **calc**

Where no changes have been made, record the calculated amounts in the table as Q.54 responses.

Respondents' rating of prior WTP responses (following C&R)

If Q.47(Total)=0 and Q.54(Total)=0, skip to the Classification data section.
Ask all respondents with a greater than zero amount for Total at Q.47 or at Q.54:

28) We understand that it may be difficult for you to decide what is the most that ***[FLAG1=1:*** you / ***FLAG1=2:*** your household***]*** would be prepared to pay for air quality improvements in general, and for each of the proposed changes in particular. Which of these phrases best describes the money amounts you answered to questions about your willingness to pay more through cost-of-living increases. *[Check one only.]*

Very accurate	**1**
Within the ballpark	**2**
Somewhat inaccurate	**3**
Probably very inaccurate	**4**
I'm not sure which one best describes my answers	**9**

If Q47:Proposed change X=0 and (Q50=0 or Q54:Proposed change Y=0) then skip to the Classification data section.

29) Next, which of these phrases best describes the way you answered our questions about *changes in visibility in national parks and other scenic areas*, as illustrated by the four photographs. *[Check one only.]*

"I was basically thinking about only the stated changes in visibility at the national parks"	**1**	**[Q.33]**
"I was thinking somewhat about the stated changes in visibility and somewhat about other needs at the national parks"	**2**	**[Q.31]**
"I was thinking basically about helping the national parks, and not about the stated changes in visibility"	**3**	**[Q.31]**
"None of the three statements above really describes my answers"	**4**	**[Q.30]**

Ask all coded Q.35:4:

30) How would you describe in your own words what you were thinking about when you answered questions about visibility in areas of great scenic beauty?

_____

_____

_____

_____

Ask only respondents with Q.29:2−4:

31) About what percent of your dollar answers about the haze reduction proposals for scenic areas (**Proposed changes X and Y**) were for visibility improvements? *[Check one only.]*

None		*Some*			*Half*		*Most*			*All*	*I'm not sure*
0%	**10%**	**20%**	**30%**	**40%**	**50%**	**60%**	**70%**	**80%**	**90%**	**100%**	**X**

33) Listed below are some of the reasons that other people have mentioned why they would be willing to pay more in higher prices or taxes to help reduce haze in and around national park areas.

Please select the one reason that is *most important* to you personally.

"So *my household and I* could enjoy conditions as natural as possible on visits to national parks in the East region"	**1**
"So *others*, now and in the future, could enjoy conditions as natural as possible on visits to national parks in the East region"	**2**
"To have conditions as natural as possible at national parks in the East region, even if no one were ever to visit them"	**3**

34) Of the two reasons remaining, which one is more important to you personally? ***[Repeat the code list from Q.33, omitting the selected item.]***

35) Please enter any other reasons that influenced your answers but were not already mentioned on the most recent screens:

_____

_____

_____

_____

Additional (non-C&R) debriefing questions

36) Which one of these statements best describes how you personally expect to benefit, directly or indirectly, from the reduction of haze in national parks and other areas of scenic beauty in the Eastern United States? *[Check one only.]*

"Not at all, because I do not ever expect to visit those areas, or anywhere else where the visibility might improve as a result of reducing the haze in those areas"	**1**
"A little, because sometimes I do or might travel to places where the program you have described would reduce the amount of haze"	**2**
"Quite a lot, because I live in an area where I expect the air would be cleaner as the result of a program to reduce haze in Eastern national parks and scenic areas"	**3**
"I'm not sure"	**9**

37) Which one of these statements best describes the types of areas in the Eastern United States where you thought that visibility would improve in the way described by the photographs, when you were answering the questions about cost-of-living increases? *[Check one only.]*

"I thought that the visibility would improve in . . .

National Park areas only"	**1**	**[Q.39]**
all rural areas with scenic vistas, whether in a National Park or not"	**2**	**[Q.39]**
some urban and suburban areas, as well as rural areas with scenic vistas"	**3**	**[Q.38]**

Ask all coded Q.37:3:

38) In fact, the visibility would not improve noticeably in any urban or suburban areas as a result of the new efforts to reduce the haze in national parks and other rural areas of great natural beauty. Bearing that fact in mind, about what percent of your dollar answers was for visibility at national parks and wilderness areas, as distinct from urban and suburban areas where you might spend a majority of your time? *[Check one only.]*

