

CHAPTER 7

SURVEY DESIGN

7.1 Survey Composition and Mailing List

The population sampled was a group of Western Massachusetts residents, all of whom were living (at the time of the survey mailing) in Berkshire, Franklin, Hampden, or Hampshire County. The sample mailing list was obtained from a U.S. marketing firm, Database America Companies, Inc. Dillman's Total Design Method (1978), a set of procedures designed to increase response rate, was followed. Nineteen hundred and ninety-four surveys were mailed to Western Massachusetts residents on May 21, 1999. Each mail packet contained a cover letter describing the purpose of the study (see Appendix D, Figure D.3), one of six versions of the survey (see Appendix B), and a postage-paid return envelope. Prior to the receiving the survey packet, each household in the sample was mailed a 4" X 6" postcard on May 6, 1999 (see Appendix D, Figure D.2). This postcard informed the household that it had been selected to receive a survey and explained the purpose of the study. A week after the survey had been mailed to respondents, households that had not yet responded to the survey mailing were sent a 4" x 6" postcard stressing the importance of the study and urging the household to respond; this postcard was mailed on May 28, 1999 (see Appendix D, Figure D.4). A few households telephoned or wrote a letter requesting another survey; such requests were met promptly. Survey respondents were also given the opportunity to receive a copy of the study's results.

The intent of the study was to survey only those residents whose primary source of drinking water was groundwater from a private well, since the water quality issues

faced by households that obtain their drinking water from their privately owned wells are quite different than the issues faced by households that use public water systems as their primary source of drinking water. However, it was difficult to determine the primary drinking water source of each resident. The sample was restricted to those towns where groundwater was the only water source and there was no municipal sewage service, based upon the information presented in the “Community Profiles” on the official web site of the Commonwealth of Massachusetts (The Commonwealth of Massachusetts, 1999). However, several ($n=66$) households that did not use a private well for their primary source of drinking water inadvertently received the survey. This occurred because in many small, rural towns, the majority of the residents may have private wells, but a small section of the town, usually the town center, is connected to a public water supply. Such towns were not excluded from the sample.

7.2 Survey Development

Verbal protocol interviews were used to pretest the survey instrument. Eighteen people, all of whom were private well owners, were asked to complete the survey, speaking out loud as they completed the survey. Each participant was paid \$20 for approximately one and a half hours of his or her time. Respondents were recruited through a newspaper ad that ran in the classified section of the Hampshire Gazette in the fall of 1998. The text of this ad is presented in Figure D.1 in Appendix D.

The verbal protocol interviews were conducted in November 1998. Transcripts of ten of the verbal protocol interviews are presented in Appendix A. Unfortunately, though all interviews were tape-recorded, eight of the interview tapes were partially inaudible. The verbal protocol interviews provided insight as to what problems respondents might

have completing the survey, and allowed the survey to be further refined in attempt to ameliorate those problems.

Several issues repeatedly arose in the pre-testing sessions. Respondents frequently expressed discomfort with the question regarding preferences for present versus future-oriented life-saving programs, which was modified from Cropper et al. (1991). Thus, further modifications to this particular question were made. The question, as it appeared in the final versions of the survey, is presented in Appendix C (Figure C.3), as well as in Chapter Eight (Figure 8.1). The pre-testing sessions also suggested that individuals often had difficulty distinguishing between various forms of groundwater contamination. For example, although a proposed groundwater protection program may have offered protection from chemical contamination only, several respondents indicated that they believed they were protected from all forms of groundwater contamination; i.e. that they had reduced their risk of all types of groundwater contamination. This may reflect part-whole bias, or embedding, effects, which were discussed in detail in Chapter Three. A few participants also seemed to ignore the hypothetical baseline (status quo) risk of exposure to chemical contaminants, opting to view their own subjective risk levels as the status quo scenario. In addition, participants were often inconsistent when performing the contingent valuation and conjoint analysis tasks. For example, many respondents gave an alternative program a rating of “9” or a “10”, but choose not to undertake that program in favor of the status quo when asked to complete the dichotomous choice contingent valuation task, although they had rated the status quo lower than the alternative program in the conjoint analysis task. In addition, respondents did not necessarily choose the program to which they gave the highest rating as the

program that they would definitely undertake and be willing to pay for. Finally, individuals often had trouble processing the risk information presented in the survey. Based upon the verbal protocol interviews, the survey was significantly modified. For example, at this stage, visual aids were developed to help individuals understand the risk reductions the alternative programs provide. In addition, based upon the ease with which individuals handled risk information presented in frequency versus percentage form, all versions of the survey were modified to present risk information in the form of frequencies only. A lengthy section of text in the survey, which discussed groundwater contamination and its potential adverse health effects, was shortened considerably. For the purposes of additional pre-testing, a small mail survey of 100 individuals living in the town of Leverett was performed.

