POSTED PRICES EXPERIMENTS ON DECISION MAKING AND
PERCEIVED RISK – WTA FOR EXPOSURE TO CONTAMINATED WATER

by

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fulfillment of the requirements for the degree Master of Science in Agricultural and
Resource Economics

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PERCEIVED RISK – WTA FOR EXPOSURE TO CONTAMINATED WATER

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ABSTRACT

We explore how participants perceive certain environmental risks. The design is an economic experiment relying on the implementation of a dichotomous choice format. The inspiration behind this study is to identify subjects’ behaviors towards exposure to contaminated water and whether the inclusion of incentives affects this behavior in any way. Heavy metals such as Arsenic (As) and Lead (Pb) have been recognized as significant pollutants, these contaminants can naturally penetrate a community’s water supply contingent on any area’s location and industrial footprint. The toxic effects of exposure to drinking water contaminated with Arsenic have been documented by various environmental agencies (Levin 1997); (Smith & Steinmaus 2009) and maximum contamination standards have been established accordingly by the Environmental Protection Agency (EPA). Focus for this study is placed on areas throughout New Castle County, Delaware, where the above mentioned contaminants have been recorded in their soil and natural waters (EPA 2014). For the sake of this study, willingness-to-accept (WTA) will be tested across three exposure paths to waters with varying concentrations of Arsenic and Lead. An experiment was conducted at three different locations within New Castle County, Delaware. Participants were asked a series of Yes/No questions on whether they would be willing to expose themselves for a randomly posted price via three different methods that
varied by perceived riskiness (hand submersion, vapor inhalation and drinking) to mixtures of water from areas that have once been measured to be contaminated with trace amounts of Arsenic and Lead. Our results suggest that participants are significantly less likely to expose themselves via vapor inhalation and drinking compared to touching the water. The regression results also show that price does not significantly affect participants’ willingness to expose themselves; however, the variance of the concentrations does influence their decision-making.
Chapter 1

INTRODUCTION

The topics of climate change and sea level rise awareness have been a primary focal point for environmental reform across the state of Delaware. Localities along the coast, some of which also serve as tourist attractions, have implemented galvanizing countermeasures to help mitigate the projected future effects of sea level rise (i.e., dykes and flood walls). Unfortunately, the same amount of concern and proactivity has yet to be directed towards residences near urban communities in New Castle County that face the threats of climate change and sea level rise. As the map in figure one shows, there are numerous hazardous waste sites and superfund sites that are scattered throughout northern New Castle County, particularly surrounding the city of Wilmington, Delaware.
The area locally known as “Southbridge” in south Wilmington is a site of industrial and legacy pollution in the soil and water, while current industry (i.e., composting and landfills) negatively affects their air quality. Community observations have shown that numerous residents of the area are aware of the potential contamination in their neighborhood, but there lacks measured evidence reflecting the
community’s awareness or concern of environmental contamination and its potential impact on human health (See appendix). Research has been done on climate change and sea level rise concerns throughout the state of Delaware as a whole. As seas rise, human exposure to toxic contamination previously locked in the soil is an emerging threat. We know little about peoples’ perceptions and behavior towards these heavy metal and consequently what policy measures may or may not be successfully implemented.

An experimental design was constructed to confront the situation mentioned above by exposing people to waters via different exposure paths to different levels of heavy metal contamination. We collected public waters from areas along the east coast that have previously reported concentrations of both Arsenic and Lead within their public drinking water utility. These experiments were approved by the University of Delaware’s Institutional Review Board (IRB). Results show that, overall, participants are not price sensitive – participants are either willing to expose themselves to the contamination or they are not, and that this decision is not sensitive to price in the ranges tested in this study (upwards of $450). Moreover, we find that participants …. The next section outlines past articles that pertain to the methods being used within this current design.
Chapter 2

LITERATURE REVIEW

2.1 Dichotomous Choice Elicitation

Many past literatures proclaim that eliciting choice experiments (CE) are an effective way of valuing the environment (List et al. 2006) (Hanley et al. 1998). However, the hypothetical nature of typical choice experiments invalidates the authenticity of certain measures such as Willingness-to-pay/accept (WTP/WTA) thus; techniques must be applied in order to mitigate hypothetical bias (Blumenschein et al. 2007). In a study from Loomis et al. (2009), a comparison was made of actual and hypothetical willingness to pay measures of both parents and non-parents for protecting infants from nitrates in drinking water. Hypothetical bias was clearly present according to their findings. The marginal WTP amounts of adults buying bottled water for reduction in risk of shock, brain damage, and mortality were cash treatments of $2, $3.70, and $9.43 respectively. In the hypothetical market these amounts were $14, $26, and $66 (Loomis et al. 2009). This goes to show that in the case of Arsenic and Lead contamination, participants could potentially misstate their true WTA amounts within a hypothetical setting. The inspiration behind designing a dichotomous choice economic experiment is to garner authentic choices from participants for they will have to physically expose themselves in order to receive
authentic payments. Another study published by Loomis et al. in 1996 further validates the structure of our particular experiment. Whereas hypothetical and actual cash WTP were elicited with dichotomous choice and open-ended question formats. When comparing the hypothetical and actual dichotomous choice responses, the hypothetical WTP was roughly two times actual WTP with the dichotomous choice format (Loomis et al. 1996; Balisteri et al. 2000). This experiment is especially distinct because concerns addressed in past literature about the impact of incentives are acknowledged (Beattie & Loomes 1997). The motivation behind forgoing a choice experiment for this study is the fact that hypothetical bias within choice experiments attribute to over-estimation of WTA/WTP values (Lusk & Schroeder 2004), therefore ruling out incentive compatibility.

2.2 WTA pertaining to Risk/Stigma

Though Grutters et al. (2008) and many other past articles base their WTA findings on the typical basis: the level of compensation to forgo an endowed good, the same concept can be applied to participants exposing themselves to a stigmatized good in a non-choice experiment setting. This instrument can still place a monetary value across a panel of participants within a Contingent Valuation study, where one directly asks respondents how much money they would be willing to pay or how much compensation they would request for a hypothetical intervention (Grutters et al. 2008). In our case this “intervention” is not hypothetical, but actually implemented. In a framed experiment measuring HIV stigma, Hoffman et al. develop a model in which
an HIV-negative agent faces the choice of whether to engage in an economic transaction with an individual known to be HIV positive (Hoffman et al. 2014). Hoffman et al. used a WTA frame for this experiment as the WTA measures given would emphasize the level of stigma for people who are HIV positive. This particular study laid some of the conceptual groundwork for our current study regarding drinking water contamination and biases related to risk. Another study by Wu et al. (2015) used dichotomous choice to study consumer demand for local honey. Essentially, this study works to identify whether participants are willing to expose themselves for a financial tradeoff.