None		*Some*			*Half*		*Most*			*All*	*I'm not sure*
0%	**10%**	**20%**	**30%**	**40%**	**50%**	**60%**	**70%**	**80%**	**90%**	**100%**	**X**

39) On the screens that follow, there will appear a number of statements that describe how different people might go about answering our questions about paying more, in higher prices and taxes, to reduce the haze in and around areas of great natural beauty in the East region of the country. When each statement appears, please select a number between **1** and **5** to indicate how well that statement describes the way in which you personally thought about your own answers to those questions. A "**5**" answer means that the statement "describes me perfectly," and a "**1**" answer means the statement "doesn't describe me at all." ***[Randomize the order of the list.]***

Doesn't describe me at all				*Describes me perfectly*	*I'm not sure*
1	**2**	**3**	**4**	**5**	**X**

a. "When I answered about how large a cost-of-living increase I would be willing to bear to reduce haze in areas of great scenic beauty, I was *consciously* thinking that reducing haze in those areas probably means reducing haze over a much greater region as well."
b. "When I answered about how large a cost-of-living increase I would be willing to bear to reduce haze in areas of great scenic beauty, I was *consciously* thinking that reduced haze there would not only improve visibility but it would probably benefit the animal and plant life there as well."
c. "When I answered about how large a cost-of-living increase I would be willing to bear to reduce haze in areas of great scenic beauty, I was *consciously* thinking that cleaner air there might also mean fewer breathing problems (and other medical benefits) for people who live in the region."
d. "When I answered about how large a cost-of-living increase I would be willing to bear to reduce haze in areas of great scenic beauty, I was *consciously* thinking that reducing haze in those areas might have a good effect on water pollution or soil pollution as well."
e. "When I answered about how large a cost-of-living increase I would be willing to bear to reduce haze in areas of great scenic beauty, I was *consciously* thinking that reducing haze would probably help reduce other types of air pollution as well."
f. "Unless I or my family are likely to visit a national park or other area of great scenic beauty in the East region, I'm not really willing to have my cost-of-living increase to pay for better visibility there."
g. "I think it's a worthwhile goal to reduce summer haze in areas of great natural beauty in the East region, but I can't afford an increase in my cost –of living just for that purpose."
h. "I think it's a worthwhile goal to reduce summer haze in areas of great natural beauty in the East region, but I'm not sure that government policies will be able to achieve the levels of changes shown in the photographs."
i. "I support a reduction of air pollution, but improving visibility in scenic areas is not among my most important reasons for doing so."
j. "I don't think that my cost of living should increase to reduce haze in scenic areas, since other people or organizations have caused the problem, not me."
k. "I'm in favor of some cost-of-living increase to help reduce haze in national parks and other scenic areas, but I just can't judge what a fair amount would be."

l. "When I answered about how large a cost-of-living increase I would be willing to bear to reduce the effects of air pollution, I was *consciously* thinking about the amounts I typically give when asked to donate to a good cause that I believe in."

m. "I believe that my answers to this survey will help government decision makers to make better decisions about air pollution matters."

n. "I believe that my answers to this survey will help government decision makers to make better decisions about national parks and other areas of outstanding natural beauty."

o. "By the time I answered questions about cost-of-living increases to help reduce haze in areas of great scenic beauty, I was a little tired of this survey and wanted to get it finished."

p. "I feel that I understood completely the different levels of visibility changes described in this survey."

q. "When I answered about how large a cost-of-living increase I would be willing to bear to reduce summertime haze in areas of great scenic beauty, I was *consciously* thinking that reducing haze in the summer might mean less haze there at other times of the year as well."

r. "When I answered about how large a cost-of-living increase I would be willing to bear to reduce the effects of air pollution, I was *consciously* thinking that there is a very real possibility that my cost of living may increase next year as a result of the policy changes described."

Continue with the Classification data section.

Classification data section

This comes at the end of all versions.

Ask all:

C1) Finally, I have a few questions about you ***[FLAG1=2:*** and your household***]***, for classification purposes only. Which of the descriptions below best describes the place where you live? *[Check one only.]*

a large metropolitan area (over 1 million people)	**1**
a large city (100,000 up to 1 million people)	**2**
a small city or town (10,000 to 100,000 people)	**3**
a very small town or rural area (under 10,000 people)	**4**
I'm not sure	**9**

C2) Are you presently . . . *[check one only]*

employed full-time	**1**
employed part-time	**2**
a full-time homemaker	**3**
unemployed	**4**
retired	**5**
a student	**6**

V1 and V2 respondents now skip to Q.C4; ask all V3, V4, V5, or V6 respondents:

C3) The federal government's National Park Service is responsible for looking after a wide range of different types of places, including historical buildings or sites, historical areas, battlefields, cemeteries, monuments, and recreation areas. But this survey is about the national parks themselves, and just those located in the continental United States, not counting Alaska and Hawai'i. These parks are usually large natural areas, often wilderness or semi-wilderness, where the federal government places restrictions on how the land can be used and on hunting and mining. The national parks usually have an admission charge.

