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Contingent Valuation and Averting Costs Estimates of Benefits for Public Water Decisions in a Small Community

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The Safe Drinking Water Act of 1974 mandated that the U. S. Environmental Protection Agency (EPA) establish maximum limits on contaminants that pose a health threat as standards for public drinking water systems. Implementation of these drinking water standards is a classic case of federal, state, and local joint action. States have assumed the enforcement of drinking water standards. State standards must have contaminant levels no higher than EPA levels but many have lower levels. Local public water authorities, in cooperation with state regulatory agencies, are responsible for selecting methods to comply with the state standards. Minimum standards are evolving over time as knowledge increases about the effects of contaminants on health, as methods improved for monitoring contaminants, and as the general concern with health has increased with growth in income.

Enforcement of newly developed standards can be a traumatic experience for local communities. The determination that supposedly safe water is a health threat is a stressful event in itself. The stress is magnified by the necessity to change individual behavior until the problem is rectified. Alternative temporary sources of water must be considered, and decisions made about the costs and benefits of these sources. While these consumer decisions

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are being made and implemented, the local agency must determine the appropriate response and how to finance it. The permanent solution usually involves public investment and therefore ultimately increases either individual water bills and/or local taxes. Thus, individuals are faced with these future permanent cost increases while coping with the temporary costs of contaminated water. In small communities, these permanent cost increases can be quite significant because they cannot take advantage of economies of scale in public water systems. The difficulties for political processes in such an environment in small communities is an interesting issue but is outside the disciplinary expertise of the authors of this paper.

The purpose of this paper is to evaluate the potential of contingent valuation (CV) and averting costs estimates of benefits to provide information on alternative permanent solutions for public decision makers in this crisis environment. In the past 25 years, contingent valuation has become one accepted method to estimate the benefits of non-market commodities. Cummings, Brookshire, and Schulze and Mitchell and Carson have provided recent treatises on CV with at least cautiously optimistic views of its potential. While controversy about CV still exists (e.g. Kahneman and Knetsch; Smith), CV is widely used in cost-benefit planning studies and in judicial considerations of environmental damages. Generally, these applications of CV concern larger populations than small rural communities and are not conducted in an atmosphere of policy crisis.

This paper reports on a case study of the application of CV in a small community in Pennsylvania in which the public drinking water system had been declared to have violated public drinking water standards. Data to estimate averting costs were also collected. The organization of this report is as follows: (1) background on the case study situation is

presented, (2) procedures used in the interviews are discussed, (3) survey results on types and costs of averting behavior in response to the unsafe drinking water are presented, (4) the CV survey and its results are presented and interpreted, and (5) the overall implications of the case study for the potential of CV and averting costs to provide information for policy decisions is considered.

Background and Chronology

The case study concerns Giardia lamblia, a protozoa found in surface water in various locations in the United States and elsewhere. The protozoa cause a gastro-intestinal disease with symptoms similar to dysentery and food poisoning. Evidence that Giardia in drinking water presented a health threat was being considered in the early 1980s. A severe outbreak in Luzerne County in Pennsylvania in 1983-84 was the topic of a recent detailed case study on this problem. EPA issued final guidelines for Giardia in June 1989 (Harrington, Krupnick, and Spofford). However, Pennsylvania already had adopted explicit standards for Giardia in its Safe Drinking Water Law in December, 1984 (Commonwealth of Pennsylvania).

The case study in this research was conducted in Milesburg, which is a village of 1,144 people near the center of Pennsylvania (U. S. Bureau of the Census). At the foot of Bald Eagle Ridge, Milesburg, a borough in Pennsylvania municipal governmental structure, is bordered on all sides by rural Boggs township. Two miles to the south is the larger community of Bellefonte with a population of 6,358. Because of the ridge-and-valley topography and history of the area, water for households in this area is provided by small, isolated private water companies or quasi-public authorities. In 1989, Milesburg's water was provided by the quasi-public Milesburg Water Authority, from a surface stream, Wallace Run,

which was filtered but otherwise untreated. The stream was subject to high coliform levels, turbidity, and insufficient summer flows. The distribution system serving 800 households, approximately 500 in Milesburg and 300 in adjacent Boggs Township, was old, leaky and unmetered (Centre Daily Times 2/7/89).

Boggs Township had built a public water system with wells as the water source in 1972 in anticipation of intensified development at the Interstate 80 interchange in the township. The expected development never materialized so the water system had considerable excess capacity as well as unpaid debt. The Boggs township system was connected to the Milesburg system and had provided water to the borough in the past when Wallace Run was insufficient. The two authorities had a standing contract for water provided to Milesburg from this connection.

Bellefonte is renowned in the region for the quality of its spring water. The city name means "beautiful fountain." Spring water is distributed by the city government, untreated. Historically the city has been unwilling to allow others to tap its water so no interconnections exist with Boggs or Milesburg.

On Tuesday, January 17, 1989, the Pennsylvania Department of Environmental Resources (DER) discovered Giardia lamblia cysts in the Wallace Run reservoir. The next day, DER issued an advisory to all customers of the Milesburg Water Authority to boil water for human consumption for one minute. No cases of giardiasis had been reported which could be traced to Wallace Run water, nor were any reported to state health officials during the course of the boil water advisory. Under state law the Milesburg Water Authority was required within 30 days to develop a plan to remedy the Giardia contamination.

The DER offered four options: 1) Drill wells. 2) Install adequate filters for Wallace Run. 3) Superchlorinate Wallace Run water. 4) Switch to a Giardia free water source such as Boggs' or Bellefonte's water supplies. An earlier plan to drill wells in the borough proved infeasible because of the risk that ground water could be contaminated from industrial and transportation facilities. Investment in appropriate treatment of Wallace Run water was considered infeasible since it provided an inadequate supply of water. Thus, the fourth option was the most viable alternative.

Although the Milesburg system was already connected to the Boggs water system the Milesburg Authority was unwilling to adopt that solution. Milesburg customers were already familiar with Boggs township water from previous connections during summer dry spells, and many considered it to be of poor quality. In addition the contract with Boggs charged a relatively high price for the water. The authority estimated it would require a dollar per day surcharge on each household to pay for Boggs water. In January 1989, Milesburg Water Authority customers were being charged a flat rate of $6 per month which had not changed in many years. The water rate was raised to $12 per month in February 1989 in anticipation of the costs of dealing with the Giardia contamination. With the surcharge for Boggs water, rates were expected to jump to $42 per month, a seven-fold increase in less than three months.

After intense, unsuccessful negotiations on charges and the possibility of merging the two systems, Milesburg Water Authority eliminated the Boggs option and proposed building a connection to Bellefonte as its solution to the Giardia contamination. The DER rejected this proposal. The interconnection to Bellefonte would take at least 18 months to construct. State officials felt continuing the boil water advisory over a year and a half seemed an

excessive burden on the customers when safe water was just a question of opening a valve. After further negotiation with DER assistance, the Milesburg Authority reached agreement with Boggs on a slightly lower rate. High turbidity in Wallace Run forced the Authority to replace Wallace Run water with Boggs water on March 28. After superchlorinating the system, the boil water advisory was lifted April 12, 1989.