2.3 Contaminant Information

The Loomis et al. (2009) article is particularly relevant to this current study because it directly involves stigmatized water. In the case of Arsenic, many toxic effects are contributed to the contaminant. Much like the nitrates discussed within the Loomis et al. article (2009), Smith & Steinhaus (2009) published within the National Institute of Health’s Annual Review of Public Health that early life exposure, both in utero and in childhood, has been receiving increased attention, and remarkable increases in consequent mortality in young adults have been reported (Smith & Steinhaus 2009). The main concerns lie within pregnant women, infants, and children. Potential effects of early life exposure to Arsenic include fetal loss, reduced birth weight, infant mortality, difficulties in child cognitive function, and childhood cancer. Due to these effects, the EPA has established a maximum contamination level of 10
parts per billion (ppb) for drinking water containing Arsenic (EPA 2013). In contrast to Arsenic, which enters drinking water supplies primarily through natural deposits in the earth, Lead contamination of drinking water in the US occurs primarily as a by-product of corrosion of lead pipes in public water systems (Levin 1997). According to the EPA, Lead in drinking water can cause a variety of adverse health effects in both children and adults. In babies and children, exposure to lead in drinking water above the action level can result in delays in physical and mental development, along with deficits in attention span and learning abilities. In adults, it can cause increases in blood pressure. Adults who drink this water over many years could develop kidney problems or high blood pressure (EPA 2014).

2.4 Risk Information/Avoidance

Larson and Gnedenko (1999) explored and empirically analyzed the behavior of Moscow citizens who were avoiding health risks from their drinking water. They investigated the types and amounts of avoidance measures used by households in Moscow to adjust drinking water quality. A sample of 615 households was surveyed. The results showed that over 88% of the sample boiled water regularly due to concerns about water quality; 23% filtered water regularly; over 30% settle water regularly; and roughly 13% buy bottled water regularly (Gnedenko & Larson 1999). Their results showed how avoidance measures related to income, opinions of water quality, and location in the city. These criteria could also be relevant within our study.
This study is relevant because of how the information regarding water quality was conveyed to survey-takers within Gnedenko and Larson’s study.

Referring back to the Wu et al. (2015) article, the authors utilized the various media messages that consumers face pertaining to locally and internationally produced honey. They found that consumers demonstrate greater demand for locally produced honey, especially when provided information about negative aspects of internationally produced honey (Wu et al. 2015).

A working paper published by Whitehead et al. (2002) measures the effects of information conveyance on three related decision processes of a consumer: risk perceptions, seafood demand, and willingness to pay for a mandatory seafood inspection program. The authors found that the announcement of a hypothetical Pfisteria-related fish kill increases the perceived risks of seafood and decreases the demand for seafood (Whitehead et al. 2002). The papers outlined in this section are important as we strive to examine the effect of information conveyance regarding the EPA standards for safe drinking water containing Arsenic and Lead.

2.5 Environmental Risks

The reason the area of Southbridge is significant is because it is deemed as one of the poorer areas of northern Delaware, as well as one of the highest polluted areas (figure 1). With this in mind, there is another article published by Casey et al. (2008) that focuses on a WTA study on compensation for the environmental risks of oil transport in the Amazon. Though the neighborhood of Southbridge is far from a

8
subsistence level area, Southbridge is economically and environmentally
disadvantaged with respect to the communities surrounding it; hence why the
community of Greenville, Delaware, is also a sample group as it is also in the
Wilmington area and is one of the wealthiest communities in the US. In the Casey et
al. (2008) article, the authors find that the levels of compensation within their sample
are relatively high. These results suggest that environmental quality is important for
its own sake, a result that is very different from the implicit assumption among many
economists (Casey et al. 2008). I am anticipating that these same results will prove
true within this study since Southbridge lies in such an environmentally significant
area as well.

The area of South Wilmington is riddled with superfund sites (EPA 2014),
which are areas recognized under the Comprehensive Environmental Response,
Compensation, and Liability Act (CERCLA). In an article by Messer et al. (2006)
three superfund sites (CA, NJ, MA) are investigated over a 30-year period, and results
show that when cleanup is delayed, the discounted value of the cleanup is mostly lost,
which can possibly attribute to losses of property values due to stigma of these areas
(Messer et al. 2006). It is studies like this and Hanley’s (2008) in particular that drive
the goal of this study, for the area of Southbridge in particular is affected by a
superfund site and is considered an Environmentally Sensitive Area (ESA).
Chapter 3

EXPERIMENTAL DESIGN

To effectively carry out this Dichotomous Choice experiment, a Willow computer program was used on Surface Pro table computers in order to provide an interactive and private interface for each participant. At the start of the experiment, participants were asked six (6) questions on whether they accept or decline (Yes/No) exposure to a randomly drawn mixture of water containing Arsenic or Lead. The possible concentrations are listed within the table below:

<table>
<thead>
<tr>
<th>Arsenic</th>
<th>Lead</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 ppb</td>
<td>0 ppb</td>
</tr>
<tr>
<td>1 ppb</td>
<td>1.5 ppb</td>
</tr>
<tr>
<td>7 ppb</td>
<td>10.5 ppb</td>
</tr>
<tr>
<td><strong>10 ppb</strong></td>
<td><strong>15 ppb</strong></td>
</tr>
<tr>
<td>13 ppb</td>
<td>19.5 ppb</td>
</tr>
<tr>
<td>20 ppb</td>
<td>30 ppb</td>
</tr>
</tbody>
</table>

The bolded concentrations in this table served as an information treatment that includes information about the EPA standards for safe drinking water regarding these
two contaminants (EPA 2012, 2014). This table shows that there are a total of 12 available mixtures across 3 different exposure paths explained below. Participants were asked a series of six Yes or No questions on whether, in exchange for a randomly determined dollar amount, they were willing to do a task:

1. Submerge their hand in a mixture of water for 10 seconds.
2. Breathe in the vapors of a mixture of water for 5 deep breaths.
3. Drink 3 ounces of a randomly drawn mixture of water.

Upon answering these questions, a demographic survey was issued within the program to identify the gender, race, income, and education level of the participants (See Appendix). Various other questions were asked to assess participants’ levels of concern and knowledge regarding sea level rise issues and drinking water contamination. Subsequently a dice roll determined which one of the six treatments would be implemented and result in cash payments. If the number of a treatment was rolled for which a participant answered “Yes” to, that treatment was then carried out under the supervision of an administrator. Upon completion of the task, the participant will be paid the posted price plus $15 time compensation. If the number of a treatment was rolled for which a participant answered “No” to, that participant will not perform the task and just receive $15 for participating. The equipment that was used for the tasks is displayed below (Figures 2-4):
Figure 2: Tray for hand submersion

Figure 3: Cool mist humidifier for inhaling
A random price generator was used to determine the random prices. The total distribution fell between $0 and $450 with the prices being drawn from a distribution averaging a payout of $25. These concentrations were randomly drawn for each participant along with the exposure path (treatment) and price.
Figure 5: Screenshot of sample choice activity questions

Figure 5 above is a screenshot of first page participants see after they confirm their consent. Note how all six sample questions are displayed in succession with Yes and No radio buttons. After answering these questions, an interactive survey was then presented. The full survey can be seen in the appendix.
Figure 6 shows a screenshot of the first two questions of the survey portion. After completion of both the choice activity and survey portion, a user-controlled dice roll was used to select which task would be performed (Figure 7).