Have you personally *ever* visited a national park within the continental United States? *[Check one only.]*

Yes, I have visited at least one national park	**1**	**[Q.C6]**
No, I have never visited a national park	**2**	**[Q.C4]**
I'm not sure	**9**	**[Q.C6]**

Ask all who have definitely or possibly visited a national park [Q.C3:1,9]:

C4) Please check (in the left column) any of the following national parks that you have personally *ever* visited. In the right column, please check any of these parks that you have visited *in the last two years*, that's since November 2001. *[Check as many as you have visited.]* ***[Randomize the display order, except that the last two options always appear last.]***

	Ever visited	Visited in *last 2 years*
Grand Canyon National Park in Arizona	**1**	**1**
Great Smoky Mountains National Park in Tennessee and North Carolina	**2**	**2**
Shenandoah National Park in Virginia	**3**	**3**
Yellowstone National Park in Wyoming	**4**	**4**
Yosemite National Park in California	**5**	**5**
I have not visited *any* of those parks	**6**	**6**
I'm not sure	**9**	**9**

Ask all:

C5) Have you, or has anyone else in your immediate family, ever suffered from a chronic (long-lasting) breathing or lung problem (like asthma, emphysema, or chronic bronchitis)? *[Check one only.]*

yes	**1**
no	**2**
I'm not sure	**9**

C6) Thank you very much for your time and cooperation; you've been very helpful.

D

APPENDIX D. COVER LETTERS ENCLOSED WITH HARD COPY OF GRAPHICAL DISPLAY

To initiate the survey, each individual who had agreed to participate in the survey was sent a hard copy of the graphical displays depicting visibility scenarios that was needed to respond to the on-line questions. Copies of the cover letter that was enclosed with that mailing are provided in this appendix.

Versions 1 and 2 of the survey received the first cover letter, which closely followed the C&R cover letter. We used the C&R cover letter because those two versions of our questionnaire closely followed the text of the C&R questionnaire. (Version 2 differed from C&R and from Version 1 in the graphical information provided, but the text relating to the conditioning and elicitation of WTP for the scenarios was still comparable to that of C&R.)

The second cover letter in this appendix is the one that was used for Versions 3, 4 and 5 of our survey.

Knowledge
NETWORKS

«FIRSTNAME» «LASTNAME»
«ADDRESS»
«CITY_MAIL», «STATE_MAIL» «Zip»

October 23, 2003

Dear «FIRSTNAME»,

The national parks have been set aside as special resources. Yet the protection and management of national parks involve costs to each of us. Therefore, decisions about how to protect and manage the parks should consider the opinions of *all* people in the country, even those who rarely or never visit the national parks.

I have a favor to ask of you. In a few days, we will be asking you to participate in an on-line survey that asks your opinions about some important issues to do with the national parks and other areas of great scenic beauty. Because the questions vary somewhat from one person to another the survey can take variable amounts of time, but for most people it will take about 30 minutes. **You will receive 10,000 bonus points for completing the survey.** The questions do not require any scientific knowledge, only that you consider each question carefully and answer it as well as you can.

The enclosed sealed envelope contains material that you will need to consult at some point in the on-line interview. **Please do *not* open the envelope now** – you will be told when to open it during the survey – but be sure that you have it near you when you start to answer the questions. We also ask you to set aside some time when you won't be distracted by other people or other activities when you are taking the survey.

We have selected a sample of *Knowledge Networks* panel members for this survey to represent the opinions of citizens from all over the country. The results are expected to have a significant influence on upcoming government decisions affecting the national parks and other areas of great scenic beauty. They will be made available to the National Parks Service and to all other interested parties.

As always in our surveys, your responses will be kept confidential and only reported in statistical form, in statements like "20% of the people living west of the Mississippi have visited Yosemite National Park."