The next week the Milesburg Water Authority raised its residential rates to $32 per month and initiated actions to require commercial customers to install water meters. Although smaller than anticipated, customers did not willingly accept the increase. Quarterly bills that were $18 in January would be $96 in July. A petition drive in June requested Wallace Run be reopened as the water source, even if still contaminated, and rates be lowered. A petition with 525 signatures was collected, and 300 residents attended a meeting to protest the new rates. More than half of the adult population served by the authority stated a preference for the boil water advisory over Boggs water at $32 per month. Several people interviewed at the time held the DER responsible for the excessive rates since DER required the authority to provide Giardia free water. Milesburg water customers received some relief from the high rates in September 1989 when DER pressure forced Boggs to reduce the price it was charging Milesburg. As a result residential rates were reduced to $20 per month.

As of the Spring of 1992, Milesburg residents continue to use Boggs water while the Milesburg Water Authority seeks financing to build the connection to Bellefonte or construct facilities to improve the quality of the water. Many residents have reportedly purchased home water softener/filtration units. Water rates have risen again to $25 per month, and customers are required to install water meters (McMullin).

Study Design and Survey Procedures

The study utilized a telephone survey. The population to be surveyed was developed from the customer list of the Milesburg Water Authority. The customer list included 557 names. The focus of the study was household consumers so businesses, civic organizations and churches were deleted. The total number of household customers was 478. Using the local telephone book, telephone numbers were identified for as many customers as possible. All customers with identifiable telephone numbers were called in April, 1989. No responses were received from some telephone numbers so a total of 370 households was contacted. Surveys were completed by 226 households. This number is 61 percent of the households contacted and 48 percent of households on the customer list. This completion rate reflected extra careful preparation and training of the interviewers because of the crisis situation.

A questionnaire was developed from questionnaires used in previous studies of CV and averting costs on similar public decisions with similar populations. Adapting previously used questionnaires made pretesting the questionnaire less important than in studies using these techniques in innovative applications. The small population in Milesburg, the limited time available for student participation in the study, and the rapidly evolving crisis made surveying as soon as possible more important than in many studies. If problems arose in the initial interviews, the questionnaire would have been revised. However, no evidence of problems with the questionnaire was apparent.

The telephone interviews were conducted by undergraduate students enrolled in a psychology/individual and family studies class taught by one of the authors. The study was explained to students during class. Students who were interested attended a meeting outside of class to learn more about the study. During this meeting, students were given background

information about Milesburg and the water situation. They also were warned that conducting the interviews might be difficult because many people in the community were very upset about the situation. Thirteen students (11 females, 2 males) chose to work on the project. They were paid a small hourly wage for their work.

One of the authors and a graduate student supervised the training and actual interviews and were present at all interview times. Several training sessions were held before interviewing began. The interviewers followed a written questionnaire that included the exact wording for the questions they asked and transition statements to move them from one question to the next. The questionnaire is included in the appendix of this report. They recorded responses directly on the questionnaires. During training sessions, the interviewers practiced in pairs until they felt comfortable with the procedure. In the initial stages of the actual interviews, the interviewers met briefly after each evening session to discuss any problems that arose and to consider appropriate procedures for handling the problems.

Once the interviewers had been trained, the interviews were conducted during the evening hours between 6:00 and 9:00 p.m. on Monday through Thursday evenings. Each interviewer worked at an individual desk with a headset/mouthpiece connected to a regular telephone. This mechanism enabled the interviewer to have both hands free to record answers during the interview. Two office suites were used for the study, with four student interviewers working in each suite.

At the beginning of a session, each interviewer was given a stack of questionnaires. Each questionnaire already had the name of a water customer and his/her telephone number on the first page. If contact was made, the interviewer either conducted the interview or noted that the respondent would prefer to be called at another time. At the beginning of

each evening session, priority was given to conducting those interviews that had been prescheduled. If the contacted individual did not want to be interviewed at all, the questionnaire was marked accordingly. Once they had worked through their stack of questionnaires, the interviewers returned them to the person supervising their suite and obtained a new set.

In order to maximize the number of respondents, interviewers were instructed to begin each interview using a standard format on page 2 of the questionnaire. As soon as the phone was answered by either the person listed as the "water user" or that person's spouse, the interviewer quickly responded with "My name is (first name) and I'm calling from Penn State University. I'm not selling anything, but I would like to talk with you for a few minutes. Is this a good time?" Most respondents answered yes, a few wanted to know a little more about what the interviewer wanted, and several hung up. The interviewer then proceeded to tell the respondent that he/she was working with people in the College of Agriculture. The interviewer went on to say that people at Penn State were concerned about the water situation in Milesburg and that we were trying to gain more information about how people were handling it and how they felt about it. At that point, the respondent again was given the option of scheduling the interview for a later point; however, most respondents completed the interview at that time.

While the majority of the interviews went smoothly, the interviewers sometimes had to use a great deal of tact and ingenuity to complete the interview. For example, one respondent was not immediately convinced that the interviewer was really a Penn State student. He proceeded to ask her numerous questions (which she answered in a good natured manner) about buildings on campus, campus life in general, and campus activities until he was

finally convinced that she was a bona fide student. Another respondent was so upset by the situation that between each question he "ranted and raved" for several minutes. The interviewer would ask a question, record the answer, and then could be heard saying "yes, . . . umm hmm . . . yes, I guess that's right . . . umm . . . umm . . . Well, I need to ask you another question here." That interview took almost an hour to complete compared to 15 to 20 minutes for most interviews. These examples illustrate the special problems interviewers can encounter in situations like this case study.

General Characteristics of Households with Completed Surveys

This section summarizes general socio-economic data on households completing the survey and presents some general responses about the problem. Economic results on averting costs and from CV are presented in a subsequent section.

Characteristics of Respondents and Their Households

Interviewers spoke to any adult member of the household who was available. The number of male and female respondents, their mean ages, their marital status, and the ages of their spouses are presented in Table 1. The number of people living in the household, the number of adults, and the ages and number of children living in the household were also obtained. The average number of people in a household was 3.02. The average number of adults (people over 21) was 2.1, while the average number of children was .93. Even though these means suggest that a typical household consisted of two adults and one child, the com-

composition of the households varied greatly. The number of adults ranged from one to five, while the number of children ranged from zero to seven.

TABLE 1

SEX, MARITAL STATUS, AND AGE OF RESPONDENTS*

Sex of Respondents	Average Age	Number Married	Average Age of Spouse
132 Women	48.7 years	107 (81%)	49.1 years
82 Men	50.1 years	74 (90%)	46.7 years

*The number of respondents does not add up to 226 because some people refused to provide personal information.