Above is a screenshot of the final page of the experiment; once finished with the survey participants knew which task was selected and for what price. Their answer selection is also displayed to them along with their total payout.
3.1 Approval Process/ Risk Minimization

This final experimental design is the product of many required revisions sent back to us by the University of Delaware IRB. Those at the Institutional Review were very patient and communicative with us as this approval process took over a year. As was stated before, many revisions were made to the design to address and mitigate risks. The main component to this design was that we personally collected public drinking waters from various locations in southeastern Maine (Arsenic) and Washington, DC (Lead) in vicinity of locations that previously had reported in government reports various levels of Arsenic or Lead in their water. The table below shows which locations were used for each concentration. Table 2 shows the locations that were used as a reference point for collecting public drinking waters for use within the experiment. Public domains, specifically libraries, were used as collection points.
Table 2: Public drinking water collection locations

<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>0 ppb – (Cape Elizabeth, ME)</td>
<td>0 ppb – (Walker-Jones Elementary School, Washington)⁠¹</td>
</tr>
<tr>
<td>1 ppb – (Bridgton, ME)</td>
<td>1.5 ppb – (Walker-Jones Elementary School)</td>
</tr>
<tr>
<td>7 ppb – (Casco, ME)</td>
<td>10.5 ppb – (Amidon Elementary School)</td>
</tr>
<tr>
<td><strong>10 ppb</strong>* - (Norway, ME)</td>
<td><strong>15 ppb</strong>* – (Walker-Jones Elementary School*)</td>
</tr>
<tr>
<td>13 ppb – (Raymond, ME)</td>
<td>19.5 ppb – (Leckie Elementary School)</td>
</tr>
<tr>
<td>20 ppb – (Baldwin, ME)</td>
<td>30 ppb – (Tubman Elementary School)</td>
</tr>
</tbody>
</table>

The above table utilizes reports showing the levels of contamination that has been observed in the past at the various locations. The study from the United States Geological Survey (2010) focused on arsenic contamination within Maine’s domestic well water. Within this study, particular towns located in the southern tier of Maine had frequently reported maximum levels of arsenic contamination between the years of 2005 and 2009. The town locations listed in the left column of table 2 each had the respective concentration of arsenic reported in the study. Another study conducted by the District Department of the Environment in 2014 focused on lead contamination within Washington D.C’s public drinking water utility lines, specifically lines

⁠¹ According to the report from the District Department of the Environment (2014) Walker-Jones Elementary School in Washington D.C. had many reported levels of lead within their school building. This is why we were able to use water collected within vicinity of the school for multiple concentrations of lead within the study.
servicing public schools within the city. As is attributable to lead contamination, many of the older school buildings within the city originally used lead piping for their plumbing systems. Due to this fact, there were schools with varying measures of lead reported in different rooms of the same building. Once locations were found with reported levels of lead and arsenic that fit the design of our study, I drove to each location to collect enough water to use for data collection purposes.

Upon collecting these waters, samples of each concentration were sent to QCL laboratories in New Castle, DE for arsenic and lead testing. All but one of the samples came back non-detectable. The only water that had a detectable amount of heavy metal was from Casco, ME. The level that was reported by QCL laboratories was a concentration of arsenic at 3ppb, which was still below the EPA standard. All of the results from both the arsenic and lead testing can be seen in the appendix.
Chapter 4

ECONOMETRIC MODEL

4.1 Panel Logit

The data from these experiments is structured as binary choices across a panel of observations. For reference of the standard structure of the model, this notation follows Mans Soderbom (2009):

\[ y_{it}^* = x_{it}B + c_i + u_{it}, \]
\[ y_{it} = 1 \{y_{it}^* > 0\}, \]

and

\[ \Pr(y_{it} = 1|x_{it}, c_i) = G(x_{it}B + c_i) \]

where \( G(.) \) is either the standard normal CDF (probit) or the logistic CDF (logit). In this case, I implemented the logistic CDF or the logit model. This log-likelihood function can be used to determine a ratio:

\[ \log L = \sum_{i=1}^{N} \left\{ d_{01i} \ln\left( \frac{\exp(\Delta x_{i2}B)}{1 + \exp(\Delta x_{i2}B)} \right) + d_{10i} \ln\left( \frac{1}{1 + \exp(\Delta x_{i2}B)} \right) \right\} \]
Chapter 5

RESULTS

5.1 Summary Statistics

This section compares summary statistics from both the Southbridge sample and the sample collected from the Osher Lifelong Learning Institute located in near Greenville, which were of particular interest due to their expected stark differences in income, education level, and ethnic background. Though data collection was done at three locations in total (also Newark, Delaware), Southbridge and the Osher Institute represent two contrasting demographics, whose characteristics are shown below.

Table 3: Means for demographic data – Southbridge & Osher

<table>
<thead>
<tr>
<th>Var</th>
<th>Southbridge</th>
<th>Osher</th>
</tr>
</thead>
<tbody>
<tr>
<td>Annual Income (dollars)</td>
<td>$21,364</td>
<td>$86,593</td>
</tr>
<tr>
<td>Sex (M=1)</td>
<td>0.49</td>
<td>0.41</td>
</tr>
<tr>
<td>Age (Years)</td>
<td>50</td>
<td>68</td>
</tr>
<tr>
<td>Education (Years)</td>
<td>11.5</td>
<td>16.4</td>
</tr>
</tbody>
</table>
As shown in table 3 and figure 8 the two samples contrast greatly in many areas. The average annual income of participants from the Osher Institute is almost 4 times that of participants from Southbridge. The Southbridge sample was split just about evenly between male and female participants, while there were slightly more female participants from the Osher Institute. Given that the majority of people who attend the Osher Lifelong Institute are retired professionals, the average age and years of education for participants are far greater relative to the residents of Southbridge.
Table 4: Contaminant Response Data

<table>
<thead>
<tr>
<th>Contaminant</th>
<th>Arsenic</th>
<th>Lead</th>
</tr>
</thead>
<tbody>
<tr>
<td>Response</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Mean Price</td>
<td>$10.65</td>
<td>$10.56</td>
</tr>
<tr>
<td>Mean PPB</td>
<td>7.7 ppb</td>
<td>9.7 ppb</td>
</tr>
<tr>
<td>Max Price</td>
<td>$446.19</td>
<td>$425.43</td>
</tr>
<tr>
<td>N</td>
<td>503</td>
<td>325</td>
</tr>
<tr>
<td>% for contaminant</td>
<td>61%</td>
<td>39%</td>
</tr>
</tbody>
</table>