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Knowledge
NETWORKS

Thank you in advance for taking part in this important study. Your opinions, along with those of the other participating *Knowledge Networks* panel members, will be valued highly by the lawmakers and officials involved in setting policies for the national parks. Meanwhile, if you have any questions about this study, please feel free to contact us at 1-800-782-6899.

Sincerely,

Mike Dennis

J. Michael Dennis
Vice President and Managing Director
Government & Academic Research
Knowledge Networks

1350 Willow Road, Suite 102, Menlo Park, CA 94025 • Phone 650.289.2000 • Fax 650.289.2001 • www.knowledgenetworks.com

Knowledge
NETWORKS

«FIRSTNAME» «LASTNAME»
«ADDRESS»
«CITY_MAIL», «STATE_MAIL» «Zip»

October 23, 2003

Dear «FIRSTNAME»,

From time to time, *Knowledge Networks* is commissioned to undertake surveys about the major issues facing our country, and about the behavior and opinions that are relevant to the framing of new policies by the federal government (as well as state and local governments).

I have a favor to ask of you. In a few days we will be asking you to participate in an important on-line survey that asks your opinions about national priorities in general, and about public policies concerning one specific issue in particular. By limiting the focus of our most detailed questions to just *one* issue for each panel member, this allows us to build a comprehensive picture without requiring each participating panel member to complete what otherwise would be an extremely lengthy questionnaire. Because the questions vary somewhat from one person to another the survey can take variable amounts of time, but for most people it will take about 30 minutes. **You will receive 10,000 bonus points for completing the survey.**

Government policies typically do not always *benefit* everybody in the country to the same extent, but in most cases the range of people paying for the policies is a very broad one. In framing policies, therefore, it is important to consider the opinions of *all* people in the country, including those who may not personally benefit from them. The topic that is assigned to you in this survey may or may not be one that you feel you know anything about, or that affects you personally, or even that interests you much. Nevertheless, because it is important that we should hear the views of all types of people on a broad range of topics, please answer all of the questions no matter what issue is selected for focus in your specific interview. The questions do not require any special knowledge, only that you consider each question carefully and answer it as well as you can.

The enclosed sealed envelope contains material that you will need to consult at some point in the on-line interview. **Please do <u>not</u> open the envelope now** – you will be told when to open it during the survey – but be sure that you have it near you when you start to answer the questions. We also ask you to set aside some time when you won't be distracted by other people or other activities when you are taking the survey.

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Knowledge
NETWORKS

The results of this survey are expected to have a significant influence on upcoming government decisions. They will be made available to all parties interested in the various topics covered. As always in our surveys, your responses will be kept confidential and only reported in statistical form, in statements like "42% of the people living west of the Mississippi have flown in a commercial airline flight since September 2001."

Thank you in advance for taking part in this important study. Your opinions, along with those of the other participating *Knowledge Networks* panel members, will be valued highly by the lawmakers and officials involved in setting policies regarding the topics covered in our *National Priorities 2003* survey. Meanwhile, if you have any questions about this study, please feel free to contact us at 1-800-782-6899.

Sincerely,

Mike Dennis

J. Michael Dennis
Vice President and Managing Director
Government & Academic Research
Knowledge Networks

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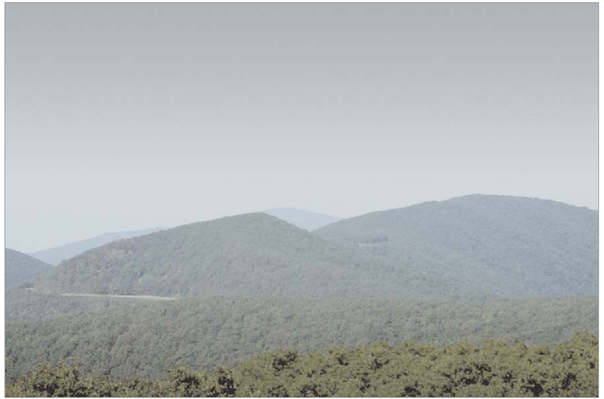
A. Visibility on about 15% of days

B. Visibility on about 20% of days



C. Visibility on about 40% of days

D. Visibility on about 25% of days

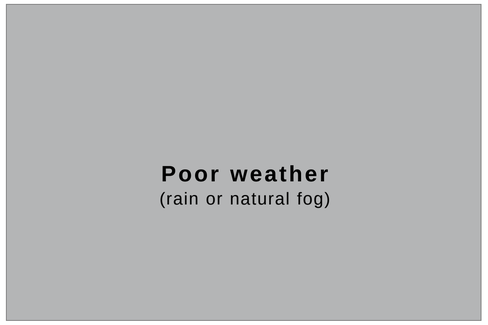
Version A

A

B

C

D



E

Proposed change X

Now occurs on about 11 summer days
(9 percent of the time)