Questions were also included about level of education of respondents and that of their spouses and also about their annual household income. Education of respondents and their spouses is presented in Table 2. The household income of respondents is presented in Table 3.

Finally, respondents were asked whether they lived in the Borough of Milesburg or in Boggs Township, and how many years they had used water supplied by the Milesburg Water Authority. Sixty-one percent of the respondents indicated that they lived in the Borough, with 39 percent living in Boggs Township. The average number of years that respondents had used Milesburg water was 19.

TABLE 2

EDUCATION OF RESPONDENTS AND THEIR SPOUSES

Education Completed	Number of Respondents	Number of Spouses
Grade School only	20 (9%)	16 (9%)
Some High School	19 (8%)	14 (8%)
High School Graduate	128 (57%)	116 (64%)
Some College/Technical School	31 (14%)	17 (10%)
Technical School Graduate	7 (3%)	6 (3%)
College Graduate (Includes Registered Nurses)	12 (5%)	9 (5%)
Post-Graduate College Work	5 (2%)	1 (1%)
Information not Available	4 (2%)	2 (1%)

TABLE 3

NUMBER AND PERCENTAGE OF HOUSEHOLDS IN EACH INCOME CATEGORY

Income Category	Number and Percentage of Households
Less than $10,000/year	16 (7%)
$10,000 - $20,000/year	45 (20%)
$20,000 - $30,000/year	63 (28%)
$30,000 - $40,000/year	33 (15%)
$40,000 - $50,000/year	27 (12%)
More than $50,000/year	11 (5%)
Refused to answer or could not answer	31 (13%)

The respondents differed somewhat from the population of Milesburg in a 1990 U.S. Census enumeration. Women are 52 percent of the population but 62 percent of the respondents. Single person households are only nine percent of the sample while they are 19 percent of the population. In the sample only 17 percent reported they had not completed high school while almost 30 percent of the adult population did not have a high school diploma. The other end of the education scale was more accurate with seven percent of the sample and eight percent of the population having a bachelor's degree or higher. The median age and income levels of the sample corresponds closely with the population values (U.S. Bureau of the Census).

Response to "Boil Water" Order

Respondents were asked whether or not they boiled their drinking/cooking water once the boil water order was given. Fifty three percent (119 households) indicated that they did boil their water while 47 percent (107 households) indicated that they did not. However, one hundred twenty households (53%) obtained water from other sources. (Some of the households boiling water also obtained water elsewhere.) Only 18 respondents continued using the unboiled water as the sole source of drinking water while seven drank both boiled and unboiled water.

Households that boiled water. Once a household began to boil water, most continued to do so until they were told it was safe to stop. Only 18 respondents indicated that their households stopped boiling water before they were told that it was safe to do so. In most cases, these families began to obtain water somewhere else. Only seven respondents reported

that the people in their households started drinking the Milesburg water before they were told it was safe to do so.

Households boiled an average of eight quarts of water a day or 56 quarts per week. Eighty-one percent of the respondents indicated that they boiled water for coffee, 66 percent boiled water to make juice and other beverages, 38 percent indicated that they boiled the water they used for teeth brushing, and 29 percent indicated that they boiled water for "other uses." These other uses often included water given to household pets. Respondents were asked how inconvenient it was to boil water. Responses were scored "1," indicating not inconvenient, "2," indicating somewhat inconvenient, or "3," very inconvenient. Mean response to this question was 2.5 indicating that, on the average, people considered boiling water to be somewhere between somewhat and very inconvenient.

Households that obtained water from other sources. Thirty three of these households purchased water, 53 obtained the water from a friend or a business, and 29 obtained water from a well or spring. (Six of the respondents gave answers which were ambiguous, and thus were not classified.) People were asked whether they needed to make a special trip in order to obtain water or whether they obtained it on a trip made for other purposes. Ninety people answered this question. Of these people, only 29 (32%) indicated that they could obtain water on another trip, while 61 (68%) indicated that they had to make a special trip in order to obtain water. Of those who made a special trip, the average number of round trip miles was 13.1. This trip was rated as either not inconvenient (scored as a one), somewhat inconvenient (scored as a two), or very inconvenient (scored as a three). The mean response to this question was 2.2, indicating that the trip was a little more than "somewhat inconvenient." Of those people who indicated that water was obtained on a trip made for

another purpose, the mean rating of inconvenience was 1.89. When obtaining water could be combined with another regularly scheduled trip it was not as much of an inconvenience as when a special trip had to be made.

Of those households that purchased water, the average amount purchased was 23 quarts (5.75 gallons) per week. This amount is less than half the amount that respondents boiled. The average estimated cost for this water was $4.94 per week. Respondents were asked how inconvenient it was to purchase water. Answers were "not inconvenient," which was given a score of one, "somewhat inconvenient," which was given a score of two, or "very inconvenient," which was given a score of three. The mean response to this question was 2.2, indicating that, on the average, respondents felt it was somewhat inconvenient to purchase water.

Problems Associated with Water

Respondents were asked whether they or anyone they knew had become ill from drinking unboiled water. Twenty-five people indicated that they knew someone who had become ill. Thirteen of these individuals indicated that they had become ill themselves, while nine indicated that it was a family member who had become ill. Fourteen of these cases of illness had occurred since the boil water order. All of these cases of illness were reported as "flu-like symptoms," or "intestinal disorders." Three reported that they had seen the doctor and that the doctor had diagnosed the illness as giardiasis. These responses perhaps reflected individuals perceptions of symptoms similar to giardiasis. No cases were confirmed medically in this situation which supports this interpretation.

Interviewees also were asked about any other problems they might have had with the water system. A variety of complaints were recorded. For example, eight people indicated

that they thought the water was too hard, 12 indicated that they had problems with laundry (not getting clothes clean, leaving residues), four did not like the taste, and seven thought there were excess minerals in the water. However, most people did not report any problems.

Choice of Water System

Respondents were asked to indicate which of three potential water systems--Bellefonte, Boggs Township, or Milesburg's Wallace Run with a new filtration system--was their first choice, second choice, and third choice for water systems. Responses are presented in Table 4. As can be seen in Table 4, most respondents named Bellefonte as their first choice for water systems. Boggs Township was named most often as third choice. Milesburg was named most often as second choice. At the time of the interviews the respondents were receiving Boggs water, but the Milesburg Water Authority was investigating connecting to Bellefonte. Obviously, these political actions are reflected in the survey responses. In addition, the majority of respondents' choice of Bellefonte as first compared to only 27% having Milesburg as first reflected an understanding that maintaining the previous water supply was not a plausible alternative with its contamination and costs for correction of the problem.