For the final mail survey, six versions of the groundwater quality survey were developed. Version A, presented in Figure B.1 of Appendix B, asks the respondent to consider groundwater quality valuation questions in the traditional conjoint format, the traditional dichotomous choice CVM format, and the modified dichotomous choice CVM format, which asked each respondent to indicate the one program he or she would undertake and be willing to pay for. This is the longest version of the survey, as the same respondent is asked to consider all three valuation formats. This version yields the richest set of information because responses to all three formats can be checked for consistency. For example, if the respondent assigned a rating of “10” to one alternative program and a rating of “5” to the status quo scenario, we would expect that respondent to vote ‘yes’ on that program in the traditional dichotomous choice CVM format and choose that program as the one he would definitely undertake and be willing to pay for in

the modified dichotomous choice CVM format. Version B, presented in Figure B.2 in Appendix B, asked respondents to consider valuation questions in the traditional conjoint ratings format and the modified dichotomous CVM format, while Version C, presented in Figure B.3 in Appendix B, asked respondents to consider valuation questions in the traditional dichotomous choice CVM and modified dichotomous choice CVM formats. In all three versions, the modified dichotomous choice CVM format is the last valuation question presented, and it is immediately followed by a request that the respondent indicate his degree of certainty (on a scale of 1 to 10) regarding the program he chose. The intent of the survey sequence is to force the respondent to think more and more carefully about what she would actually do, creating an increased sense of commitment to a particular program, as the criteria for supporting the program becomes increasingly stringent throughout the survey. Versions AA, BB, and CC are different from Versions A, B, and C, respectively, only in that they present the proposed groundwater protection programs in a different order; Versions A, B, and C present programs that protect only the respondent's household first, while versions AA, BB, and CC present programs that protect all Massachusetts households first. This allowed for a test of order effects.

7.3 Survey Description

The survey is a booklet (8 ½ inches by 7 inches), printed in black text on white paper. The booklet cover is presented in Figure C.1 of Appendix C. Each version of the groundwater quality survey has 6 sections. The first section, titled "Household Characteristics" contains 17 questions that seek to obtain basic information about the household, its source of water supply, its knowledge about groundwater quality issues, its feelings about the current quality of its water, and measures it may have taken to improve

groundwater quality. Two of the questions in this section were developed to allow the respondent to indicate his feelings regarding trade-offs between risk and income (Question 16), and the likelihood that technology will develop to address future groundwater quality problems (Question 17). These questions were included because prior stated preference method studies have found that some individuals appear unwilling to make trade-offs between health and money, and because the results of Cropper et al.'s work (1991) suggest that some individuals may express infinite discount rates because of beliefs that technology will develop to address future environmental problems. The first section of the survey is presented in Figure C.2 in Appendix C.

The second section of the survey presents the modified form of the question taken from Cropper et al. (1991). The modified question, discussed above in section 7.1, asks responses to choose between a program that focuses on saving lives in the present and a program that focuses on saving lives at some future date. This date may be 10, 25, or 50 years in the future, depending upon the version of the survey the respondent received. The respondent is also asked to indicate her point of indifference between the two programs. This section of the survey is presented in Figure C.3 in Appendix C, as well as in Figure 8.1 in Chapter Eight.

The third section of the survey presents some brief information about groundwater contamination in Massachusetts, stating that most of the well water in the state is not protected from chemical sources of contamination and that such contaminants may cause adverse health effects, including cancer (see Figure C.4 in Appendix C). The respondent is asked to consider several types of groundwater quality programs and is presented with a discussion of the four attributes of each program: extent of protection,

the one-time immediate cost to the respondent, the chance of being exposed to unsafe levels of chemicals in well water this year, and the chance of being exposed to unsafe levels of chemicals in well water ten years from now. The attribute “extent of protection” has two levels; a groundwater protection program protects either the respondent’s household only, or all Massachusetts residents. There are nine possible bid levels for the cost attribute; these bids levels are \$50, \$100, \$200, \$300, \$500, \$800, \$1000, \$1200, and \$1600. Bid levels were randomly assigned to the respondents.