Under the proposed change,
would occur on about 26 summer days
(22 percent of the time)

Now occurs on about 43 summer days
(36 percent of the time)

Under the proposed change,
would occur on about 60 summer days
(50 percent of the time)

Now occurs on about 43 summer days
(36 percent of the time)

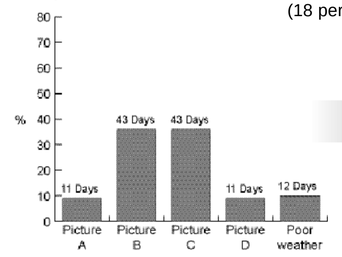
Under the proposed change,
would occur on about 22 summer days
(18 percent of the time)

Now occurs on about 11 summer days
(9 percent of the time)

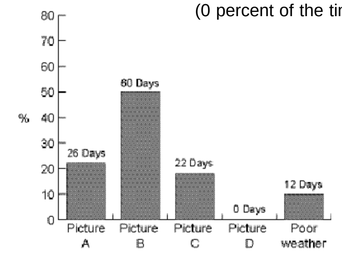
Under the proposed change,
would occur on about 0 summer days
(0 percent of the time)

Now occurs on about 12 summer days
(10 percent of the time)

Under the proposed change,
would occur on about 12 summer days
(10 percent of the time)



NOW



UNDER THE PROPOSED CHANGE

Proposed change Y

Now occurs on about 11 summer days
(9 percent of the time)

Under the proposed change,
would occur on about 86 summer days
(72 percent of the time)

Now occurs on about 43 summer days
(36 percent of the time)

Under the proposed change,
would occur on about 22 summer days
(18 percent of the time)

Now occurs on about 43 summer days
(36 percent of the time)

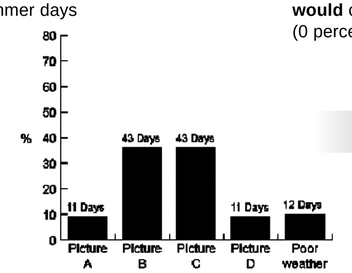
Under the proposed change,
would occur on about 0 summer days
(0 percent of the time)

Now occurs on about 11 summer days
(9 percent of the time)

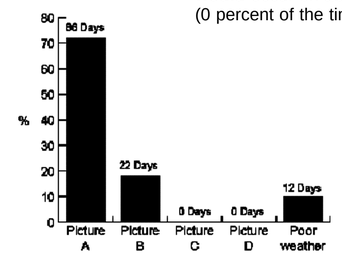
Under the proposed change,
would occur on about 0 summer days
(0 percent of the time)

Now occurs on about 12 summer days
(10 percent of the time)

Under the proposed change,
would occur on about 12 summer days
(10 percent of the time)



NOW



UNDER THE PROPOSED CHANGE

If the law doesn't change

Now occurs on about 11 summer days
(9 percent of the time)

With no change to current laws,
would occur on about 4 summer days
(3 percent of the time)

Now occurs on about 43 summer days
(36 percent of the time)

With no change to current laws,
would occur on about 6 summer days
(5 percent of the time)

Now occurs on about 43 summer days
(36 percent of the time)

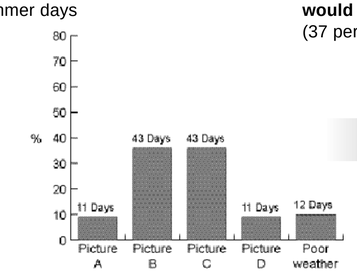
With no change to current laws,
would occur on about 44 summer days
(37 percent of the time)

Now occurs on about 11 summer days
(9 percent of the time)

With no change to current laws,
would occur on about 54 summer days
(45 percent of the time)

Now occurs on about 12 summer days
(10 percent of the time)

With no change to current laws,
would occur on about 12 summer days
(10 percent of the time)



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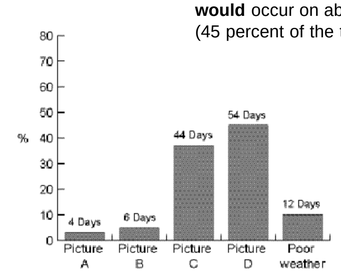