TABLE 4

RESPONDENTS' CHOICE OF WATER SYSTEMS

	Water System		
	Bellefonte	Boggs Township	Milesburg
First Choice	134 (66%)	14 (7%)	54 (27%)
Second Choice	53 (26%)	56 (28%)	93 (46%)
Third Choice	15 (7%)	132 (65%)	55 (27%)

Characteristics of Averting Activity Groups

Respondents were classified by what actions they took in response to the boil water advisory. Table 5 summarizes the classifications and shows mean values of various survey rates for each group. The numbers of families taking each averting behavior is not the same as described in the previous section because 24 respondents who did not complete the valuation section were not included in the tabulations in this table. The 16 respondents who reported they drank the contaminated water may be distinct from the rest of the sample. They are younger, somewhat better educated, and have higher incomes. While these differences are not statistically significant, the result may reflect the small size of the group. Only 18.8% of the families that continued to drink had at least one family member who was likely to be home during the day, i.e. occupation listed as home-maker or retired. In contrast, almost half those families that hauled or boiled water had an adult at home. Time available for averting behavior may have precluded averting behavior for the 16 who drank the contaminated water, especially since their income was almost as high as those who bought. For those households with an adult at home, income seems to be a determinant of buying versus hauling or boiling. Families with young children avoided drinking the water. Only 1 of 37 families with young children were in the "Drank" group, though 3 others boiled and drank. Anyone with experience of water borne disease avoided drinking the water. None of the 25 respondents who knew of someone who had become ill from the water drank it.

The political activity of the different response groups also forms an interesting pattern. Those who continued to drink the water were the most politically active. Half the "Drank" group went to at least one meeting. The least active were those who boiled their water. Only 18% of this group went to at least one meeting. About one-third of the respondents in all

TABLE 5

CHARACTERISTICS OF AVERTING ACTIVITY GROUPS

	One Activity Only				Boiled and				
	Drank	Boiled	Bought	Hauled	Drank	Bought	Hauled	Other	Total
Frequency	16	66	17	64	6	13	18	2	202
Mean									
Income [a]	3.8	3.0	3.9	3.2	4.0	3.3	3.2	***	3.3
Age	45.0	50.9	46.7	47.4	48.0	51.6	47.2		48.6
Education [b]	3.7	2.9	3.4	3.3	4.0	2.9	3.8		3.3
Young Child at Home [c]	0.06	0.14	0.18	0.22	0.33	0.08	0.28		0.17
Attended a Meeting [c]	0.50	0.18	0.35	0.31	0.67	0.38	0.33		0.30
Adult at Home [c]	0.19	0.47	0.41	0.48	0.33	0.38	0.39		0.43

*** Too few observations to average.

[a] Averages of nominal categories in Table 3 with one being lowest and six being highest.

[b] Averages of nominal categories in Table 2 with one being lowest and seven being highest.

[c] Dummy variable, 1 if true.

the other groups went to a meeting. Only seven percent of all respondents thought the federal government should set drinking water standards. Fifty-one percent thought local government should set standards and 42 percent thought state government should. Although they desired more local control, a plurality of 47 percent believed drinking water standards were at about the right level. Forty-four percent believed they were too high while nine percent thought they were too low.

Averting Costs

Recent studies (Harrington, Krupnick and Spofford; Abdalla; Roach) have estimated averting costs for contaminated drinking water in Pennsylvania. Use of their methodology in this study provided estimates that could be compared with the CV estimates. Averting costs have the advantage of being based on actual market behavior rather than just an individual's statement of value and therefore can be used to validate CV estimates.

Two arguments suggest averting costs form a lower bound on willingness to pay (WTP). The first argument is simply a measurement issue. The costs that a survey can measure do not reflect all of the costs of pollution. For example, parents using Giardia contaminated water supplies may feel that their children feel insecure about the safety of all tap water after living with boil water restrictions. The cost of boiling water cannot capture this type of harm even though parents may be willing to pay to see that their children feel safe. In economic terms, environmental quality enters both the household production function and the utility function. Averting costs measure the impact on production costs but not the direct loss of utility.

The second argument relates to the formal theoretical difference between WTP and averting costs measures. Willingness to pay is defined as a change in the minimum expenditures necessary to maintain the same level of utility given an improvement in the quality of the environment, say from Q_0, Giardia contaminated, to Q_1, Giardia free water. Utility is not observable. Averting expenditures show what people actually spent to get from Q_0 to some better quality level, perhaps less then Q_1. Boiling drinking water eliminates the risk of ingesting Giardia through drinking but does nothing to avoid ingesting it while singing in the shower. Remediation by the water supplier eliminates both risks; boiling eliminates only one. Thus, averting cost measures abstract from both the utility level and the quality levels that influence WTP. Bartik has shown that with some plausible assumptions these abstractions force averting costs to be lower than willingness to pay.

The restrictive assumptions necessary for averting costs to be a lower bound on WTP include 1) no sunk costs, 2) no income effects from loss of work through illness, 3) no direct utility from the averting behavior, and 4) no joint production (Bartik). Under these assumptions, averting costs measures calculated here approximate a lower bound on WTP. The restrictive assumptions are imposed as follows. This study does not consider sunk costs since it ignores the costs of capital equipment, such as home water filters or new private wells. No effort has been made to evaluate the costs of illness, either directly or through the loss of productivity, largely because no evidence of illness was available before the survey, unlike the Luzerne County study of Giardia (Harrington, Krupnick, and Spofford). The non-joint production and direct entry into the utility function are more difficult to control. Survey results suggested water quality was important to respondents, and anecdotal evidence suggests that Milesburg residents continue to use bottled water (McMullin), an indication that either

or both of these assumptions are violated. By being conservative in the calculation techniques these problems are minimized though not explicitly controlled. Averting cost was calculated for three forms of behavior-- boiling water, buying water, and hauling water from another location.

Boiling water has two variable cost components--the cost of energy and the cost of time. The questionnaire asked the number of quarts per day that the respondent boiled. It takes approximately 0.35 kilowatt-hours of electricity to boil a half gallon of water (Roach). In 1989, the local electric utility in Milesburg was charging an average of $0.055 per kilowatt-hour to residential customers (West Penn Power). Dividing the number of quarts per day by two to convert to half gallons and multiplying by 0.35 and 0.055 yields dollars per day energy cost. Harrington, Krupnick and Spofford empirically determined that it takes four minutes to boil a quart of water to control Giardia. Since boiling water does not preclude participating in other activities, e.g. reading, watching television, cooking food, etc., only one quarter of this time was assumed to be actually lost by boiling water (Abdalla). The survey did not collect adequate labor market information to formally assess the marginal opportunity cost of time for the respondents. As a proxy, two estimates of hourly wage were used. The low estimate was the minimum wage in effect in 1989, $3.35 per hour (Council of State Governments). The high estimate was the midpoint of the range of family income stated by the respondent divided by 2,080 hours per year to derive an hourly wage. Multiplying one minute of boiling time per quart boiled by the wage rate yields an opportunity cost of boiling per day. The energy cost and opportunity cost of time were summed and multiplied by 30.42 days per month to obtain the monthly averting costs of boiling water.