Much effort was directed at effective communication of the risk attributes of each groundwater protection program. The respondent is first presented with baseline, status quo risks levels, which reflect no groundwater protection. The baseline risk of being exposed to an “unsafe level” of chemical contaminant in well water is 20/1000, or 2%, this year, and 30/1000, or 3%, ten years from now. An unsafe level of chemical contaminant is defined as one above the U.S. Environmental Protection Agency’s Maximum Contaminant Level. During the development of the survey, one major concern was the presentation of the household’s risk of groundwater contamination from chemical sources. Considerable effort was directed at creating a hypothetical situation that was plausible. The baseline, or status quo, risks of exposure to chemical contaminants in drinking water were estimated using public water system data provided by the Massachusetts Department of Environmental Protection. While one may argue that the risk of exposure for the household using a private well may be very different than the risk for a household using water from a public source, no data is available on the levels of chemical contaminants in private wells.

Each groundwater protection program differed in the risk reduction it could provide; these risk reductions were randomly assigned to respondents. The risk levels for this year, achieved under a groundwater protection program, range from 2/1000 (0.2%) to 18/1000 (1.8%). The risk levels ten years from now, under groundwater protection, range from 2/1000 (0.2%) to 20/1000 (2.0%). Two of the four groundwater protection programs each respondent was asked to evaluate emphasized immediate risk reductions (i.e., the risk reduction this year exceeds the risk reduction in ten years), while the remaining two programs emphasized risk reductions ten years from now (i.e., the risk reduction ten years from now exceeds the risk reduction this year). Because the prior literature (see Chapter Five) and the pre-testing sessions (see Appendix A) indicate that individuals have trouble distinguishing between small changes in risk, the risk levels for this year and ten years from now always differ by at least 5/1000 (0.5%). In addition, as a result of the pre-testing sessions, all risk information was presented in frequency format (e.g. the baseline risks are 20/1000 for this year and 30/1000 in ten years from now). Each risk level is also accompanied by a graphic to aid the respondents in understanding the reductions in risk offered by each proposed groundwater protection program.

The fourth section of the survey is comprised of the valuation questions. Each respondent is asked to consider 5 options: the status quo scenario and four options for protecting groundwater from chemical contaminants. Two of the four options protect the respondent's household only; the remaining two options protect all residents of Massachusetts. Each version of section four is presented in Appendix B. In versions A and AA of the survey there are three valuation formats: traditional conjoint ratings,

traditional dichotomous choice contingent valuation, and modified dichotomous choice contingent valuation (see Figure B.1). In versions B and BB, the respondent is asked to value the four alternative programs in two formats: traditional conjoint ratings and modified dichotomous choice CVM (see Figure B.2). Finally, in versions C and CC the respondent is asked to value groundwater protection in two formats: traditional dichotomous choice CVM and modified dichotomous choice CVM (see Figure B.3).

Following the valuation tasks, Section 5 of the survey asks respondents to indicate their motivations for responding to the valuation questions in the manner they did. Respondents that received either Version A, AA, B, or BB are asked to indicate why they rated the program to which they assigned the most unfavorable rating in the manner that they did. All respondents are asked to indicate why they chose the particular program they did in the modified dichotomous choice CVM question. If the respondent chose a program that protects only his household in the modified dichotomous choice CVM format, he is asked to indicate the reasons for his choice. Section 5 of the survey is presented in Figure C.5 of Appendix C.

The final section of the survey, Section 6, contains 8 questions regarding socioeconomic characteristics of respondents. For example, the respondent is asked to provide his or her age, gender, race, income range, highest level of education attained, the total number of household members, the number of infants in the household, and the number of children between the ages of 1 and 18 in the household. The purpose of collecting such socioeconomic data is to test if implicit discount rates and willingness-to-pay values for groundwater protection depend upon socioeconomic characteristics. It is reasonable to speculate that households with children, particularly infants, may be more

concerned about groundwater contamination, possibly having higher willingness-to-pay values for protection and greater values for future protection. Figure C.6 of Appendix C presents Section 6 of the survey instrument.

The back cover of the survey booklet is presented in Figure C.7 of Appendix C; it thanks the respondent for participating in the study, indicates that the questionnaire should be placed in the postage-paid envelope and mailed back to the University as soon as possible. In addition, on the back cover of the survey booklet, respondents are provided with a contact address and telephone number, and are given the opportunity to make written comments regarding the survey. Finally, respondents are asked to write their name and address on the back of the postage-paid reply envelope if they wish to receive a copy of the study's results. We now turn to a discussion of those results in Chapter Eight.