WITH NO CHANGE TO CURRENT LAWS

Version B.1

A

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C

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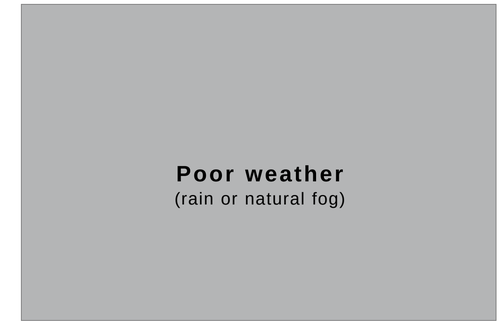


E

Proposed change X

Now occurs on about 11 summer days
(9 percent of the time)

Under the proposed change,
would occur on about 86 summer days
(72 percent of the time)

Now occurs on about 43 summer days
(36 percent of the time)

Under the proposed change,
would occur on about 22 summer days
(18 percent of the time)

Now occurs on about 43 summer days
(36 percent of the time)

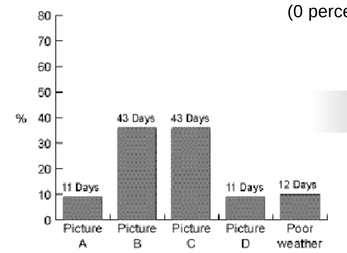
Under the proposed change,
would occur on about 0 summer days
(0 percent of the time)

Now occurs on about 11 summer days
(9 percent of the time)

Under the proposed change,
would occur on about 0 summer days
(0 percent of the time)

Now occurs on about 12 summer days
(10 percent of the time)

Under the proposed change,
would occur on about 12 summer days
(10 percent of the time)



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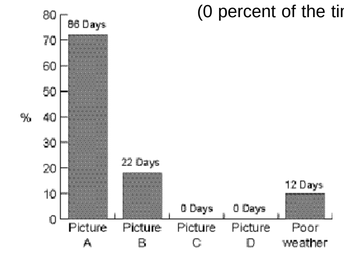


UNDER THE PROPOSED CHANGE

Proposed change Y

Now occurs on about 11 summer days
(9 percent of the time)

Under the proposed change,
would occur on about 26 summer days
(22 percent of the time)

Now occurs on about 43 summer days
(36 percent of the time)

Under the proposed change,
would occur on about 60 summer days
(50 percent of the time)

Now occurs on about 43 summer days
(36 percent of the time)

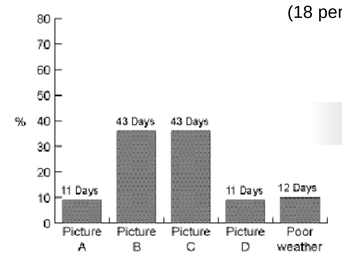
Under the proposed change,
would occur on about 22 summer days
(18 percent of the time)

Now occurs on about 11 summer days
(9 percent of the time)

Under the proposed change,
would occur on about 0 summer days
(0 percent of the time)

Now occurs on about 12 summer days
(10 percent of the time)

Under the proposed change,
would occur on about 12 summer days
(10 percent of the time)



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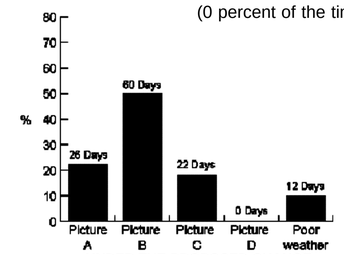


UNDER THE PROPOSED CHANGE

If the law doesn't change

Now occurs on about 11 summer days
(9 percent of the time)

With no change to current laws,
would occur on about 4 summer days
(3 percent of the time)

Now occurs on about 43 summer days
(36 percent of the time)

With no change to current laws,
would occur on about 6 summer days
(5 percent of the time)

Now occurs on about 43 summer days
(36 percent of the time)

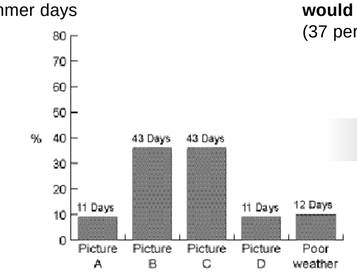
With no change to current laws,
would occur on about 44 summer days
(37 percent of the time)