Hauling water from an alternate source includes operating costs of the automobile and the opportunity cost of travel time. To avoid the non-joint production problem, only trips made specifically to get water were included in costs. Those trips with mixed purposes implicitly were assumed to have zero marginal cost for water. The survey asked number of round-trip miles traveled to obtain water. Because the Giardia contamination was expected to be short-lived, only variable costs of operating an automobile--$0.079 per mile in 1989 (Motor Vehicle Manufacturers Association of the U. S.)--were included. Trip mileage was divided by 35 miles per hour to yield the amount of time involved. No allowance was made for time to collect the water at the source. Even for a special trip, people may derive some other benefits from the travel time so only half the time was considered lost (Abdalla). Again the minimum wage and the stated family income were used to assign dollar values to the travel time. Since the survey did not ask for trips per week, Roach's finding of 1.62 trips per week was used to find weekly costs. Multiplying by 4.33 weeks per month yielded a monthly averting cost for hauling water.

The questionnaire asked directly how much was spent per week to buy water as well as the quantity purchased. To standardize the purchase price, an alternative cost was calculated using the average for all respondents, $0.954 per gallon. Assuming most people would buy water in the course of their regular grocery shopping trips or would have it delivered to their home, opportunity cost of time to buy water was assumed to be zero.

This process resulted in high and low estimates of costs per month for each of the averting behaviors evaluated. The three costs must be aggregated to give a high and low estimate of total averting costs for mixed activity households. The boiling and buying were each based on a stated quantity obtained so these could be summed. No quantity was asked

in the hauling question sequence so it was assumed that only half as much water was obtained by hauling if some other averting behavior also was being used. So, only half the hauling costs were added to the other costs in these cases. It was also impossible to tell which of the buying cost estimates would be lower (since it depended on whether the respondent's price was above or below the mean). The minimum of the two buying measures was used for the low estimate of total averting cost and the maximum for the high estimate.

Besides the high and low estimates, total monthly operating costs that assumed a zero opportunity cost of time were calculated. The mean number of adults at home was nearly one for hauling and boiling households which could be consistent with an opportunity cost of time lower than wage rates or even approaching zero. In addition, the allocation of joint time for these activities is arbitrary so another estimate would simply be monetary outlays.

Mean averting costs are presented in Table 6. An analysis of variance with averting activities as the classification variable and different estimation procedures as repeated measures was conducted to determine statistical significance of these measures. A significant within subject effect existed, $F(2, 384) = 71.25$, which indicates that the estimation procedures yielded significantly different results. The between subjects effect was also significant, $F(6, 192) = 11.47$, which indicates significant differences among costs of activities. A significant interaction also existed between estimation procedure and activity, $F(12,384) = 12.41$. Newman-Keuls tests were conducted for the mean costs by activities for each estimation procedure. For the high estimate, boiled and hauled ($59.64), boiled ($53.81), and boiled and bought ($52.88), were significantly higher than hauled only and drank only, and the $35.55 for boiled and drank was significantly higher than the drank only. For the low estimate, bought ($21.18); boiled and bought ($24.63), and boiled and hauled ($20.05) are significantly greater

than drank, hauled, and boiled and drank. Boiled was also greater than drank. For the operating cost estimates, bought is significantly higher than all other means, boiled and bought is significantly higher than all others except bought and boiled and hauled, and boiled and hauled is significantly higher than drank, boiled, and boiled and drank.

The significant interaction between estimation procedure and activity costs reflects the opportunity costs of time. The groups that boiled had the highest costs for the high estimates, the costs were equivalent with the bought group for the low estimates, and operating costs were in the lowest group for the boil only and boiled and drank group. In contrast, the bought group was the greatest for operating costs only. Given that income was the highest for the bought group, these results suggest that operating costs and perhaps the low estimates were the best averting cost estimates. Using family income per hour to value time for households with an average of about .5 adult at home probably overstates time costs, especially since some of these households may have had opportunity costs even below the minimum wage. In addition, the allocation of time to boiling may have been too high. More research on these issues is definitely warranted.

Contingent Valuation Estimates

Estimation of WTP with CV has several advantages over implying WTP from market behavior such as averting costs discussed in the previous section. While not so relevant for this study, CV can be used in situations in which related market behavior is unavailable. Admittedly, averting costs can be calculated in this case study but costs for water of the exact perceived quality as alternative public water sources are unknown. In addition, CV does not require estimating the value of time with arbitrary assumptions or with limited survey data

TABLE 6

MEAN WILLINGNESS TO PAY AND MEAN AVERTING COSTS BY AVERTING ACTIVITY

	One Activity Only				Boiled and				
	Drank	Boiled	Bought	Hauled	Drank	Bought	Hauled	Other	Total
	- Dollars -								
Willingness to Pay Amount for									
First Choice	13.75	17.09	20.24	19.22	18.83	21.69	19.11	*	18.25
Second Choice	12.94	15.45	18.82	17.03	20.50	18.15	16.44		16.43
Third Choice	8.75	11.04	10.00	11.28	13.00	11.69	14.05		11.17
First Choice - Third	5.00	6.04	10.24	7.94	5.83	10.00	5.05		7.08
Bellefonte	14.19	16.71	20.18	18.75	20.50	20.77	18.39		17.94
Boggs	8.13	11.00	9.82	12.06	13.00	13.15	13.72		11.40
Milesburg	13.13	15.88	19.06	16.72	18.83	17.62	17.50		16.51
Averting Costs**									
High Estimate	0.00^{c}	53.81^{a}	28.32^{abc}	14.28^{bc}	35.55^{ab}	52.88^{a}	59.64^{a}		35.30
Low Estimate	0.00^{f}	17.32^{de}	21.18^{d}	7.10^{ef}	8.29^{ef}	24.63^{d}	20.05^{d}		13.72
Operating Cost	0.00^{j}	2.55^{j}	21.18^{g}	4.42^{ij}	1.22^{j}	13.78^{h}	9.41^{hi}		6.05

* Too few observations to average.

** Means with the same superscript letter are not significantly different from each other for a particular estimation procedure.

on labor market behavior. Finally, CV estimates are a direct measure of the theoretically desirable quantity rather than an approximation. As a result, CV is often used to value activities, such as recreation, for which implied market values have been widely utilized in the past.

One would expect that CV could be utilized successfully in this case study. In their conservative assessment of CV, Cummings, Brookshire, and Shulze concluded that familiarity and prior evaluation experience with the commodity were prerequisites for successful application of CV. Both conditions are met in this study. Individuals had consumed both Milesburg and Boggs water, and presumably they had experience with Bellefonte water given the geographical proximity of the communities. Household water have been purchased through the Milesburg Water Authority, and the previously discussed changes in charges provided experience with different charges for water. The water system choice therefore meets these criteria for successful CV. However, the emotional situation of the water crisis does pose a problem--can individuals respond rationally to CV questions under such a situation?