Figure 9: Histogram of Prices Posted
*This represents the percentage for the EPA standard

Figure 10: Percentage Yes by Contaminant Level
Table 4 breaks down the response data gathered from all three samples. As can be seen in the table the Yes responses are split evenly for both concentrations, while more participants answered No to exposure tasks involving arsenic. Note how the average prices for both Yes and No responses pertaining to arsenic are only 9 cents apart; even the average prices for lead responses are just 62 cents apart. In figure 10, the percentage of Yes answers are broken down by concentration for both contaminants. For both arsenic and lead the majority of yes responses coincided with concentrations at 0 ppb and the respective EPA standards for each respective contaminant. Figure 11 displays the percentage of total “Yes” responses by price. As can be seen, the majority of yes responses fell within the $0-1 range and $9-11 range. This shows that the sample of participants were generally not price-sensitive. For
example, there were many instances where participants were willing to undergo an exposure task at a high concentration for $0, while there were also instances where participants refused to undergo an exposure task at lower concentrations for prices upwards of $400. This table also shows that the sample is slightly more averse to arsenic contamination than to lead. Note how the margin between the mean concentrations (ppb) is narrower for arsenic than for lead, with the max prices being higher. Another key factor to take note of is how the mean concentrations attributed to the no responses hover around the EPA standards. This is important given the fact that less than half of the sample (131 out of 267) had the EPA standard information shown to them.

5.2 Regression Results

This section displays the results of the first experiments that were conducted in late June of 2015 in Newark, DE and compares them with the results from experiments conducted in Southbridge and the Osher Lifelong Learning Institute. There were a grand total of 1,602 data points collected from 267 different participants. The same experimental design mentioned in the previous chapter was executed.

Much effort went into recruiting participants from all three locations. In Newark, the main recruitment method was on-the-spot while also placing signs at high traffic spots near the local creamery and swimming pool areas. An informal recruitment script was used to gather participants going to and from the areas. Over the span of two days, these methods worked fairly well. Recruitment at Southbridge
required much more planning ahead. Flyer were developed and distributed throughout
the neighborhood roughly a week before our team of researchers collected data in the
area. The flyers worked very well as participants got the word out about the study
quickly. In fact, our recruitment efforts in Southbridge were so effective that we only
had to spend one day collecting data due to the high volume of participants. Perhaps
the most convenient location for recruitment was the Osher Lifelong Learning
Institute. Since the Osher Institute is a satellite campus of the University of Delaware,
recruitment flyers were sent by email to the staff of the institute. From there, the staff
posted announcements and sent email reminders to their enrolled students about our
economic study. This took a major amount of recruiting pressure off of us as many
participants had caught wind of our research prior to us showing up there.
Figure 12: Data Collection Tent Setup - Newark

The above figure is a picture of the setup for data collection that took place in Newark, DE. This location is a very popular summer spot that is frequented by people from around the Newark area as it was next to a creamery. Participants were seated around the tent area and implementation was done privately in a nearby gazebo hidden from view. Data collection for both Southbridge and the Osher Lifelong Learning Institute took place indoors and a portable partition was used to section off a private implementation station.
Table 5: Logit Regression Results

<table>
<thead>
<tr>
<th>Variable</th>
<th>Newark</th>
<th>Southbridge</th>
<th>Osher</th>
<th>Combined</th>
</tr>
</thead>
<tbody>
<tr>
<td>Decision (Dep.)</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td>Price</td>
<td>.005 (0.005)</td>
<td>-.002 (0.003)</td>
<td>-.001 (0.004)</td>
<td>.001 (0.002)</td>
</tr>
<tr>
<td>EPA Standard</td>
<td>.869 (0.648)</td>
<td>.641 (0.803)</td>
<td>1.340** (0.640)</td>
<td>.909** (0.381)</td>
</tr>
<tr>
<td>Submerge (Constant)</td>
<td>2.46*** (0.586)</td>
<td>1.86** (0.650)</td>
<td>2.66*** (0.581)</td>
<td>2.26*** (0.331)</td>
</tr>
<tr>
<td>Inhale</td>
<td>-.867** (0.367)</td>
<td>-.588 (0.388)</td>
<td>-1.91*** (0.397)</td>
<td>-1.05*** (0.211)</td>
</tr>
<tr>
<td>Drink</td>
<td>-2.11*** (0.388)</td>
<td>-1.21** (0.401)</td>
<td>-1.98*** (0.378)</td>
<td>-1.72*** (0.214)</td>
</tr>
<tr>
<td>Arsenic-dummy</td>
<td>-.380 (0.366)</td>
<td>-.021 (0.381)</td>
<td>-655* (0.347)</td>
<td>-.355* (0.203)</td>
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<tr>
<td>Lead-above EPA</td>
<td>-2.31*** (0.455)</td>
<td>.385 (0.511)</td>
<td>-2.34*** (0.466)</td>
<td>-1.58*** (0.257)</td>
</tr>
<tr>
<td>Arsenic-above EPA</td>
<td>-1.79*** (0.458)</td>
<td>-.261 (0.443)</td>
<td>-2.26*** (0.475)</td>
<td>-1.39*** (0.250)</td>
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<tr>
<td>Log likelihood</td>
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<td>-237.19</td>
<td>-262.57</td>
<td>-780.22</td>
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<td>Wald chi^2</td>
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<td>117.25</td>
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<td>528</td>
<td>546</td>
<td>1,602</td>
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* = 10%; ** = 5%; *** = 1%
-Panel Logit Coefficient (Standard Error)

In table 5, the dependent variable “Decision” is a binary dummy variable for the responses (where Yes=1) with “price” being the posted price corresponding with each response. The variables “drink” and “inhale” represent the respective exposure paths while Task 1 (drinking) was omitted as a base treatment and is represented by the constant variable. The “EPA Standard” variable is a binary dummy measure (where info=1) representing the effects that our information treatment had on certain
participants. The Willow software was programmed such that approximately half of all participants would receive information regarding the EPA standard for safe drinking water and half would not. The “Arsenic-dummy” variable is a binary dummy variable (where Arsenic=1) that identifies which contaminant was presented with a certain exposure path. “Lead-above EPA” is a variable that displays the effects on decisions for measures of lead presented that were above the EPA standard level of 15 ppb. “Arsenic-above EPA” displays the same effects on decisions for measures of arsenic presented that were above the EPA standard level of 10 ppb.