Now occurs on about 11 summer days
(9 percent of the time)

With no change to current laws,
would occur on about 54 summer days
(45 percent of the time)

Now occurs on about 12 summer days
(10 percent of the time)

With no change to current laws,
would occur on about 12 summer days
(10 percent of the time)



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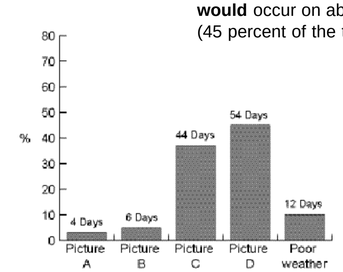

WITH NO CHANGE TO CURRENT LAWS

Version B.2

A

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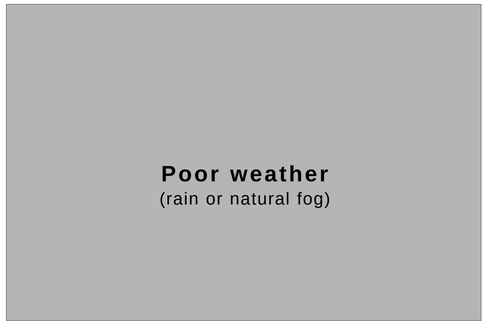
D



E

Proposed change X

Now occurs on about 11 summer days
(9 percent of the time)

Under the proposed change,
would occur on about 11 summer days
(9 percent of the time)

Now occurs on about 43 summer days
(36 percent of the time)

Under the proposed change,
would occur on about 47 summer days
(39 percent of the time)

Now occurs on about 43 summer days
(36 percent of the time)

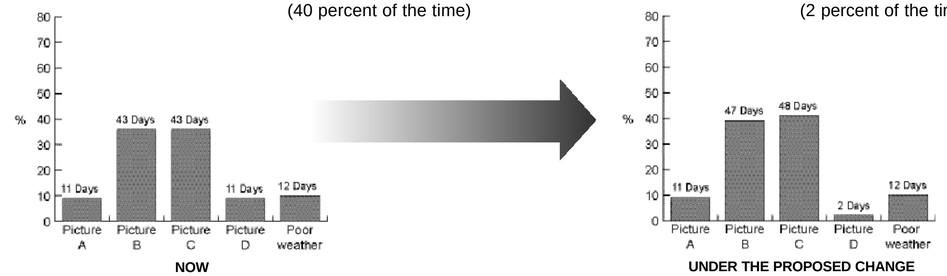
Under the proposed change,
would occur on about 48 summer days
(40 percent of the time)

Now occurs on about 11 summer days
(9 percent of the time)

Under the proposed change,
would occur on about 2 summer days
(2 percent of the time)

Now occurs on about 12 summer days
(10 percent of the time)

Under the proposed change,
would occur on about 12 summer days
(10 percent of the time)



Proposed change Y

Now occurs on about 11 summer days
(9 percent of the time)

Under the proposed change,
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(72 percent of the time)

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(36 percent of the time)

Under the proposed change,
would occur on about 22 summer days
(18 percent of the time)

Now occurs on about 43 summer days
(36 percent of the time)

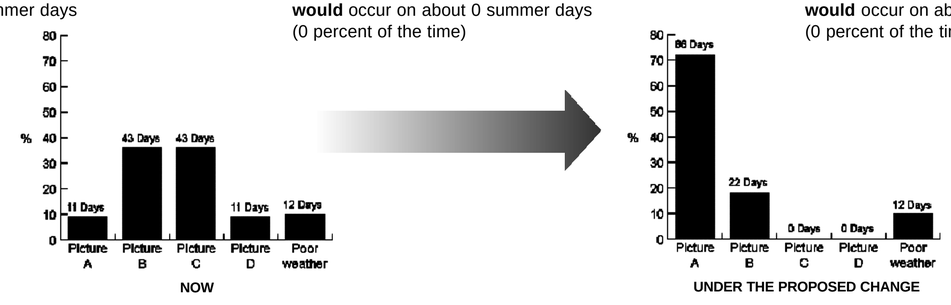
Under the proposed change,
would occur on about 0 summer days
(0 percent of the time)

Now occurs on about 11 summer days
(9 percent of the time)

Under the proposed change,
would occur on about 0 summer days
(0 percent of the time)

Now occurs on about 12 summer days
(10 percent of the time)

Under the proposed change,
would occur on about 12 summer days
(10 percent of the time)