Procedures

Considerable literature exists about the appropriate procedures for CV. One of the central issues has been the question format. After considerable experimentation with bidding games that simulate auctions, the preferred method now appears to be dichotomous choice or the referendum format where individuals are presented with a dollar amount for the choice and asked for a yes or no response if their WTP is greater than or equal to or less than the dollar amount, respectively. This method provides the correct incentives for revealing true preferences and is consistent with most market experiences of consumers (Hoehn and

Randall; Mitchell and Carson). Despite its conceptual merit, this method does have empirical limitations. Pragmatically, a prior distribution of WTP is necessary for a realistic specification of dichotomous choices bids, which can be costly and time consuming to collect. Secondly, a functional form must be assumed for a logit (or probit) equation in order to calculate WTP, and WTP has been demonstrated to be sensitive to this functional form choice (Bowker and Stoll; Boyle and Bishop). Therefore, this study used the open-ended method, which is the other currently popular method.

The open-ended CV questions were related to the choices of water systems in Table 4 with questions 8 and 9 on page 7 of the questionnaire. The order of valuation of the choices was randomly assigned prior to the interview. Interviewers based Question 9 on the answers to Question 8. For example, if a questionnaire had second choice in 9a, and the respondent identified Bellefonte as their second choice in 8; Bellefonte would be inserted in 9a. In previous research, the authors found order effects for commodities that did not meet the criteria of Cummings, Brookshire and Shulze (Laughland, Musser, and Musser). Given the nature of these commodities, it was not expected here and analysis of variance with order as a classification variable did not detect any order effects.

CV Results

Means of the CV questions are summarized in Table 6. The overall and means for averting activity groups were of orders of magnitude consistent with order of choice--first choice had the highest WTP, second choice the intermediate value and third choice the lowest WTP. The one exception was the Boiled and Drank Group in which the second choice was higher than the first choice. This group had small numbers and one individual responded $8 and $18 for the first and second choices, respectively, while others gave consistent values.

Mean WTP was $17.94, $16.51, and $11.40 for water from Bellefonte, Milesburg, and Boggs, respectively. These same patterns existed in the means for each averting group. Of course, these results are not surprising given the order of choices and consistency of the mean WTPs with these choices. An analysis of variance of the CV estimates was conducted with averting activity as the classification variable and sources of water as repeated measures. Activity was not significant, indicating no relationship between WTP and averting activity. Source of water was significant at the .0001 level $F(2, 186) = 14.59$. The 95% confidence intervals for overall WTP were calculated as, $19.23-$16.65 for Bellefonte, $17.78-$15.24 for Milesburg, and $12.53-$10.27 for Boggs. Thus, WTP for Boggs was significantly different from the other two sources. The small, insignificant difference between first and second choices compared to an eight and six dollar difference with the third supports the perceived opposition to Boggs water. From a WTP perspective, individuals were indifferent between Bellefonte and Milesburg Water. The order of choice must have reflected either support for the position of the Authority or a recognition that Milesburg water would be more expensive or infeasible.

The distributions of CV bids provides further insight in the valuations. Of the 202 observations with complete CV answers, 59 offered the same amount for all three choices. More than half of the respondents, 114, bid the same amount for Bellefonte and Milesburg water. This pattern of responses further supports the view that many individuals did not distinguish among the water sources, especially for the two with the same means. The group with the same bids may have been offering what they would pay for safe, drinkable water.

The distribution does suggest some strategic bidding. Strategic responses have been given considerable attention in the CV literature. Mitchell and Carson concluded that little

evidence of this behavior exists in their review of literature even though they reported that CV responses tended to have a downward bias. Using their typology of strategic behavior, provision of some form of drinking water was certain. If respondents were valuing a source they felt was certain, incentives to free ride and underbid exist as do answers that minimize response efforts. However, respondents who felt that their CV answers might determine the outcome might have less incentive to strategic bid. The prevalence of past and current water charges among the responses do suggest some minimum effort responses. Ten respondents offered what they had originally been paying, $6, and 37 respondents offered what they were paying after charges were increased in January, $12. The latter response tied for the mode with $20. The lower bids also may be protest bids with the implication that "I should be getting drinkable tap water for what I'm paying now, and should not need to pay more." Respondents who offered different valuations for each alternative water source also could be strategic bidders. The difference between their bid for their first choice and last choice in Table 6 indicates how much they were willing to favor one alternative over another. However, the highest difference between bids was observed for those who bought water, $10.24, who also had high operating costs of averting. A large majority of those who bought water, 83%, chose Bellefonte as their first choice. These respondents may value high quality water and may be willing to pay more for high quality and much less for poor quality. Whether the difference is a true measure of the difference in value or an artifact of strategic bidding to discourage the selection of their third choice is impossible to judge.

Further evidence on these issues was obtained with bid equations. Separate equations were estimated for each water source with seemingly unrelated regression estimation procedures and are reported in Table 7. Significant regressions were obtained for all three

equations. The R^2's are low but the magnitude usually obtained for bid equations and for most cross-section regressions. The income classes in Table 3 were grouped into three categories after preliminary inspection of the data. Less than $10,000 is the deleted category and dummies were included for $10,000-$40,000 and more than $40,000. The positive coefficients, which are larger for the higher income group than the second category, are consistent with expected income patterns; however, these coefficients are only significant in the Milesburg equation. Presence of young children in the household had a positive sign as expected, but again was only significant in the Milesburg equation. Years on Milesburg water had a significant but small sign for Milesburg water as did attending political meetings for Bellefonte and Milesburg water. Coefficients for the dummy variables on the convenience of averting behavior are not as expected. Not Inconvenient was the deleted category. The signs on Somewhat Inconvenient responses are positive in all equations and significant for Bellefonte. However, the magnitudes are smaller and not significant for Very Inconvenient in all equations. This pattern suggests either protest bidding among those who found averting behavior inconvenient or some misunderstanding of the question.