The regression results for the Newark sample show that the inhalation, drinking, and hand submersion treatments are statistically significant. For both inhalation and drinking, participants were more likely to answer “No”, while for the hand submersion treatment participants were more willing to expose themselves to the water. This means that the concentrations for these treatments affected participants’ acceptance rates. Participants were more likely to answer “No” to exposure paths pertaining to both Arsenic and Lead above the EPA standard, with both variables statistically significant at the 1% level. This finding does not necessarily determine the effectiveness of the EPA information treatment, but rather that higher concentrations significantly affected the decision-making of participants within this sample. What is most intriguing is how the EPA standard, price, and contaminant variables are not statistically significant. Interestingly, the results show that participants were not price sensitive. As stated in the earlier section, there were participants who refused to undergo certain exposure tasks at the lowest levels for prices upwards of $400. This
finding goes against standard economic predictions and demonstrates the strong reaction that participants had to this setting. This shows that a majority of the participants had their minds made up coming into the session that no matter how much we would be willing to offer them (up to the $450 cap used in this study), they were absolutely not willing to expose themselves.

As can be seen in the results from Southbridge, there are far less significant variables within this regression. What is most surprising is that even though Southbridge is a very low income neighborhood, the price variable is even less statistically significant for this sample than for the Newark and Osher samples. Southbridge is an area that is constantly exposed to environmental hazards and is seemingly surrounded by potential superfund sites and hazardous waste areas. This was a concern brought to the attention of the experiment administrators by many of the participants. This constant exposure can help explain why only the hand submersion and drinking treatment are statistically significant across all variables for the Southbridge sample. Their level of significance is also notable. Within the Newark sample, five variables were significant at either the 1% or 5% level, while in Southbridge, the two lone significant variables are significant at 5% respectively. Just like the previous sample, participants were more likely to answer “No” to the drinking treatment, but more willing to expose themselves to contaminated water via hand submersion. What also should be noted is the extreme discrepancy between the samples in regards to income, education levels, and race. The demographics for the Newark sample were not listed in the previous section, but the sample characteristics
can be compared to that of the Osher Institute participants, except for their age. Though the Southbridge sample is less educated than the Newark and Osher samples, there seems to be an ingrained knowledge of contamination in their decisions implied by the regression results. However, what can also be seen within this analysis is the fact that the Southbridge sample answered “Yes” to more questions than the Newark and Osher samples. There were a total of 346 yes responses from the Southbridge sample; 333 from the Osher institute, and 327 from Newark. When attention is drawn to the “Lead-above EPA” and “Arsenic-above EPA” variables these measures are not significant, which means that when the concentrations of these contaminants were above the EPA level it did not affect peoples’ decisions. Given also that less than half of the entire sample had information regarding the EPA standard, this means that participants reacted negatively when higher concentrations were presented, regardless of the EPA information treatment, which is different than previous studies (Wansink and Schulze, 2013).

The fact that the community of Southbridge is identified as a lower-income community definitely plays a role in their results. Often was the case that many residents heard there was an opportunity to make extra money by participating in research. As the day went on, the volume of participants increased so much so that sessions had to shut down early due to the experimental team running out of cash to pay participants with. Though this was the case, it still baffles me that price is not at all significant for this sample in particular. This event confirms that in the case of this particular study, the higher concentrations and the exposure paths influenced decisions.
more than price, therefore causing participants to be more risk-averse, no matter how substantial the financial trade-off may have been.

In contrast to both the Newark and Southbridge samples, the Osher sample displayed the most significant measures in their results. Not only were all three exposure treatments statistically significant, but the EPA standard and contaminant variables were as well. This implies that the participants from the Osher Institute responded strongest to the information displayed throughout the program. The same pattern of results followed within this sample as in the others: participants were more likely to answer “No” to the drinking and inhalation treatments, while more willing to expose themselves via hand submersion. Perhaps the most noteworthy event is the EPA standard variable being statistically significant at the 5% level, with the coefficient being much higher than for the other locations. According to the results there appears to be a significant stigma towards lead, which can be seen in the contaminant variable which is statistically significant at 10%. Some participants, in response to the project made references to the lead poisoning warnings that they had read about in the past, when the symptoms and causes of lead poisoning had first come into the public light. Age may also help to explain why the Osher participants were more risk-averse overall. All of the coefficients are especially high compared to the previous two samples, and extremely significant as well. The only non-significant variable is price.
Chapter 6

CONCLUSION

In conclusion, across all samples, the price variable did not have a significant effect on decisions made towards potential exposure to waters deemed contaminated with Arsenic or Lead. This is consistent with research related to stigma that shows that people tend to either shun or accept a potentially stigmatized object and in general do not show much response to price (see for instance, Messer (2006), Kanter et al., (2009), Kecinski et al., 2015; and Hoffman et al., 2012). Participants were more willing to expose themselves via hand submersion at statistically significant levels as opposed to drinking and vapor inhalation. Surprisingly, the price variable was not statistically significant during any iteration of the logit regression, despite the lower-income sample answering “Yes” to more tasks overall. For both the Newark and Osher samples, participants’ decisions were influenced more when confronted with higher concentrations of lead as opposed to arsenic. This experiment proved successful in capturing the effects that particular exposure paths and concentrations have on participants’ choices and willingness-to-accept values. Aspirations for the findings of this study were to provide statistical evidence regarding peoples’ stigma towards contaminated waters and how this stigma is contingent upon their knowledge of the mixtures and a proposed financial tradeoff. It was shown throughout this paper
that a wealth discrepancy made an impactful difference on decisions made regarding exposure to potential contamination. The next steps will be to gather data from geographically and socially diverse samples and compare the data aggregately and independently. The eventual end goal will be to relay and communicate these findings with environmental planners and policy-makers tasked with abating and mitigating the effects of sea-level rise on urban areas. From an environmental justice perspective, this study would serve as a preliminary look into how residents from environmentally impacted areas view potential exposure to contamination. It can be stressed that residents within the community of Southbridge are just as averse to drinking contaminated water as residents within Greenville, even though the wealth gap is substantial. The results infer that the EPA information treatment had a significant effect on those who are more educated. That being the case, this study could potentially campaign for a concerted effort to educate those within lower-income areas about environmental issues such as contamination and pollution, as well as about the contaminants in question and their properties.
REFERENCES

   <http://water.epa.gov/lawsregs/rulesregs/sdwa/arsenic/index.cfm>


5. Casey, James F., James R. Kahn, and Alexandre A.f. Rivas. "Willingness to Accept Compensation for the Environmental Risks of Oil Transport on the


   <http://water.epa.gov/drink/info/lead/index.cfm>.


Appendix A

FULL INSTRUCTIONS & SURVEY

A.1 INSTRUCTIONS

*Please read these instructions carefully and do not communicate with anyone else while you are making your decisions.*

- Every decision you make involves a certain amount of money that you receive to perform a task.
- You will make 'Yes' or 'No' decisions.
- At the end of the study, which task will be implemented will be determined by a random draw.
- We will also ask you to fill out a survey at the end.