If the law doesn't change

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With no change to current laws,
would occur on about 4 summer days
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Now occurs on about 43 summer days
(36 percent of the time)

With no change to current laws,
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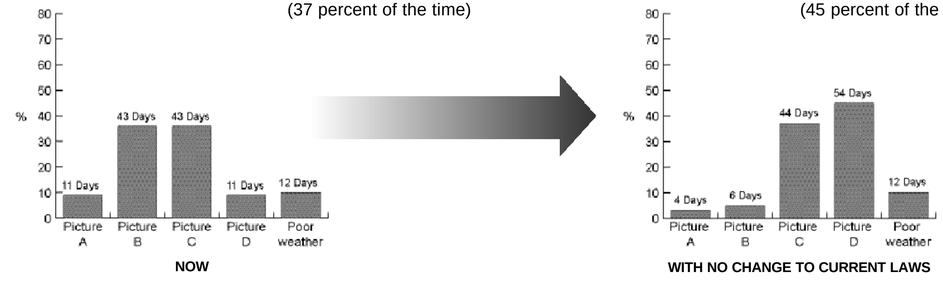
(37 percent of the time)

Now occurs on about 11 summer days
(9 percent of the time)

With no change to current laws,
would occur on about 54 summer days
(45 percent of the time)

Now occurs on about 12 summer days
(10 percent of the time)

With no change to current laws,
would occur on about 12 summer days
(10 percent of the time)



Version C.1

A

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C

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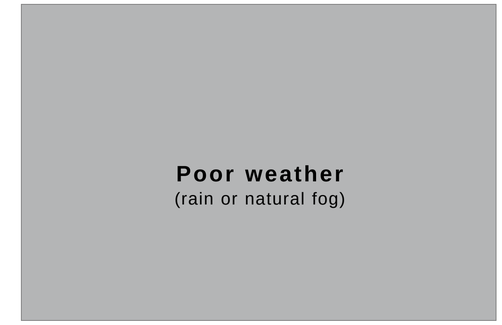

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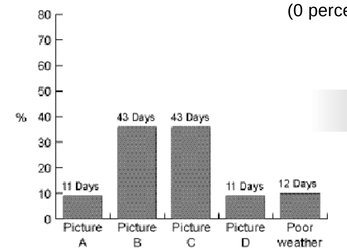

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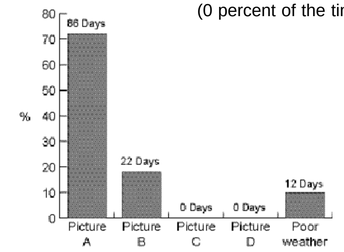

UNDER THE PROPOSED CHANGE

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Now occurs on about 11 summer days
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Under the proposed change,
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Under the proposed change,
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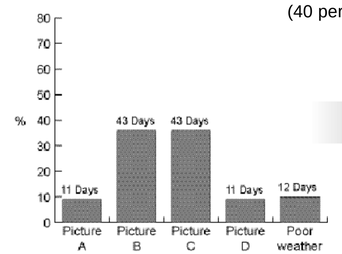

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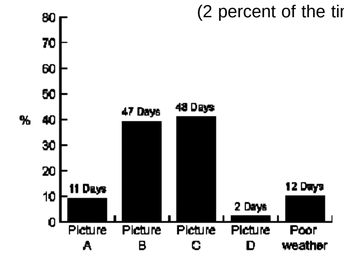

UNDER THE PROPOSED CHANGE

If the law doesn't change

Now occurs on about 11 summer days
(9 percent of the time)

With no change to current laws,
would occur on about 4 summer days
(3 percent of the time)

Now occurs on about 43 summer days
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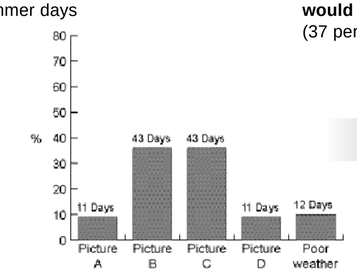

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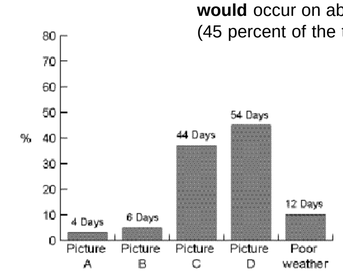

WITH NO CHANGE TO CURRENT LAWS

Version C.2

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