The signs for first choice are all positive and significant for Boggs and Milesburg which indicates that individuals were willing to pay more for this choice than their third choice (the excluded category). Signs were also positive and significant for the second choice for Boggs and Milesburg. The magnitudes of the coefficient for second choice are similar to the first choice, which indicates that individuals who ranked these sources first or second had a definite preference for these choices over the third choice. The second choice for Bellefonte was not significant and close to zero in magnitude. The behavior for Bellefonte may reflect only 14 individuals in the third choice or excluded category. Other than the second choice

TABLE 7

REGRESSION OF WILLINGNESS TO PAY FOR OPTIONS

Option	Bellefonte	Boggs	Milesburg
Constant	8.84**	5.65*	4.03
	(3.27)	(2.64)	(2.90)
Income Dummies			
$10,000-$40,000	2.92	1.85	5.09*
	(2.50)	(2.21)	(2.38)
More than $40,000	5.22	3.04	7.02*
	(2.84)	(2.53)	(2.71)
Young Child in House	1.58	1.05	4.16*
	(1.82)	(1.60)	(1.72)
Years on Milesburg Water	0.06	0.05	0.10*
	(0.05)	(0.04)	(0.05)
Attended a Meeting	4.62**	1.83	3.74*
	(1.51)	(1.35)	(1.44)
Averting Behavior			
Somewhat Inconvenient	3.66*	1.87	2.45
	(1.85)	(1.64)	(1.77)
Very Inconvenient	0.33	0.05	1.49
	(1.80)	(1.59)	(1.71)
Option was			
First Choice	2.92	5.69**	3.33**
	(1.70)	(1.91)	(1.27)
Second Choice	-0.18	5.08**	3.07**
	(1.79)	(1.15)	(1.01)
R^2	0.16	0.11	0.17
F	3.43**	2.33*	3.79**
n	176	176	176

Standard Errors in parentheses.

* Significant at the 0.05 level.

** Significant at the 0.01 level.

variable in the Bellefonte equation, the choice variables indicate that CV answers were consistent with preferences.

WTP estimates from the CV estimates were compared with the overall averting cost estimates. Student's t statistics were calculated to test the null hypothesis that WTP is greater than averting costs consistent with averting costs being a lower bound on WTP. The statistics were -5.83, -7.89 and -6.34 respectively for hypotheses between WTP for Bellefonte and high estimates, WTP for Boggs and high estimates, and WTP for Milesburg and high estimates. Under a one tailed test, the null hypotheses could be rejected for all these tests. This analysis further confirms the discussion in the previous section that the assumptions used for high averting costs overestimated averting costs. The statistics for comparing WTP for Bellefonte, Boggs and Milesburg with low estimates were 3.33, -1.94, and 2.21. In this case, the null hypothesis could be rejected only for Boggs which is consistent with judgments of quality of Boggs water. None of the statistics for WTP and operating costs estimates allowed rejection of the null hypothesis. Thus, CV estimates appear to be greater than averting costs using the low estimates and operating costs estimates.

Conclusions

This study demonstrated that CV estimates of WTP can be collected on local public water decisions even in the midst of a serious conflict. The response rate of 61% of those contacted is at least as high as many response rates for mail surveys reported in Mitchell and Carson. Although it was not documented in the interviews, it was clear to the interviewers that many water customers were very upset about the situation. An additional indicator of emotional state is that some people refused to be interviewed--often saying that they were too

upset about the situation to speak with us. Fortunately, over half of the water customers who were reached agreed to be interviewed. Achievement of this level of cooperation required much more attention to preparing the interviewers and sensitivity on their part to the situation.

The estimates of WTP also seem plausible. Mean WTP were not significantly different for the two preferred sources but were higher than the third choice that was being forced on the community. In addition, WTP estimates were higher than two of the three averting costs estimates as theoretically predicted and were significantly related to income and other plausible variables in at least some of bid equations.

Some indicators of possible strategic bidding were found. WTP was significantly higher for those who found averting behavior inconvenient than those who did not find it inconvenient but the same relationship did not hold for those who found it very inconvenient in the regression equations. In addition, many individuals gave the same answer to the CV questions as the $6.00 past and $12 recent monthly change which were infeasible in the current situation. Therefore, the WTP estimate may have some downward bias consistent with past studies of strategic bidding.

Despite these limitations, the WTP estimates provide information that helps to understand the political controversy. Mean WTP were $17.94, $16.51, and $11.40 for Bellefonte, Milesburg, and Boggs water respectively. While these estimates had the same order as the indicated choices of interviewees, the CV results indicated a WTP more for water from sources other than Boggs. On the other hand, the monthly charge for Boggs water at the time of the survey was $32.00 a month, nearly three times mean WTP for this water. Even with some downward bias in WTP due to strategic bidding, the ensuing controversy is

not surprising. After rates were reduced to $20.00 a month, the political response seems to have been reduced. Thus, these values are useful in predicting political opposition to customer charges.

The CV values also provide a broad view of the community's preferences that may not be available in public hearings or other informal methods of collecting information on public choices. A minority actually preferred Boggs water. A larger minority reported the same WTP for all three water sources. These minority views may not have been expressed comfortably in public in a small community where the majority had opposing views.

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Appendix

WATER QUALITY STUDY

Household: _____ ID# _____

Telephone: _____

Name of Interviewer: _____

DATE/TIME CALLED	OUTCOME*

*Record whether interview was completed, whether there was no answer, if you are to call at another time--very important in this case to make sure that you are someone else does so--or any other outcome of the interview.

PART I: INTRODUCTION

Introduce self and ascertain that correct name/phone number has been reached. If someone who is obviously a child answers the phone, ask to speak to his/her mother or father. Once you have an adult on the phone:

Hello, my name is _____, and I'm calling from Penn State University. We are doing a study on water quality, and would like a few minutes of your time. We're not selling anything. Your name was selected at random, and your answers will be confidential.

Before we continue, I need to know if this is the _____ household?

NO: Check to see if you have dialed correct number--

Is this (phone number)?

If you've dialed incorrectly, or there is a discrepancy between name/number, apologize and thank the person for their time.

YES: Continue--

Is this Mrs./Mr. _____?

YES: Continue with interview.

NO: Ask to speak with either Mr. or Mrs. _____. If the appropriate adult answers, then give initial introduction (with name, etc., skip part about household, and continue with interview.) If neither is available, try to find out when they will be back. Note on log. Thank person and say you'll call back later.

Mr./Mrs. _____we are interested in people's reactions to situations such as the one in Milesburg, where you have had a lot of trouble with the public water system. This is a research project for Penn State University and not related to any state or local government agency. We hope the information we gain from this and from other research will help other communities when they are faced with similar problems. We would like to ask you some questions about your use of water and your opinions about what the Milesburg Water authority should do. This should take only about 10 minutes. Do you have a few minutes to answer questions for us now?

NO: If person says no, or hesitates, try...

Would you prefer to have us call at another time or speak to someone else in your household?

If person does not want to answer questions, but thinks another person should, then ask if that person is available. If another time would be better--either for the person to whom you are speaking or for the alternate--then find out what time would be best. If person does not want to answer, and does not want you to call back, thank them for their time, and politely say good bye. Be sure to record new time and/or alternate person to call on cover sheet.

PART II: ONCE PERSON HAS AGREED TO ANSWER QUESTIONS:

You do receive your water through the Milesburg water system. Is that correct?

NO:

From the information we have, you were a Milesburg water customer. Because this survey concerns only those people who use Milesburg water, these questions would not be appropriate for you. But I do want to thank you for your time, anyway. Good bye, now. (Etc.)