**Implementation of 'Yes' decisions**

- If you selected 'Yes' to the randomly determined task, you will receive the amount of money you agreed to and perform the task in a shielded area to ensure privacy. This money will be added to the $15 that you will receive for your participation in the study.

**Implementation of 'No' decisions**
• If you selected 'No' to the randomly determined task, you will not perform the task but also not receive the amount of money involved with the task. Thus, you will only receive the $15 that you will receive for your participation in the research.

**Example 1:** If you selected 'Yes' for *Task 1* for $10 and this task is randomly determined at the end of the study, you will perform *Task 1* and you will receive $10. Thus, your total earnings will be $25 ($10+$15).

**Example 2:** If you selected 'No' for *Task 3* for $20 and this task is randomly determined at the end of the study, you will **not** perform *Task 3* and you will **not** receive the $20. Thus, your total earnings will be $15.

*Please raise your hand if you have any questions and we will come to you to clarify.*
A.2 SURVEY

1. How thirsty are you right now? 5
   Not Thirsty (1)   Very Thirsty (9)

2. In a typical week, approximately how many glasses (12 oz.) of tap water do you consume?

3. How often does your household drink the following types of water?
   Tap Water: 5
   Not Often (1)   Very Often (9)
   Filtered Tap Water: 5
   Not Often (1)   Very Often (9)
   Bottled Water: 5
   Not Often (1)   Very Often (9)

4. Are you concerned about the quality of your drinking water?
   □ Yes    □ No

5. Are you concerned about exposing yourself to contaminants in your neighborhood through touch?
   □ Yes    □ No
6. Are you concerned about exposing yourself to contaminants in your neighborhood through inhalations?

- Yes
- No

7. How concerned are you about the following in your water?

- Arsenic: 5
  - Not Concerned (1)
  - Very Concerned (9)

- Chromium: 5
  - Not concerned (1)
  - Very Concerned (9)

- Lead: 5
  - Not Concerned (1)
  - Very Concerned (9)

- Medication: 5
  - Not Concerned (1)
  - Very Concerned (9)

- Nutrients: 5
  - Not Concerned (1)
  - Very Concerned (9)

- Other (please specify): 5
  - Not Concerned (1)
  - Very Concerned (9)
8. How risky do you consider drinking tap water? 5
   Not Risky (1) □ □ □ □ □ □ □ □ □ □ Very Risky (9)

9. How risky do you consider filtered tap water? 5
   Not Risky (1) □ □ □ □ □ □ □ □ □ □ Very Risky (9)

10. How risky do you consider bottled water? 5
    Not Risky (1) □ □ □ □ □ □ □ □ □ □ Very Risky (9)

11. Before today, have you ever felt like drinking water may be a risk to your health?
    □ Yes □ No

12. Before today, have you ever felt like exposing yourself to water through touch may be a risk to your health?
    □ Yes □ No

13. Before today, have you ever felt like exposing yourself to water through inhalation may be a risk to your health?
    □ Yes □ No

14. How concerned are you about contaminants in your neighborhood? 5
    Not Concerned (1) □ □ □ □ □ □ □ □ □ □ Very Concerned (9)
15. How concerned are you about sea level rise negatively affecting you? 5
   Not Concerned (1) ____________________________ Very Concerned (9)

16. How concerned are you about sea level rise negatively affecting your neighborhood? 5
   Not Concerned (1) ____________________________ Very Concerned (9)

17. How concerned are you about sea level rise negatively affecting the state of Delaware? 5
   Not Concerned (1) ____________________________ Very Concerned (9)

18. How concerned are you about sea level rise negatively affecting the United States? 5
   Not Concerned (1) ____________________________ Very Concerned (9)

19. How concerned are you about sea level rise negatively affecting places around the world? 5
   Not Concerned (1) ____________________________ Very Concerned (9)

20. How concerned are you about flooding negatively affecting you? 5
   Not Concerned (1) ____________________________ Very Concerned (9)

21. How concerned are you about flooding negatively affecting your neighborhood? 5
   Not Concerned (1) ____________________________ Very Concerned (9)
22. How concerned are you about flooding negatively affecting the state of Delaware? 5
    Not Concerned (1)  
    Very Concerned (9)

23. How concerned are you about flooding negatively affecting the United States? 5
    Not Concerned (1)  
    Very Concerned (9)

24. How concerned are you about flooding negatively affecting places around the world? 5
    Not Concerned (1)  
    Very Concerned (9)

25. How much do you know about global warming? 5
    Very Little (1)  
    A Great Deal (9)

26. How much do you know about sea level rise? 5
    Very Little (1)  
    A Great Deal (9)

27. How much do you know about flooding? 5
    Very Little (1)  
    A Great Deal (9)

28. What is your country of origin?
    ◯ U.S.
    ◯ Other
29. What is your gender?
   - Female
   - Male

30. Do you have children?
   - Yes
   - No

31. If yes, how many children live at home?

32. If yes, how many children under the age of 10 live at home?

33. What is your age?

34. Including yourself, how many people live in your household?

35. What is your relationship status?
   - Single
   - Married
   - Divorced
   - Widowed
36. Employment status: Are you currently...
   - Employed for wages
   - Self-employed
   - Unemployed
   - Full-time student
   - Retired
   - Other (please specify) [ ]

37. Housing: Do you live in a house or apartment?
   - House
   - Apartment

38. Housing: Does your household rent or own?
   - Rent
   - Own

39. What is your race?
   - American Indian and Alaska Native
   - Asian
   - Black or African American
   - Native Hawaiian and Other Pacific Islander
   - White
   - Some other race
40. What is your highest level of education obtained?
   - Some High School
   - High School Degree
   - Some College
   - College Degree
   - Graduate Degree
   - Other (please list)

41. What is your annual household income?
   - $0-$10,000
   - $10,001-$20,000
   - $20,001-$30,000
   - $30,001-$40,000
   - $40,001-$60,000
   - $60,001-$80,000
   - $80,001-$100,000
   - $100,001-$150,000
   - $150,001-$250,000
   - More than $250,000
42. What is the zip code of your current primary residence? 

43. What zip code (or city, state, County) did you grow up in?
Appendix B

QCL ARSENIC & LEAD RESULTS
# B.1 ARSENIC

## QC Laboratories

### Analytical Report

Printed 06/19/15 12:52 QC36

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**MR. JONES**  
U OF D ECONOMICS & STATISTICS  
531 S. COLLEGE AVE  
213 TOWNEEND HALL  
NEWARK, DE 19716

---

**Account No:** AL0863, U OF D ECONOMICS & STATISTICS  
**P.O. No.:**  
**Inv. No.:** 170921 PI

**Project No.:** AL0863, U OF D ECONOMICS & STATISTICS  
**PWSID No.:**

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**PIN:** 20261  
**Serial Number:** 4723505

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Page 2 of 7
## QC Laboratories
### Analytical Report

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- **P.O. No.**: 77002421 PI
- **Project No.**: AL0063, U OF D ECONOMICS & STATISTICS
- **PWSID No.**: 

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**Note**: All results are within the acceptable range for the specified parameters.

**Sample Descriptions**:
- LS567032-3: Sample collected at 7-2 LEACH HILL RD ME 04015.
- LS567035-4: Sample collected at 10-258 MAIN ST ME 04268.

**Sample Details**:
- Sample IDs are unique identifiers for each sample.
- Samples were collected on the specified dates and times.
- Analysis was performed by QA/QC laboratories.

**Analytical Methods**:
- EPA 200.8 Rev 5.4 was used for arsenic analysis.

**Reported Values**:
- Arsenic levels were measured and reported for each sample.
- All reported levels were found to be within the acceptable range.

**Prepared By**: [Signature]

**Date**: 06/18/15

**Serial Number**: 77002421 PI

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**Page 3 of 7**
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DEFINITIONS

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<td>NF</td>
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Data Qualifiers (EPA CLP Convention)

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Warranties, Terms, and Conditions

- Unless otherwise specified in the Parameter field, analyses (excluding “Field Parameters”) were performed at the QCL Southampton Division (1205 Industrial Boulevard, Southampton, PA 18966). Food, pharmaceutical, and dairy testing were performed the QCL facility in Horsham (702 Electronic Drive, Horsham, PA 19044).

- The test results meet all TN1 or other applicable regulatory agency requirements, including holding times and preservation, unless otherwise indicated.

- The report shall not be reproduced, except in full, without the written consent of the laboratory.

- All samples are collected as “grab” samples unless otherwise identified.

- The reported results relate only to the sample as tested. QCL is not responsible for sample integrity unless sampling has been performed by a member of our staff.

- QCL is not responsible for sampling and/or testing omissions. Note that regulatory authorities may assess substantial fines for testing omissions. Please track your sample collection schedules and results on a regular basis (e.g., weekly, monthly, or quarterly) to ensure compliance. QCL’s internet program “LIVE ACCESS” will provide you with real-time access to collection dates and testing results. Please contact Customer Service for further information.

- The following personnel or their deputies have approved the results of the tests performed by QCL: Nicki Smith (Environmental Chemistry), Amanda Lukaszewski (Pharmaceutical), Ryan Baker (Dairy), Karen Battista (Food Micro), Jonathan Deceni (Food Chemistry), Sue Abbott (QCL Delaware).

QCL Accreditations

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<td>PA 09-003131; NJ PA166; NY 11223</td>
<td>CT PH-0768; DE PA-018; MD 206</td>
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<td>Reading Division</td>
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<td>Vineland Division</td>
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Page 5 of 7
## B.2 LEAD

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**QC Laboratories**

**Analytical Report**

Account No: AL0863, U OF D ECONOMICS & STATISTICS  P.O. No: 1707447  PWSID No:  
Project No: AL0863, U OF D ECONOMICS & STATISTICS  

---

**Sample ID**  Sample Description  Samp. Date/Time/Temp  Sampled by  
L5643632-3  #19 4200 KENSAS AVE NW WASHINGTON DC 20011  06/10/15 02:00pm  NA  Customer  

**Parameter**  Result  RL  Units  Method  DF  Qual  Test Date, Time, Analyst  
**METALS**  
Lead  ND  0.00200  mg/l  EPA 200.8 Rev 5.4 1  06/12/15 09:27PM  JW  

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**Sample ID**  Sample Description  Samp. Date/Time/Temp  Sampled by  
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**METALS**  
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---

**PIN:** 26361  **Serial Number:** 4706153
## DEFINITIONS

The following terms or abbreviations are used in this report:

<table>
<thead>
<tr>
<th>Term</th>
<th>Abbreviation</th>
<th>Description</th>
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<tbody>
<tr>
<td>MPN</td>
<td>Most probable number</td>
<td></td>
</tr>
<tr>
<td>CPU</td>
<td>Colony forming unit</td>
<td></td>
</tr>
<tr>
<td>POS</td>
<td>Positive</td>
<td></td>
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<tr>
<td>NEG</td>
<td>Negative</td>
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</tr>
<tr>
<td>PRES</td>
<td>Presumptive</td>
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<tr>
<td>MFL</td>
<td>Membrane filtration</td>
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</tr>
<tr>
<td>TNC</td>
<td>Too numerous to count</td>
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<td>PL</td>
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<td>NTU</td>
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<td>RL</td>
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<tr>
<td>MDL</td>
<td>Maximum Contaminant Level</td>
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<td>QAP</td>
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ND The analyte was not detected at a concentration above the RL / MDL.

J Estimated value ≥ MDL but < RL. Applies to organics and general chemistry results (see below for metals)

Q Indicates this analyte did not meet quality control requirements.

DRY Indicates the result was calculated and reported on a dry weight basis.

TIC tentatively identified compounds (library search compounds); concentrations are estimated values only.

ppm (mg/l) Parts per million: equivalent to 1 milligram per kilogram (mg/Kg) for solids or one milligram per liter (mg/l) for aqueous samples.

ppb (ug/l) Parts per billion: equivalent to 1 microgram per kilogram (ug/Kg) for solids or one microgram per liter (ug/l) for aqueous samples.

< Less than: In conjunction with a numerical value, indicates a concentration less than RL / MDL.

> Greater than: In conjunction with a numerical value, indicates a concentration greater than RL / MDL.

### Data Qualifiers (EPA CLP Convention)

<table>
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<td>B</td>
<td>Analyte was detected in the method blank</td>
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<tr>
<td>E</td>
<td>Concentration exceeds calibration range</td>
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<tr>
<td>U</td>
<td>Unidentified compound or detected above MDL/RL.</td>
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<tr>
<td>N</td>
<td>Presumptive evidence of compound or detected at MDL/RL.</td>
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<td>P2</td>
<td>Column precision criteria not met, report higher value</td>
</tr>
<tr>
<td>Other</td>
<td>Defined in case narrative or data package</td>
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### Warranties, Terms, and Conditions

- Unless otherwise specified in the Parameter field for analytes excluding “Field Parameters” were performed at the QCL Southampton Division (1205 Industrial Boulevard, Southampton, PA 18966). Food, pharmaceutical, and dairy testing were performed by the QCL facility in Horsham (703 Electronic Drive, Horsham, PA 19044).
- The test results meet all TNI or other applicable regulatory agency requirements, including holding times and preservation, unless otherwise indicated.
- The report shall not be reproduced, except in full, without the written consent of the laboratory.
- All samples are collected as “grab” samples unless otherwise identified.
- The reported results relate only to the sample as tested. QCL is not responsible for sample integrity unless sampling has been performed by a member of our staff.
- QCL is not responsible for sampling mechanisms or testing; emissions. Note that regulatory authorities may assess substantial fines for testing emissions. Please track your sample collection schedules and results on a regular basis (e.g., weekly, monthly, or quarterly) to ensure compliance. QCL’s internet program “LIVE ACCESS” will provide you with real-time access to collection dates and testing results. Please contact our customer service for further information.
- The following personnel or their deputies have approved the results of the tests performed by QCL: Nicki Smith (Environmental Chemistry), Amanda Lukaszewski (Pharmaceutical), Ryan Baker (Dairy), Karen Batista (Food Micro), Jonathan Decenzi (Food Chemistry), Sue Abbott (QCL Delaware).