YES: Continue with survey.

1. How long have you used the Milesburg water system?

_____

2. Until the recent conversion to Boggs Township water, Milesburg residents were advised to boil all water consumed by humans. Did your household boil the water that you used for human consumption?

YES _____ *(Go through list then go to question 3a on next page)*

Which of the following did you use boiled water for?

_____ Drinking water

_____ Making coffee, tea, or other hot beverages

_____ Making cold beverages such as orange juice or kool-aid

_____ Brushing teeth

_____ Bathing infants or young children

_____ Any other uses *(List)* _____

(Go to question 3a on page 4)

NO _____ *(Skip next page and go to question 4a on page 5)*

3a. When did you begin boiling water? _____

3b. About how much water did you have to boil each day?

_____

3c. What type of cooking stove do you have?

_____ Electric
_____ Gas
_____ Wood
_____ Coal
_____ Other *(specify)* _____

3d. Would you say that boiling your family's water was
_____ Not inconvenient?
_____ Somewhat inconvenient?
_____ Very inconvenient?

3e. Did you continue to boil water until the conversion to Boggs Township water?

YES _____ *(Go to question 5 on page 6)*

NO _____ When did you stop boiling your water?

_____

Why did you stop boiling your water?

_____

After you stopped boiling your water, what did you do for drinking water?

_____

If resumed drinking water, go to question 4a on next page.
If bought water, go to question 4b on next page.
If obtained water somewhere else, go to question 4c on next page.

4a. You said that you continued to drink (resumed drinking) the Milesburg water?

YES _____ Did you worry about getting sick from drinking the water?

YES _____ NO _____

Did you feel that the Milesburg water was safe to drink?

YES _____ NO _____

NO _____ Did you obtain drinking water somewhere else?

YES _____ Where did you obtain your water?

_____

If bought water, go to 4b.
If obtained water elsewhere, go to 4c.

4b. About how much water per week did you need to purchase for your family?

_____

How much would you estimate this water cost you per week?

_____

Would you say that purchasing this water was

_____ Not inconvenient?
_____ Somewhat inconvenient?
_____ Very inconvenient?

4c. You said that you obtained your family's water in _____. Did you need to make a special trip to obtain this water?

_____ YES About how many miles round trip did you need to go to obtain this water?

_____

Would you say that making this trip to obtain water was
_____ Not inconvenient?
_____ Somewhat inconvenient?
_____ Very inconvenient?

_____ NO

Would you say that obtaining water this way was
_____ Not inconvenient?
_____ Somewhat inconvenient?
_____ Very inconvenient?

5. When you had visitors in your home, did you serve them the same water that you served your family?

_____ YES

_____ NO

6. Has anyone in your family, or anyone else you know, become ill from drinking the water without boiling it?

_____ YES

Who? _____

When? _____
(Probe for an answer: Was it this year, that is since January 1, 1989?)

What type of illness did they have? _____

_____

If it was a <u>family member</u>: Did you/they see a doctor?

_____ YES

Did the doctor say that the illness was due to your drinking water?

_____ YES

Did he say it was due to giardia cysts?

_____ YES

_____ NO

_____ NO

_____ NO

7. Have you or your family had any other types of problems that you feel are associated with the water system?

_____ YES Would you please explain?

_____

_____ NO

8. There are basically three ways to provide safe drinking water to Milesburg residents. One way is to permanently hook up to the Boggs Township water system, another way is to permanently hook up to the Bellefonte water system, and a third way is to improve or build a new water filtration system for the Milesburg water authority. Of these three methods which would you most prefer to see happen?

First choice _____

Which would be your second choice?

Second choice _____

Which would be your last choice?

Third choice _____

9a. Of course, any of the above changes will involve some cost. One way of paying for these changes would be to increase your monthly water bill. We would like you to think back to what you were paying for water before you began using Boggs Township water. That is, assume that your water bill is still $6.00 per month. If your water bill was going to be raised above that amount in order to:

(3rd choice) _____

what would be the most per month you would be willing to pay in order to have your water meet DER standards?

$_____

9b. If your water bill was going to be raised in order to:

(2nd choice) _____

what would be the most per month you would be willing to pay in order to have your water meet DER standards?

$_____

9c. Finally, if your water bill was going to be raised in order to:

(1st choice) _____

what would be the most per month you would be willing to pay in order to have your water meet DER standards?

$_____

10. Of the three systems just mentioned, and if all three systems were equally safe, which do you think has the best quality of water? *(If needed: Which is the best water in terms of taste, smell, and softness?)*

_____

11. Moving on to a new topic. . . There have been many meetings held in Milesburg to discuss the water system and what to do about it. Have you attended any of these meetings.

_____ YES
About how many have you attended? _____

_____ NO

12. Who do you think should determine water quality standards:

_____ Local government

_____ State government, or

_____ The Federal government?

13. Do you think present water quality standards set by DER are:

_____ Too high

_____ About right, or

_____ Too low?

PART III: PERSONAL INFORMATION

Finally, I would like to ask you for some information about your household, so that we can better understand people's answers. Of course, this information is also completely confidential.

14. First, how many people live in your household?

_____

15. Would you please give me their relationship to you, and their ages? *(If prompts are needed:* Let's start with you--You are a male/female and what is your age? Are there any other adults? How old is he/she? Are there any children? How old is he/she?, etc.)

_____

_____

_____

_____

_____

_____

_____

16. Are you employed or a student?

YES _____ Full Time? _____ Part Time? _____

What is your occupation? _____

NO _____

17. *(If applicable)* Is your husband/wife employed or a student?

YES _____ Full Time? _____ Part Time? _____

What is his/her occupation? _____

NO _____

18. What is the highest grade of school which you completed?

_____

(If applicable) What is the highest grade of school which your husband/wife completed?

_____

19. We would also like to know what is your best estimate of the yearly income of your entire household (before taxes)? _____

If person hesitates, then continue . . .
Perhaps it would help if I gave you some ranges, and you can tell me which range best describes your family income . . .

Is it . . .

Less than $10,000 per year? _____
Between $10,000 and $20,000 per year? _____
Between $20,000 and $30,000 per year? _____
Between $30,000 and $40,000 per year? _____
Between $40,000 and $50,000 per year? _____
More than $50,000 per year? _____

Refused to answer _____

Couldn't answer _____

20. One final question...Do you live in the borough or in Boggs Township?

_____ Milesburg borough

_____ Boggs Township

(Go on to the next page . . .)

PART IV: THANK YOU TO PEOPLE FOR PARTICIPATION AND OFFER TO SEND RESULTS

We want to thank you for your participation. Would you like to receive a copy of the results of this survey? (*If so, get name/address and record on on this page--we will then tear this page off, along with the cover page.*) Again, thank you very much for your time. Have a nice evening.

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