### QCL Accreditations

- **Southampton Division**
  - EPA ID: PA00018
  - NELAP IDs: PA 09-00131; NJ PA166; NY 11223
  - State IDs: CT PH-0706; DE PA-0108; MD 206
  - FDA Reg #: 2215218

- **Delaware Division**
  - State IDs: DE 00011: MD 138
  - Reading Division State ID: PA 06-03543

- **West Rutherford Division**
  - N2 0015
Appendix C

PRELIMINARY SURVEY – SOUTHBridge WEEKEND 2014

On Saturday, July 19, 2014, a team of researchers administered a survey titled the “Southbridge Health and Environmental Concern Survey.” This particular day was selected because it represented the second day of “Southbridge Weekend,” an annual celebration within the neighborhood that attracts hundreds from all over the city. A free carnival event was held at Elbert playground in the heart of the Southbridge community. At this event, many vendors and community organizations set up exposition tables to be frequented by the attendants of the carnival. Recruitment of respondents was executed on site, with a $2 bill serving as the incentive for participation in the survey. The 10-15 minute survey was to be filled out by respondents, over the age of 18, at a tent rented out by the representatives of the University of Delaware.

As is customary with most surveys, demographic criteria were addressed at the beginning. These questions served to identify the age, race, sex, education, labor status, and income of the respondents in question. These questions are pertinent in order to identify which segment of the population is being surveyed specifically. The next topic addressed was residential status respective to the community of Southbridge in particular. The goal of this was to ascertain how many of the respondents actually
reside in Southbridge, the amount of time they have lived there, as well as if they own a home there. The idea behind this is to see if residency in Southbridge has an effect on residents’ overall health and environmental concern. Throughout the rest of the survey, there are questions that gauge the respondents’ level of concern about the effects of pollution by the use of a three-point scale (Not at all concerned, Concerned, Greatly concerned). Respondents were asked to label their level of concern towards the potential effects that certain pollutants could have on their everyday life within the community. Specifically, respondents were urged to disclose their concern for how certain metals, gases, and particulate matter could potentially affect air quality, drinking water, locally grown food, plant life, local fishing, and soil quality.

The same three point scale was applied in the next segment of the survey which addresses health concerns tied to pollution. Participants were asked to disclose concern regarding potentially harmful outcomes of exposure to pollution. Cancer, birth defects, genetic diseases, asthma, headaches, and fatigue were included in this segment as well as the potential damage to the nervous, reproductive, and urinary systems. The final segment of the three point concern scale culminated in addressing overall exposure to pollutants in Southbridge (including air, soil, and both environmental and drinking waters). Particularly, this portion of the survey addresses the vagueness and uncertainty of past, present, and future pollution exposure. The back end of the survey looks to identify each respondent’s feelings towards the agenda of sea level rise and pollution mitigation. Questions were asked to ascertain the overall knowledge of these issues and whether the community of Southbridge feels
these topics are of high priority socially and economically. For instance, questions ask if the respondent would be willing to pay higher taxes in order to help improve pollution, flooding, sea level rise impacts, as well as the overall environment of Southbridge. These inquiries will help to identify Southbridge’s eagerness for environmental reform as well as send a message to state legislature that the community is prepared to take action. After full completion of the survey, an envelope containing a $2 bill along with the informed consent for the study was given out to each successful respondent.

What we gained from this survey is that there is significant concern about the pollution of drinking water within the community as well as the flooding that occurs frequently after a heavy rain; however, the knowledge of factors, such as Sea Level Rise, that attribute to these issues is severely lacking within the community (Fig. 13a-13c). These charts represent the sample of respondents for the Southbridge Health and Environmental Concerns Survey. These bars show that 77% of the sample believes that flooding is an extremely serious issue for the community (Figure 13a) and that 95% are greatly concerned for the pollution of their drinking water (Figure 13b). However the third figure shows that knowledge of Sea Level Rise is severely lacking within the community, with 78% of the sample knowing little to nothing about Sea Level Rise and its potential effects (Figure 13c).

The figures below indirectly imply that many residents of the area of Southbridge, and quite possibly residents of similar areas nationwide, do not fully know what is in the water they come into contact with daily. It is this lack of
knowledge that inspired one of the main objectives of this study: To examine how respondents respond to the possibility of being exposed to small amounts of contaminated waters. Great concentration will be placed on the rates of acceptance/denial from participants to real-time exposure to water contaminated with Arsenic and Lead.
Figure 13a: Survey question addressing seriousness of flooding
Figure 13b: Survey question addressing concern for pollution of drinking water
Figure 13c: Survey question addressing knowledge of sea level rise
Appendix D

IRB LETTER
DATE: June 17, 2015

TO: Maik Kecinski
FROM: University of Delaware IRB

STUDY TITLE: [764612-1] Assessing and measuring environmental risk preferences

SUBMISSION TYPE: New Project

ACTION: APPROVED
APPROVAL DATE: June 17, 2015
EXPIRATION DATE: June 16, 2016
REVIEW TYPE: Expedited Review

REVIEW CATEGORY: Expedited review category # (7)

Thank you for your submission of New Project materials for this research study. The University of Delaware IRB has APPROVED your submission. This approval is based on an appropriate risk/benefit ratio and a study design wherein the risks have been minimized. All research must be conducted in accordance with this approved submission.

This submission has received Expedited Review based on the applicable federal regulation.

Please remember that informed consent is a process beginning with a description of the study and insurance of participant understanding followed by a signed consent form. Informed consent must continue throughout the study via a dialogue between the researcher and research participant. Federal regulations require each participant receive a copy of the signed consent document.

Please note that any revision to previously approved materials must be approved by this office prior to initiation. Please use the appropriate revision forms for this procedure.

All SERIOUS and UNEXPECTED adverse events must be reported to this office. Please use the appropriate adverse event forms for this procedure. All sponsor reporting requirements should also be followed.

Please report all NON-COMPLIANCE issues or COMPLAINTS regarding this study to this office.

Please note that all research records must be retained for a minimum of three years.

Based on the risks, this project requires Continuing Review by this office on an annual basis. Please use the appropriate renewal forms for this procedure.
If you have any questions, please contact Nicole Farnese-McFarlane at (302) 831-1119 or nicolefm@udel.edu. Please include your study title and reference number in all correspondence with this office.